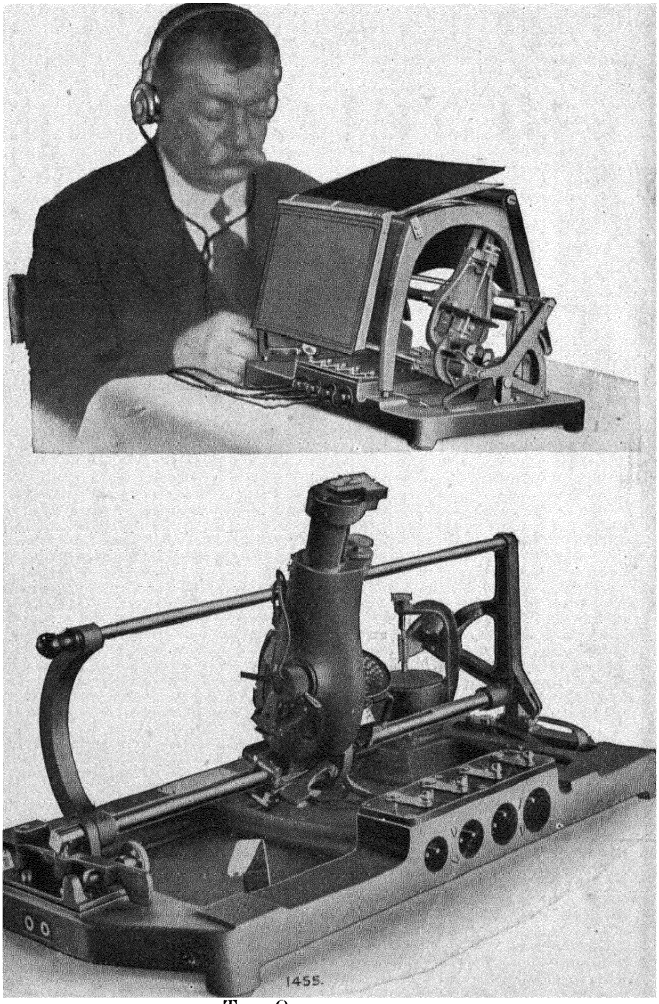
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THE OPTOPHONE.

A wonderful new invention for enabling the blind to read ordinary printed matter.

(*See article.*)

THE NEW AGE ENCYCLOPÆDIA

EDITED BY
SIR EDWARD PARROTT, M.A., LL.D.
ASSISTED BY A LARGE STAFF OF SPECIALISTS

VOL. VIII.
Ophir—Rig

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ABBREVIATIONS USED IN THIS WORK

ac., acres.
alt., altitude.
Amer., American.
anat., anatomy.
anc., ancient.
ann., annual.
Arab., Arabian.
arch., architecture.
astron., astronomy.
A.S., Anglo-Saxon.
A.V., Authorized Version.

biol., biology.
bor., borough.
bot., botany.
b.p., boiling-point.
Brit., British.

c., about (Lat. *circa*).
cap., capital.
cent., century.
cf., compare.
chem., chemistry.
Chin., Chinese.
class., classical.
co., county.
Co., Company.
coll., college.
comm., commune.
cub. ft., cubic feet.

d., died.
Dan., Danish.
dep., department.
dist., district.
div., division.

E., east.
eccles., ecclesiastical.
ed., editor, edited, edition.
e.g., for example.
Eng., English.
Episc., Episcopal.

fl., flourished.
Flem., Flemish.
fort. tn., fortified town.
Fr., French.
ft., feet.

Gael., Gaelic.
geol., geology.
geom., geometry.
Ger., German.
gov.-gen., governor-general.
Gr., Greek.

Heb., Hebrew.
h.p., horse-power.

Ind., Indian.
in., inch. inches.
I., isl., island.
Ital., Italian.

Jap., Japanese.

Lat., Latin.
l. bk., left bank.

m., miles.
mar., maritime.
maths., mathematics.

M.E., Middle English.
med., medicine.
M.P., Member of Parliament.
m.p., melting-point.
mrkt. tn., market town.
MS., manuscript; MSS., manuscripts.
Mt., Mount.
mts., mountains.
munic., municipal.
myth., mythology.

N., north.
Norweg., Norwegian.
N.T., New Testament.

O.E., Old English.
O.T., Old Testament.

par., parish.
parl., parliamentary.
Pers., Persian.
Pop., Population.
Port., Portuguese.
Presb., Presbyterian.
prof., professor.
Prot., Protestant.
prov., province.
pub., published.

r. bk., right bank.
R.C., Roman Catholic.
riv., R., river.
R.V., Revised Version.
ry. jn., railway junction.

s., south.
Scot., Scottish.
seapt., seaport.
Soc., Society.
Span., Spanish.
sp. gr., specific gravity.
sq. m., square miles.
Swed., Swedish.

temp., temperature
theol., theology.
terr., territory.
tn., town.
trans., translation, translated.
trib., tributary
Turk., Turkish

U.K., United Kingdom.
univ., university.
U.S., United States of America.

vil., village.
vols., volumes.

w., west.
wat.-pl., watering-place.

yds., yards.

zool., zoology.

Note.—Names printed in small capitals, and occurring in the course of an article, indicate that there is a special article under that head.

THE
NEW AGE ENCYCLOPÆDIA.
Vol. VIII.

Ophir, a region, whose exact locality is disputed, famed for its gold. From Ophir the ships of Solomon brought gold, silver, and jewels; geographers place it variously in S. Arabia, in Mashonaland, in Ceylon, and on Malabar coast of India.

Ophiuroidea. See under ECHINODERMATA.

Ophthalmoscope, instrument specially constructed to aid in minute examination of the eye, and particularly its interior. It consists of a small mirror, pierced in its centre by a small circular perforation. Concave and convex lenses are used with it. Atropine, or some other pupil dilator, is often used before examination.

Opie, JOHN (1761–1807), Eng. painter; *b.* in Cornwall; went to London (1780), where his talent was immediately recognized. His *Assassination of Rizzio* (1787) secured his election to Royal Academy. Best examples of his works are *Mary Wollstonecraft Godwin, William Godwin,* and *William Siddons.*

Opisthobranchiata. See under GASTEROPODA.

Opium, dried, milky juice (*latex*) of unripe capsules of the white poppy—*Papaver somniferum.* It is produced chiefly in Asia Minor, India, and China. The opium poppy is cultivated from seed sown from Nov. to March, and successive crops are ready from May to July. The flowers are white or purplish; and a few days after the petals have fallen, when the capsules are about 1½ in. in diameter, they are cut round the middle with a knife, and left overnight for the juice to flow out and harden. After further drying on poppy leaves, the dark, plastic masses are made into lumps for sale.

Opium is bitter, and has a characteristic smell. Its properties depend upon the nineteen or twenty alkaloids it contains. The chief of these are: *Morphine* (9 per cent.); *narcotine* (5 per cent.); *papaverine* (0·8 per cent.); *thebaine* (0·4 per cent.); *codeine* or *methylmorphine* (0·3 per cent.); *narceine* (0·2 per cent.). Morphine, the most important alkaloid, is separated from the others by extracting the opium with hot water, and boiling the extract with milk of

lime. Alcoholic tincture of opium is known as *laudanum*. It contains about 0·75 per cent. of morphine.

Opium is used medicinally, mainly to relieve pain and to produce sleep, and for this purpose is best given hypodermically as morphine. It is also employed to relieve vomiting and to stop diarrhœa, to lessen distressing coughing, to stop bleeding in the stomach and intestines; while it is valuable in heart disease, diabetes, in cystitis and other inflammatory conditions, for hæmoptysis, and, as Dover's powder, to cause perspiration in, for instance, common cold. Externally the *linamentum opii* and fomentations sprinkled with laudanum are of value in relieving pain.

Opium is sometimes eaten; its stimulating effect is followed by depression, which produces craving for more. Most opium grown is used for smoking, the Chinese being specially addicted thereto. Nevertheless, they are overcoming the habit; public burnings of opium-pipes are taking place, and whole districts are being denuded of the poppy. Opium is very poisonous; one-eighth of a grain has proved fatal to an infant, and four grains to an adult.

A person addicted to opium eating or the morphine habit is usually pale, with dull eyes, suffering from nervous irritability, dyspepsia, and circulatory disturbances, with sometimes albuminuria or glycosuria (albumin or sugar in the urine). The treatment of the condition is to isolate the patient, gradually diminish the amount of opium or morphine, until in a fortnight the quantity has been reduced to nothing. Sudden cessation of the drug may cause serious nervous disturbances and collapse. Cure is usually effected at the end of a few weeks, but relapses are common.

The greatest amount of opium was produced by India, about 80,000 chests, each containing 1 Chin. picul (133⅓ lb.), being exported annually, nearly all to China, while about 5,000 chests were consumed annually in India itself, before 1907. In 1907, on the Chin. Government attempting to put down the use of opium, the Brit. Government offered to reduce the export of Ind. opium to China by one-tenth each year, so that in ten years the export to China would cease altogether, but only on condition that China should reduce her native production at the same time. In 1907 an agreement between Britain and China provided for the progressive reduction of importation from India, on condition that China should stop producing opium. In 1912 China failed to carry out the bargain; she increased the area of production and imposed duties on Ind. opium.

A conference of the Powers at the Hague, Jan. 1912, drew up a convention of twenty-five articles by which they agreed to control the supply of and gradually suppress the manufacture of opium. The export of opium from India to China has ceased since 1917. In 1917–18 exports on private account amounted to 4,264 chests (the lowest recorded). These went chiefly to Indo-China, Java, and Siam. On government account 8,274 chests were ex-

ported to U.K., Hong-Kong, and Straits Settlements.

Opon, tn., Cebu, Philippines (10° 19′ N., 123° 52′ E.); on Mactan I., opposite Cebu city; scene of death of Magellan (1421). Pop. 12,500.

Oporto, city, archiepisc. see, Entre-Douro-e-Minho, Portugal (41° 10′ N., 8° 38′ W.); prominent seaport and large commercial centre on Douro R.; centre of port wine trade; spinning and weaving of cotton, woollens, and silk; manufactures filigree work, hats, soap, tobacco, iron and steel goods, leather; distilling, sugar refining, tanning, shipbuilding. Notable features are cathedral (12th cent.), São Martinho (founded *c.* 560), São Francisco (15th cent.); Nossa Senhora da Serra do Pilar (Augustine convent, now barracks), São Pedro (Capuchin convent, now a public library, museum, and art academy); Ponte de Dom Luiz (iron bridge with single arch of 560 ft.); univ.; fine public parks. Originally *Portus Cale* before Roman conquest; taken by Visigoths (A.D. 540); in Moorish hands (716–1092); prominent through Port. history; taken by French (1809). Pop. 194,000.

Opossums. See under MARSUPIALS.

Oppeln, tn., Poland (50° 40′ N., 17° 56′ E.), on r. bk. of Oder; leather goods, cement, wood, and cattle exported; church of St. Adalbert (10th cent.); the 14th cent. castle of dukes of Silesia is now used as government building. Pop. 34,000.

Oppenheim, EDWARD PHILLIPS (1866–), Eng. novelist; has written a long series of novels which have enjoyed wide popularity, and which are marked by intricacy of plot and by natural and lifelike character-drawing; included in these are: *Mysterious Mr. Sabin, Master of Men, The Yellow Crayon, A Lost Leader, Mr. Wingrave, Millionaire; The Missioner, The Temptation of Tavernake, Mr. Grex of Monte Carlo, The Kingdom of the Blind, The Double Traitor, The Other Romilly,* and *Mr. Lessingham goes Home.*

Oppy, vil., dep. Pas-de-Calais, France (50° 23′ N., 2° 54′ E.), 7 m. N.E. of Arras; formed a strong point in the Ger. defences during the battle of Arras (April–May 1917); the British carried the wood in front of it after a bitter struggle; the village was taken and lost (May 3) as the result of a counter-attack by the Prussian Guards; finally occupied by the British (Sept. 1918).

Opsonic Index. See under BACTERIOLOGY.

Optical Projection, a method of producing on a screen a magnified illuminated image of a small transparent picture. The picture is usually a photographic positive on a glass 'slide,' which can be slipped into position in the path of a beam of light focused on the screen. The source of light is in the heart of the lantern, and may be either a lime light or an electric light. The rays are thrown through a powerful lens or system of lenses known as the condenser, and as they converge they are received by a second system of lenses, the relative positions of which may be altered to suit the distance and size of

the screen. When the slide is inserted between the condenser and the second system of lenses, an image of the transparent picture on the slide is projected on the screen. The image is sharply focused by adjustment of the lenses. In a good type of lantern the magnification of the image is within control, depending upon the relative positions of the source of light, the condenser, the slide, and the focusing system of lenses. The use of the lantern, not only as a means of rational entertainment (as in the early 'magic lantern'), but also as an important piece of educational equipment, has greatly grown within the last forty years. See MOVING PICTURES; also Wright's *Optical Projection* (1891).

Optic Nerve. See EYE.

Optics. See LIGHT.

Option, right to demand sale of ('call option') or right to sell ('put option') stock on a future day at price fixed on day of granting option. A *straddle* option is a 'put and call option' in the same stock.

Optophone, an instrument which enables the blind to read ordinary printed matter, invented by Dr. E. E. Fournier d'Albe and modified and developed by Messrs. Barr and Stroud, Ltd., of Glasgow. The attainment of the result depends on the well-known fact that the element selenium (in its grey crystalline form) varies in its electric conductivity according to the intensity of the light which falls upon it.

In the optophone five (or more) small spots of light—each spot pulsating at a rate corresponding to a musical note—are focused on the printed page, forming a vertical row of small dots of a height equal to the height of the letters to be read. The line of dots is caused to pass along the line of letters, and when a dot falls on black its light is largely absorbed, whereas when it falls on white paper its light is reflected. The reflected light is caused to fall upon a tablet, the surface of which is formed as a light-sensitive selenium bridge. The electrical conductivity of the selenium bridge varies with the pulsations of light that fall upon it, so that when the bridge is connected in series with a battery and a telephone a pulsating current passes in the circuit, and the telephone sings out the notes corresponding to the spots of light that fall on white paper.

Thus a 'white-sounding optophone' may be constructed, white paper being indicated by the chord composed of all the musical notes, while when any spot falls on a portion of a letter the corresponding note is silenced.

The instrument, as now constructed, is arranged for 'black-sounding,' a compensating or balancing system being provided which produces the result that the notes are heard in the telephone when the corresponding spots of light fall on black. Each letter is thus indicated in the telephone receiver by a characteristic motif (or tune) comprising a succession of single notes and chords. In this way printed letters are translated into a sound alphabet which can readily be learned.

To produce the pulsating spots

of light a straight filament electric lamp is so arranged, in conjunction with a reflecting prism and lenses, that an image of the filament is produced in a radial direction in the plane of a rotating disk. This disk is perforated with small holes arranged in five concentric circles near its edge, and is caused to revolve rapidly by means of a tiny magnetic electric motor driven by current from small secondary cells or from a lighting circuit. Thus five bright spots in line are produced, each spot pulsating at a rate depending on the number of perforations in the circle to which it corresponds and the speed of the motor. The light passing through the disk is focused on to the paper, producing the result above indicated. For example, as the line of light spots passes over the letter V, a descending followed by an ascending arpeggio will be sounded, while the letter capital T gives out the highest note of the series, followed by a chord of four notes, followed again by the high note.

In a comparatively short time the characteristic tune (or motif) for each letter—and later the longer motifs corresponding to syllables and words—can be learned, and a practised reader should be able to recognize words at least as easily as a telegraph operator interprets the succession of clicks in the Morse code.

Oran, fort. seapt., Algeria (35° 42′ N., 0° 35′ W.), on Mediterranean; bishop's see; Fr. military centre and naval station; contains grand mosque, R.C. cathedral, Château Neuf (1563), Château Vieux (citadel), Fort de la Moune, museum, etc.; taken by French (1831); chief exports are wool, cereals, wine, grain, esparto grass, cattle, sheep, hides, tomatoes, potatoes; taken by Spaniards from Moors (1509); flourished in 15th cent.; abandoned after severe earthquake (1792). Pop. 123,100.

Orang, or ORANG-UTAN (*Simia*), a genus of Simian apes (see under PRIMATES), found in forests of Sumatra and Borneo; vegetarian and arboreal; with brain most like that of man.

Orange, fruit of *Citrus aurantium*, a tree included in the Rutaceæ, to which the lemon and the lime also belong. Among sweet varieties may be mentioned the Jaffa and the Tangierine; the Seville, or bitter orange (*C. vulgaris*, or *C. Bigaradia*), is used for marmalade, and the bergamot orange (*C. Bergamia*) yields oil of bergamot, used in perfumery. Orange trees are very prolific, and bear glossy, evergreen foliage and masses of white, sweet-scented flowers, which yield oil of neroli on distillation. The orange is a native of Asia, probably of Chino-Jap. origin, and was first introduced into Mediterranean countries by the Portuguese, still prominent among its cultivators and exporters. Oranges for export, being collected whilst green, lack the delicate flavour which characterizes the naturally ripened fruit.

Orange. (1) Tn., Vaucluse, France (44° 8′ N., 4° 49′ E.), 13 m. N. of Avignon; numerous Roman remains; silks, textiles; cap. of independent principality (11th cent.); passed to house of Nassau (16th cent.); acquired

by France (1713). Pop. 11,000. (2) Tn., New South Wales, Australia (33° 15′ s., 149° 5′ E.); bracing climate makes it a sanatorium for consumptives; gold, copper, silver mines; breweries, tanneries. Pop. 7,600. (3) City, New Jersey, U.S. (40° 45′ N., 74° 11′ W.); manufactures electrical goods, hats, boxes. Pop. 29,600.

Orange, largest S. African riv.: rises in Drakensberg Mts., E. Basutoland; flows *c.* 1,300 m. in general westerly direction to the Atlantic (28° 37′ s., 16° 30′ E.); forms s. boundary of Orange Free State; receives Caledon and Vaal on r. bk.; navigation impeded by bar at mouth and rapids 20 m. farther up.

Orange, WILLIAM OF. See WILLIAM III.

Orange Free State, or ORANGE VRIJ STAAT, inland prov. of the Union of S. Africa (28° 35′ s., 27° E.), bounded N. and N.W. by Transvaal, W. and S. by Cape of Good Hope, E. by Basutoland and Natal. The surface is an immense plateau from 3,000 to 5,000 ft. above sea-level, generally flat with a few low ridges and numerous isolated hills, known as kopjes, not exceeding 7,000 or 8,000 ft. On the borders of Natal (S.E.) are the Drakensberg Mts., with part of Mont aux Sources (11,000 ft.), Platberg (8,000 ft.), Melanies Kop (7,500 ft.), Draken's Berg (5,682 ft.) in the Orange Free State. Rivers are few: Vaal (boundary between Transvaal and Orange Free State), Orange (boundary between Cape Province and Orange Free State), Modder, Caledon, Klip, etc.; none navigable; no lakes. Climate is very healthy, but dry and hot; ann. rainfall, *c.* 20 to 30 in. in northern provinces; average rainfall, *c.* 14 in. in W. and S.W., where droughts are common and severe; hottest in W., where temperatures of 105° F. are not unusual. Flora is scanty; the plains are generally covered with grass after rains, but for many months they are dry and barren; few trees (viz., willow, mimosa, acacia, euphorbia, gum, pepper-trees, aloe, etc.); large tracts of pasture and arable land, though only a small area is under cultivation (mainly N. and E.). Fauna includes hyena, lynx, baboon, monkey, ant-bear, wild-cat, jackal, springbok; numerous snakes, tarantulas, scorpions; destructive locust plagues. Principal products are wheat, maize, Kaffir-corn, fruit, tobacco; important stock rearing (sheep, cattle, horses, ostriches); coal mines in N.; diamond mine at Jagersfontein in W.; salt pans near Bloemfontein; chief exports are wool, skins, ostrich feathers, hides, mohair, mealies, wheat, meal, and dairy produce. Dairy farming is extending.

History.—Orange Free State was originally inhabited by Bushmen, Hottentots, and Bantu tribes. Boer settlements were made in 1824; 'Great Trek' by Boers from Cape Colony and agreement with Bantuang chief ceding country between Vet and Vaal Rivers to Boers (1836), and republic proclaimed with Piet Retief as first commandant-general; annexed by Great Britain (1848); became an independent Dutch republic (1854), with president (elected for five years), executive council, and Volksraad

(Parliament); enjoyed excellent government under distinguished president (Sir) John Brand (1864–88); warred with and defeated Moshesh (1867); 'Conquered Territory' acquired and boundaries fixed (1870); Kimberley diamond fields (discovered 1867) annexed by Britain (1871); compensation of £90,000 paid to Orange Free State Government; Reitz president (1889–96); Steyn president (1896–1900); having formed alliance with Transvaal, Orange Free State joined that republic in S. African War (1899–1902); annexed by Britain (1900), and made crown colony as Orange River Colony; responsible government granted (1907); joined Union of S. Africa (1909), its old title, 'Orange Free State,' being restored.

Government.—The province is divided into 24 districts; administered by administrator, provincial council (25 members elected for three years), and executive committee (four members); there are 39 municipalities. Principal towns are Bloemfontein (cap.), Kroonstadt, Heilbron, Ladybrand, Harrismith. Dutch Reformed Church predominates; majority of population is Dutch-speaking. Education is generally compulsory; both English and Dutch are taught to all children unless parents object. The province has over 800 government and government-aided schools; Grey Univ. Coll. (Bloemfontein). Railway mileage over 1,000. Area, 50,389 sq. m.; pop. 528,200 (including 181,700 whites). See South Africa.

Orangemen. After the battle of the Boyne the oppressed Irish Catholics began to form semi-revolutionary societies, and the Protestants formed in opposition the society known as the Loyal Orange Institution, the avowed objects of which are to support and defend the Prot. succession to the throne and the Prot. religion in Church and State, as settled by Bill of Rights and Act of Settlement of 1688. Though the society derives its name from William III. (of Orange), it was not definitely established in Ulster till 1795, but system is of earlier date. It is divided into lodges, which have extended to Great Britain and the colonies. Certain anniversaries—*e.g.*, July 1, that of the battle of the Boyne, and Nov. 5, that of William's landing at Torbay—are commemorated, and the public celebration of these has done much to keep alive sectarian animosities, leading not infrequently to riotous encounters. See Ireland.

Oratorio, a sacred musical composition of an extended nature, the words generally taken from Scripture. The term comes from the *Oratory* in which St. Philip Neri assembled his congregation to listen to tentative experiments of the kind. The first oratorios dealt almost exclusively with Christ's sufferings, and consisted chiefly of antiphonies and short choruses. Ital. composers, like Scarlatti and Carissimi, subsequently selected other Biblical subjects for treatment; but it was not until the master-mind of Handel operated on the form that oratorio assumed its highest power and interest. Handel's *Messiah* still remains

the most popular of all oratorios, the leader in a splendid series, which includes *Israel in Egypt*, *Samson*, and *Judas Maccabœus*. After Handel, as a master of oratorio, came Mendelssohn, whose *Elijah* and *St. Paul* occupy a front rank. Haydn's *Creation* stands in a manner by itself, the style being somewhat light and the text a hybrid re-cast of Scripture and *Paradise Lost*. Amongst well-known works more or less in the nature of oratorios and produced in the 19th cent. may be mentioned Beethoven's *Mount of Olives*, Spohr's *Last Judgment*, Gounod's *The Redemption* and *Mors et Vita*, and Elgar's *Dream of Gerontius*.

Patterson, *Story of Oratorio* (1902).

Orbit (Lat. *orbis*, 'a ring'), path followed by a celestial body in its revolution round (1) its primary or (2) a common centre of gravity. The paths traced by the planets and their satellites, in the solar system, are ellipses; one focus of the ellipse is occupied by the primary mass.

Orcagna, or ARCAGNUOLO ('archangel'), designations of Andrea di Cione (*c.* 1316 to *c.* 1376), Ital. painter, sculptor, and architect, of Florence; painted frescoes of Santa Maria Novella; was architect of Or San Michele, with its exquisite marble tabernacle; National Gallery, London, has his *Crowning of the Virgin*.

Orchard, a plantation of cultivated fruit trees. The soil should be deep and well drained, or if shallow it should be loosened as deeply as possible, trench ploughed, and well blended with manure by repeated harrowings. The best situation is a gentle slope towards the south; the worst aspect is a north-easterly one. Where necessary, shelter from strong winds should be given by means of a belt of trees. The fruit trees are best planted in straight lines. Of pyramid pears or apples (when the trees are thinned to 6 ft. apart in a few years) 4,840 trees per acre are required, the distance apart being 3 ft.; 2,722 plants per acre at 4 ft. apart are required for gooseberries and currants on poor soil; 1,742 at 5 ft. apart for the same on better land; 1,210 at 6 ft. apart for these or for pyramids which are to be permanent; 302 at 12 ft. apart for bush trees, pyramids, and nuts; 193 at 15 ft. apart for standard plums, damsons, or Kentish red cherries; 134 at 18 ft. apart for the same; 108 at 20 ft. apart for apples, pears, etc., as standards; 90 at 22 ft. apart for the same; 75 at 24 ft. apart for the same, or for the moderate growing cherries; 48 at 30 ft. apart for cherries where pastured underneath. Strawberries for market require, at 1 foot, 43,000 per acre; 1½ ft., 19,350; 2 ft., 11,000. In the foot planting, the alternate plants are ploughed up in the second and third years, leaving the plantation 2 ft. apart each way. If cherries are selected, the intermediate space may be filled with some of the early fruiting apples and pears as well as plums and damsons, which must be removed when the cherries require all the room. Cherries are best grown on grass land. Attention should be paid to the very differ-

ent rate at which trees progress, or some parts of the orchard will become crowded, while others will be too thin. If an entire apple or pear orchard is required, the rows should be alternated.

Orchardson, Sir William Quiller (1835–1910), Brit. genre and portrait painter; *b.* Edinburgh; settled in London (1863); R.A. (1877); knighted (1907); reticent yet with dramatic effects; *Napoleon on the Bellerophon, Her First Dance, Her Mother's Voice* (Tate Gallery); portraits: *Master Baby, Mrs. Orchardson, Sir Walter Gilbey,* etc.

Orchestra, a body of performers on musical instruments, where stringed instruments played with the bow constitute an essential feature of the combination. The use of orchestral accompaniment to dramatic music was begun in Italy and France about the beginning of the 17th cent., Monteverde of Mantua probably having most to do with its development. In his opera *Orfeo* (1608) he employed an orchestra of thirty-six instruments, consisting of harpsichords, violins, viols, lutes, guitars, organs of wood, trumpets, flutes, and other instruments. Orchestral music gradually developed into a separate branch of art, and has become perhaps the greatest of all forms of musical composition. Comparatively early, the violin became the leading instrument—a position which it has maintained—and subsequently all instruments of the viol class were discarded in favour of the violin, viola, violoncello, and double bass. This family of instruments constitutes what is termed the full-stringed band. The different kinds of instruments used in the modern orchestra and their numerical proportion to one another are determined partly by the size of the combination and partly by the nature of the works to be performed. An example of a well-arranged orchestra contains fourteen first violins, twelve second violins, ten violas, eight violoncellos, eight double-basses, one harp, three flutes, one piccolo, three oboes, one cor anglais, three clarinets, one bass clarinet, three bassoons, one contra fagotto, four horns, four trumpets and cornets, three trombones, one bass tuba, three kettledrums (tympani), one side drum, one bass drum, one triangle, and one pair of cymbals. The manner in which the tones of the different instruments are blended or contrasted in an orchestral composition is termed orchestration or instrumentation. Orchestral music, apart from its use in connection with works of a dramatic nature, received little attention till the beginning of the 18th cent. Amongst those most intimately associated with its development are Bach, Gluck, Haydn, Mozart, Beethoven, Schubert, Schumann, Mendelssohn, Berlioz, Wagner, Brahms, Tschaikowsky, Dvorák, and Richard Strauss.

Berlioz, *Traité d'Instrumentation* (1844; Eng. trans. 1856).

Orchha. (1) Native state, Bundelkhand, Central India; surface largely jungle covered; climate hot; rice, barley, pulses grown; coarse cotton cloth manufactured; iron smelted. Area, *c.* 2,080 sq. m.; pop. 321,600. (2) Tn., former cap. of above

(25° 21′ N., 78° 38′ E.); contains numerous magnificent buildings. Pop. 1,800.

Orchids (Orchidaceæ), family containing the most specialized of monocotyledonous plants; characterized by their herbaceous nature, entire and parallel-veined leaves, and irregular flowers with six petal-like segments, one of which forms a variously modified lip. Orchids occur all over the world, but are most common in tropical countries. In temperate regions generally terrestrial, thousands of tropical species are epiphytic, growing upon branches of jungle undergrowth and trees, without being parasitic. Almost all are specially modified for insect fertilization, most interesting being the arrangement of pollen in club-shaped pollen masses or pollinia, which become glued to the head of any insect seeking the flower's nectar, and are so borne to other flowers. Orchids are extensively cultivated for the variety and beauty of shape and colour; from several species of *Orchis* salep is prepared, and vanilla from unripe fruit of *Vanilla planifolia*.

White, *Book of Orchids* (1902); Darwin, *On the Various Contrivances by which British and Foreign Orchids are fertilized by Insects* (1862; new ed. 1904).

Orchil, another name for ARCHIL.

Orczy, THE BARONESS (MRS. MONTAGU BARSTOW), Eng. playwright and novelist; studied painting and exhibited at the Royal Academy; took up writing (1900), and won recognition with a series of detective stories known as *The Old Man in the Corner* (1905); *The Scarlet Pimpernel* (1905) had a great success and was dramatized, and is still being played. Other novels include *I Will Repay, Beau Brocade, The Elusive Pimpernel, Unto Cæsar, The Laughing Cavalier, A Sheaf of Bluebells,* and *The First Sir Percy* (1920).

Order in Council. An Order in Council is an order made by the king in Council, generally on the instigation of the executive officers of the crown. In recent years it has been the increasing practice in numerous Acts of Parliament to authorize the permanent departments by Order in Council to make rules under the Acts, so that the details of legislative action are entrusted to permanent officials, and not elaborated, as of old, by Parliament. Orders in Council are also issued authorizing treaties, regulating colonial government, and determining appeals heard in the Privy Council by its judicial committee (see PRIVY COUNCIL). Historically, Orders in Council were the weapons employed by the Brit. Government in their commercial warfare with Napoleon as a reply to his Berlin (1806) and Milan (1807) Decrees.

Orders, HOLY, the state of those who have entrusted to them the power of exercising certain functions in the Christian Church. Thus the Anglican Church recognizes three orders—bishops, priests, and deacons; the R.C. Church calls these (with the sub-deaconate) the *major orders;* the *minor orders* are acolytes, exorcists, readers, and doorkeepers, but these are

now only preliminaries to the priesthood. The Eastern Churches have the same major orders, but only readers besides; the Armenian hierarchy is the same as the Roman. There has been much controversy between Roman and Anglican theologians as to the validity of Anglican orders; in the bull *Apostolicæ Curæ* of 1896 Leo XIII. declared them to be invalid. In the Gr. Church, however, Anglican orders are recognized.

The early history of orders in the Christian Church is much disputed. Some deny the Catholic claim that the threefold ministry existed from the beginning. Presbyterians defend their Church government on historic grounds. It is probable that at first (*e.g.*, in the N.T.) bishops and presbyters were not differentiated. In the early 2nd cent. the monarchical episcopate was evolved. See BISHOP.

Gore, *Church and Ministry, Orders and Unity;* Lindsay, *Church and Ministry in Early Centuries.*

Orders of Knighthood. See KNIGHTHOOD.

Ordinaries. See HERALDRY.

Ordnance. Formerly a term for artillery (and earlier still for firearms and military armaments generally), the word ordnance is now almost out of use in this sense. We no longer speak of big guns as 'pieces of ordnance.' But from its earlier use the word survives in the title of the 'Master-General of the Ordnance,' the 'Army Ordnance Department,' 'Army Ordnance Corps,' and the 'Ordnance Survey.'

The master-general of the ordnance was one of the officers of state from the time of our Tudor sovereigns. He had his office in the Minories in the eastern part of the City of London, where his storehouse was installed in a suppressed Franciscan friary, and further room for his stores was found in the Tower. He was the keeper of the king's artillery and reserves of firearms and ammunition. As he was responsible for the purchase of such arms and stores his office was a profitable one, usually held by a noble or titled courtier, who employed clerks and mechanics to do the actual business. The master-general of the ordnance is now an officer of the headquarters staff of the army, usually of general's rank. Under him are the director of artillery, the director of fortifications and works, and the director of barrack construction. Normally he has charge of armaments, provision and inspection of arms and ammunition, the ordnance factories and arsenals, fortifications, barrack construction and maintenance, technical committees on material, inventions, contracts for these services, and the administration of the funds voted by Parliament for them. During the Great War many of these services were turned over to the Ministry of Munitions established to deal with providing artillery, shells, etc., for the huge armies raised to meet the emergency.

Under another officer of the headquarters staff, the quartermaster-general, there is a 'director of equipment and ord-

nance stores' who has under him the Army Ordnance Department, charged with the custody and distribution of all kinds of munitions and stores for the army in peace and war, with the exception of food, fuel, and forage, which are provided by the Royal Army Service Corps, and medical and veterinary stores, which are under the charge of the Royal Army Medical Corps and the Royal Veterinary Corps. The practical work of the dep. is carried out by a staff of inspectors, by the Army Ordnance Corps, and by civilian employees—storekeepers, foremen, labourers, etc., at the various stores and depots. In peace time the Army Ordnance Corps is in charge of the mobilization stores, which are kept distinct from the stores held for current use. In the field in war time companies of the corps are employed on the lines of communication, and at the base and railheads, acting under the director of ordnance services. A company on the line of communications has the establishment of two officers, 25 warrant officers and sergeants, and 140 rank and file. During a campaign a depot of the corps is like a general shop for the army, kept well stocked to supply an endless variety of necessaries, arms, clothing, equipment, tools, barbed wire, cooking utensils, stationery, printed forms, books—in fact, anything and everything that may be needed within the wide limits of its work.

Ordnance Survey. The Ordnance Survey is now under the Board of Agriculture; but inasmuch as the work was originated by officers of the Royal Engineers under the Board of Ordnance, and is still carried on by officers and men of that corps, it remains a semi-military institution. The survey was begun, for military purposes, in 1747; but it was not until 1783 that the great base was measured and the trigonometrical survey commenced. When the Board of Ordnance was abolished in 1855, the direction of the work was placed under the War Office. In 1870 it was transferred to the Board of Works, and finally, in 1890, to the Board of Agriculture and Fisheries.

The original map of Great Britain, ordered in 1797, was pub. on a scale of 1 in. to the mile. The survey of Ireland, on a scale of 6 in. to the mile, was ordered in 1824. In 1840 the survey of Scotland and of the six northern counties of England was begun on the same scale. In 1855 the surveys were ordered to be on the following scales: $\frac{1}{63360}$ (or 1 in. to the mile), $\frac{1}{10560}$ (or 6 in. to the mile) for the whole U.K.; $\frac{1}{2500}$ (or 25·344 in. to the mile) for all cultivated districts; $\frac{1}{500}$ (or 126·72 in. to the mile) for all towns of over 4,000 inhabitants. There are also surveys of the U.K. on scales of 2, 4, and 10 m. to the inch. See White's *The Ordnance Survey of the United Kingdom* (1886).

The dep. has also the duty of preparing maps for all military purposes, and of copying those prepared by the intelligence division of the War Office. During the Great War it issued 32,872,000 maps, plans, and diagrams to the Army and Navy.

Ordovician System, group of strata occurring between the Cambrian and the Silurian formations; well developed in region formerly inhabited by Ordovices (Celtic tribe in Wales); hence name suggested by Lapworth (1879); Murchison called the group Lower Silurian; consists of all types of sedimentary rocks, as sandstones, slates, and quartzites, or metamorphic rocks; are divided as follows: Caradoc or Bala series; Llandeilo beds; Arenig beds; contain numerous fossil remains, including molluscs, plants, fish, and insects. The Ordovician period was one of great volcanic activity.

Ore, substance taken from the earth's crust, containing minerals from which on a large scale metals may be obtained with profit. Gangue, vein-stuff, or matrix is the extraneous earthy matter associated with the ore —*e.g.*, quartz. The ore may contain native metal or metal combined with sulphur, oxygen, etc.

Before smelting, the ore undergoes preliminary dressing operations consisting of coarse and fine crushing, breaking up the ore and waste, and so enabling its concentration by screening, sorting, and washing out the waste. The recent introduction of magnetic separators and flotation methods of concentration is a notable advance. Reciprocating or gyrating rock breakers break down blocks of 1½ yds. cube to about 9 inches; high-speed crushing rolls are advantageous when it is desired to obtain a granular product; and stamp mills, which are simply mechanically worked pestles weighing up to 10 cwt. apiece, crush to meshes varying from $\frac{1}{60}$ to $\frac{1}{40}$ of an inch. For finer crushing, ball mills are used, and the finest grinding is accomplished by tube mills originally devised for grinding cement.

By means of strong electromagnets ores may be concentrated by extracting minerals containing iron, tungsten, etc. Low grade ores can be concentrated to repay smelting by means of flotation; from a 2–3 per cent. ore concentrates up to 20 per cent. can be produced. The ore is crushed to fine powder with water, to which are added small traces of amyl alcohol, cresol, or other suitable liquid which renders the water capable of frothing, and finally blowing air through the mass. The ore is found concentrated in the froth, while the finely divided quartz, etc., remains suspended in the liquid or sinks to the bottom.

Orebro. (1) Prov., Central Sweden. Area, 3,500 sq. m.; pop. 207,000. (2) Tn., cap. of above (59° 17′ N., 15° 13′ E.); trade in iron-mining products and timber; machine shops, chemical works, match factories; here Lutheranism established as state religion (1529). Pop. 30,000.

Oregon, N.W. state, U.S. (44° N., 120° W.); bounded N. by Washington, W. by Pacific Ocean, S. by Nevada and California, and E. by Idaho; length from N. to S., 375 m.; breadth, 290 m.; area of land surface, 96,699 sq. m.; area of water surface, 1,092 sq. m.; coast-line, c. 300 m., steep and rocky with numerous indentations.

Oregon is traversed by volcanic

and snow-capped mountains—Cascade Mts. running parallel with coast, with highest peaks, Mt. Hood (11,225 ft.), Mt. Jefferson (10,200 ft.), Pitt (9,750 ft.), Diamond Peak (8,807 ft.); Steens Mts. in S.E. (9,000 ft.); Blue Mts. in E., with average elevation *c.* 6,000 ft.; undulating tableland running eastward, broken by several mountain ranges; extensive plains and large valleys with fine arable and pasture land. Principal rivers are Columbia, Snake, Deschutes, Willamette, Rogue; numerous lakes in S.—viz., Malheur, Harney, Summer, Goose, Warner, Klamath, etc. Climate is varied; mild on coast with heavy rainfall in winter; dry and hot E. of Cascade Mts., with severe winters; irrigation necessary in some parts. Numerous aquatic birds; abundant marine fauna. Extensive forests, especially in W. and mountain regions; chief trees are pine, fir, spruce; also hemlock, cedar, maple, ash, aspen, oak, and others. Principal products are wheat, hay, hops, sugar-beet, potatoes, fruits, timber, live stock, wool, dairy produce: gold, silver, copper, coal are mined; lead, gypsum, quicksilver, nickel, opals found. Chief industries are lumbering, flour milling, fish canning, paper making, printing, publishing, slaughtering and packing, machinery; valuable fisheries (salmon, trout, herring, oyster, halibut, cod, etc.).

Spain ceded territory north of 42° to U.S. (1819); Astoria founded by John Jacob Astor (1811); several trading posts established by North-Western Fur Co. and Amer. Fur Co.; Ind. mission founded (1834); serious boundary disputes between Great Britain and America, which were finally settled (1846), boundary being fixed at 49° N. lat. Oregon became a state in 1859, and was admitted into the Union.

Oregon has a governor, senate (30 members, elected for four years), and house of representatives (60 members, elected for two years); the state has two senators and three representatives in Congress, and is divided into 36 counties. Principal towns are Portland, Astoria, Salem (cap.), Eugene. Elementary education is compulsory; there are Oregon Univ. at Eugene, State Agricultural College, and other colleges. Total railway mileage exceeds 3,600. Pop. *c.* 888,200.

Lyman, *History of Oregon* (1903); Clark, *Pioneer Days in Oregon History* (2 vols. 1905).

Orel, or ORLOV. (1) Government, Central Russia; cap. Orel; surface undulating and well cultivated; principal rivers, Don, Oka, and Desna, with their tributaries; agriculture chief occupation; horses and cattle are reared; its manufactures include machinery, wagons, leather, and glass; tobacco, oil, hemp produced. Area, *c.* 18,000 sq. m.; pop. 2,816,200. (2) Tn., cap. of above (52° 55′ N., 36° 7′ E.); produces candles, ropes, oil, flour; distilleries, breweries, tobacco factories; founded at end of 16th cent.; sacked several times in 17th cent. Pop. 97,200.

O'Rell, MAX. See MAX O'RELL.

Orenburg. (1) Government, Tatar Bashkir Republic, E. Russia; contains 500 sq. m. of lakes; steppe land in E.; agriculture important; 'black earth' near Urals is very fertile; stock raising; coal, salt deposits, copper, gold, iron, and argentiferous lead found. Area, 73,255 sq. m.; pop. 2,272,000. (2) Tn., cap. of above (51° 48′ N., 55° 12′ E.); trade centre; textiles, metallic goods, sugar are chief articles of commerce; contains military schools and arsenal; Orenburg–Tashkent strategic railway completed in 1905. Pop. 146,800.

Orense. (1) Prov., N.W. Spain; very mountainous; well watered by Minho R.; climate humid; rich pasture feeds black cattle and other stock. Area, 2,694 sq. m.; pop. 406,600. (2) Tn., cap. of above (42° 19′ N., 7° 50′ W.), on Minho R.; famous anc. bridge; Gothic cathedral; manufactures flour, leather, iron, chocolate; hot springs known to Romans. Pop. 16,000.

Orford, fishing vil. and par., E. Suffolk, England (52° 6′ N., 1° 32′ E.); has oyster and other fisheries. Its former importance has been ruined by encroachments of the sea. Pop. 850.

Orford (Robert Walpole), Earl of (1676–1745), Brit. statesman; son of a Whig country gentleman of Houghton, Norfolk; member of Parliament for Castle Rising (1701); sat for King's Lynn (1702–42); Tories seized a pretext for imprisoning him (1712); Townshend married his sister Dorothy (1713), and Walpole became first lord of Treasury and chancellor of Exchequer (1715); on collapse of South Sea Co. was called to power (1721), and retained it for twenty-one years. One of the greatest Brit. statesmen; sought to bring the court and the House of Commons into working alliance, to unite the nation under the new dynasty by keeping as free as possible from foreign alliances, and to make the nation prosperous, and may be said to have succeeded in these aims; at the same time he was a man of coarse moral fibre, gross pleasures, and no intellectual tastes, who undoubtedly gave a low tone to politics and did not hesitate to stoop to corruption to secure party successes.

Morley, *Life.*

Organ, musical instrument found in most churches and large concert halls. Its history has been described as 'nothing more than a narrative of the efforts made by men to bring under the control of one performer a large number of the instruments called flutes' (Stainer). The particular sort of pipe or flute, the use of which led eventually to the construction of an organ, was the *flûte-à-bec* or beak-flute—that is, a pipe with a mouthpiece, which was placed against the lips to receive the breath of the player. The first step in organ building was to set several flutes on end over a box of wind supplied by bellows. The contrivance known as *Pan's Pipes,* a graduated series of open pipes fixed together, may have furnished the idea for this. What the earliest organs were like we have no means of determining, for descriptions are meagre and indefinite, and there are no sur-

vivals. The instruments mentioned by many of the Latin authors (notably Tertullian) must have been of a rudely primitive kind, if for no other reason than that as yet there was no keyboard. Even when this was invented, in the 6th or 7th cent., the keys were so large and clumsy that they had to be struck with the clenched fist. As late as the 12th cent. the compass did not exceed two octaves, usually without semitones. An organ set up in Winchester Cathedral in 951 was the largest then known, having twenty-six pairs of bellows operated by seventy men. This instrument had ten keys, with forty pipes to each key. Gradually the keys approximated more to the modern form, though for long the sharps were white and the naturals black, the reverse of the present colours. Early in the 15th cent. the important addition of *Pedals* or keys for the feet was made. This now essential feature of the organ progressed quickly in Germany, where it originated, but was slow in reaching England. Another important invention was the *Swell*, the enclosing of a complete department in a box, the front of which is constructed on the Venetian-blind principle, so that the sound 'swells' out or diminishes under the control of a foot-pedal. The swell was first applied by Abraham Jordan to a London church organ in 1712.

No verbal description can possibly convey a clear idea of the construction and working of a large and complicated instrument like the modern organ. For this the technical handbooks must be consulted; or, better still, an organ should be seen in process of building. Broadly speaking, there are three main departments: (1) the pipe-work; (2) the mechanism by which the player is enabled to produce and control the sound from the keys; and (3) the mechanism for blowing. As regards the pipes, these are of two chief divisions—metal pipes and wood pipes. Every 'speaking' *stop* has its separate set of pipes, running usually throughout the entire compass of keyboard or pedalboard. These sets are controlled by the familiar handles to the right and left of the player; so that when the player draws, say, a stop marked 'Flute,' he is operating on a series of pipes constructed to produce a flute quality of tone. Every stop has its individual tone character. Further, some stops are of unison pitch (8-ft. stops), some an octave lower, some an octave and some two octaves higher. In the pedal, the foundation pitch is an octave lower than that of the manual. The longest organ pipes made are 32 ft., the shortest half an inch or less. In most cases an organ has at least two manual keyboards besides pedal. The lower manual is then called the 'Great,' the upper the 'Swell.' In a three-manual instrument the lower is the 'Choir.' Concert and cathedral organs have often four or five manuals, the additions representing so-called 'Solo' and 'Echo' organs. All these can be played separately, or combined by coupling actions. In recent years electric action applied to organs has secured many advan-

tages, notably that of a shifting console. Blowing is also now frequently done by electric motor. For *American Organ*, see under HARMONIUM.

Hopkins and Rimbault, *The Organ and its Construction.*

Organic Chemistry. See under CHEMISTRY.

Oriente. (1) Formerly *Santiago de Cuba*, E. prov. Cuba (20° N., 75° 50′ W.); mountainous, with fertile valleys and plains; sugar, tobacco, coffee, cocoa, bananas produced; copper, iron, manganese, mercury, petroleum, marble, slate found. Area, 12,468 sq. m.; pop. 461,400. (2) E. prov., Ecuador, S. America (2° s., 77° W.); contains large stretch of country in Amazon valley; hilly, well wooded; fertile agricultural districts; sparsely settled. Pop. *c.* 80,000.

Origen (A.D. 185–254), Christian theologian, and most voluminous writer of the early Christian Church; *b.* Alexandria; studied in the catechetical school, a leading seat of theological speculation; became head of the school (203). He devoted himself diligently to the study of philosophy and Scripture; spent most of his time in Alexandria till 231, though he journeyed in Syria and elsewhere; ordained priest in 230, but a dispute arose, and he was deprived of his order. The remainder of his life he spent mostly in Palestine. Of his very numerous writings, only a few have come down to us. His *Hexapla*, or editions of the Gr. versions of the O.T., is preserved in part. Origen wrote commentaries on the Scriptures, but as he adopted 'allegorical' method of interpretation, much of what he wrote is not now valuable. His main apologetic work is that against Celsus. His theology is intricate, many sided, and contradictory.

Swete, *Patristic Study;* Harnack, *History of Dogma;* Bethune-Baker, *Introduction to History of Christian Doctrine;* Farrar, *Lives of the Fathers.*

Orihuela, city, episc. see, Alicante, Spain (38° 6′ N., 0° 56′ W.); anc. bishopric and former seat of univ.; in plain of great fertility; leather, silk, and other textile industries; trade in wine, cereals, fruit, oil; remains of Moorish stronghold. Pop. 30,000.

Orinoco, riv., N. of S. America, rises in Sierra Parima (9° 34′ N., 61° 40′ W.), and flows through Venezuela into Atlantic Ocean; over 1,500 m. long; flows through densely wooded and hilly region, and forms delta *c.* 120 m. from sea; principal tributaries, Apure, Meta, Guaviare, Ventuari, Caura, and Caroni; chief port, Bolivar. The Cassiquiare, which leaves the Orinoco in 3° 10′ N., 66° 20′ W., establishes water communication between the systems of the Orinoco and the Amazon. The Orinoco was explored first by Ordaz (1531). As hundreds of miles of the Orinoco and its tributaries are navigable, the river and its affluents are of great commercial importance.

Orioles (Oriolidæ), an Old World family of passerine birds, with brilliant yellow plumage. The golden oriole (*Oriolus galbula*) breeds rarely in England.

Orion. (1) In class. myth., a great hunter who presumed to

love the goddess Artemis, for which audacity she slew him; afterwards he was placed among the stars. (2) In astron., a constellation known to the ancients: it contains stars of the first, second, and lesser magnitudes, and is popularly recognized by its three collinear stars forming the 'belt of Orion.'

Orissa, former kingdom, India (20° 30′ N., 86° 20′ E.); was great centre of Buddhism, afterwards of Hinduism; now a div. of Bihar and Orissa, S.W. Bengal; low fertile plain traversed by Mahanadi, Brahmani, and Baitorani, backed by forest-clad hills. Total area, 13,770 sq. m.; pop. 5,131,800. Brit. div. of Orissa comprises districts of Puri, Cuttack, Sambolpur, and Balasor, with Angul. Orissa has twenty-four tributary states, occupying hills towards Central Provinces. Area, 28,050 sq. m.; pop. 3,200,000. A costly system of irrigation canals (*Orissa Canals*) has done much to mitigate havoc and distress wrought by famine and inundation.

Orizaba. (1) Tn., Vera Cruz, Mexico (18° 51′ N., 97° 5′ W.); produces coffee, cotton, sugar, flour, tobacco; first locality visited by Cortez; headquarters of Fr. army (1862). Pop. 32,900. (2) PEAK OF, dormant volcanic mountain, between Puebla and Vera Cruz, Mexico (19° N., 97° 20′ W.); most lofty summit in Mexico (*c.* 18,200 ft.).

Orkney Islands, group of islands and islets off E. part of N. coast of Scotland (59° N., 3° W.), forming county by themselves; separated from mainland by Pentland Firth; comprise twenty-nine inhabited islands, thirty-nine smaller islands (useful for grazing purposes), and large number of rocky islets or *skerries*; principal island, Pomona or Mainland, containing more than half population. Coast-line is irregular, with deep bays; navigation rendered difficult by rapid currents; surface of islands low except in Hoy. Islands contain numerous lakes, principal being Stenness and Harray, in Pomona. Only towns are Kirkwall and Stromness, on Pomona. Antiquities, which are numerous and interesting, include cairns, brochs, stone circles (standing stones of Stennis), Picts' houses, castles, and churches. Original inhabitants believed to have been Picts; subdued by Harold Haarfager in 875, and continued under Norse rule till 1231; pledged to Scot. crown (1468). Agriculture and fishing are leading industries. Area, 376 sq. m.; pop. 25,900.

Orlando, VITTORIO EMANUELE (1860–), Ital. statesman and jurist; *b.* Sicily; prof. of constitutional law at Palermo; was for many years attached to ministry of Giolitti. In 1916 he became minister of the interior in Boselli's cabinet, in which office he was severely criticized for leniency towards the neutralist and pacifist agitators, but perceiving danger of the movement, he changed his policy. Succeeded Boselli as prime minister (1917), and proved a tower of strength at time of Cadorna's disastrous defeat at Caporetto, by stiffening the national resistance, and in a series of patriotic speeches sustained the nation in the face of danger. In the Inter-Allied

Peace Conference in Paris (1919) he was one of the 'Big Four,' on whose decisions all matters of supreme importance were final. His inability to settle the Fiume question at Paris brought about the fall of his ministry (June 1919). He became ambassador to Brazil (Oct. 1920).

Orleans, city, cap. Loiret, France (47° 54′ N., 1° 55′ E.), on riv. Loire; commercial centre; manufactures include blankets, cottons, machinery, agricultural implements, tobacco, preserved vegetables; trade in wine, grain, wool, oil, live stock; with fine cathedral, Ste. Croix (13th cent. onwards), St. Aignan, St. Euverte, St. Pierre-le-Puellier (10th cent. onwards); Hôtel-de-Ville (1530), with picture and sculpture gallery, and natural history museum; palais de justice; episc. palace; Hotel-Dieu (hospital); houses of Joan of Arc (Maid of Orleans), Agnes Sorel, and Diane of Poitiers; equestrian statue of Joan of Arc. The Celtic *Genabum* destroyed by Cæsar, Orleans was renamed *Civitas Aureliani* by the Romans (A.D. 272); besieged by Attila (451); sacked by Northmen (855, 865); dukedom of Orleans held by Fr. royal family, 14th cent. onwards; siege of English raised by Joan of Arc (1429); a stronghold of Protestantism in 14th cent.; taken by Germans in Franco-German War (1870), and retained until end of war. Pop. 72,100.

Orleans, LOUIS PHILIPPE ROBERT, DUKE OF (1869–), head of Fr. Orleanists; went to France at Bourbon recall (1871); exiled with his father, the Comte de Paris (1886); served in Brit. regiment in India (1888); arrested on return to France (1890), but allowed to depart.

Ormerod, ELEANOR ANNE (1828–1901), Eng. entomologist; consultant to Royal Agricultural Soc. (1882–92); pub. *Textbook of Agricultural Entomology* (1892).

Ormesby, par. and vil., N. Riding, Yorkshire, England (54° 33′ N., 1° 13′ W.); pop. 14,600.

Orme's Head, GREAT, headland, Carnarvonshire, Wales (53° 20′ N., 3° 52′ W.); immediately N.W. of Llandudno. To the E. is a smaller promontory known as Little Orme's Head.

Ormiston, vil. and par., Haddingtonshire, Scotland (55° 55′ N., 2° 54′ W.), 3 m. S.S.E. of Tranent; coal mines. Pop. 1,600.

Ormond, vil., winter resort, Florida, U.S. (29° 15′ N., 81° 7′ W.); broad ocean beach (30 m. long) is favourite course for motor races; oranges, grape-fruit grown. Pop. 800.

Ormskirk, mrkt. tn., Lancashire, England (53° 34′ N., 2° 55′ W.); ironfounding, brewing, rope-making; royalists defeated in vicinity (1644). Pop. 7,400.

Ormuz. See HORMUZ.

Ormuzd. See under AHRIMAN; PARSEES.

Orne, dep., N.W. France (48° 40′ N., 0°); formed of part of Normandy, Alençon, and Perche; large forests in W.; chief river, Orne; cap. Alençon; wheat, oats, barley cultivated; apples for cider extensively grown; its horses are famous; manufactures ironware, lace, linen; iron mines, mineral springs. Area, 2,371 sq. m.; pop. 307,400.

Ornes, vil., Meuse, France (49° 14′ N., 5° 31′ E.), 8 m. N.E.

of Verdun; formed the pivot of the Fr. defence at the beginning of the battle of Verdun (Feb. 24, 1916); in woods behind the Twins of Ornes, two heights N.E. of the vil., the Germans had concentrated a great mass of artillery, and after the French had been driven back, these heights afforded the attackers a wide view of the battlefield, which the Kaiser personally came to inspect. See VERDUN, BATTLE OF.

Ornithodelphia. See MAMMALS.

Ornithodorus. See MITES.

Ornithology (Gr. *ornis*, 'a bird'; *logos*, 'science'), the branch of zoology which deals with birds and bird life. It is concerned with one of the most familiar and largest of vertebrate classes, remarkable for the diversity and unified perfection of its organs, and containing more than 12,000 species.

Birds are feathered creatures —a sure guide to their identity, for no bird is without *feathers*, and no other creature possesses them. To birds the feathers are of the utmost importance, for not only do they form a light coat suitable for a creature which has conquered the air, but their conservation of warmth enables the body to be kept at the uniformly high temperature (sometimes as much as 112° F.) which is an index of a bird's extraordinary metabolism and activity. So they have helped in the conquering of climate, for wherever food is to be found, there birds occur irrespective of cold, from Arctic to Antarctic. Feathers, however, are not uniformly sprinkled over the body, but, with a few exceptions, are confined to definite feather tracts, or *pterylia*, which differ in position in different birds. In the feathers reside the distinctive colours, and these may be due to fine striations which disperse the light rays giving metallic colours, or to deposition of actual pigment, which is sometimes so soluble that, in the Turacos for example, it washes out when the birds bathe.

Birds are, again, predominantly flying creatures, only a few, such as the extinct great auk, the burrowing parrot (*Stringops*), the penguins, and the running birds, having almost or altogether lost the power of flight. And with this habit many of the peculiarities of bird structure are associated (see FLIGHT). The wings are moved by exceedingly strong breast muscles attached at the lower end to a ridge, the keel, on the front of the breastbone or sternum. As a rule, the stronger the muscles and the flight of a bird the larger the keel, which is altogether absent from the flightless running birds.

Apart from those directly concerned with flight, a few other bird characteristics may be mentioned. Many are skeletal: thus the lower jaw is composed of several bones, and unites with the skull through a quadrate bone; the skull itself is articulated with the skeletal axis through a single condyl; the surfaces of the vertebræ are saddle-shaped, concave from side to side, convex up and down; and the vertebral column ends in a set of fused vertebræ forming the ploughshare bone or pygostyle, which supports the

tail feathers. A few bodily peculiarities are the absence of sweat glands in the skin, the only skin gland being the oil or preen gland on the rump; the frequent presence of crop, gizzard, and compound vent or cloaca; the four-chambered heart, with only a right aortic arch; and the presence of a song-box or syrinx with vocal cords at the lower end of the bronchial tubes.

Of the *life activities* of birds many deserve mention. *Moulting* of mammals is represented in birds by a more perfect autumnal moult, when the plumage is completely renewed, and often assumes a striking variation of colour: thus the speckled ptarmigan of spring becomes grey in autumn and snow-white in winter. A spring moult also takes place, but it is less complete, although it furnishes the breeding garb, and is particularly characterized by the changes of design and colour which accompany it. The wooing of birds is of a nature peculiar to themselves, for no other creature, unless it be man himself, makes so much 'business' of the preliminaries. The antics, stately exhibitions, scrapings, and curtseyings of the males in some species, and the coyness of the females, have a distinct suggestion of love-dazed humanity. Chiefly associated with the courting season is the wonderful power of *song*, best developed at this time in the males. But apart from exquisite emotional expression given to comparatively few in perfection, birds also have warning calls, food calls, and so on, recognized by their kind. Associated also with the breeding season is the *nest-building* habit. See NEST.

The *food* of birds and their feeding habits are of great interest, especially as these are generally correlated with adapted structures in beak, claws, and food tract. Many species confine themselves to a diet of grain and seeds, and these, such as the finches, have short stout beaks with splitting edges, large storing crops, and grinding gizzards; but the latter structures are small and the beak slender in such as feed on worms, insects, and the like. An almost abnormal food habit is exhibited by the honey-sipping humming-birds. In such tree-inhabiting species the feet are formed on the same plan, the toes being long, supple, and separate, suited for clinging to branches, and armed with moderate claws. In the birds of prey the claws become hooked talons and the beak curved and strong—fit structures to grasp and tear active living prey such as birds and mammals. Of birds which find their food on the seashore or in streams, the majority have long, unfeathered wading legs and swimming feet. But the latter may be completely webbed to the tip of the toes (as in ducks), half-webbed (as in the avocet), or having separate toes margined with a simple or lobed membrane (grebe and coot). The aquatic birds also present the greatest variety of beak structure, each type adapted to a special requirement. The avocet, curlew, and many others, which pick dainties from deep in mud, have extremely long, slender bills;

the spoonbill dabbles in mud with its curious beak for insects, larvæ, molluscs, and worms; ducks for the same end sift the same material through the plates bordering their bills; fish-eating birds have beaks curved at the tip to retain their slippery prey; the pelican stores its catch in a large dilatable sac attached to its lower jaw. In all such birds the mechanical gizzard and crop are reduced in favour of purely digestive apparatus.

The *development* of birds—from egg, through chick, to adult—is familiar, but two great divergences may be mentioned. Some young are hatched equipped for an immediate start in life—*e.g.*, the young of the farmyard fowl, such being known as *Præcoces;* while the majority leave the egg naked and blind, and have to be fed until they can use their own wings—*e.g.*, the blackbird, robin, etc., these being known as *Altrices.* The young are covered with moderately simple down feathers, and often pass through several stages of plumage before the adult coloration is attained. It is a curious and unique fact that two distinct down stages, a white and a dusky brown, occur in a species of penguin.

Birds as a class enter greatly into human economy. They are amongst the comparatively few creatures which man has been able to *domesticate:* their flesh is eaten, their eggs form an invaluable source of nourishment, the nests of the Eastern edible swifts are made into soup, the oil-bird of America furnishes oil and 'butter.' Apart from their food value they have been put to little direct use by man, but trained pelicans catch fish for their Chinese owners. Many species are the objects of sport, as the game birds, or the agents of sport, as the hawking falcons; the plumage of others is esteemed by some as ornament; and the agelong accumulations of the food-refuse and excrement of seabirds form the invaluable GUANO deposits of a few tropical islands. But the most beneficent work of birds towards man is indirect; for, although some destroy fruit and grain, these depredations are more than overbalanced by the unsparing war waged by birds upon destructive insects, insect larvæ, and vermin.

Birds fall into two sub-classes: I. Archæornithes—Extinct Birds, such as the tailed *Archæopteryx.*

Sub-class II. Neornithes—including the divisions of (1) Ratitæ or Running Birds; (2) the extinct Toothed Birds or Odontornithes; and (3) the Keeled Birds or Carinatæ, which include almost all living forms. The latter were once conveniently, if roughly, divided by their predominant habits into Swimmers (*Natatores*), Waders (*Grallatores*), Gallinaceous Birds or Scratchers (*Rasores*), Birds of Prey (*Raptores*), Climbers (*Scansores*), and Perchers (*Insessores*), the last two groups in part containing the Picarian Birds, characterized by their habits of building nests and laying white eggs at the bottom of excavations in trees, stems, or in the ground. Present classifications group existing Carinate Birds in about thirty more or less distinct orders, separated

into four divisions according to the minute arrangement of the palatal bones of the skull.

Lea, *The Romance of Bird Life* (1909); Pycraft, *History of Birds* (1910); Coward, *Migration of Birds* (1912); Hartert and others, *A Hand-List of British Birds* (1914).

Ornithophily. See under POLLINATION.

Ornithorhynchus, DUCKMOLE, DUCKBILL, or PLATYPUS, one of the Monotremes—a primitive mammal found in the rivers of Australia and Tasmania, in the banks of which it burrows. It has many peculiar characters; is an active swimmer, with webbed and clawed feet, and jaws flattened like a duck's bill, with which it grubs in mud for worms, crustacea, aquatic insects, and such-like. Two eggs are laid at a time. This egg-laying determines it as belonging to the Monotreme sub-class of mammals.

Orontes, riv., N. Syria; rises in Anti-Libanus; flows N. to Antioch, then W.S.W. to enter Mediterranean (36° 4′ N., 36° E.); lower course is very beautiful. Length, 250 m.

Orpheus (class. myth.), Gr. hero; son of Apollo and Calliope (according to principal legend); *b.* Thrace; journeyed with Argonauts, and by his lyre, given by Apollo, delivered companions from dangers; able to charm animate and inanimate objects with his music. On death of his wife Eurydice, Orpheus descended to Hades to rescue her, but lost her by disobeying orders and looking back to see if she was following him. There are diverse legends concerning his death; killed by Zeus, or torn in pieces by Mænads, women of Thrace. The myth was probably woven round the person of some historical sacred Thracian bard.

Orpiment (As_2S_3), arsenic trisulphide; sometimes found as a natural ore, but more usually prepared by precipitation from a solution of arsenious oxide in hydrochloric acid by sulphuretted hydrogen, or by heating arsenic with sulphur; formerly used as a pigment.

Orpington, vil. and par., Kent, England (51° 22′ N., 0° 6′ E.), 5 m. S.E. of Chiselhurst; fruit and hops grown; gives name to a well-known breed of poultry. Pop. 4,300.

Orrell, par. and tn., Lancashire, England (53° 32′ N., 2° 42′ W.); cotton, nails; coal mining. Pop. 6,300.

Orrery, a machine for demonstrating the motions of the solar system; was probably invented by George Graham (1675–1751). One constructed by John Rowley in 1715 for Charles Boyle, 4th Earl of Orrery, was named after him by Sir Richard Steele.

Orsay, COUNT D'. See D'ORSAY.

Orsha, tn., Mogilev gov., Russia (54° 30′ N., 30° 24′ E.), 45 m. N. of Mogilev; has tanneries and limekilns, and is river port at head of steamer navigation on Dnieper. Pop. 13,000.

Orsini, FELICE, COUNT DI (1819–58), Ital. patriot; fought in war of independence (1848); laboured with Mazzini till imprisoned (1854); pub. *Austrian Dungeons in Italy* (1857); executed in Paris for attempted assassination of Napoleon III.; left *Memoirs.*

Orsova, or OLD ORSOVA, fort. tn., Rumania (44° 44′ N., 22° 23′ E.), on the Danube, above the 'Iron Gates,' near the former junction of the Hungarian, Serbian, and Rumanian frontiers. Pop. 4,600. When Rumania declined to permit the Central Powers to transmit supplies to Turkey, a Ger. army corps was ostentatiously sent to this point (July 1915); when Rumania declared war (Aug. 27, 1916) she seized the heights N. of the Danube dominating Orsova, and blocked the river to the enemy. Part of this force was hemmed in by the Austro-German advance into Rumania, but heroically fought its way through to the Alt R., where it was compelled to surrender (Dec. 3, 1916). On an island 3 m. down the river is New Orsova, formerly a Turk. fortress. Pop. 3,000.

Orthez, tn., Basses-Pyrénées, France (43° 29′ N., 0° 47′ W.), on Gave de Pau; trade in leather, hams, chocolate; scene of Wellington's victory over Soult (Feb. 27, 1814). Pop. 6,400.

Orthoclase, or potash felspar, consists of silicate of aluminium and potassium; white, green, and transparent; an important rock-forming mineral, being the characteristic felspar of granite; a suggested source of potash.

Orthodox Eastern Church. See GREEK CHURCH.

Orthography. See SPELLING.

Orthoptera (Gr. *orthos,* 'straight'; *pteron,* 'a wing'), an order of insects which includes earwigs, cockroaches, mantidæ or praying-insects, stick and leaf insects, grasshoppers, locusts, and crickets. These possess the common characters that the young reach maturity by a series of slight changes or moults, from three to six in number, instead of by a violent metamorphosis as in most other insects. The adults have mouths adapted for biting, are carnivorous or vegetarian, and may possess or lack wings. Amongst Orthoptera are found the largest of insects; and they are also amongst the oldest, for one Orthopterus form has been found in Silurian rocks. To-day their distribution is world-wide.

Ortigueira, seapt., Corunna, Spain (43° 40′ N., 7° 50′ W.), 20 m. E.S.E. of Ferrol; popular sea-bathing resort. Pop. 19,000.

Ortler Spitze, highest mountain (12,800 ft.), Tyrol, Italy (46° 30′ N., 10° 34′ E.); highest peak in E. Alps.

Orton, ARTHUR. See TICHBORNE CASE.

Ortona-a-Mare, seapt., Chieti, Italy (42° 21′ N., 14° 26′ E.); cathedral; coasting trade; devastated by earthquakes (1782 and 1818). Pop. 15,000.

Oruro. (1) Dep., Bolivia (18° S., 67° 30′ W.); part of Titicaca basin; much of it is arid; tin, silver, copper. Area, 20,657 sq. m.; pop. 140,000. (2) Tn., cap. of above; gold, silver, and tin mines; intended to be a railway centre, several lines being constructed. Pop. 22,500.

Orvieto, city, on Paglia, Perugia, Italy (42° 43′ N., 12° 6′ E.); situated on isolated rock, 640 ft. high; has numerous interesting houses, palaces, and churches—*e.g.,* cathedral (13th–16th cent.), churches of S. Andrea, S. Giovenale, S. Domenico; bishop's, Faina, Papi, and other palaces. Orvieto

was anc. *Volsinii*, later *Urbs Vetus;* passed to popes *c.* 10th cent.; first podesta elected (1199); became part of kingdom of Italy (1860); wines. Pop. 18,300.

Oryx, a genus of African antelopes, with maned neck, long, straight horns, and long tail. The gemsbok (*O. gazella*) and beisa (*O. beisa*) are two common species.

Osaka, or OZAKA, seapt., Honshiu, Japan (34° 44′ N., 135° 32′ E.), on Yodogawa; second largest city in Japan; a network of canals; possesses a mint and an arsenal; cotton mills, iron and glass works, sugar refining, shipbuilding; numerous other small industries; suffered severely from fire (1909). Pop. 1,460,200.

Osborne, royal mansion, Isle of Wight, England (50° 45′ N., 1° 15′ W.); presented to the nation in 1902 by Edward VII. as convalescent home for naval and military officers; houses Royal Naval College.

Osborne Judgment. See under TRADE UNIONS.

Osbourne, LLOYD (1868–), Amer. novelist; *b.* San Francisco; stepson of Robert Louis Stevenson; resided at Samoa with Stevenson from 1887 to 1896, and, in collaboration with him, wrote *The Wrong Box* (1889), *The Wrecker* (1892), *The Ebb Tide* (1894); by himself, *Love, the Fiddler* (1903), *Baby Bullet* (1905), *Three Speeds Forward* (1906), *The Exile, The Little Father of the Wilderness, The Kingdoms of the World* (1911).

Oscar II. (1829–1907), King of Sweden and Norway (1872–1905), of Sweden (1905–7), succeeded his brother Charles XV.; a gifted writer; the separation of Norway and Sweden took place in his reign.

Oschatz, tn., on Döllnitz, Saxony, Germany (51° 19′ N., 13° 7′ E.); sugar, leather, felt, woollens. Pop. 10,700.

Oschersleben, tn., on Bode, Saxony, Germany (52° 3′ N., 11° 13′ E.); sugar, chocolate, bricks, tiles, agricultural implements, and artificial manures. Pop. 13,100.

Osh, tn., Ferghana, Turkestan, Central Asia (40° 40′ N., 72° 45′ E.); active trade with China; near it is 'Throne of Solomon,' a place of Moslem pilgrimage. Pop. 48,100.

O'Shaughnessy, ARTHUR WILLIAM EDGAR (1844–81), Eng. poet, charming sonneteer and lyrist; wrote *Epic of Women* (1870), *Lays of France* (1872), *Music and Moonlight* (1874), *Songs of a Worker* (posthumous, 1881).

Oshkosh, tn., Wisconsin, U.S. (44° 9′ N., 88° 26′ W.); trades in lumber and allied industries; meat packing and dairy farming; flour, tobacco, boilers, motors. Pop. 36,500.

Osier (*Salix viminalis*), species of willow from twigs of which baskets are made; grown in what are termed osier beds along low-lying flanks of watercourses, or on land subject to periodic inundation (*e.g.*, the Fen district); raised from cuttings, about a foot and a half long, of vigorous two-year-old shoots, which strike root very readily. The slips are cut for commercial purposes when about 8 ft. long.

Osimo, tn., Ancona, Italy (43° 30′ N., 13° 29′ E.); anc. *Auximum;* cathedral; silk, ribbons, and hosiery. Pop. 18,500.

Osiris. See EGYPT (*Religion*).

Osler, SIR WILLIAM (1849–1919), physician and author; *b.* Canada; studied at Montreal, London, Berlin, and Vienna; became regius prof. of medicine at Oxford (1905–19); received a baronetcy (1911). A man of broad culture, high personal idealism, profound medical knowledge, and great ability, he had a great power of inspiring others, and was a most successful teacher. His publications on medical subjects include his classic *Principles and Practice of Medicine* (7th ed. 1909), *System of Medicine* (7 vols. 1907); he has also written *Science and Immortality* (1904), *Æquanimitas and Other Addresses* (1904), *Counsels and Ideals* (1905), and *A Way of Life* (1914). M'Gill Univ., in which he was prof. (1874–84), has decided to establish a chair of medicine as a memorial.

Osman Digna (1836–1900), leader of Sudan tribesmen; originally a slave-dealer at Suakin on the Red Sea; appointed governor of E. Sudan by the Mahdi; invested the Egyptian garrisons of Sinkat and Tokar near Suakin, and defeated troops sent to their aid near Sinkat and at El Teb (1883–4); was himself severely defeated later at El Teb and Tamai by Anglo-Egyptian troops (1884), and at Amideb by the Abyssinians (1887); carried on guerrilla war thereafter, and lived to take part in the battle of Omdurman (1898), but was captured, imprisoned, and subsequently put to death at Wady Halfa (1900).

Osmerus. See under SALMON FAMILY.

Osmiridium, alloy of osmium and iridium; almost infusible and very hard; is only acted on by the strongest of aqua regia; used for tipping gold pen nibs, for delicate bearings and other purposes where resistance to wear is essential.

Osmium (Os=190·9), a metallic element of platinum group, found along with platinum ores; bluish-white; sp. gr. 22·48; m.p. 2,300–2,500° c.

Osmium tetroxide, OsO_4, or 'osmic acid,' in aqueous solution, is used for hardening tissues in microscopic preparations.

Osmosis is the process of diffusion which takes place through a septum or membrane (*e.g.*, parchment) separating two liquids of different density or concentration—*e.g.*, water and sugar solution. If not interfered with, the passage of liquid goes on in both directions until the concentration on each side is the same. As a result of this process a pressure, called 'osmotic pressure,' is set up within the liquid enclosed by the membrane. This pressure increases with the concentration of the dissolved substance and with the temperature, obeying, for dilute solutions, the same laws (Boyle's and Charles's) that would obtain if the substance were spread over the same volume in the state of gas instead of in solution, osmotic pressure taking the place of gas pressure. For different substances (dissolved) the resulting pressures are found to be inversely proportional to the molecular weights—the counterpart of Avogadro's hypothesis for gases.

Osmosis takes place through

animal and vegetable membranes. In plants, for example, the cell walls of root hairs and adjoining cells form a membrane through which dissolved food material is taken in from the soil, and the internal osmotic pressure assists largely in the upward movement of the sap.

Osnabrück, tn., Hanover, Germany (52° 17′ N., 8° 3′ E.), 28 m. N.N.E. of Münster; seat of R.C. bishopric; has episc. palace and 14th cent. cathedral; cigars, chemicals, nails, machinery, musical instruments. Pop. 65,900.

Osowiec, fortress, on riv. Bobr, Poland, 30 m. N.W. of Bielostok, held up the Ger. advance for many weeks during the great drive of 1915; Russian garrison withdrew to Bielostok (Nov. 20, 1915).

Osprey, or FISH-HAWK (*Pandion*), forms a genus and family of birds of prey found in the Old World and America, and an occasional visitor in Britain; feeds on marine and freshwater fishes. The so-called 'osprey plumes' are taken not from this bird, but from the egret.

Ossa, mountain, Thessaly, anc. Greece (39° 45′ N., 22° 40′ E.); joins on to Pelion; modern Kissavos (6,398 ft.).

Ossett, tn., Yorkshire, England (53° 41′ N., 1° 33′ W.); woollen mills; collieries; centre of rag and artificial wool trade; mineral springs. Pop. 14,100.

Ossian. See MACPHERSON, JAMES.

Ossining, tn., on Hudson R., New York, U.S. (41° 10′ N., 73° 50′ W.); iron foundries; patent medicines, pianos, shoes; Sing Sing state prison. Pop. 11,500.

Ostade, name of two Dutch painters, brothers, *b.* Haarlem. (1) ADRIAN (1610–85), pupil of Franz Hals, and later influenced by Rembrandt; excelled in depicting rural life: *Rustics in a Tavern, The Village School,* etc. (2) ISAAC (1621–49) painted somewhat similar subjects, but chiefly out-of-door scenes—frozen canals, roadside inns, etc.

Ostashkov, tn., on Lake Seliger, Tver, Russia (57° 8′ N., 33° 12′ E.), 105 m. W.N.W. of Tver; leather, cotton, tallow; boat building, malting. Pop. *c.* 15,000.

Ostend, seapt., wat.-pl., W. Flanders, Belgium (51° 14′ N., 2° 56′ E.); modern importance as Belgium's second port is due largely to its being on main passenger route between London and Continent; extensive improvements to inner and outer harbours completed in 1905; headquarters of Belgian fishing fleet; casino; racecourse; fashionable bathing and holiday resort; fisheries, oyster-beds; taken by French (1745 and 1794). Pop. 43,000.

In the Great War Ostend had considerable military and naval importance. The British were anxious to retain it because it offered a jumping-off point for an advance against the Ger. flank. It was occupied by Brit. marines (Aug. 27, 1914), and part of the 7th Division and the 3rd Cavalry Division were landed there (Oct. 7–8). After the fall of Antwerp (Oct. 9) the Belgian and Brit. forces retired along the sea front through Ostend, which was entered by the Germans (Oct. 22). When the fighting settled down to trench warfare, Sir John French was anxious to

advance along the coast in co-operation with the navy; but the project was not favoured by the French. In August 1917 Sir Douglas Haig attempted the task; but though the British after a long and bitter struggle won the Flanders ridges, the Germans still held their positions on the coast. With the inauguration of the unrestricted submarine campaign Ostend became an important naval position communicating by canal with the Ger. base at Bruges. A daring attempt was made (April 23, 1918) to seal up the port, so as to prevent the egress of U-boats; but though the old cruisers *Sirius* and *Brilliant* were sunk outside the harbour, the channel was not effectively blocked. A second attempt (May 9–10, 1918) resulted in the sinking of VINDICTIVE in the harbour. Ostend was finally recovered by the Belgians (Oct. 17, 1918). The Germans had constructed strong defences along the sea front in apprehension of a naval landing. It was frequently bombarded from the sea and bombed from the air, the Kursaal and other prominent buildings in the town suffering considerable damage.

Osteology, the science which treats of the bones. See BONE; SKELETON.

Osteopathy, method of treating disease based on theory that diseases are due to displacement of bones; consists in treating bones, blood-vessels, etc., by a system akin to massage; much practised in U.S.; a few qualified doctors in Britain have taken it up, and many laymen testify to wonderful cures.

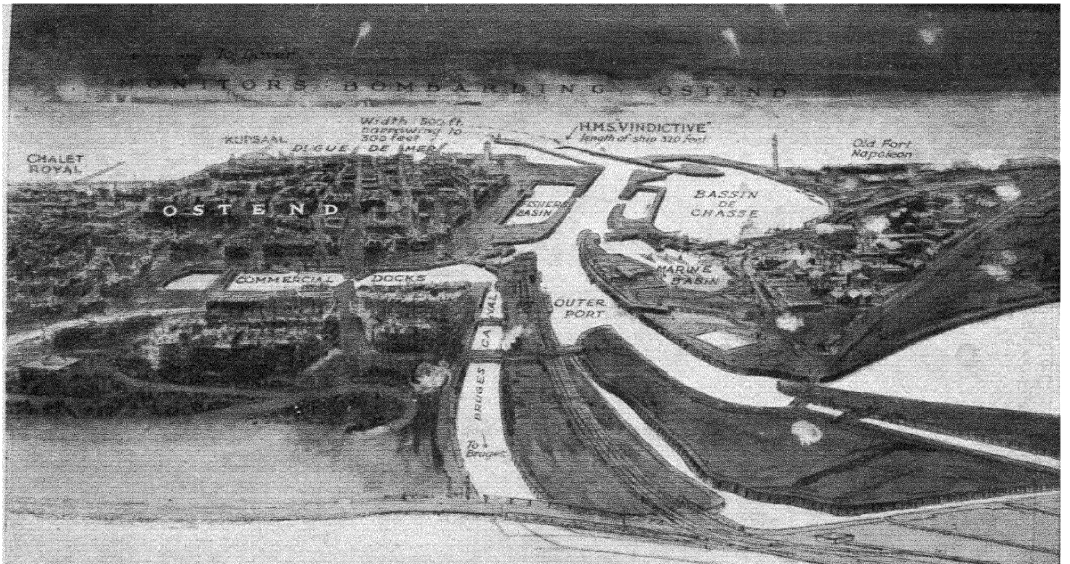
Osterode, tn., on Lake Drewenz, Poland (53° 41′ N., 19° 57′ E.); machinery, sawmills, agricultural produce. Pop. 14,300. The Russians were decisively defeated here (Sept. 1, 1914).

Ostia, anc. harbour of Rome, Italy (41° 46′ N., 12° 18′ E.), at mouth of Tiber; place attained great commercial importance, but declined after construction of safer and larger harbours by Claudius and Trajan. Excavations began in 18th cent.; ruins include forum, temples, warehouses, and barracks; modern village of Ostia near site, contains cathedral and episc. palace.

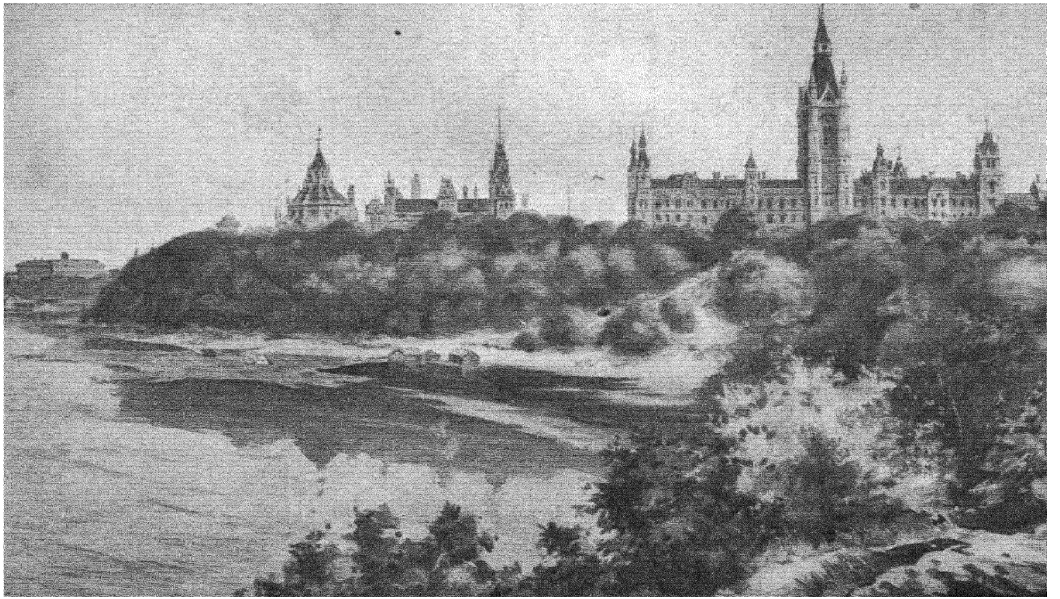
Ostiaks, or OSTYAKS, Siberian aborigines. The Eastern Ostiaks inhabit the Yenisei basin, above the confluence of the Lower Tunguska, and are believed to be a southern branch of the Samoyedes. The Western Ostiaks inhabit the Ob basin, and form one of the three main branches of the Ugrian Finns.

Ostracism, judicial expedient of anc. Greece. Citizens not liable to process at common law but dangerous to state were banished, after ballot in which names of proscribed were written on earthen tablets; said to have been introduced into Athens by Cleisthenes (509 B.C.). Once a year, in the public assembly, every citizen had the privilege of writing the name of any citizen who he thought ought to be temporarily expelled from the city; six thousand votes were required. Among those who were thus ostracized were Miltiades, Themistocles, Aristides, and Alcibiades.

Ostracoderms (Gr. *ostracon*, 'a shell'; *dermos*, 'skin'), or Hy-



BIRD'S-EYE VIEW OF OSTEND DURING THE BOMBARDMENT AND THE SINKING OF 'VINDICTIVE' ON MAY 10, 1918.



OTTAWA, THE CAPITAL OF THE DOMINION OF CANADA.
(From a water-colour drawing by F. Baragwanath.)

postomata, extinct primitive fishes without jaws and without backbone, but with complicated protecting shields; the oldest known vertebrates, found in Silurian and Devonian rocks.

Ostrau, MAHRISCH-, tn., on Ostrawitza, Moravia, Czecho-Slovakia (48° 59′ N., 17° 23′ E.); collieries, ironworks; chemicals, soap, oil, bricks. Pop. 37,000.

Ostrich. See RUNNING BIRDS.

Ostrog, tn., Volhynia, Ukraine (50° 20′ N., 26° 30′ E.), 90 m. w. of Jitomir; tanneries, potteries, oil works, breweries, tobacco factories. Pop. 15,700.

Ostrogoths. See GOTHS.

Ostrolenka, tn. and fortress, Poland (53° 4′ N., 21° 39′ E.), 21 m. W.S.W. of Lomza, on l. bk. of Narev; scene of decisive defeat of the Poles by the Russians (May 26, 1831); captured in Ger. advance on Warsaw from the north (Aug. 1915). Pop. 9,000.

Ostrovo, LAKE, Macedonia, Greece (40° 45′ N., 21° 45′ E.). In Aug. 1916 the Bulgarians drove the Serbians back in this region, but in Sept. the latter began to advance and stormed the mountain ridges N. of the lake. See under SALONICA.

Osuna, town, Seville, Spain (37° 16′ N., 5° 7′ W.); grain, fruit, mats, esparto ropes, bricks, pottery. Pop. 18,000.

Oswaldtwistle, tn., Lancashire, England (53° 44′ N., 2° 25′ W.); cotton mills, paper works, chemical works, potteries. Pop. 15,700.

Oswego, port, New York, U.S. (42° 8′ N., 76° 19′ W.); falls of Oswego R. supply water-power for large cornflour mills, starch works, match factories; hosiery, engines, lumber. Standard Oil Company's box shops and Deep Rock mineral springs are located here. Pop. 24,200.

Oswestry, tn., Shropshire, England (52° 52′ N., 3° 4′ W.); has workshops of Cambrian Ry.; manufactures iron goods, leather, agricultural machinery. In neighbourhood is old British camp. Pop. 10,000.

Otago, prov. dist., South Island, New Zealand (45° 20′ S., 169° E.); rugged mountains and forests in W.; agricultural land in E.; contains Sutherland waterfall (1,904 ft.); agriculture, sheep farming, fruit culture, gold mining; coal, limestone, lignite exist. Area, 25,312 sq. m.; pop. 191,100.

Otaheite. See TAHITI.

Otchakov. See OCHAKOV.

Othman. See under CALIPH.

Otley, mrkt. tn., on Wharfe, Yorkshire, England (53° 54′ N., 1° 42′ W.); textiles, leather, and printing machines. Pop. 9,800.

Otocorys, a genus of LARKS.

Otocyon. See DOG FAMILY.

Otranto, Brit. merchant ship, built for Orient Steam Navigation Co. (1909); displacement, 12,000 tons; converted during Great War into armed mercantile cruiser; attached to Cradock's squadron at Coronel, but escaped; sunk in collision with s.s. *Kashmir* about 8 m. off Irish coast, while carrying U.S. troops—casualties numbered about 350.

Ottawa. (1) Cap. of Dominion of Canada, in Ontario prov. (45° 25′ N., 75° 43′ W.), beautifully situated on Ottawa (s. bk.) at confluence with Rideau, below Chaudière falls. Notable features are R.C. cathedral, Christ Church, government buildings on Parlia-

ment Hill, Archive Buildings, and Royal Mint on Nepean Point, museum, art gallery, univ., art academy, gov.-gen.'s residence (Rideau Hall), and several public parks. On Feb. 4, 1916, Parliament buildings almost completely destroyed by fire, the interior of Senate and House of Commons being completely ruined. Ottawa is centre of lumber trade; manufactures leather, ironware, machinery, matches, furniture, electric cars; numerous saw and flour mills. Founded in 1829, Ottawa was named Bytown until 1854; became capital of the two Canadas (1858), of Dominion (1867). Rideau Canal joins Ottawa with Kingston on Lake Ontario. Pop. 87,100.

Ottawa River, Canada (45° 28′ N., 75° 20′ W.); enters St. Lawrence by two channels, enclosing the isl. on which stands Montreal; numerous lake expansions in course; very large lumber trade; falls furnish water-power; is navigable for small craft for 250 m.; length 685 m.

Otter. See WEASEL FAMILY.

Otterburn, vil., Redesdale, Northumberland, England (55° 15′ N., 2° 10′ W.); the scene of Douglas's defeat of Hotspur in 1388, celebrated in the ballads *Chevy Chase* and *The Battle of Otterburn.*

Otter-hounds. See DOG FAMILY.

Ottery St. Mary, mrkt. tn., Devonshire, England (50° 45′ N., 3° 16′ W.); Coleridge's birthplace; lace. Pop. 3,700.

Otto I., or OTTO THE GREAT (912–73), Emperor of the Holy Roman Empire, son of Henry the Fowler; was elected King of Germany (936). Chief events of his reign were the rolling back of the Magyar invasion at the battle of Lechfield (955), and his two Italian expeditions against Berengar (951 and 961), which resulted in the latter's expulsion from Lombardy. He was crowned emperor (962) by Pope John XII., who was afterwards deposed by him. An able and energetic ruler, he succeeded in reviving the empire of Charlemagne on a more stable basis. See HOLY ROMAN EMPIRE.

Otto II. (955–83), Emperor of Holy Roman Empire; succeeded his father, Otto the Great (973); warred successfully against Bavaria, Denmark, and Bohemia, and checked Fr. attempts on Lorraine; made himself master of Apulia and Calabria, but was defeated by Saracens (982); a generous patron of the Church.

Otto III. (980–1002), Emperor of Holy Roman Empire (983); crowned (996), and with Popes Gregory V. and Sylvester II. sought to revive Roman greatness, and to bring mediæval empire to its height, but his hopes were frustrated by general revolt in Italy (1001); was a visionary, largely influenced by churchmen; Germany deteriorated during his reign.

Otto IV. (*c.* 1175–1218), Emperor of Holy Roman Empire, son of Henry the Lion, Duke of Bavaria, and Matilda of England; was elected Ger. king in opposition to Philip of Swabia, but was unable to make good his pretensions till 1208, when Philip was murdered; was crowned emperor (1209) by Pope Innocent; excommunicated for annexation of Apulia (1210); Germany set up rival emperor in Frederick of Hohen-

staufen (1212), crowned by Pope; Otto invaded France, Pope's ally; defeated at Bouvines (1214).

Otto of Roses. See ATTAR.

Ottumwa, city, on Des Moines, Iowa, U.S. (41° 2′ N., 92° 29′ W.), 82 m. S.E. of Des Moines; coal mines, iron and steel works; starch, flour, canned goods. Pop. 24,700.

Otway, THOMAS (1652–85), Eng. dramatist; *b.* at Trotton, Sussex; educated Christ Church, Oxford. His life was embittered by a long intrigue with Mrs. Barry. In 1680 he wrote a poem, *The Poet's Complaint of his Muse,* the fine tragedy called *The Orphan,* and *Caius Marius.* In 1682 appeared his greatest drama, *Venice Preserved.*

Oudenarde, tn., on Scheldt, E. Flanders, Belgium (50° 51′ N., 3° 36′ E.); Notre Dame (13th cent.), St. Walburga, and fine town hall; textile industries, leather. Here allies under Prince Eugène defeated French under Vendôme (1708). Pop. 6,700.

Oudh. See UNITED PROVINCES OF AGRA AND OUDH.

Oudinot, NICOLAS CHARLES (1767–1847), Duke of Reggio (1810); Marshal of France (1809); distinguished in revolutionary wars under Marceau and Masséna; led 'grenadiers of Oudinot' in chief campaigns till capitulation of Paris (1814); he submitted to Bourbons, and continued to hold high commands.

Ouida, pseudonym of LOUISE DE LA RAMÉE (1840–1908), Eng. novelist; lived chiefly in Florence; author of *Strathmore, Under Two Flags, Puck, Moths,* etc.; had great popularity.

Oulchy-le-Château, vil., dep. Aisne, France (49° 13′ N., 3° 22′ E.), N. of the Ourcq, 10 m. N. of Château-Thierry; was captured by the Germans in their great final offensive (June 1918), and retaken by the French and Americans (July 23, 1918).

Ouless, WALTER WILLIAM (1848–), English portrait painter; *b.* St. Helier, Jersey; studied in London; elected A.R.A. (1877) and R.A. (1881); has exhibited regularly at the Royal Academy since 1869; has carried on the best traditions of Eng. portrait-painting, his work being both vigorous and refined; among his works are portraits of Cardinal Newman, Darwin, and Mr. Justice Manisty.

Oullins, tn., Rhône, France (45° 52′ N., 4° 50′ E.); textiles, machinery, glass, leather; nursery gardens. Pop. 12,200.

Oulton Broad, urban dist., Suffolk, England (52° 29′ N., 1° 43′ E.); yachting centre for Broads. Pop. 4,100.

Ounce. See under WEIGHTS AND MEASURES.

Ounce. See CAT FAMILY.

Oundle, tn., on Nen, Northamptonshire, England (52° 29′ N., 0° 28′ W.); public school; brewing. Pop. 2,700.

Ourcq, riv., France, rises in the heights N. of the Marne near Fère-en-Tardenois and flows W. to La Ferté Milon, where it turns S. to join the Marne at Lizy. In the first battle of the Marne (Sept. 1914) the Fr. 6th Army and the Brit. army attacked the German right flank on the Ourcq. The Germans again crossed the Ourcq in June 1918, and were thrown back in July 1918. See MARNE, BATTLES OF THE.

Ouro Preto, city, Minas Geraes, Brazil (20° 18′ s., 43° 18′ w.): owing to mountainous situation, streets steep and crooked; has numerous interesting buildings and mining school; once famous gold-mining centre, but mines now almost exhausted; iron, manganese, asbestos found in vicinity. Pop. *c.* 10,000.

Ouse. (1) Riv., Yorkshire, England (53° 43′ N., 0° 44′ W.), formed by junction of Swale and Ure, and enters Humber, navigable to York: length, 60 m. (2) Great Ouse, riv., Northampton, England (52° 20′ N., 0° 21′ E.), falls into Wash; navigable to Bedford; length, 160 m. It was reported in Dec. 1919 that the Board of Agriculture was about to undertake work of cleaning, dredging, and making up the banks of the river at cost of 2 millions. (3) Little Ouse, trib. of Great Ouse. (4) Riv., Sussex, England (51° N., 0°); flows into Eng. Channel.

Ouseley, Sir Frederick Arthur Gore (1825–89), Eng. composer; *b.* London; entered Church; became precentor of Hereford Cathedral and prof. of music at Oxford (1855); wrote several important treatises on music, and ed. various collections of sacred music. His best work as a composer is to be found in his Church music. He left his fortune for the endowment of St. Michael's Coll., Tenbury, for the training of choristers.

Outram, Sir James (1803–63), Brit. soldier; appointed aide-de-camp to Sir John Keane in first Afghan War (1838); performed famous ride in disguise through Afghanistan (1839); won title of 'Bayard of India' by defence of Haidarabad (1843); distinguished in Indian Mutiny (1857–8).

Ouzel, Water. See Dippers.

Ovar, tn., Beira, Portugal (40° 51′ N., 8° 38′ W.), on Aveiro Lagoon; fishing centre; wine, wheat, onions. Pop. 10,500.

Ovariotomy, the operation of removing one or both of the ovaries, for cystic and other changes, or to alleviate morbid conditions in other organs of generation; first successfully performed, partially, by Houston of Carluke, Scotland, in 1701, and completely by M'Dowell of Kentucky in 1809; Spencer Wells, Keith, and others have revived the operation.

Ovary, Diseases of. See Gynæcology.

Oven, an enclosed chamber for bread-baking and cooking generally; requires to be equably heated, and may be either internally or externally fired.

Over, par. and tn., Cheshire, England (53° 12′ N., 2° 35′ W.); salt and chemical trade; cattle and sheep fairs. Pop. 7,000.

Overture, the name of a musical form, originally given to the opening number of an opera. Strictly it is the instrumental introduction to any vocal work, whether opera or oratorio; but there is also the concert overture, an individual composition; Beethoven's *Egmont* and Mendelssohn's *Hebrides* are specimens.

Overyssel, prov., Netherlands (52° 25′ N., 6° 30′ E.), between Zuyder Zee and Prussian provinces Hanover and Westphalia; W. is generally under cultivation; E. provides rich pasture land. Chief industries are dairying,

fishing, cotton manufacture, and brick making. Capital, Zwolle. Area, 1291, sq. m.; pop. 432,800.

Ovid, PUBLIUS OVIDIUS NASO (43 B.C.–A.D. 17), Roman poet; *b.* Sulmo; son of Roman knight; educated in rhetoric, Rome, with view to legal career; after filling minor offices, abandoned law for poetry. In A.D. 9 he was suddenly banished to Tomi, a town situated in a semi-civilized country near mouth of Danube; reasons for banishment very obscure. At Tomi Ovid spent remaining years of life, in discomfort and apprehension of barbarian inroads from Scythia; wrote continually but vainly to friends and patrons to procure his return. In character Ovid was a genial pleasure-seeker; probably greatest master of the elegy, his style is smooth and pleasing, never harsh or discordant. The *Amores,* dealing in three books with his relations with Corinna, who occupied his affections between his first and second marriage; the *Ars Amatoria,* giving directions to both sexes for the gratification of affection; the *Remedia Amoris,* sequel in different vein to *Ars Amatoria;* and *Medicamina formæ,* on the use of cosmetics — constitute his earlier poems. Next come *Metamorphoses* (in hexameters), recounting mythical tales of transformations; *Fasti*—unfinished antiquarian calendar; *Tristia*—poems of exile; and *Epistulæ ex Ponto,* completing bulk of poet's work.

Church, *Ovid.*

Oviedo. (1) Prov., N. Spain; coal, iron, mercury, and copper are largely mined; industries include agriculture, stock raising, and fishing. Area, 4,205 sq. m.; pop. 715,500. (2) City and episc. see, cap. of above (43° 22′ N., 5° 52′ W.), 16 m. from port of Gijon, Bay of Biscay; it has fine cathedral and a university; manufactures textiles, leather, matches, and has national arms factory and metallurgical industries. Pop. 55,200.

Ovillers (-la-Boisselle), vil., dep. Somme, France (50° 3′ N., 2° 40′ E.), 3 m. N.E. of Albert; was cut off in the Brit. advance (July 8, 1916), but the garrison of 2 officers and 124 men of the Prussian Guard continued to resist till July 17. See SOMME, FIRST BATTLE OF THE.

Ovoca. See AVOCA.

Ovule. See FLOWER.

Ovum, or EGG, is a single cell which, when fertilized by male seed, develops into a many-celled animal. Eggs are distinctively female products, and the majority are so minute as to be almost invisible. In some groups of animals, however, the egg reaches large size, notably in the closely related groups of reptiles and birds, where it is covered with a limy protecting *shell.* In all cases, however, the ovum remains a single cell, its size depending on the amount of food material or *yolk* which accompanies the essential portion. This essential portion, as in all cells, consists of a protoplasmic body in which is embedded a nucleus or germinal vesicle, containing a number, definite for each species, of tiny chromatin threads (*chromosomes*). It is generally held that in the nucleus, and probably in the chromosomes, there resides the

maternal heritage of the offspring, the mysterious foundations upon which, in conjunction with those of the male cell, are built the sum-total of the characters of the progeny. Following fertilization the egg passes into the *embryo* stage, during which is reproduced in miniature the ancestral ascent through lower forms. When the several members of the young individual are distinctly formed, but not sufficiently developed for its independent existence, the structure is known as the *fœtus*. During this stage nourishment is derived from the maternal blood through the structure called the placenta.

Eggs vary as much in their mode of deposition as in their size and appearance. The majority are laid singly, as in birds and reptiles, but many also are held together in aggregates, such as the clumped spawn of frogs, the ribbons of toads or nudibranch molluscs, or the floating egg rafts of some aquatic insects. Except in cases of vegetative reproduction, the egg is the beginning of all living things; but this fact is not always patent, for, characteristically in mammals, and exceptionally in other groups, the eggs develop and hatch in the body of the mother, and living young are born.

Owen, Sir Richard (1804–92), Eng. zoologist; conservator of Royal Coll. of Surgeons, and, till 1884, superintendent of the Natural History Dep. of Brit. Museum; a comparative anatomist of great skill. His pub. papers, dealing with the description and classification of animals, cover a wide field: amongst Invertebrates—Sponges, Brachiopods, Cephalopods; amongst Vertebrates—Recent Fishes, Monotremes, Marsupials, Apes, and fossil reptiles, birds, and mammals. He also pub. general memoirs on the comparative anatomy of vertebrates.

Owen, Robert (1771–1858), Eng. Socialist reformer; married daughter of David Dale, owner of cotton mills at New Lanark on Clyde (1799), and started to reform conditions of work of the hands. Owen's importance is that he provided models for future legislation, and roused strong feeling against existing conditions of labour; he pub. *A New View of Society* (1813), in which he preached Socialism.

Owen, Will (1869–), Eng. humorous artist; entered the Civil Service, but later turned to drawing; best known for his illustrations of W. W. Jacobs's novels, and his contributions to the humorous pages of illustrated magazines and papers.

Owensboro, city, Kentucky, U.S. (37° 47′ N., 87° 6′ W.), on Ohio R.; coal mines; tobacco, lumber; centre of farming and stock raising region. Pop. 16,000.

Owl, nocturnal bird of prey, with sharp strong beaks and claws. The 'wise' look so characteristic of owls is due to the fact that the eyes are large, are directed forwards, and are surrounded by a whorl or circle of fine radiating feathers. Owls are found all the world over, living mainly in trees but sometimes in old buildings, and feeding usually on rats, mice, and smaller mammals, or on birds, reptiles, and insects. They fall

into two families: the True Owls (Bubonidæ), with almost 300 species, including the large eagle owls (*Bubo*), which kill hares, rabbits, or even young deer; the Brit. tawny, long-eared, and short-eared owls (*Syrnium* and *Asio*); and the Barn Owls (Strigidæ), with 26 species, but only one Brit. and European representative—the white or common barn owl (*Strix*).

Oxalic Acid $(COOH)_2,2H_2O$, crystalline solid, soluble in water; poisonous; salts present in wood sorrel (*oxalis*), rhubarb, dock; formed when sugar, fats, etc., are oxidized with nitric acid; prepared commercially by heating sawdust (in presence of air) with caustic potash and soda, or by heating the cheaply obtained synthetic formates. It is largely used in dyeing and calico printing.

Oxenham, John, Eng. author; writer of romances of love and exciting adventure, which have gained a wide popularity; these include *John of Gerisau* (1902), *Barbe of Grand Bayou* (1903), *Carette of Sark* (1907), *Great-Heart Gillian* (1909), *The Quest of the Golden Rose* (1912), *Mary All-Alone* (1913), *Broken Shackles* (1914), *My Lady of the Moor* (1916), *The Fiery Cross* (1917), *High Altars* (1918); has also written verse, including the following books: *Bees in Amber* (1913), *The King's Highway* (1916), *The Vision Splendid* (1917) *Hearts Courageous* (1918), *All Clear* (1919); and a vol. of essays, *Winds of the Dawn* (1919).

Oxford, city, parl. and munic. bor., co. tn., Oxfordshire, England (51° 46′ N., 1° 16′ W.), seat of celebrated univ.; beautifully situated on junction of Cherwell and Thames. The principal streets (High Street, Queen Street, Cornmarket Street, and St. Aldate's Street) meet at place called *Carfax*, in centre of old Oxford. The town belongs to an earlier date than the univ., and takes a prominent place in history; after many attacks by Danes, it was taken by Sweyn in 1013; in 1142 besieged by Stephen; Ridley, Latimer, and Cranmer were martyred here in reign of Mary Tudor; during Civil War town became headquarters of Charles I.'s party, and was the scene of Jacobite riots in beginning of George I.'s reign.

The university is believed to have originated in 12th cent., and now comprises 21 colleges and one hall:—

All Souls, founded by Chichele in 1437, possesses beautiful chapel and important library; front quadrangle remains almost unchanged. *Balliol*, founded by Devorguilla, mother of Balliol, King of Scotland, in 1269. *Brasenose*, built on site of Brasenose Hall in 1509, contains a particularly fine gateway. *Christ Church*, most magnificent of all Oxford colleges, was founded by Wolsey in 1525 as Cardinal Coll.; site included St. Frideswide Priory, and some of the old buildings still exist; coll. was remodelled by Henry VIII., and in 1532 named Christ Church; buildings are of great architectural interest, particularly those built by Wolsey; old church of the Priory serves as cathedral and coll. chapel. *Corpus Christi* was founded in 1516; *Exeter*, founded 1314; *Hertford*, founded 1874, but since

13th cent. there have been many halls on same site; *Jesus*, founded in 1571 for Welshmen by Price, and site provided by Elizabeth; *Keble*, erected by subscription in 1870 in memory of Keble. *Lincoln*, founded in 1429; refounded in 1474; contains fine chapel. *Magdalen*, was founded in 1458 by Bishop of Winchester, who bought up Hospital of St. John the Baptist; hospital chapel and kitchen still remain; notable features are bell-tower and beautiful gardens; chapel music is celebrated. *Merton* was founded first in Surrey in 1264 by Merton, and removed to Oxford in 1274; chapel and library particularly noteworthy. *New*, founded in 1379; chief features are chapel cloisters and gardens. *Oriel*, founded by Edward II. in 1326; now almost completely modern (St. Mary's Hall was incorporated with Oriel in 1896). *Pembroke* was founded in 1624. *Queen's* was erected in honour of Queen Philippa in 1340; buildings belong mostly to 17th and 18th centuries. *St. John's*, built in 1555 on site of St. Bernard's, includes portions of old coll.; Canterbury quadrangle was erected by Laud. *Trinity*, founded 1555, stands on site of Durham Coll.; some of the anc. buildings still remain. *University*, endowed by William of Durham in 1249; none of old buildings remain. *Wadham*, founded 1613, occupies site of Austin Friary; contains beautiful chapel and gardens. *Worcester*, founded in 13th cent. as Gloucester Coll., was refounded in 1714. *St. Edmund's Hall* was founded in 1226.

Other educational institutions are St. Hugh's Hall, St. Hilda's Hall, Somerville Coll., and Lady Margaret Hall for women; Manchester Coll., Mansfield Coll., Wycliffe Hall, Pusey House, and St. Stephen's House; connected with univ. are Sheldonian Theatre (where univ. public ceremonies take place), Ashmolean Museum, Univ. Museum, Indian Institute, Bodleian Library, Divinity School, Clarendon Press buildings, Univ. Galleries, Univ. Observatory, Radcliffe Observatory and Library, and Taylor Institute. Apart from cathedral, principal churches are St. Mary's, St. Michael's, St. Peter's-in-the-East, St. Giles's, and All Saints'. Oxford contains many interesting old houses and remains of a castle. The university was opened for first time to women (1920). Pop. 53,000.

Godley, *Oxford* (1911); J. Wells, *The Charm of Oxford* (1920).

Oxford (ROBERT HARLEY), EARL OF (1661–1724), Brit. statesman; Speaker of House of Commons (1701–5); northern secretary of state (1704–8); chancellor and under-treasurer of Exchequer (1710–11); cr. Baron Harley of Wigmore, Earl of Oxford, and Earl Mortimer (1711); first lord of Treasury (1711), and made Treaty of Utrecht; impeached and imprisoned (1715); acquitted (1717), but never regained power; highly praised by literary men, who had reason to be grateful for his liberal patronage. His character, though blackened by rivals, was without serious faults. *Life*, by Roscoe.

Oxford and Bucks Light Infantry. 1st and 2nd Batts. derive from the 43rd (Monmouthshire Light

Infantry), raised in 1741, and the 52nd (Oxfordshire Light Infantry), raised in 1755, respectively. United honours up to the eve of the Great War: Quebec (1759), Martinique (1762), Havana, Mysore, Hindustan, Martinique (1794), Vimiera, Corunna, Busaco, Fuentes d'Onor, Ciudad Rodrigo, Badajoz, Salamanca, Vittoria, Pyrenees, Nivelle, Nive, Orthes, Toulouse, Peninsula, Waterloo, S. Africa (1851-52-53), Delhi (1857), New Zealand, Relief of Kimberley, Paardeberg, S. Africa (1900-2).

During the Great War the regiment, with T.F. and Service battalions, numbered ten battalions, together with two allied Canadian and New Zealand regiments (52nd Regiment of Canadian Militia or Prince Albert Volunteers, and 6th (Hauraki) Regiment of Dominion of New Zealand). 2nd Batt. was part of 5th Infantry Brigade in original B.E.F.

1914.—2nd Batt. was in all the desperate fighting of the first months of the war; had specially trying time at Mons (Pâturages), and during retreat did rearguard duty and was sent back to Pont-sur-Sambre to delay enemy, who did not, however, proceed by that route. On the Aisne took part in splendid resistance offered at Soupir Farm. Co-operated with Guards Brigade (Oct. and Nov.) in Zonnebeke fighting. The front companies, with Connaught Rangers and Northants, played gallant part in crushing the attack of the Prussian Guard before Ypres (Nov. 11).

1915.—2nd Batt. was engaged in Ypres area.

1916.—Oxford and Bucks Territorials fought at Aubers Ridge. 6th (Service) Batt. in Ypres salient during early part of the year; in Somme battle (Sept.) prominent in capture of Guillemont, in Oct. being engaged around Gueudecourt. 3rd Batt. in terrific fighting for Delville Wood and in attack on Pozières. 1st Batt. saw hard fighting in Mesopotamia campaign.

1917.—T.F. battalions in fighting at Bellicourt, Holnon, Wieltje, and Havrincourt. Service battalions in the Sailly-Saillisel dist., where they drove back strong Ger. counter-attacks. After following up enemy in his retreat to Hindenburg Line, Service battalions were moved to the Ypres area, where they figured in the capture of Langemarck (Aug.). Later in year were in first battle of Cambrai (begun Nov. 20), and subsequently sustained heavy casualties in repulsing numerous determined counter-attacks.

1918.—2nd Batt. made a glorious last stand at Doignies in the Lagnicourt–Beaumetz area on the opening day of the great Ger. offensive. 4th Batt., with ill-fated 5th Army, was conspicuous for splendid bombing in defence of Enghien Redoubt (see Conan Doyle's *British Campaign, 1918*, p. 84). Same battalion also distinguished itself in desperate fighting in Holnon Wood, where 18th Corps was severely tried. During great advance regulars reappeared on scene, taking part in the attack on Gomiécourt as part of Byng's 3rd Army (battle of Bapaume, Aug. 21–31), also in capture of Sapignies.

Oxfordshire, co., England (51° 45′ N., 1° 15′ W.); bounded N.

by Warwick and Northampton, E. by Bucks, S. by Berks, W. by Gloucester. Surface generally is level; N. mostly bare and bleak, but in S. are finely wooded hills and valleys; S.E. crossed by branch of Chiltern Hills; well watered by numerous beautiful rivers, including Thames and its tributaries, Windrush, Evenlode, Cherwell, and Thame. Soil is particularly fertile, Oxfordshire being one of the most productive counties in England; chief crops are barley, oats, and wheat; stock raised; paper made at Shiplake and elsewhere, gloves at Woodstock, blankets at Witney, agricultural implements at Banbury; manufactures of bricks, blankets, tweeds, gloves, and lace also carried on. Chief towns are Oxford (co. tn.), Banbury, Henley, Chipping Norton, Abingdon, and Woodstock; celebrated univ. at Oxford and other educational institutions. Oxford and Bampton are among few remaining castles; there are many eccles. remains, finest specimen being Dorchester Abbey; interesting churches at Iffley, Adderbury, and Minster Lovell; many fine mansion-houses. County returns three members to Parliament. Oxfordshire played prominent rôle in Civil War; battles of Chalgrove (1643) and Cropredy Bridge (1644). Area, 755 sq. m.; pop. 189,500.

Oxfordshire, in Victoria County Histories.

Ox Group, a section of the cattle tribe (Bovidæ), distinguished by a broad, naked muzzle, the presence of round or ridged equal horns, long tails, usually tufted, and a dewlap on the throat of the male. Although common in Europe, Asia, and Africa, there is only one Amer. species and one in Celebes. This last is the small black anoa (*Anoa depressicornis*), included in the group of the buffaloes, to the young of which it presents a striking resemblance. Closely related to the buffaloes are the bisons (*Bison*), comprising two species—the European and the Amer. bison—the American, now nearly extinct, being slightly smaller than the European species (only found in the forests of Lithuania and the Caucasus).

Distinguished from the bisons and oxen by the different position of the long hair forming a fringe over shoulders, flank, and tail, the yak (*Poëphagus*) inhabits the high plateaus of Tibet, where the tame animals are used as beasts of burden.

Those nearly related to the typical oxen are three Oriental species, comprising the shy gaur (*Bos gaurus*), with arched back and strange concave profile, found in the large Ind. forests; the *gayal* or *mithan* (*Bos frontalis*), occurring in Assam and adjacent districts, with shorter and rounder horns, and without the large frontal crest of the gaur; and the BANTENG.

Lastly, the typical ox is represented at the present day only by domesticated breeds (see CATTLE) belonging to two species, *Bos taurus* and *Bos indicus*, though half-wild herds of the former have been preserved at Chillingham Castle, Northumberland, and Cadzow Castle, Lanarkshire.

Oxides. See under OXYGEN.

Oximes, first obtained by Victor Meyer (1882), are colour-

less liquids or crystalline solids. They contain the group >C=NOH, being formed by interaction of hydroxylamine and aldehydes (aldoximes) or ketones (ketoximes): $>CO+H_2NOH=>C=NOH+H_2O$.

Oxus, or AMU DARIA, important river, S. Turkestan, Central Asia; rises in Pamir plateau, forms for some distance boundary between Afghanistan and Bokhara, flows through Bokhara and Khiva, and falls into southern extremity of Sea of Aral (43° 40′ N., 59° 8′ E.) by numerous mouths. Two headstreams of Oxus, Aksu or Murghab and Ab-i-Panja, unite at Kala Wamar; river has many tributaries in upper course, but few after it enters deserts of Turkestan, where streams often disappear in sand; forms a delta *c.* 90 m. from Sea of Aral. River banks in some parts are fertile, and canals are made to assist in cultivation; in some seasons Oxus floods large tracts of country. Navigable as far as Charjui, where it is crossed by railway from Merv to Samarkand; there is regular steamer service. Length, 1,550 miles.

Oxygen (O, 16·00), gaseous element, molecule $= O_2$; occurs free in air (one-fifth of the total volume) and combined in water (88·81 per cent.), and in the rocks of the earth's crust (44 to 48 per cent.); the most plentiful and widely diffused terrestrial element. Oxygen was first obtained by Scheele (1773), and by Priestley (1774), who prepared it by heating 'mercurius calcinatus' (HgO), named by Lavoisier (oxygen= acid-producer), who thought it the essential constituent of an acid, and explained its function in combustion.

Preparation.—It is now commercially prepared by the fractional distillation of liquid air. (See NITROGEN.) On a small scale it may be prepared by heating oxygenated compound—*e.g.*, potassium chlorate, manganese dioxide, red lead, etc.

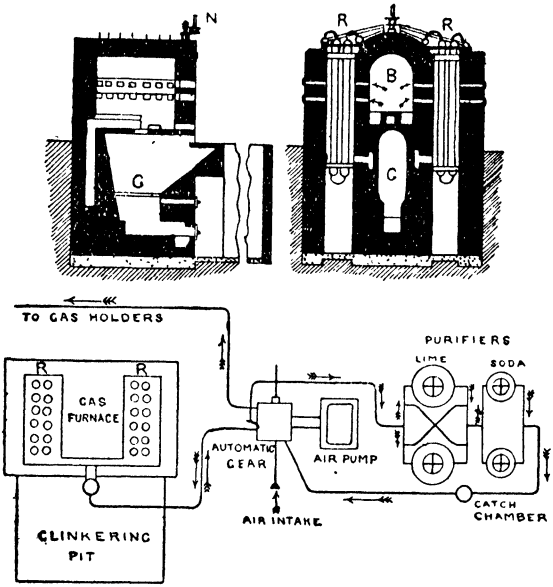
Properties.—Colourless, invisible, tasteless, odourless gas; coefficient of solubility in water at 0° C. = 0·0489. Liquid oxygen is pale blue and strongly magnetic; b.p. (atmospheric pressure) −182·5°; critical temp. −119°; critical pressure, 58 atmospheres. Solid oxygen melts below −223°. Vigorously supports combustion of phosphorus, sulphur, charcoal, iron, wood, a taper, etc. In the oxyhydrogen flame platinum melts, and lime shines with a dazzling light (lime-light). It is used industrially in conjunction with acetylene for the oxy-acetylene flame used in welding.

Physiological Action.—Oxygen is necessary for respiration, and for the decay of dead organic matter. It is thus converted into atmospheric carbon dioxide, from which the carbon is removed by green plants in sunlight. On account of its vigorous action pure oxygen is substituted for air when respiration is difficult, as in cases of suffocation, gaseous poisoning, and low vitality. Its long-continued respiration is harmful.

Oxides are formed by combination with every element except (bromine) fluorine, and the members of the helium family. They may be basic, acidic, neutral, or peroxides.

Oyama, Prince Iwao (1842–1916), Jap. soldier-statesman, a Samurai of Satsuma; attaché with Ger. army, Franco-German War (1870); helped to reorganize Jap. army (1873), and a commander during Satsuma rebellion (1877); minister of war (1880–95); led 2nd Army in Chino-Jap. War (1894–5), when he reduced Port Arthur, Wei-hai-wei, etc.; field-marshal (1898); chief of general staff (1899); and commander-in-chief in Manchuria, Russo-Jap. War (1904–5). Brit. Order of Merit (1906); keeper of Privy Seal (1914).

Oyster Bay, summer resort, New York, U.S. (40° 52′ N., 73° 31′ W.), on N. coast of Long I.; oyster fisheries; Russian and Japanese peace plenipotentiaries met here (1905). Pop. 21,800.



Plant for the Preparation of Oxygen—two sectional elevations and plan.

B, Combustion chamber; G, producer gas generator; N, nitrogen blow off; R, retorts.

Oyster-catchers. See Plover Family.

Oystermouth, better known as 'The Mumbles,' coast par. and vil., Glamorganshire, Wales (51° 36′ N., 4° W.); favourite wat.-pl.; castle (14th cent.); oyster dredg-

ing is extensively carried on. Pop. 6,100.

Oysters, a genus (*Ostrea*), of Lamellibranch or bivalve molluscs which forms a favourite food supply of many nations. Its members possess the general structure of Lamellibranchs, and in particular of the Pseudo-Lamellibranchia. They are inactive creatures, protected by a heavy shell, composed of two unequal valves, the larger and convex left valve being that on which the animal lies, the lighter, flat right valve forming the upper lid. The two valves are held together by a single strong muscle. Oysters, of which there are many species, live in all seas, near the shore, preferably in shallow water free from disturbing currents. They congregate in great banks or beds, and so great is the fertility of the individuals that during the spawning season, from May to Sept., the sea in the neighbourhood is turbid with the young or 'spat.' The young oysters grow about an inch in diameter each year until the third year, after which growth becomes much slower. Seven to ten years is a common age for average oysters.

The catching of oysters for food forms a great industry, centred chiefly in the U.S., France, and Britain. Many oysters are dredged from native beds, but still more are cultivated in special ponds and on artificial banks. The annual consumption is reckoned in many hundreds, almost thousands, of millions.

Related to the edible oysters are the pearl oysters (*Meleagrina* or *Margaritifera*) of tropical seas, the shells of which supply useful and ornamental articles of mother-of-pearl, and from which marine pearls are obtained.

Ozaka. See OSAKA.

Ozokerite, mineral wax varying from very soft to hard; colours—brown, yellow, green; may be streaked or spotted; generally found in bituminous sandstones of coal measures, chiefly in Galicia and Austria, and in Utah (U.S.). The purified solid is used in the making of candles, and with rubber in making insulating material.

Ozone (O_3), an allotropic form of oxygen, obtained most effectively by passing oxygen through a tube in which it is acted on by the silent electric discharge from an induction coil; ozone is generally formed in small quantities whenever oxygen is produced; it occurs free in air, to a very slight extent, and it is produced during lightning storms; ozone is a gas with a peculiar odour; it is chemically intensely active, as it is very unstable and breaks up into ordinary oxygen when heated; it is a powerful oxidizing agent, bleaching dyes, changing metals to oxides, sulphides to sulphates, and displacing iodine from iodides. It is now used on a large scale for the purification and sterilization of drinking water.

Ozorkow, tn., Kalisz, Poland (51° 56′ N., 19° 18′ E.), 80 m. w. by s. of Warsaw; cloth manufactures; suffered greatly from fire in July 1908. Pop. 11,000.

P

P, the sixteenth letter of the alphabet, is the voiceless labial stop, and has phonetic relations with B, F, and V, with all of which it is interchangeable—*cf. pater, vater, father;* is silent in English before certain related consonants, as in 'receipt,' 'pneumonia,' etc. The letter appears in various forms in Semitic, Greek, and Roman alphabets, assuming its present form under Roman Empire. In the Morse Code employed in army signalling P is written thus : · — — ·

π. By this Gr. letter is indicated in maths. the ratio of the circumference of a circle to its diameter, which enters into so many mathematical expressions. Value can only be expressed as a never-ending decimal — 3·14159265 . . . , but for calculations of no great accuracy $\frac{22}{7}$ may be used.

Paardeberg, on r. bk. of Modder R., Orange Free State, S. Africa (28° 57′ S., 25° 20′ E.); scene of Cronje's surrender (Feb. 27, 1900).

Paarl, tn., on Berg R., Cape of Good Hope, S. Africa (33° 39′ S., 18° 54′ E.); wines; fruit farming and tobacco growing in dist.; wool washing and carriage building. Pop. 5,800 (white).

Pabianice, tn., Piotrkow, Poland (51° 30′ N., 19° 20′ E.); textiles, paper, agricultural machinery. Pop. 27,500.

Pabna, or PUBNA. (1) Dist., E. Bengal and Assam, India (24° 20′ N., 89° 27′ E.); generally low and flat; rice, rape, mustard. Area, 1,839 sq. m.; pop. *c.* 1,500,000. (2) Tn., cap. of above, 75 m. W.N.W. of Dacca; oil, bricks, carpets. Pop. *c.* 20,000.

Paca (*Agouti paca*), large nocturnal rodent found in forests and on river banks in Central and S. America. Related to AGOUTI.

Pachmann, VLADIMIR DE (1848-), Russian pianist, an interpreter of Chopin; extraordinary command of *pianissimo;* first appeared in Russia (1869), then in Leipzig (1878), Vienna, Paris, and London (1882); retains high favour of the public.

Pachuca, cap. of Hidalgo, Mexico (20° 5′ N., 98° 50′ W.); silver mines; meteorological observatory. Pop. 39,000.

Pacific Ocean, largest of the five great oceans of the world, occupying about half the water surface of the globe; extends from Arctic Ocean at Bering Strait to the Southern Ocean at *c.* 40° S., and lies between America (on E.) and Australia and Asia (on W.); total length from N. to S., *c.* 9,000 m.; greatest breadth (near equator), over 10,000 m. Area—68,634,000 sq. m.; drainage area, however, is only 7,500,000 sq. m. (much less than that of Atlantic); the largest Asiatic rivers are Amur, Hoang-Ho, Yang-tse-Kiang, Mekong, Menam, Canton; Amer. rivers are Yukon, Fraser, Columbia, Colorado. Salinity is less than that of Atlantic. Mean depth is about 2,500 fathoms;

greatest depth on Asiatic side—viz., 40 m. E. of Mindanao (Philippines), 32,089 ft. (greatest recorded ocean depth); between Midway Islands and Guam, 31,614 ft.; E. of Kermadec Islands, 30,920 ft.; N.E. of Japan, 27,925 ft. The coastline of America and Australia is generally mountainous, with few inlets—Gulf of California, Puget Sound, etc.; the Asiatic coast is generally flat, with many large indentations—Yellow, China, Japan, Okhotsk Seas, etc.

Pacific Ocean has innumerable continental and oceanic islands, mainly in centre and W., either of volcanic or coral formation—viz., New Zealand, New Guinea, Borneo, Sumatra, Java, Japan, Philippines, New Hebrides, Galapagos, Solomon, Fiji, Samoa, Hawaii, Ladrones, Carolines, Aleutians, etc. Climate generally is tropical. The principal prevailing winds are the two trade-winds blowing from N.E. and S.E., with broad belt of equatorial calms between them. Monsoons also blow regularly, and violent storms occur in lat. 30° to 5° N., in the China Sea, etc.

Pacific Ocean was discovered by Vasco Nuñez de Balboa (1513), when he crossed the Isthmus of Panama; traversed by Magellan (1520–1), and named Pacific on account of calms encountered there after previous violent storms. Brit. Pacific cable connects Vancouver, Australia, and New Zealand; Amer. cable links San Francisco and Manila (Philippines). Chief steamship routes are from Vancouver and San Francisco to New Zealand, Australia, and Japan; another route from New Zealand to Europe passes round Cape Horn. The PANAMA CANAL will revolutionize Pacific trade routes. Chief powers represented in Pacific are Britain, Japan, U.S., and France.

Fox, *Problems of the Pacific* (1912); Murray and Hyort, *Depths of the Ocean* (1912).

Padang, seapt., Sumatra, Dutch E. Indies (0° 52′ s., 100° 24′ E.); exports coffee, spices, rubber, tobacco, copra. Pop. 40,000.

Paddington. (1) W. div. of London, N. of Hyde Park (51° 31′ N., 0° 5′ W.); terminus of Great Western Ry. Pop. 142,600. (2) E. suburb, Sydney, New South Wales (33° 52′ s., 151° 11′ E.); beer, leather, soap. Pop. 24,200.

Paddle-worm (*Phyllodoce*), genus of bristle-worms (*Chætopoda*) belonging to the order Polychæte, in which the parapodia are modified into paddles; found on Brit. coasts.

Paderborn, town, Westphalia, Germany (51° 43′ N., 8° 45′ E.); railway plant, glass, soap; large trade in cattle. Pop. 29,000.

Paderewski, IGNACE JAN (1860–), Polish pianist and statesman; *b.* Podolia, Russian Poland; showed great precocity, playing the piano in public at the age of twelve; studied at the Warsaw Conservatoire and in Berlin; first concert tour was made in 1878; not proving sufficiently successful, he devoted himself to teaching music in Warsaw and in Strasbourg; in 1884 he turned to the concert platform again, and in 1887 appeared in Vienna with marked success; this was followed by many tours in Germany, England, France, and U.S.,

and Paderewski became recognized as one of the greatest of pianists. During the Great War he was sent to America as plenipotentiary by the National Polish Committee; gave numberless concerts, delivered many addresses, and is said to have spent the greater part of his fortune in his efforts to rouse sympathy for the Polish cause. In Jan. 1919 he was made prime minister of the reconstituted Polish state, and became one of the Polish delegates to the Peace Conference; finding himself out of agreement with many of his own supporters, he resigned the premiership in Dec. 1919.

Padiham, tn., on Calder, Lancashire, England (53° 48′ N., 2° 19′ W.); cotton mills, coal mines, stone quarries. Pop. 13,600.

Padstow, mrkt. tn. and port, Cornwall, England (50° 33′ N., 4° 56′ W.); has good harbour; trades in fish; site of former monastery; has several interesting churches. Pop. 2,500.

Padua, or PADOVA. (1) Prov., Venetia, Italy (45° 25′ N., 11° 55′ E.); fertile plain; wheat, rice, wine, silk. Area, 826 sq. m.; pop. 550,600. (2) City, N. Italy, cap. of above, on Bacchiglione; Lat. *Patavium;* chief features—arcaded streets, several ancient bridges, churches of St. Anthony Eremitani (13th cent.), Madonna della Arena (frescoes by Giotto), Santa Giustino, Palazzo Regione (1172–1219), univ. (13th cent.), library, Donatello's equestrian statue of Gattamelata, Museo Civico; chief industries, machine works, chemicals, silk, distilleries; great centre of learning and art during Middle Ages and Renaissance. Pop. 105,000. Foligno, *Padua* (in Mediæval Towns Series).

Paducah, city, Kentucky, U.S. (37° 7′ N., 88° 41′ W.), at junction of Tennessee and Ohio; sawmills; railway workshops; trade in tobacco. Pop. 25,100.

Pæony (*Pœonia officinalis*), a member of the Ranunculaceæ, possessing showy, honey-bearing flowers and tuberous roots; fruit a follicle.

Paganini, NICOLO (1784–1840), Ital. violinist and composer; founder of modern school of violin-playing; concertos a supreme test of proficiency; travelled widely; first appeared in London in 1831.

Page, GERTRUDE (MRS. DOBBIN), novelist, chiefly S. African settings; author of *Love in the Wilderness, The Edge of Beyond, The Rhodesian, Paddy the Next Best Thing,* etc.

Page, THOMAS NELSON (1853–), Amer. author and diplomatist; excels in depicting Southern life during the Civil War period; U.S. ambassador to Italy since 1913; pub. *In Old Virginia* (1887), *The Burial of the Guns* (1894), *The Old Gentleman of the Black Stock* (1897), *The Old Dominion: her Making and her Manners* (1907), *The Land of the Spirit* (1913), *Thomas Jefferson: the Apostle of Liberty* (1918), etc.

Page, WALTER HINES (1855–1918), Amer. diplomat and journalist; *b.* N. Carolina, U.S.; educated at Johns Hopkins Univ.; became a partner in the publishing firm of Doubleday, Page, and Co.; ed. *The Forum,* New York (1890–5); *Atlantic Monthly,* Bos-

ton (1896–9); *World's Work*, New York (1900–13); appointed by President Wilson American ambassador in London (1913), and endeavoured as 'a working member of the English-speaking democracy' to promote Anglo-American unity; retired, owing to ill-health (Aug. 1918). Author of *The Rebuilding of Old Commonwealths* and *The Southerner* (a novel).

Pageant (M.E. *pagyn, padgin*, forms of Lat. *pagina, to* which *t* was added, as in other words—*e.g.*, ancient), an attempt at representation of historical events—when possible, at actual scene of action; usually shows progress in history of a town, nation, or empire, an institution (*e.g.*, army), or some aspect of civilization (*e.g.*, The Masque of Learning, Edinburgh, 1912); great feature of early 20th cent.—*cf.* Quebec Tercentenary Pageant (1908), Bath Pageant (1909), Union of S. Africa Pageant at Cape Town (1910), Festival of Empire, London (1911)—all arranged by Frank W. C. C. Lascelles. Louis N. Parker (1852–), dramatist, has produced many pageants.

Paget, Sir James (1814–99), Brit. surgeon, lecturer, St. Bartholomew's Hospital, and warden of its coll. (1843–51); Arris and Gale prof., Coll. of Surgeons (1847); surgeon-extraordinary to Queen Victoria (1853); baronet (1871); pres. of the Royal Coll. of Surgeons (1873); great reputation as surgeon, pathologist, and physiologist; discovered the parasite *Trichina spiralis*. His *Lectures on Surgical Pathology* (1853) rank with Virchow's *Cellular Pathology*.

Memoirs and Letters, ed. by son, Stephen Paget.

Pago-Pago, or Pango-Pango, seapt. on S.E. coast of Tutuila, Samoan Islands, Pacific (14° 19′ S., 170° 42′ W.); was ceded (1872) to U.S. for naval and coaling station, and with other islands of Samoan group E. of 171° W. passed to that country by Tripartite Treaty (1900). Has only good harbour in group; high-powered radio station.

Pahang. See Malay States.

Pahlanpur. See Palanpur.

Paignton, seaside resort, Devonshire, England (50° 26′ N., 3° 35′ W.); cider. Pop. 11,200.

Pain, Barry (1867–), Eng. journalist and humorous author; he succeeded Jerome K. Jerome (1897) as editor of *To-day*; served in R.N.V.R. (1915–16), and afterwards on London Appeal Tribunal; pub. *In a Canadian Canoe* (1891), *Playthings and Parodies* (1892), *Another Englishwoman's Love Letters* (1901), *The Gifted Family* (1909), *One Kind and Another* (1914), *The Problem Club* (1919), etc.

Paine, Thomas (1737–1809), Eng. author and agitator; went to Philadelphia (1774), where he pub. *Common Sense* (1776), advocating Amer. independence; returned to England (1787) and pub. *The Rights of Man*, a reply to Burke's *Reflections on the French Revolution*; prosecuted for sedition and fled to France; secretary to Convention (1793); on fall of the Girondists was imprisoned for ten months, during which he completed *The Age of Reason*, a plea for Theism; died in America, but remains later brought to England by William Cobbett.

Painlevé, PAUL (1863–), Fr. statesman and scientist, Socialist-Republican in politics; was appointed minister of instruction and inventions affecting national defence to the Briand cabinet (Oct. 1915); succeeded General Galliéni as minister of war; member of the War Committee; prime minister and minister of war (Sept.–Dec. 1917); president of the parliamentary aviation group (1918); as minister of war he was accused by General Nivelle's supporters of having interfered with the Fr. offensive (April 1917), which ended in a breakdown, but made a successful defence; appointed advisory director-general to Chinese Government railways (1920). Author of numerous scientific works and a *Life* of Nurse Cavell; Chevalier of the Legion of Honour and Member of the Institute.

Painting. The history of painting may be said to begin with liberation of art from the magnificently decorative and dignified, but formal and lifeless style of the Byzantine mosaicists. The 13th cent. Florentine master, Cimabue, is generally credited with being the 'father of modern painting,' but his excessively rare extant works prove him to have been scarcely more than an excellent follower of the Byzantine tradition. It was his pupil, Giotto, in Florence, and Duccio, in Siena, who first broke away from this tradition and infused life into the frozen images of their predecessors. Each became the founder of a great school that tried to bring painting into closer touch with life. The medium of these early painters was *tempera*—*i.e.*, ground colours mixed with the yolk of eggs. Although these primitives produced many portable altar-pieces and panels, they were essentially painters of frescoed wall decoration, which demands a broad treatment of flat masses of colour, this colour being invariably subordinated to linear design. Throughout the 13th and 14th centuries the painters worked entirely in the service of the Church.

Italian Renaissance.—In Siena the tradition of Duccio was carried on by Simone Martini, Lippo Memmi, and the Lorenzetti; but this art, which had never entirely shaken off the fetters of Byzantinism, was incapable of further developments, and, by the end of the 14th cent., had fallen into stagnation and decay. To the Florentines whole worlds were left to conquer—the worlds of perspective anatomy, light and shade, movement, plastic life. But Giotto had moved too rapidly, and for a century his followers, the Giottesques, contented themselves with imitating his types and motifs without adding a new word to the artistic language. On the threshold of the Renaissance, Masaccio broke new ground by increasing the weight and volume of his figures and investing his frescoes with something of statuesque classic dignity. Others continued to build upon the foundations laid by him.

The Florentine painters of the 15th cent. were stimulated by the spirit of the revival of classic learning and by the newly awakened love of classic art. They approached Nature and all

the pictorial problems with passionate curiosity. Uccello and Andrea del Castagno developed the science of perspective; Domenico Veneziano was the first Florentine to introduce the *oil technique*, which gradually was to oust the technique of tempera painting; Piero dei Franceschi was the discoverer of atmosphere; the Pollaiuoli, and after them Luca Signorelli of Cortona, almost exhausted the significance of the human body in muscular action; Filippo Lippi's pupil, Botticelli, was the supreme master of expressive decorative line and rhythmic movement.

Other schools had meanwhile risen in Italy. In Padua, the great seat of learning, the erudite and travelled Squarcione had founded a school for the study of the antique, from which issued not only the great Mantegna, the most 'classic' of the Italian painters, but its influence spread over the whole of N. Italy, and became paramount at Ferrara and the surrounding cities. In Umbria, at Perugia, Fiorenzo di Lorenzo, the first of a long line of painters whose art reflects the tenderness and gentle beauty of the lovely Umbrian landscape, became the teacher of Pinturicchio and Perugino—the most typical of the Umbrian masters.

The end of the 15th and the beginning of the 16th centuries witnessed the full flowering of the Renaissance, dominated by the mighty triple constellation of LEONARDO DA VINCI, RAPHAEL, and MICHELANGELO. Further development on their lines was impossible, and where art falls into mere imitation, decline is inevitable. Leonardo's followers contented themselves with the more or less mechanical copying of their master's types and designs. Raphael and Michelangelo impressed their genius upon Rome and the greater part of Italy. The 16th cent. is the age of the *Mannerists*, or imitators of one master. Of those whose strong personality added a new note to the artistic achievement of the country are Correggio, who worked mostly at Parma, and perfected the art of *chiaroscuro;* and Andrea del Sarto, 'the perfect painter,' in Florence, where portraiture found a strong exponent in Bronzino.

The Mannerists were followed by the *Eclectics*, or imitators of many, who issued mainly from the Academy of the Caracci in Bologna. A wholesome reaction was the movement of the *Naturalists*, led by Caravaggio and Ribera, who had their headquarters in Naples, and who returned to a closer touch with Nature. After them came complete decadence, except in Venice, where the rise of painting had been tardy, but where a great decorative tradition lingered to the end of the 18th cent.

Venetian painting owed its characteristics partly to the Republic's constant intercourse with the splendour-loving East, partly to the unique atmospheric conditions of the lagoon city, which could not fail to develop that keen sense of beautifully harmonized, mellow colour, which is to be found in Venetian art from the days when Jacopo Bellini and his sons, Giovanni and Gentile Bellini, founded the school from

which were to issue such masters as Giorgione, Palma, and Titian, through the late 16th cent., which could boast a Tintoretto and a Paolo Veronese, to Tiepolo, the brilliant and facile decorator who held undisputed sway in the 18th cent.

Flemish School.—In the north, in Flanders, the art of painting did not reach perfection by a process of gradual evolution, as in Italy. It sprang from a flourishing school of miniaturists and illuminators, fully fledged, as Minerva issued in full armour from the head of Jupiter. The first masters of whom we have definite knowledge, the brothers Van Eyck (born in the second half of the 16th cent.), who are known as the inventors of *oil painting*, represent the highest achievement of the early Flem. school. Technical perfection, exquisite finish, painstaking precision in the rendering of the minutest details of costume, types, arch., and landscape, could not go further. Yet, whilst every touch was guided by close study of actuality, the realism of the Van Eycks and their followers at Bruges—Memlinc and Gerard David—or of the Tournai master, Robert Campin, and of his pupils, Rogier van der Weyden and Jacques Daret, was anything but photographic. Their works are charged with tender feeling, poetry, and symbolism, and have a wonderful rhythm of design and pure, brilliant colour.

Towards the end of the 15th cent., when Bruges had lost its political importance and Antwerp had become the chief centre of commercial activity, the artistic hegemony, too, passed from Bruges to Antwerp, where Quentin Matsys became the founder of an important school. But already with Mabuse, who died in 1532, and even more with Barend van Orley, a pupil of Raphael, the national tradition was sacrificed to the mannered imitation of the later Italians, until new life was infused into Flem. painting, towards the end of the 16th cent., by RUBENS, a true son of his race. His pictures, which represent the Flemish taste and the Flemish character of his period, have extraordinary vitality and movement. As a painter of the nude he stands unrivalled. He had a whole army of assistants, who continued to work in his manner, but of whom only few were destined to rise to greatness. Chief among them was Van Dyck, who became the favourite painter of Charles I. and his court, and who in this capacity exercised an enormous influence upon the art of portraiture in England. But the towering genius of Rubens was as fatal for Flem. art as Raphael's and Michelangelo's had been for Ital. art. It created a generation of accomplished imitators, and stayed the normal course of slow evolution.

Holland.—The early art of Holland is almost merged with that of the primitive Flemings. The Reformation and the War of Independence waged against Spain retarded progress and were inimical to the fostering of the arts. But with peace art became democratic; it entered the citizen's home. The 17th cent. in Holland witnessed the rise of landscape and of genre painting,

of still-life, and of civic portraiture. Excepting REMBRANDT, the greatest of all Northern masters, a magician of golden light and mysterious shade, an artist whose profound human sympathy with all life made him probe the full significance of the visible world, the Dutchmen were, above all, realists. The 'small masters'—Terburg, Vermeer, Jan Steen, Dow, Metsu, and their kin—were the discoverers of indoor atmosphere, and delighted in expressing the material beauty of all manner of textures. Landscape was raised to the dignity of a subject worthy of being painted for its own sake, and not as a mere background, by Hobbema, Ruysdael, and their followers. Paul Potter, Cuyp, and others devoted themselves to animal painting, whilst a whole band of able craftsmen, fascinated by the surface qualities of flowers, fruit, and inanimate objects, confined their attention to still-life. The 18th cent. in Holland was a period of stagnation.

Germany.—In Germany local schools were flourishing as far back as the 14th cent., though most of the painters' names are unknown to fame. Such schools arose in the Rhineland, at Cologne, Augsburg, and Prague. The early Ger. painters lacked the classic rhythm and beauty of the early Italians. This characteristic absence of a real sense of pure beauty clung to the school even in later ages. Albert Dürer himself (1471–1528) is no exception to the rule. He is intensely dramatic and serious, simple and direct, and combines in his work all the qualities that mark the Ger. Renaissance, a movement which was intellectual and moral rather than artistic. A keener sense of beauty, stimulated by contact with Ital. art, was the gift of Holbein, whose noble style, while retaining the typical Ger. quality of careful minute observation, had none of the taint of Ger. ugliness, and was marked by sympathetic insight into character. Holbein became court painter to Henry VIII. of England, and gave the impetus to the great school of miniature painting that was to arise in that country.

France.—The early art of France was ruled by the contending influences of the Flemings and the Italians. Indeed, nearly all the early painters were of foreign, mostly of Flem., birth. The first great master of Fr. birth was the illuminator Jean Fouquet. In the 16th cent. the leading figures in Fr. art were Jean and François Clouet, whose exquisite portraits are closely allied to the style of Holbein. In 1531 François I. called to France the Italians Primaticcio and Rosso, who started the school of Fontainebleau, thus introducing the Italianizing tendencies from which Fr. art was to suffer for two centuries, during which most painters, including the great Poussin and the landscape painter Claude Lorrain, received their training in Rome. In the pompous age of Louis XIV. the official Italianizing school, presided over by Le Brun, ruled with autocratic sway, but under the following reigns the decoration of the boudoir rather than of the state-room became the painters' chief

object. Watteau, the great painter of the *fêtes galantes*, determined the direction of the Fr. *rococo*, which broke away from formal classicism, and devoted itself to the decorative rendering of the artificial, pseudo-bucolic life of the ruling classes, which gradually degenerated into coarse suggestiveness. Boucher and Fragonard must be mentioned among the great Fr. masters of the 18th cent.

Spain.—In Spain, individual expression was from the outset handicapped by the strict censorship of the Church and the Inquisition. Dominated during the 15th cent. by Flem. and during the 16th cent. by Ital. influences, Span. painting never entirely ceased to retain its national characteristics of intense seriousness and sombreness. Span. painting first rose to great achievement at Seville, which produced in the first half of the 17th cent. the two greatest masters of the Span. school—Velazquez, the first real impressionist portrait painter, and a very magician of the brush, unrivalled in the atmospheric truth of his tone-values; and Murillo, 'the embodied expression of Span. Catholicism.'

The tradition of Velazquez was carried on at Madrid by a generation of painters who, like his son-in-law, J. B. del Mazo, had come under the spell of his genius. Then followed a complete eclipse of the Span. genius, until the versatile Goya (1746–1828) made the national spirit flare up in a bright flame for a brief while. He was not only a painter, but a brilliant etcher and lithographer, and a great satirist.

Britain.—Eng. art was entirely under the domination of foreign schools until with Hogarth (1697–1764) arose a painter whose robust, healthy style created a truly Eng. and democratic art, to oppose the essentially aristocratic art of the masters that had been called to the Eng. court from abroad—from Holbein to Van Dyck, Lely, Kneller, Moro, Mytens, Largillière, and many others. Hogarth, it is true, put his art to the service of his self-imposed mission as a preacher of morality, but in his painted sermons and anecdotes purely artistic considerations are never sacrificed to literary interest. The efflorescence of Brit. portrait-painting belongs to the second half of the 18th cent., and was headed by Gainsborough and Reynolds. Gainsborough based his style on the cool elegance of Van Dyck, and became the painter of all that was refined and dandified in Eng. society of that period. He delighted in cool harmonies of colour, and his best work is distinguished by a feathery looseness of touch. Reynolds drew his inspiration from the Venetians, the Bolognese, and, above all, from Rembrandt. He was an eclectic who for ever preached the 'grand manner,' but was at his best when he forgot his theories and devoted himself to straightforward portraiture. One of the greatest British masters of portrait-painting, whose true merit has only comparatively lately found due acknowledgment, was the Scotsman Raeburn, who exceeded all his contemporaries in virility of brushwork and incisiveness of

characterization. He is the father of the modern Scot. school of portraiture. On a much lower plane is Romney, whose pleasing paintings of pretty women follow a rather mechanical convention and are lacking in character and sincerity.

The Royal Academy was founded in 1768, with Reynolds as first president. His advocacy of eclecticism, and his encouragement of the imitation of the Bolognese with their bituminous shadows, laid the foundation to the decline of the school, which, however, continued to excel in portraiture, and produced such distinguished painters as Hoppner, Opie, and Lawrence. The early Eng. landscape painters, notably those of the *Norwich School*, of which John Crome was the head, based their art on that of the Dutch school. A special branch of landscape, combined with animal and sporting life, was cultivated by G. Morland and J. Ward.

The significant movements of 19th cent. art, which are almost exclusively confined to France and England, was a constant struggle between classicism, or the pursuit of an arbitrarily imposed ideal of classic beauty, and a more naturalistic conception of painting. Classicism began to choke the free development in France during the First Empire under the lead of Louis David, who reflected the spirit of the Revolution and of the Napoleonic era by turning to the history and art of ancient Rome for his inspiration. His pupil, Ingres, one of the world's greatest draughtsmen, but a cold, formal painter, became the head of the *Classicist School*, against which the *Romanticists* under Delacroix rose in revolt. Apart from romantic subject-matter, Delacroix and his followers, basing their style upon Rubens and the Venetian colourists, instead of Raphael and Gr. sculpture, restored a new vitality to the art.

In England, too, the early part of the 19th cent. was marked by complete exhaustion, although with Constable arose a new school of landscape painting. Constable may be called the discoverer of the landscape in movement. He exercised an enormous influence not only upon Delacroix, but upon the Fr. painters of the thirties, who became known as the 'Barbizon school.' Among the masters of this school were the lyricist, Corot; the epic poet of nature, Millet; the animal painters, Troyon and Jacque; Diaz, who connects the Barbizon school with the Romanticists, Daubigny and Rousseau.

The next school that revolted against the classicism which remained the official art of France were the *Realists*, headed by Courbet, whose chief dogma was that it does not matter *what* you paint, as long as it is well painted. The *Impressionists*, headed by Monet, again were inspired by an Eng. master, Turner. The impressionists based their technique on their scientific knowledge of spectral analysis, dividing light into its constituents, the pure colours of the spectrum. Another group of impressionists, led by Manet, devoted themselves to the representation of contemporary life. The influence of the impressionists has been enor-

mous, and has permeated the art of every country. In England, Whistler was among its chief exponents.

All these movements sailed under the flag of a return to nature from the artificialities of eclectic academic art. The same claim was made for the Eng. *Pre-Raphaelites*, the chief among whom were Holman Hunt, Millais, and Rossetti, but the realism of this Eng. group consisted in a minute rendering of details, sometimes at the loss of the more important general truth. Their chief merit is that they cleared the palette of Eng. painters of its bituminous dreariness, and introduced something of the sincere spirit of the early primitives.

Modern Tendencies.—Towards the end of the cent., European art represents a chaotic confusion of the most varied tendencies and a loss of national characteristics, caused perhaps by easier means of communication and international exchange of ideas. Dissatisfaction with the convention of traditional methods, and with an art that is tied to the more or less faithful representation of superficial facts, and the recognition of the impossibility to carry the illusion of reality farther than it had been carried by the different modern realistic groups, finally led to the rather archaistic movement of the so-called *Post-Impressionists*, originated by Cézanne, von Gogh, and Gauguin. Their art is essentially synthetic, and not imitative or representative. It is claimed for them that they probe the real significance of things, instead of being satisfied with representing their mere outward appearance. In this they have much in common with the painters of China and Japan, from whom they differ, however, in so far as they adopted a coarse, unbeautiful technique, far removed from the calligraphic suppleness of Eastern art. The most extreme groups of these modernists are the *Cubists* and the *Futurists*, whose pictures and intentions are utterly incomprehensible without lengthy printed explanations. See also JAPAN (*Art*).

Haldane Macfall, *A History of Painting* (8 vols.); T. Leman Hare, *Masterpieces in Colour*; Ruskin, *Modern Painters*; Muther, *History of Modern Painting*.

Paints, liquids applied for decorative purposes; prepared by mixing colour powders or pigments (generally chromates or oxides) with a drying oil such as linseed oil; satisfactory results only obtained if some volatile solvent such as turpentine or stale naphtha is added to 'thin' the mixture. Driers are added to cause the paint to dry more quickly than it would otherwise do. Lead salts are most used as driers. Artists' colours are much finer than common paints, vehicle used being linseed oil, camphor, and amber resin mixed at high temperature.

Varnishes are resinous liquids giving protective coating; used separately or to form enamel paints.

Paish, SIR GEORGE (1867–), Brit. economist; assistant editor of the *Statist* (1894–1900), joint editor (1900–16); governor, London School of Economics; member of Departmental Committee, Board of Trade, on rail-

way accounts and statistics (1906–8); adviser to chancellor of the Exchequer and Brit. Treasury on financial and economic questions (1914–16); knighted (1912); pub. *Railways in Great Britain* (1904), *Railroads of U.S.* (1913), *Savings and the Social Welfare* (1911), *A Permanent League of Nations* (1918), etc.

Paisley, parl. burgh, river port, and seat of important manufactures, in Renfrewshire, Scotland (55° 51′ N., 4° 26′ W.), on White Cart near its junction with the Clyde; consists of old town, new town, and suburbs; possesses old abbey, founded *c.* 1163, and numerous public buildings. Industries include dyeing, bleaching, engineering, weaving, founding, brewing, distilling, tanning, and manufacture of cotton thread (see COATS FAMILY), starch, soap, corn-flour, and preserves. Pop. 89,400.

Pakhoi, or PEIHAI, treaty port, on Gulf of Tong-king, Kwang-tung, China (21° 26′ N., 109° 6′ E.); exports sugar, indigo, ground-nut products; port of Limchow. Pop. 20,000.

Pakokku, cap. of Pakokku dist., on Irawadi, Upper Burma (21° 20′ N., 95° 5′ E.); commercial centre; shipbuilding yards; millet, sugar-palms, rice, tobacco cultivated in district; petroleum oilfields; rich forests of teak and other timbers. Pop. 12,000; (dist.) 365,000.

Palæobotany may be looked upon as a branch of botany dealing with the structure, affinities, and distribution in time and space of fossil vegetable remains. These remains usually occur in a fragmentary condition, and may be preserved in a variety of ways as impressions of the external structure. Internal structure is provided by petrifactions in which the whole of the plant tissues are thoroughly penetrated with calcium carbonate or silica. In Palæozoic times the flora included a large group of fern-like forms and conifers belonging to families now extinct. The most interesting epoch was the Carboniferous, with its gymnosperms and vascular cryptogams—giant horsetails, club mosses (*e.g.*, Lepidodendron), and ferns (Filicales). (See FERN.) In Permian times modifying conditions appear. Though a few forms persisted into the Mesozoic period, a new series of plants—the cycads, ginkgo, and conifers—dominate the period. Tertiary times are marked by the sudden appearance and almost immediate dominance of the angiosperms, many of which are closely allied to modern species. Cycads, ferns, and conifers predominate to begin with, but in the Miocene period the flora approximated more nearly to that of the present.

Scott, *Studies in Fossil Botany;* Seward, *Fossil Plants;* Reid, *Origin of the British Flora.*

Palæography, science of anc. handwriting. Stone and metals were used in early times for the reception of writing, but were early appropriated to inscriptions; leaves are used in the East; bark (Lat. *liber*) gave its name to Lat. book; the Teutonic book, *Buch,* is derived from beech, the wood of which is specially suitable for inscription; and the Egyptian papyrus is one of the great historic writing materials. Linen

was also used in Egypt, but the papyrus rolls appear in the earliest sculptures and are extant from the third millennium. *Papyrus* superseded skins in Greece in the 5th cent. B.C. or earlier, and is said to have been introduced into Italy in the 2nd cent. B.C.; it was manufactured in Egypt until the 10th cent. A.D., and used until that time for ephemeral matter throughout Europe.

Skins have a long history as writing materials, and when the discovery was made by which the skin was turned into *vellum* it slowly displaced the papyrus. The discovery, according to tradition, was made at Pergamum in the first half of 2nd cent. B.C.; hence name *parchment*. Shortly afterwards it was introduced into Rome. Papyrus, however, was used throughout the Dark Ages, and the ancient custom of using waxen *tablets* continued among the Greeks and Romans until the 4th cent. A.D. The Romans used vellum largely for backing books, but in the Middle Ages this material became the literary writing material; it is still the material for legal title deeds, etc. PAPER was used from 9th cent. A.D. onwards, and came into general use in the 14th cent.

The Greeks and Romans used the stylus for writing on wax tablets, etc., the reed (*calamus*) for the papyrus. No mention of the quill (*penna*) is found until the 5th cent. A.D. *Ink* of various colours and ingredients had been used from Egyptian times, and black has always been the usual colour. A MS. written over an obliterated MS. is called a *palimpsest*; often valuable class. texts have been deciphered under mediæval writings.

The class. *roll*, the first form of book, is composed of various membranes fastened together, following one after the other as the script is unrolled; the wax tablets, however, were joined like the leaves of a modern book, and received the name *codex*, applied later to the vellum books made in a similar way, a way which speedily became universal, although legal documents of a certain nature have been enrolled right down to modern times, a method which, in fact, gave its name of the Rolls to the old Record Office. *Diploma*, the folded membrane of the early codices, has given the Fr. word *diplomatique* (the modern Lat. *res diplomaticus*); the single sheet was called leaf (*folium*). The system of columns, called pages (*paginæ*), went back to class. times. The *Codices* of the Dark Ages very often employed triple columns.

Writing from right to left is the custom of Semitic nations, and is found in the first Gr. remains. The practice of separating words by a blank was established in the 9th–11th cent. The titles, placed at the end of the roll, as a colophon, in class. literature, commenced in the Middle Ages to appear at the heads of books, and were for long smaller than the text. The paragraph was marked by the Greeks, and the first letter thereof enlarged, and a system of punctuation evolved. Both Gr. and Lat. MSS. are divided into the two main classes of *book-hand* and *cursive*—everyday writing. The

book-hand was the special sort of legible and decorative handwriting used before the invention of printing for much-valued books and books intended for sale. It is judged, *a priori*, to have developed out of the cursive. Both have a separate history of development. Gr. and Lat. MSS. may also be classified as in *majuscules* (large letters) or *minuscules* (small letters), and the majuscules are either capitals or uncials, the former having a square, the latter a curved shape. The history of the word *uncial* is not known, but it was employed in this way in common speech in the Dark Ages. Lat. capitals have also a less square form, called *rustic*, and Lat. palæography developed styles of 'half' and 'mixed' uncial. Nearly all literary documents were written in majuscules until the 9th cent.

Greek MSS.—Gr. manuscripts of an early period (1st cent. B.C. or 1st cent. A.D.) were found in excavations at Herculaneum in 1752, but no more have been found in class. territory, despite the numerous modern diggings. A great number of those that have survived have been conserved in Egyptian tombs and belong to the periods of Macedonian and Roman supremacy over Egypt; while the rest, later examples, belong to the Byzantine Empire, which had its seat at Constantinople and kept Gr. culture alive throughout the Middle Ages.

In the earliest specimens, many of the capitals (A, E, I, O; B, K, M, N, T, X, and the rudimentary form of S) of our present alphabet are present. The second Gr. period, which began in A.D. 284, was chiefly marked by the development of long heads and tails to the letters. Many of these MSS. are not from the tombs, but from the old libraries of Europe. Three vellum codices of the Bible, in Gr. uncials of the 4th and 5th cents., are now known by the places of their compilation or assigned creation, as *Codex Vaticanus*, *Codex Sinaiticus*, and *Codex Alexandrinus*. These, the palimpsest *Ephræmi Syri rescriptus* of the 5th cent., and the *Codex Bezæ* of the 6th cent., are the 'five great uncials.' The Byzantine minuscule hands which became literary scripts in the 9th cent. have been classed as *codices vetustissimi* (9th–10th cent.), *codices vetusti* (10th–13th cent.), *codices recentiores* (13th cent. to 1453), *codices novelli* (later than 1453, the end of the Græco-Roman empire).

Latin MSS.—As it first appears in the 1st cent. A.D. in Roman tablets, an occasional papyrus, and the wall scratchings (*graffiti*) at Herculaneum and Pompeii, the *Lat. cursive* is easily seen to be the parent of our modern handwriting; several of our small letters stand there in a medley with our present capitals, though many of these letters have since undergone revolutions. In the book-hands, however, the rustic capitals often employed from the 1st to the 6th cent. are very nearly the same as our present capitals.

Mediæval MSS.—The barbarians who overran the Roman Empire and built up our modern nations adopted the Roman script and developed it in their

different ways. At first they devoted themselves, not to literary products, but to working out useful cursive scripts from which, later, new book-hands were made. After the acceptance of Christianity, handsome religious books were in demand. Ireland produced, among other famous MSS., the *Book of Kells*, in half-uncials of the 7th cent., with the beautiful illuminations which were the mediæval contribution to palæography; and England, who learned her script chiefly from her Irish missionaries, produced the uncial Bible of Jarrow (*c.* 700), half-uncial Lindisfarne Gospels (of the same period), Bede's *Historia Ecclesiastica* (8th cent.), and the *Liber Vitæ* of Durham (9th cent.).

Irish writing gave way to French in England at the Norman Conquest. Fr. writing owed much to Charlemagne's renaissance. He ordered the production of sumptuous books, and his helper, Alcuin of York, started a school of calligraphy at Tours, where he was abbot (796–804).

The book-hand of the 15th cent. was adopted by the first printing-presses, though the Ital. printers soon turned back to models of the 12th cent., which was considered the great age of handwriting. Extensive contractions have been used from Gr. times in all cursive hands for economy of time and space, and an elaborate system of abbreviations was evolved in the Middle Ages. These may be found explained in Wright's *Court Hand Restored* (1776; 9th ed. 1879, by C. T. Martin), and Martin's *Record Interpreter* (1892).

Sir E. M. Thompson, *Greek and Roman Palæography* (3rd ed. 1906); F. G. Kenyon, *Palæography of Greek Papyri* (3rd ed. 1906); W. Wattenbach, *Anleitung zur Lateinischen Palæographie* (4th ed. 1886), and *Anleitung zur Griechischen Palæographie* (3rd ed. 1895); and E. H. J. Reusen, *Eléments de Paléographie* (1899).

Palæolithic Age. See AGE.

Palæontology (Gr. *palaios*, 'ancient'; *ōn, ontos*, 'being'; *logos*, 'science'), the science which reads in fossils the history of the past and endeavours to trace from them the story of life's progress in the world. That branch which deals with fossil animals is known as Palæozoology, that with plants as Palæobotany.

To earlier observers *fossils* presented great difficulties. The two main theories which for many centuries held sway were that they were sports of nature with no more meaning than a mineral crystal, or that, as Xenophanes suggested about 500 B.C., they actually represented the remains of entombed animals. Many centuries passed before universal recognition was given to fossils as the remains of living things, but Werner (1750–1817) first suggested that by their aid different geological formations could be recognized.

But palæontology as a science began with Cuvier and Lamarck, both of whom described many fossil remains and showed their relationships with living animals. At the same time, William Smith, 'the father of Eng. geology,' had observed in England

that in different rock layers different series of fossils were preserved. One cannot pass over unmentioned the magnificent work accomplished for palæontology by Richard Owen (1804–93) and by Louis Agassiz (1807–73), and for palæobotany by Brongniart in 1828. New life was given to the researches of palæontologists by Darwin's evolution theory, and since his time innumerable workers have entered the field, of whom we can note only Prof. Cope (1840–97), whose remarkable investigations on vertebrates were illumined by wide-reaching generalizations, and Prof. von Zittel (1839–), who has been described as the premier palæontologist.

Palæontology has accomplished much for her sister sciences of geology, botany, and zoology. She has helped to fill in our pictures of the world in ages long dead. From the nature of the fossil animals and plants discovered are revealed some of the conditions of their lives: whether they lived in fresh water or in the sea, in marshy places or on dry land, and still more in detail, even whether they lived in the abysses of ocean or in shallow water. Furthermore, fossils of the same kind found in different places indicate that similar conditions prevailed, and often that the rocks in which they occur were formed at the same time.

To the biologist results are even more interesting and more important. Occasionally a missing link is found—the toothed bird Archæopteryx, which, distinctly avian, shows evidence of descent from reptile stock; or an extinct group may help to fill a gap in the table of descent—the reptilian Dinosaurs of Mesozoic times possess characters which point to the coming of birds. Thus palæontology illumines the history of life and sheds its own light upon the evolution of living things. Close study has shown that even in limited periods evolution has been at work—for example, pond snails (*Viviparus* or *Paludina*), found in the lowest and highest layers of the Pliocene deposits of Slavonia, appear to be distinct species, but specimens from the intermediate layers show that by gradual steps the highest form developed from the lowest. Another well-known example is that furnished by the horse and its ancestors. These in early Tertiary times at first possessed five toes, but were succeeded by species in which the number of toes was gradually reduced until at the end of the series representatives of our domesticated horse (*Equus*) appear in Pliocene deposits with only one toe.

A wider view gives further support to the theory of organic evolution. Zoologists, on grounds of the complexity and integration of their structures, place in ascending order fishes, amphibians, reptiles, and birds. This is exactly the order in which those groups first appear as fossils.

Von Zittel, *History of Geology and Palæontology* (Eng. trans. 1901); Ray Lankester, *Extinct Animals* (1905); Woods, *Elementary Palæontology: Invertebrate* (1909).

Palæospondylus. See under CYCLOSTOMATA.

Palæotherium. See under HORSE FAMILY.

Palagonite, a fine dark red pulverulent rock, found usually in thin layers between ancient flows of basaltic lava, and known to occur in Iceland, Antrim, and Tenerife. It is really a weathered and oxidized basic tuff or ash-bed, composed of shreds of black volcanic glass, pumice, and rock fragments. Palagonite is found also among the red clays which cover a large part of the bed of the ocean, derived either from floated pumiceous volcanic cinders, or from the ejecta of submarine volcanoes.

Palamau, dist., Chota-Nagpur, Bihar and Orissa, India (23° 52′ N., 84° E.); coal mines; silk and lace exported. Area, 4,914 sq. m.; pop. 625,000.

Palamcottah, tn., Tinnevelly, Madras, India (8° 42′ N., 77° 46′ E.); mission station. Pop. 21,000.

Palamedeidæ. See SCREAMERS.

Palanpur, or PAHLANPUR, native state, Gujarat, Bombay, India (24° 12′ N., 72° 28′ E.); mountainous and well forested in N.; wheat, rice, sugar-cane cultivated. Area, 1,766 sq. m.; pop. 225,000.

Palatinate (Ger. *Pfalz*), former prov. of Bavaria, now federal state, Germany (49° 30′ N., 7° 50′ E.); leading town, Spires; most important rivers are Rhine and Lauter; soil very fertile, and produces corn, flax, fruits, and vegetables in large quantities; principal minerals are coal, iron, quicksilver, and salt. In old Germany Palatinate was much larger region, ruled by a count palatine; two capitals were Heidelberg and Mannheim. Upper and Lower Palatinate disjoined after Thirty Years' War, when Upper Palatinate (*Oberpfalz*) fell into hands of Bavaria; manufactures include machinery, chemicals, paper, beer, leather, and tobacco; cattle rearing carried on. Area of Palatinate, 2,289 sq. m.; pop. 937,100.

Palatine, earliest inhabited of the seven hills on which anc. Rome stood, its foundation being attributed to Romulus; Roman emperors resided on the Palatine, hence *Palatium* ('palace'), a royal residence, and hence the long use of the word 'palatine' as an adjective to describe persons entrusted by the crown with special privileges and powers, and also the districts over which these were exercised—*e.g.*, the *Comes palatinus* of the early Frankish kings, the 'paladins' of Charlemagne, the counts palatine of the Rhine, etc., and in England the three counties palatine, Chester, Durham, and Lancaster, within whose bounds their owners—the Earl of Chester, the Bishop of Durham, and the Duke of Lancaster — exercised royal powers. Though most of this jurisdiction has now been taken over by the crown, certain privileges remain.

Palawan, isl., Philippines (10° N., 119° E.); mountainous, forest-covered; exports rattans, resin, timber; fine natural harbour at Malampaya. Area, 4,370 sq. m.; pop. 35,000.

Palazzolo Acreide, tn., Syracuse, Sicily (37° 4′ N., 14° 54′ E.); ruins of fine Gr. theatre; magnificent tombs and interesting primitive sculptures in neighbourhood. Pop. 15,000.

Pale. See IRELAND (*History*).

Palembang, seapt., cap. of Palembang residency, Sumatra

(3° s., 104° 43′ E.); cotton, pepper, silk, dyewoods; great trading centre in Middle Ages; health station for troops of Dutch E. Indies. Pop. (tn.) 60,200; (dist.) 760,500.

Palencia. (1) Prov., Old Castile, Spain; mountainous in the N.; chief rivers, Pisuerga and Carrion; produces grain, wine; noted for manufacture of woollen textiles, rugs, mantles. Area, 3,256 sq. m.; pop. 196,500. (2) City, cap. of above (42° 2′ N., 4° 36′ W.), on Carrion; cathedral; centre of ironfounding, cloth, blanket and flannel weaving. Pop. 16,500.

Palermo, city, cap. of Sicily (38° 7′ N., 13° 22′ E.), on N. coast facing Ital. mainland; important seaport in sheltered bay; beautifully situated in fertile valley (Conca d'Oro) partly surrounded by mountains; chief products are machinery, chemicals, sumach, essences, sulphur, tartar, wine, green and dry fruits, tobacco. Notable features are fine cathedral (1169–85), San Giovanni degli Eremiti (1132), La Martorana (1143), Santa Maria della Catena; royal palace with beautiful Capella Palatina; Chiaramonte (Lo Steri, 1307), Bruiccia, Abetelli, and numerous other palaces; univ. (1805), Museo Nationale (with celebrated metopes from the temples of Selinunt), libraries, town-house, theatres, and old gateways. Founded by Phœnicians; conquered by Carthaginians, Romans, Saracens, and Normans (1071); then cap. of kingdom of Sicily; captured by Garibaldi (1860), and annexed to Sardinia. Pop. 345,900. The province of Palèrmo is largely mountainous. Area, 1,948 sq. m.; pop. *c.* 804,600.

Palestine, country, W. Asia (31°–33° N., 34° 20′–36° E.); name specially designates area between anc. Dan and Beersheba and beyond Jordan; extreme length, 145 m.; average breadth w. of Jordan, 40 m. It has been called by many names—'Land of Israel,' 'Land of Canaan,' 'Holy Land,' etc. Country may be divided into (1) plain of Philistia, Sharon, etc., broken only by Mount Carmel, bordering Levant; (2) hilly country of Judah, Samaria, and Galilee, intersected by many deep, water-cut ravines, and culminating in Jebel Jermuk, 3,934 ft. above Mediterranean; (3) the Jordan rift-valley, El Ghor, containing the Dead Sea, 1,292 ft. below Mediterranean and with maximum depth of 1,308 ft.; (4) the tableland of Arabia, generally 2,000 ft. high and attaining extreme height of 4,245 ft., sloping abruptly on w., more gradually to E. Principal rivers are Jordan, rising in valley of Lebanon, and passing through waters of Merom and Sea of Galilee into Dead Sea; Kishon (Nahr el Makutta), draining Plain of Esdraelon between Samaria and Galilee; Yarmuk, draining Hauran plateau, and entering Jordan on E.; Jabbok (Zerka), trib. of Jordan; Arnon (Mojib), entering Dead Sea. The Brook Kedron is generally dry. Lakes are Merom, Sea of Galilee, and Dead Sea. Cap. Jerusalem.

The Sinaitic Mts. are composed chiefly of crystallines, which are of Archæan age; to the N. these are covered by sandstone and

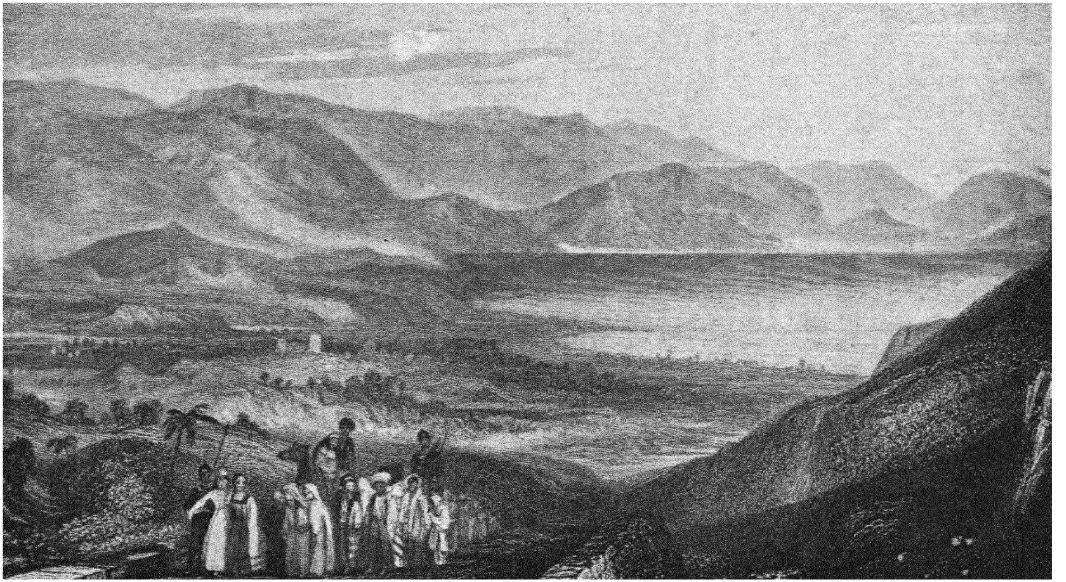
limestone deposits of Carboniferous age; the coastal plain is of Pleistocene formation, and volcanic rocks are found upon the limestone tableland of Moab; the Jordan valley coincides with a displacement or fault, so that the strata to the W. have been depressed and those on the E. raised; hence the two sides are of different geological character, crystallines overlaid by sandstones and limestones being found on the E., chalks and more recent deposits on the W.

The Mediterranean climate is extremely hot in summer and very wet in winter, the rainy season lasting from Dec. to March. Characteristic trees are the olive, cedar, and sycamore; wheat, wine, olives, and many fruits are reared; sheep and goats thrive in valleys and (in dry seasons) on mountains. Railways running inland from Haifa, and from Joppa to Jerusalem, are connected by line from Egyptian frontier, and one from Joppa–Jerusalem line to Plain of Esdraelon or Megiddo.

History.—According to the earliest Egyptian and Babylonian inscriptions, Palestine was already in the 4th millennium B.C. inhabited by a Semitic race. Probably Babylonian supremacy was established towards close of 4th or beginning of 3rd millennium B.C.; an inscription of about 2920 expressly states that Lugalzaggisi of Babylon was supreme over whole region from Mediterranean to Persian Gulf. About 2500 B.C. there occurred an invasion of the Amorites, who spread over all W Asia; a result of this was decay of Babylonia and its conquest by the Elamites. The traditional rise of the Heb. nation (see JEWS) occurs during Elamite period, which lasted till *c.* 2230, when Khammurabi, mentioned in Genesis as Amraphel, liberated his country from Elamite control and established his authority in Palestine as well as in Babylon. This second period of Babylonian rule probably lasted till the end of the 18th cent. B.C., soon after which the country must have come under Egyptian suzerainty; and it has been suggested that it was conquered by the Hyksos prior to their invasion of Egypt.

The Egyptians retained control of Palestine until reign of Amenhotep IV. (succeeded *c.* 1392), when their power began to decline, owing partly to the king's religious reforms and partly to the invasions of warlike people from the N. The Hittites are known to have invaded Syria in Amenhotep III.'s reign, but their great conquests began in that of Amenhotep IV., when appeals from all parts of Syria and Palestine for aid against them were sent to the Pharaoh at Tell-el-Amarna. After this the Hittites seem to have become predominant in the country, and they carried on a long struggle against Egypt. Eventually (*c.* 1303) they concluded a treaty with Rameses II., whereby Palestine was recognized as a prov. of Egypt. The rise of the Aramæans was probably contemporary with that of the Hittites, whom they eventually superseded.

From the end of the 13th cent. B.C. Palestine was undisturbed by the great surrounding



PALESTINE: THE DEAD SEA, JERICHO, AND THE MOUTH OF THE JORDAN.
(From a drawing by J. M. W. Turner, R.A.)



GENERAL ALLENBY ENTERING JERUSALEM, DEC. 11, 1917.
(Official photo.)

nations, and during a period of comparative isolation the Hebrews established their supremacy first under judges and later as a monarchy (see JEWS). This kingdom soon split into the two states of Israel and Judah, whose relations were marked by three distinct periods—(1) mutual hostility and constant war; (2) alliance and combined enmity to Syria; (3) fresh disputes, and the gradual decay of both kingdoms before the increasing power of Assyria and Babylonia. Israel was eventually conquered by Assyria *c.* 722 B.C.; and, after a prolonged struggle against Assyria and Egypt in turn, Judah was defeated by Nebuchadnezzar in 588; Palestine thus passed under control of the Babylonian Empire, and so remained until, with the fall of Babylon in 539 B.C., it came to the possession of Cyrus of Persia. Under the Persians a settled form of government was established by Ezra and Nehemiah; and this period was marked by the growth of organization, order, and ritual among the Jews. Pers. domination came to an end with the break-up of Pers. Empire before the victorious armies of Alexander the Great, after whose death Palestine came to the hands of one of his generals, Laomedan; in 320 it was seized by Ptolemy Soter of Egypt; between 314 and 301 it was held by Antigonus of Syria, but at the latter date it reverted to the Ptolemies, and became a buffer between Egypt and Syria. After a time of struggle between the Ptolemies and the Seleucids it was taken by Antiochus the Great (*c.* 198); his successors, Seleucus Philopator and Antiochus Epiphanes, persecuted the Jewish inhabitants and endeavoured to hellenize the country, a policy which resulted in a national rising under Mattathias and the establishment of the Asmonæan dynasty by his son, JUDAS MACCABÆUS. The dominion of the Asmonæans continued till 63 B.C., when internal disputes led to the intervention of the Romans; the country was then conquered by Pompey. The conduct of affairs was left to Antipater the Idumæan, who curried favour with the Romans, and whose son, Herod the Great, became king of all Judæa (40 B.C.).

During the first half of the 1st cent. A.D., Palestine passed through four distinct political phases: in the time of Herod the Great it had been a single united kingdom, but at his death (4 B.C.) it was divided up into principalities under his sons, Archelaus, Herod Antipas, and Herod Philip; before long Samaria and Judæa became a Roman prov., while Galilee, Trachonitis, and Ituræa continued under native rulers; then the former kingdom was revived for a short time under Herod Agrippa; and finally the entire country became a Roman prov. Owing to the cruel oppression of the Roman governors a great rebellion broke out in A.D. 66, but was eventually put down by Titus, and in 70 Jerusalem was utterly destroyed. After the suppression of Bar Cochba's revolt in 132–5, the new city of Ælia Capitolina was built by Hadrian on the site of Jerusalem.

Palestine remained under Roman control for several centuries, and after A.D. 395 formed part of the Byzantine Empire; it was taken early in 7th cent. by Chosroes of Persia, but was recovered by Byzantines in 629. The Saracens obtained possession of it in 636, and remained supreme for four centuries. In the 11th cent. it was taken by the Seljuk Turks, and in 1095 Peter the Hermit's exposure of the treatment to which Christian pilgrims were subjected by Mohammedans led to First Crusade; this resulted in capture of Jerusalem and election of Godfrey de Bouillon as Lat. king of Jerusalem. During 12th and 13th centuries eight other crusades were carried on, and in the 13th and 14th centuries occurred the great Mongol invasions. The country was eventually captured by the Ottoman Turks in 1516, and formed part of Selim I.'s empire. It remained under Turk. dominion except for a short time in 19th cent., when it was held by Egypt.

The Palestine Exploration Fund, founded 1864, has provided survey maps, etc. Dr. Bliss excavated the S. wall of Jerusalem in 1896–8, and Gath in 1898–1900. Macalister began to excavate Gezer in 1902.

The progress of hostilities in Palestine during the Great War is detailed in the following pages. By the Treaty of Peace with Turkey (signed Aug. 10, 1920) the administration of Palestine is entrusted to a mandatory (Britain), and declaration originally made (Nov. 2, 1917) by Brit. Government and adopted by Allied governments in favour of a national home for the Jewish people in Palestine is reaffirmed. Provision is also made for a special commission (chairman, SIR HERBERT SAMUEL) to study and regulate all questions and claims relating to the different religious communities. The Zionists are attempting to raise £25,000,000 from Jews all over the world to finance emigration to Palestine, establish institutions, erect buildings, including offices and schools, and for the upkeep of the Heb. univ. in Jerusalem. Area under Brit. occupation *c.* 7,000 sq. m.; pop. *c.* 600,000.

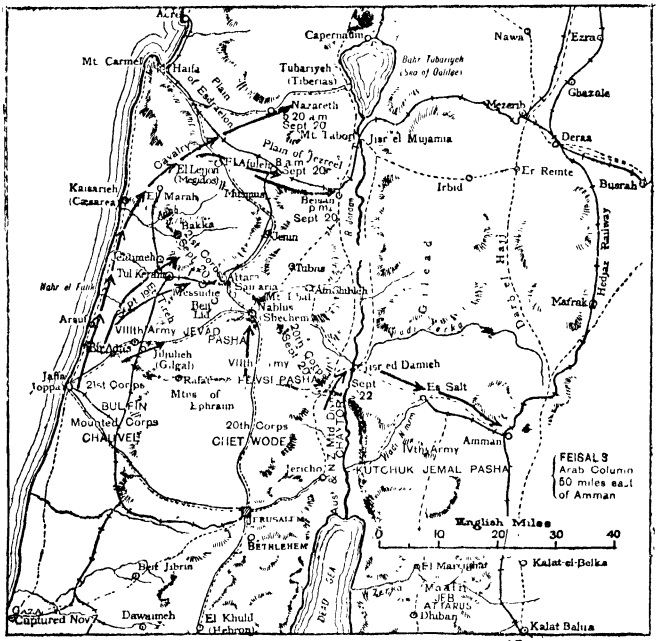
Huntingdon, *Palestine and its Transformation* (1911); Smith, *Historical Geography of the Holy Land* (new ed. 1911); Baedeker, *Palestine and Syria* (1912); Bentwich, *Palestine and the Jews, Past, Present, and Future* (1919).

Palestine Campaign.—In the earlier stages of the Great War the defence of Egypt on the E. was conducted along the line of the Suez Canal, but after failure of the second Turk. attack (Aug. 1916) it was decided to pursue the enemy across the Sinai desert and to constitute the defence in Palestine. By gradual stages the movement developed into a campaign against the Turks with a view to bringing about their general defeat and rescuing the Levantine seaboard from their dominion.

A railway was rapidly constructed along the coast route in the direction of El Arish. Before the end of Nov. two infantry divisions, the Imperial Cavalry, and the Anzac mounted troops were concentrated at

Mazar, and, after the water supplies had been organized, moved eastwards (Dec. 20), the cavalry entering El Arish (Dec. 21), which had been evacuated by the Turks, who had fallen back on Magdhaba, a fortified post on the track to their railhead at Auja. This position was taken by a general attack (Dec. 22), the Turk. commander, Klaat Bey, and 1,200 prisoners being captured. On Jan. 8, 1916, Rafa surrendered.

No further advance took place till the following year. General Sir Archibald Murray unwillingly undertook a further advance. On March 25, 1917 the troops—cavalry, camelry, artillery, and infantry—moved out across the plain towards Gaza, their immediate objective being the Wady el Ghuzze, a small stream running parallel to the frontier 5 m. s. of Gaza. It was occupied without resistance, and Sir Charles Dobell attempted to seize Gaza by a *coup de main*. In a dense fog a section of the troops,



Final Operations in Palestine.

moving along the coast, actually fought their way into the town, but 200 of them were there surrounded and captured. On the northern flank the 2nd Australian Light Horse captured the commander, Musa Kiasim Pasha, and the staff of the 53rd Division, and by late afternoon the Turks were virtually surrounded. It was getting dark, the water gave out, and instead of throwing in his reserve division Dobell ordered the whole force to fall back. Next day the Turks counter-attacked, and suffered heavy losses, but the British withdrew behind the line of the Wady el Ghuzze. Dobell was left in command for another attempt to capture the historic city. The defending force under the Ger. general von Kressenstein amounted to five divisions of infantry and one of cavalry. Dobell's now included four divisions, with two mounted divisions and the Camel Corps. The first stage was the capture of the ridges s. of Gaza to Sheikh Abbas; it was only partially successful (April 17), and again Dobell decided to keep his general reserve in hand. The reports in the Brit. press represented the battle as a small skirmish, but, as a matter of fact, over 7,000 Brit. casualties had been incurred. Dobell was relieved of his command (April 21); Murray was superseded by Allenby (June 28).

Several months were occupied in improving communications, pushing forward the railway and reorganizing the troops, and in the interval the Turks under instruction of General von Falkenhayn, who had come to Aleppo, prepared a strong defensive front from Gaza to Beersheba. By a series of raids (July–Oct.) Allenby carefully gave the impression that Gaza was again the direct objective. But his strategy really envisaged a turning attack from Beersheba. While pressure was kept up in front, mounted troops and infantry were sent round by night and attacked Beersheba from the E., capturing the town and taking 1,800 prisoners and nine guns (Oct. 31). Meantime, in order to attract the Turk. reserves while preparations were afoot for the capture of the Hareira–Sheria heights on the Hebron road, a strong attack was made on the Gaza sector. The 52nd (Lowland) Division stormed Umbrella Hill on the coastal flank, and Fr. and Ital. detachments, with W. Indian troops, assisted East Anglians and Scots when they went forward with a number of tanks (Nov. 1). The Hareira-Sheria heights were brilliantly stormed in four days of continuous fighting, in which the Welsh Division was conspicuous (Nov. 5). This operation proved decisive; the Turks began a general retreat, and Gaza was occupied without difficulty (Nov. 7). The same evening the British were 8 m. beyond the city. No further stand was made by the Turks till they reached Hebron and Jerusalem. On Nov. 9 the mounted troops moved forward beyond Ascalon and occupied Esdud and Ekron, and reached the ry. jn. at El Mansurah, where the line from Jerusalem branches off

from the Damascus-Beersheba track (Nov. 15). Meantime the coastal flank was secured by an advance to Jaffa (Joppa), which was occupied by Anzac mounted troops (Nov. 17). A pause was now necessary for the reorganization of communications, but it was essential first to obtain hold of the one good road which traverses the Judæan ridge from N. to S., from Nablus (Shechem) to Jerusalem. This was effected by Nov. 21, when the infantry had secured Neby Samwîl ridge, the traditional site of Samuel's tomb, looking down on Jerusalem, 5 m. to the S.E.

The Welsh Division entered Hebron (Dec. 6), but were held up by bad weather before Bethlehem, which was to be spared from damage. The London territorials cut the Shechem road, and the Welsh, turning eastwards from the Bethlehem road to the Jericho route, isolated Jerusalem. The mayor advanced to the Brit. lines under a white flag, and Allenby entered the Holy City on foot by the Jaffa Gate (Nov. 11). He went as a liberator, offering freedom of worship to all faiths. The Turks made a determined but vain attempt to recover the city. For seven weeks there was a lull in the fighting. Then the Anzacs moved towards Jericho, and infantry fought their way up to the historic town, which was occupied unopposed (Feb. 21, 1918). With this victory the conquest of southern Palestine was complete. Meanwhile, to assist the King of the Hejaz in his attacks E. of the Dead Sea, Allenby undertook a series of raids across the Jordan into Moab. New Zealanders cut the Hejaz railway S. of Amman (March 27), but a Turk. threat against the small force left to hold Es Salt made retirement advisable, and the whole force was withdrawn across the Jordan, with the exception of troops left to hold the bridgehead at Hajlah. At the end of April another raid was carried out against Es Salt; but the Arabs failed to cooperate, and the troops were again withdrawn (May 4). Meantime Falkenhayn had been replaced by Liman von Sanders; the pressure of the Germans on the Western front caused the 52nd and 74th Divisions to be sent to France; Ind. divisions were sent from Mesopotamia to take their place; but a considerable period was required for reorganization. It was essential that the offensive should be renewed well before the time when the autumn rains turn the plains of Sharon and Esdraelon into swamps. The Turks had a total force of about 32,000 rifles, 3,000 sabres, and 400 guns S. of Beirut; while the Brit. numbers were 57,000 rifles, 12,000 sabres, and 540 guns. The vital points in the enemy's communications were El Afule, Beisan, and Deraa. Allenby's plan was to sweep through the coastal sector into the Plain of Esdraelon (Armageddon) by the gap at Jiljulieh, the anc. Gilgal, 10 m. in width, to shepherd the Turks towards El Afule into the arms of the cavalry, and then to push down the Vale of Jezreel to Beisan, so hemming the enemy against the Jordan. The battle began on

Sept. 18, when Chetwode's corps, the 10th and 53rd Divisions, swung its right forward, E. of the Bireh-Nablus road, against heavy opposition. Then the artillery, supported by the fire of two destroyers, began the bombardment of the Turks' coastal defences. The attack, which was evidently unexpected, was immediately successful. The 75th, 7th (Meerut), and 60th Divisions rapidly overran the first defensive system, and without pause advanced against the second. Thrown into confusion, the enemy began to retreat, closely pursued by Australian Light Horse, Chasseurs d'Afrique, and Spahis. Chetwode now began to co-operate, and in a series of heavy engagements forced the Turks back. On the 19th the cavalry turned through the hills of Samaria into the Plain of Esdraelon at Abu Shusheh, while on the hill front the 14th Brigade turned towards El Afule, and the 13th rode into Nazareth (Sept. 20), capturing the papers and some of the staff of the Ger. commander-in chief. Meantime the 4th Division came up the Wadi Arah from the coast by way of El Lejjun (Megiddo) to Afule, and pressed on through the Vale of Jezreel to Beisan, having covered 80 m. in 34 hours. Thus all the main outlets of escape remaining to the Turk. 7th and 8th Armies had been closed. They could avoid capture only by using the tracks which run S.E. from the vicinity of Nablus to the crossings of the Jordan at Jisr ed Damieh. During the night the enemy realized his position and began to retreat. Organized resistance ceased (Sept. 21); his columns were harried by the repeated attacks of the Royal Air Force; New Zealand Mounted Rifle Brigade and Brit. West Indies battalions seized the crossing at Jisr ed Damieh. By the evening of the 24th the 7th and 8th Turk. Armies had ceased to exist. The battle had been decisive.

Allenby then occupied Haifa, so securing another avenue of supply, and the Turk. 4th Army took to flight. Across the Jordan Amman was occupied (Sept. 24), and 5,000 Turks were caught between the British and the Arabs advancing along the railway from Maan. Already the Desert Mounted Corps had begun to move towards Damascus, and the 4th and 5th Cavalry Divisions, and the Australian Mounted Division crossing the Jordan below the Sea of Galilee, were marching through Gilead towards Deraa. On Oct. 1 Damascus fell, twelve days after the opening of the battle. Three Turk. armies had been destroyed; over 60,000 prisoners and 300 guns had been taken; some 17,000 of the enemy remained, though only 4,000 were effective rifles. The strain on the pursuers was heavy, but the Turks were given no rest. Allenby proceeded to seize the Beirut–Rayak railway, which gave him a new port of supply leading to Damascus (Oct. 8). Onward into Syria the advance continued through difficult mountain country, where the Turks, had they not been thoroughly demoralized, might have offered effective resistance.

The rest of the campaign is

simply a chronicle of the fall of towns famous from antiquity. Tripoli was taken on Oct. 13; Homs was occupied about the same time; and Aleppo was entered by a detachment of Arabs on the 25th. Muslimie junction, on the Bagdad railway N. of the town, was seized, and Allenby was preparing to advance to Alexandretta when Turkey signed the armistice at Mudros which closed the war in the Near East (Oct. 30).

W. T. Massey, *Allenby's Final Triumph* (1920); General Murray's *Dispatches* (1920).

Palestine, city, Texas, U.S. (31° 46′ N., 95° 37′ W.); cotton industries, iron foundry, saw and grist mills. Pop. 10,500.

Palestrina, GIOVANNI PIERLUIGI DA (*c* 1524–94), Ital. composer; *b.* Palestrina; director of sacred music at the Vatican (1551), when he wrote an epoch-making set of Masses dedicated to Pope Julius III.; music director at the Lateran (1555), and at S. Maria Maggiore (1561). The prevalent Church music being condemned by Council of Trent (1562), Palestrina was commissioned to reform it, and wrote his celebrated *Marcellus Mass*, still regarded as a classic.

Paley, WILLIAM (1743–1805), Eng. theologian; archdeacon of Carlisle (1782), sub-dean of Lincoln, and rector of Bishop Wearmouth (1795); famed for his *Evidences of Christianity* (1794); wrote also *Horæ Paulinæ* (1790), *Natural Theology* (1802), etc. *Life*, by G. W. Meadley (1809).

Palghat, tn., Malabar, Madras, India (10° 45′ N., 76° 39′ E.); is important commercially and strategically owing to position in Palghat pass of Nilgiri Hills; key to W. coast. Pop. 46,000.

Palgrave, SIR FRANCIS (1788–1861), Eng. historian; deputy keeper of public records (1838–61); author of *History of England, Rise and Progress of the English Commonwealth, History of Normandy and England*, etc.

Palgrave, FRANCIS TURNER (1824–97), Eng. critic and poet; son of Sir Francis Palgrave, the historian; prof. of poetry at Oxford (1886–95); author of *Idylls and Songs* (1854), *Lyrical Poems* (1871), *Visions of England* (1881), etc.; also compiled the *Golden Treasury of English Lyrics* (1861 and 1897).

Palgrave, SIR REGINALD FRANCIS DOUSE (1829–1904), Eng. author, and clerk to the House of Commons (1886–1900); son of Sir Francis Palgrave and brother of Francis Turner Palgrave; knighted in 1892; pub. *The House of Commons: Illustrations of its History and Practice* (1877), *The Chairman's Handbook* (1903), *Oliver Cromwell* (1890), and ed. first two books of Sir T. E. May's *Treatise on the Law of Parliament* (1893).

Pali, the language of cultured people in N. India from about 650–150 B.C., and the first lingua franca used in India, filling a similar rôle to that of Latin in mediæval Europe: inscriptions, religious treatises, canon law, learned literature were all written in Pali, besides which it exercised a profound influence on the surrounding cruder dialects. It is still the literary language of Buddhists in Siam, Indo-China, Burma, and Ceylon. In

origin Pali is closely related to Sanskrit, and thus belongs to the Indo-European group. In 1882 a Pali Text Soc. was founded, which has pub. many of the more valuable Pali works.

Palimpsest. See PALÆOGRAPHY.

Palisades. See HUDSON RIVER.

Palissy, BERNARD (1510–89), Fr. potter; worked as a glass painter, and settled at Saintes (1538), where he laboured for sixteen years to discover the secret of enamel manufacture, and at length achieved success; appointed 'inventor of rustic figulines' to the king, and established a workshop in Paris (1564). He was an advanced thinker and lecturer on natural philosophy; escaped massacre of St. Bartholomew; but in 1585 was thrown into the Bastille as a Huguenot, and died there.

Palitana, native state, Kathiawar, Bombay, India (21° 31′ N., 71° 53′ E.); noted for horse breeding; cap. Palitana, situated at base of Satrunjaya Hill, sacred to Jains, and covered with temples. Area (state), 289 sq. m.; pop. (state) 53,000, (tn.) 13,500.

Palk Strait separates India from Ceylon (10° 5′ N., 80° E.); passage difficult owing to shoals and coral reefs on either side.

Palladium (class. myth.), an ancient image of Pallas kept at Troy. Legend said that as long as it was safe the city could not be taken. But towards the end of the siege Odysseus and Diomedes entered the city in disguise and removed it — according to some accounts to Greece, others say to Rome.

Palladium (Pd, 106·7), metallic element in platinum group; occurs, alloyed with platinum or gold, in S. America and the Harz. Silvery white, sp. gr. 11·4; unalterable in air, when heated in oxygen forms PdO; dissolves in hot nitric acid; used for coating silver, and as a substitute for gold in dentistry. After heating, palladium 'occludes' (*i.e.*, absorbs) about 900 times its volume of hydrogen, increasing nearly 10 per cent. in bulk.

Pallas Athene. See under ATHENA.

Palm. See PALMS.

Palma, port, Majorca, cap. of Balearic Isles (39° 35′ N., 2° 43′ E.); seat of bishopric; cathedral, episc. and royal palaces; trades in wine, cereals, fruit, etc.: new harbour works completed in 1910. Pop. 68,400.

Palma, or SAN MIGUEL DE LA PALMA, one of the Canary Islands (28° 42′ N., 17° 52′ W.); chain of high mountains runs N. to S.; wines, silk, fruits, wax produced; chief town, Santa Cruz. Area, 280 sq. m.; pop. 44,000.

Palm Civet. See under CIVET FAMILY.

Palmer, EDWARD HENRY (1840–82), Brit. Orientalist; engaged in survey of Sinai (1869); Lord Almoner's prof. of Arabic at Cambridge (1871); perished in an expedition connected with Arabi's Egyptian rebellion; wrote *Oriental Mysticism* (1867), *Desert of the Exodus* (1871), *Dictionary of the Persian Language* (1876), *Arabic Grammar* (1874), etc.

Palmer, ROUNDELL. See SELBORNE, EARL OF.

Palmerston, tn., cap. Northern Territory of S. Australia (12° 28′ S., 130° 51′ E.), on Port Darwin; mining. Pop. *c.* 1,500.

Palmerston (HENRY JOHN TEMPLE), VISCOUNT (1784–1865), Brit. statesman; succeeded his father in peerage (1805); secretary of war in Tory government of Duke of Portland (1809), and retained this office till Huskisson's resignation (1828); he adhered to Canning under Lord Liverpool's administration, and warmly supported Canning's policy of aiding revolution abroad, during that statesman's brief premiership (1827), deserting the Tory party. He became minister of foreign affairs under the Whig government of Earl Grey (1830), and made alliance with the new constitutional ruler of France, Louis Philippe, thus ending long enmity of England and France; actively assisted in establishing Belgian kingdom and supported popular claimants, Donna Maria in Portugal and Isabella in Spain; remedied unfortunate result of Canning's assistance to Greece—*i.e.*, the weakening of Turkey—by helping to put down revolt of Turk. pasha, Mehemet Ali (1840).

These measures met with strong opposition at home, especially after disasters in Afghanistan (1841), and the ministry went out of office. Under Lord John Russell he again became foreign minister (1846–51); vote of censure on his policy carried in House of Lords, counter-vote in House of Commons (1850), Palmerston making an impressive speech of vindication in the Lower House. He was dismissed by the queen (1851) for unauthorized action with regard to France; home secretary in Aberdeen administration (1852); premier (1855–58, 1859–65); last years marked by temporizing in all great questions being agitated at home and abroad. He was not an impressive personality, but was skilful and very popular.

Dalling and Ashley, *Life* (1870–76); *Queen Victoria's Letters* (1907).

Palmistry, or CHIROMANCY, the pseudo-science which claims to reveal character or destiny by a study of the lines of the palm and general formation of the hand; practised by the Jewish Kabbalists and the Brahmans of India, recognized by many Gr. and Roman thinkers (*e.g.*, Aristotle and Augustus), in the Middle Ages by Hartlieb and Cocles (who foretold his own murder, 1504), by d'Arpentigny and Desbarrolles in the middle of 19th cent., and has had a considerable revival of late years; first introduced into England by the gipsies in 16th cent. The practice of palmistry for money (fortune-telling) is now forbidden under the Vagrancy Act, though the law is constantly evaded.

Palmitic Acid ($C_{15}H_{31}COOH$), a fatty acid present in palm oil; it occurs combined with glycerine as *palmitin* in fats and oils from which the acid is obtained by hydrolysis; it is crystalline and insoluble in water; its sodium salt is one of the constituents of hard soap, and its potassium salt of soft soap.

Palm Oil, stiff, dark-coloured grease, used for soap-making and as railway grease; it is extracted by boiling the fruit pulp of several palms in water, the oil separating and being skimmed off.

Palms, a group of monocotyledons mainly tropical in distribu-

tion; the majority are arborescent and unbranched (*Hyphæne*, the doum palm, branches), and bear an apical crown of leaves, which are primarily entire, but become palmately or pinnately divided. Some genera (*e.g.*, *Calamus*, the rattan palm) are climbers, whilst others, such as *Nipa*, a swamp palm, have a very short stem and radicle leaves. The inflorescence is large, and during its earlier stages is enclosed by a protective sheath or spathe. In the majority it is axillary, but in a few (*e.g.*, *Corypha*, the talipot palm; *Metroxylon*, the sago palm) it is terminal, and results in the death of the plant. The flowers are trimerous, and may be dicœcious or monœcious. On fertilization a berry (*Phœnix*, the date palm) or a drupe (*Cocos*, the coco-nut palm) is produced. Economic products—fibre (*Cocos*), oil (*Cocos*, *Elæis*), vegetable ivory (*Phytelephas*), sago (*Metroxylon*), areca nuts, etc.

Palmyra, celebrated anc. city in Syria, once important centre of caravan trade owing to central position in oasis in the Syrian desert. Under first Roman emperors Palmyra was independent, with large trade and considerable importance as commercial and religious centre; during the Parthian War in 3rd cent. rose to great power; under Odenathus and then Zenobia Palmyra extended its sway far and wide, till it was captured by Romans and Zenobia taken prisoner (*c.* 270) and dethroned by Roman emperor Aurelian. It was captured early in Arabian Conquest and turned into a Moslem fort; is now inhabited by wandering Arabs. Ruins of city are extensive and magnificent, the chief being those of temple of Baal, with colonnade *c.* 1 m. long.

Wright, *Palmyra and Zenobia.*

Palpitation. See HEART.

Palsy. See PARALYSIS.

Palwal, munic. tn., Punjab, India (28° 9′ N., 77° 20′ E.); depot for cotton of dist.; of great antiquity; said to have been restored 57 B.C. Pop. 13,000.

Pamiers, tn., Ariège, France (43° 7′ N., 1° 36′ E.); flour, woollen goods, bricks, leather, wine, paper manufactured; iron and steel goods important, especially chains and carriage springs. Pop. 10,000.

Pamirs, lofty plateau region, in Central Asia (38° 30′ N., 74° E.), where Hindu Kush, Himalayas, Kuen-Lun and Tian Shan Mts. converge; average height, *c.* 13,000 ft. Mountain ranges are separated by broad valleys or *pamirs*, chief of which are Great Pamir, containing Lake Victoria; Little Pamir; Pamir-i-Wakhan; Sarez Pamir, with river Murghab; Rang Kul, Kara Kul, and Taghdumbash Pamirs. These valleys are drained mostly by tributaries of Oxus, occasionally contain lakes, and are intersected at intervals by passes; region almost destitute of vegetation, except along banks of rivers and lakes, where there is fine pasturage during summer months for great-horned sheep, etc.; climate severe and storms sudden and violent; inhabited by Kirghiz tribes.

Pampa, terr., Argentina, S. America (36° 30′ S., 65° W.), W. of Buenos Aires; belongs almost entirely to pampas region;

large sheep and cattle ranches. Area, *c.* 56,320 sq. m.

Pampas, vast plain in Argentina, stretching from Andes to Atlantic and from Gran Chaco to Rio Colorado (30°–40° S., 57°–70° W.); consists mainly of level expanse covered with shingle; in some parts solitary trees to be found; contains several salt lakes; in N.E. is more fertile district, covered with pampas grass, where horses, cattle, and sheep are reared; part of region along the Parana is suitable for agriculture. Area, *c.* 250,000 sq. m.

Pampas Hare. See VISCACHA.

Pampero, name applied in mediterranean and littoral regions of Argentine Republic to violent S.W. winds blowing off the Pampas; usually accompanied by thunderstorms and heavy rain. Duration of phenomenon is usually short, but in River Plate region strong winds may blow for a day or two. Greatest intensity occurs in first few hours, during which temp. may fall as much as 25 to 30 degrees, affording much relief from previous intense heat. The average number of pamperos in estuary of Rio de la Plata is from 20 to 25 per annum, but only one or two are of sufficient violence to do damage to shipping. They are most frequent in Feb., Aug., and the last quarter of the year. Also experienced on the coasts of Uruguay and S. Brazil.

Pamphylia, originally a narrow, mountainous region on S. coast of Asia Minor lying along Gulf of Adalia; intersected by several rivers from the Taurus; inhabited by mixed races.

Pamplona. (1) City, cap. of Navarre, Spain (42° 49′ N., 1° 38′ W.); strong fortress on spur of Pyrenees; fine 14th cent. Gothic cathedral. Pop. 30,400. (2) Tn., Colombia, S. America (7° 40′ N., 72° 54′ W.); breweries, match factories; in vicinity are abandoned gold and silver mines. Pop. 20,000.

Pan (Gr. myth.), son of Hermes and god of shepherds; specially worshipped in Arcadia. In art Pan is represented with horns and goat's feet, and playing on a set of pipes.

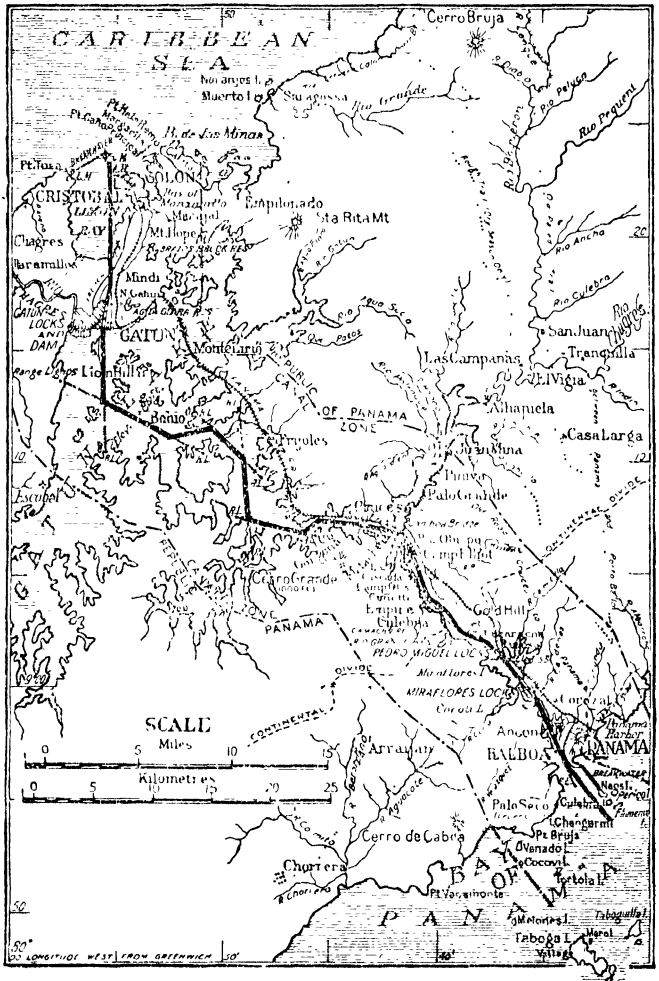
Panacea ('the all-healing'), daughter of Æsculapius, who had a temple at Oropus.

Panama. (1) Republic, Central America, since 1903; formerly dep. of Colombia. Off the coast lie numerous islands; several large bays—Almirante, Gulf of San Blas, Chiriqui Lagoon, and Gulf of Panama. Traversed by the Sierra de Chiriqui and Cordillera de Veragua. Chief rivers are Bayano, Tuira, and Chagres. Climate is tropical; soil very fertile, but greater portion unoccupied, and only small part of occupied portion is cultivated. Chief industries are cattle raising, agriculture, and pearl fishing. Most important products are bananas, coffee, caoutchouc, cocoa, sugar, and hides. A railway (47 m.) follows course of Panama Canal and connects ports of Colon and Panama; it belongs to U.S., as does the canal zone, which extends 5 m. on either side of canal, but does not include cities of Colon and Panama. Several other private lines traverse country, and a concession was granted (1917) for construc-

tion of a line from Chagres R. to Almirante. The republic is divided into seven provinces; the district surrounding gulf of same name is known as Darien; the chief ports are Panama (cap.), Puerto Mudis, Pedregal, Dulce, Montijo, Colon, Bocas del Toro, and Puerto Bello. Extreme length, 480 m.; breadth, between 37 and 110 m.; area, 32,380 m.; pop. 336,700. (2) Cap. of above republic (9° N., 79° 33′ W.), on Panama Gulf, at Pacific terminus of Panama Canal; has fine cathedral. City (founded 1519) and harbour are under jurisdiction of U.S. in all that relates to sanitation and quarantine. Pop. 61,400.

Panama Canal. In 1838 the republic of Colombia granted a concession to a Fr. company to make a canal or railway across isthmus, but beyond surveying and reporting in favour of a lock canal at an estimated cost of £5,600,000 nothing was done. The construction of the Panama railway by W. H. Aspinwall (1855) greatly strengthened demand for a maritime canal, and for several years surveys were conducted to ascertain and develop possibilities of various schemes. The Clayton-Bulwer Treaty, between U.S. and Great Britain (1850), declared for free and equal passage of ships of all nations, through a canal, if and when made, and this attitude was later confirmed by the Hay-Pauncefote treaty of 1901, which, however, substituted for the joint control clause in first treaty one permitting U.S. to construct independently and police the canal. Meanwhile the Colombian Government, deeming that the balance at Washington was swinging towards the Nicaragua route, granted as a counterstroke a concession for the construction of a canal to Lieutenant Lucien Napoleon Bonaparte Wyse of the Fr. navy.

In 1879, at a congress held at Paris, it was decided to cut a sea-level canal through the isthmus at an estimated cost of £42,000,000, and a new company, the Compagnie Universelle du Canal Interocéanique, was formed, with Ferdinand de Lesseps, of Suez Canal fame, as president. Work began in 1882, but from the first the enterprise was dogged by difficulties, the chief of which were the tropical floods of the Chagres R., and the ravages of yellow fever and malaria among the staff and workmen, of whom it is estimated that 40,000 died from disease in the canal zone during the Lesseps régime. In 1888 the company became bankrupt, under circumstances which produced charges of fraudulent transactions and of corruption on a colossal scale. A new canal company, formed in 1894, continued the work, a lock-canal having been substituted for the original sea-level waterway, but funds gave out long before the end was in sight. Negotiations were opened with the U.S. Government, which finally acquired (1904) the company's concession, plans, plant, and all other property for the sum of £8,000,000. At the time of the transfer some £60,000,000 had been spent and about 80,000,000 cubic yds. of material excavated and removed. The



Map of the Panama Canal.

Panama republic (formed in 1903), in consideration of a lump payment of £2,000,000 and an annual payment of £50,000, to begin in 1913, ceded to U.S. a strip of territory extending 5 m. on each side of the centre line of the canal, and extending 3 m. into the sea at each terminal. In 1905 an International Board of consulting engineers, assembled by President Roosevelt, had voted in favour of a sea-level canal, but this decision was reversed by Congress (1906), and the lock-canal project adopted.

The first two years of work under Amer. control were devoted principally to preparatory operations, the building of railway tracks and houses, the collection of plant, and the carrying out of sanitary measures to protect the working force from the ravages of fever. Under the energetic direction of Colonel Gorgas, the extirpator of yellow fever in Havana, a large sum of money was most profitably expended on drainage, on water-supply systems, and on the extirpation of the disease-spreading mosquito. To the credit of the medical staff, the canal zone, which in 1904 was a fever-infested jungle, now has a death-rate lower than that of the average Amer. city.

In 1906 the task of assembling a large labour force began in earnest, and for nearly eight years from 20,000 to 40,000 men were employed, an enormous number of steam-navvies and other labour-saving devices were brought into action, and the largest engineering works ever known were set up at Gorgona for the repair of tools and machinery. So well had everything been planned, including the vesting of sole executive power in Colonel (now Major-general) G. W. Goethals, that the rate of excavation improved steadily till the completion of the work. The canal, probably the greatest of all engineering feats, was formally opened on Aug. 15, 1914, the total Amer. expenditure on the enterprise approximating to £80,000,000.

The canal begins on the Atlantic side at Cristobal, in Limon Bay, a dredged channel, 7 m. long and 500 ft. wide, leading to the Gatun docks, where a lift of 85 ft. brings a ship into the artificial Lake Gatun, with a surface area of nearly 140 sq. m , created by damming the Chagres and other rivers. The construction of the Gatun dam, the greatest ever built—1½ m. long, 100 ft. high, ½ m. wide at the bottom—was the outstanding engineering feature of the Panama Canal. After crossing the lake (24 m.), the canal enters the Culebra Cut, 9 m. long and 300 ft. bottom width, at Obispo, leaves it by the Pedro Miguel Lock with a drop of 30 ft., passes through the Miraflores dock to sea-level, and then for 8 m. to Port Ancon, where the Pacific is reached. It is about 50 m. from deep water in the Atlantic to deep water in the Pacific, but as the distance from deep water to shore line on either side is about 4 m., the length of the canal proper is approximately 42 m. The canal ranges in width from 300 to 1,000 ft., the

average bottom width being 649 ft. and the minimum width 300 ft. It has a minimum depth of 41 ft. Each of the locks is 110 ft. wide and 1,000 ft. long; and all three locks are built in duplicate, so that vessels going in opposite directions may constantly pass. The water running over the spillways is utilized by turbines for electric power to operate gates and valves and for towing apparatus of the locks. All vessels are handled through locks by electric towing locomotives running on rails on the lock walls, and elaborate precautions are taken to prevent collisions with lock gates. From end to end the canal is lighted by electricity and gas, floating buoys being used in Lake Gatun. The time of transit averages from 7 to 8 hours, with a minimum of a little over 4 hours.

The Panama Canal Bill, signed by President Taft in 1912, aroused considerable feeling in Great Britain because of one of its provisions—that no tolls should be levied on vessels engaged in the U.S. coast trade, though all others were subject to tolls. This was regarded as a breach of the Hay-Pauncefote Treaty, and after the election of Dr. Woodrow Wilson to the presidency, the offending clause was ultimately deleted, and the canal thrown open to the world's shipping on equal terms. Strong fortifications for defence against hostile attack have, however, been constructed at both terminals, and the whole canal zone —436 sq. m.—made a military reservation. The canal government acts as agent for ships, the service including coaling, provisioning, etc., and a dry dock is being constructed at Pacific entrance.

The opening of the canal has materially changed the routes between many countries. It has shortened sea distances between European ports and the Pacific coast of N. and S. America by about 6,000 m., and has brought all Amer. ports on Pacific 2,800 m. nearer to New York than Liverpool. Even distances from certain Oriental ports are less by Panama Canal than by Suez Canal. The canal has been in use ever since its formal opening, except that interruptions owing to landslides in the Culebra (now Gaillard) Cut led ultimately to suspension of traffic from Sept. 1915 till April 1916. Since that date traffic has moved with only slight delays. For year ending June 30, 1919, 1,168 vessels (excluding canal vessels and barges), carrying a cargo of 4,029,742 tons, passed from Pacific to Atlantic; while 861 vessels, with cargo of 2,778,065 tons, crossed from Atlantic to Pacific—making a total of 2,029 vessels using the canal, carrying cargo of 6,807,807 tons. Of the total number of ships 623 were British, 839 American, 124 Norwegian, 74 Danish, 78 Chilean, 61 Peruvian, 75 Japanese, 96 French, and 16 Dutch. The tolls levied for this period were $6,269,176.

Johnson, *Four Centuries of the Panama Canal* (1906); Balsenhur, Knapp, and Johnson, *The Panama Canal* (1915); and *The Canal Record*, pub. weekly by the canal authorities.

Panax. See GINSENG.

Panay. (1) Isl., Philippines (11° N., 122° 30′ E.); mountainous, well watered; rice, cotton, sugar-cane, coffee, some weaving; chief seaport, Iloilo. Area, 4,752 sq. m.; pop. 743,600. (2) Tn., Panay, Philippines (11° 30′ N., 122° 48′ E.), 3 m. S.S.E. of Capiz. Pop. 15,000.

Panch Mahals, dist., Gujarat, Bombay, India (22° 45′ N., 73° 50′ E.); large forests; iron, lead, manganese, and mica found in hills; timber is chief export. Area, 1,606 sq. m.; pop. 260,000.

Pancreas, a gland present in vertebrates (with exception of some divisions of fishes), associated with the stomach. It secretes ferments which aid the process of digestion by changing proteids to peptones, starch into sugar, and fats into fatty acids and glycerine. The pancreas of cattle or sheep used as food is known as *sweetbread.*

Panda. See RACCOON FAMILY.

Pandan, tn., Panay I., Antique prov., Philippines (11° 42′ N., 122° 4′ E.), 75 m. N.N.W. of Iloilo. Pop. 14,000.

Pandanaceæ, natural order of tropical trees and shrubs; flowers are unisexual and arranged on a spadix.

Pandects. See JUSTINIAN I.

Pandharpur, munic. tn., Bombay, India (17° 41′ N., 75° 26′ E.); temple dedicated to Bithoba, an incarnation of Vishnu; resort of pilgrims. Pop. 33,000.

Pandion. See OSPREY.

Pandora (Gr. myth.), first woman; created by Zeus to bring discord to men's hearts; *Pandora's box,* containing every human ill, on being opened by Epimetheus spread its contents throughout the world, Hope alone being left.

Pangani, port and dist., Tanganyika terr. (5° 17′ S., 38° 52′ E.), on Pangani R.; exports ivory and sugar. The dist. and river were the scene of fighting during the Great War. Pop.: port, 4,000; dist., 67,000.

Pangolins. See EDENTATES.

Panhandle, name given to long narrow tract of land in N.W. of Virginia, between Ohio and Pennsylvania (40° N., 80° 40′ W.); also to northern extension of Idaho (47° 30′ N., 116° 30′ W.).

Panicum. See MILLET.

Panipat, munic. tn., Punjab, India (29° 24′ N., 76° 59′ E.); manufactures brass vessels, silver and glass ornaments, cotton goods, blankets. Pop. 27,000.

Panizzi, SIR ANTONIO (1797–1879), Ital. scholar and librarian; implicated in Piedmontese rising (1821), and fled to England; prof. of Italian, Univ. Coll., London (1828); assistant librarian, Brit. Museum (1831); librarian-in-chief (1856–66); produced standard eds. of Ital. classics—Boiardo, Ariosto, Dante, etc.

Panorpidæ. See under SCORPION FLIES.

Pansy, or HEARTSEASE (*Viola tricolor*), a herbaceous dicotyledon; many varieties are garden favourites; flower (yellow or yellow and purple) is pentamerous.

Pantheism is the philosophical and religious conception which identifies God with the sum of finite existences, or regards God as the single principle of which these are the manifestations. It is found in Hindu, Gr., mediæval, and modern philosophy; one of its greatest exponents was Spinoza.

It fails to satisfy the needs of most, and is criticized on the grounds that it denies as against theism the transcendence of God, and that it makes impossible any adequate recognition of the personality and freedom of man.

Panther. See CAT FAMILY.

Pantholops. See CHIRU.

Pantin, tn., Seine, France (48° 53′ N., 2° 24′ E.), N.E. of the fortifications of Paris; glass works, sugar refineries, railway shops, tobacco and chemical factories, distilleries. Pop. 36,400.

Pantograph, instrument for copying maps, plans, sketches, etc., on the same or a different scale; consists of long wooden or metal arms so arranged that while the artist traces over the original figure with one, a pencil placed in another makes an enlarged, reduced, or exact copy, as may be desired.

Pantomime was originally the name given to a class of actor, not to the spectacle or play in which he took part; in modern times it signifies a play dependent more on pageantry, gesticulation, and burlesque than on strength of plot or excellence of acting. The real origin of modern pantomime is probably to be found in the improvised comedy of mediæval Italy, the principal conventional characters of which were *Pantaleone* (Pantaloon), *Arlecchino* (Harlequin), and *Columbina.* It was at the beginning of the 18th cent. that pantomime was introduced into England, and the three characters mentioned above were familiar figures till the later half of the 19th cent. The 20th cent. pantomime is a composite affair, containing ballets, spectacular effects, popular songs, and topical jests. The biggest and most representative pantomime is that presented annually at Drury Lane Theatre, London.

Panton, tn., Lugo, N.W. Spain (42° 32′ N., 7° 36′ W.); produces grain, wine, live-stock. Pop. 13,000.

Pantopoda. See PYCNOGONIDA.

Paoli, PASQUALE (1726–1807), Corsican patriot and soldier; almost won independence of Corsica from Genoa, and later from France; took refuge in England, and became friend of Johnson and Boswell; governor of Corsica under the French (1790), but welcomed Brit. occupation (1794); died in London.

Papacy. The papacy is the highest office in the R.C. Church, and its occupant is called the Pope. According to the teaching of the R.C. Church, the office of the papacy is of divine origin, having been established by Christ before His ascension into heaven. On this theory of Church constitution it is the office Christ Himself would hold had He elected to continue on earth His public ministry; and consequently the Pope is believed to hold Christ's place on earth, to be His representative and the visible head of His Church. He is styled by his Church 'the Vicar of Christ' and 'Successor of St. Peter,' who was the first to hold the office of Pope. In the constitution of this Church the Pope fulfils a threefold function—viz., he is Bishop of Rome, Patriarch of the West, and head of the whole Church. As Bishop of Rome his rule will be more detailed and more immediate in

the diocese of Rome than in any other diocese. As Patriarch of the West his personal authority in the West will be fuller and more immediate than in the East. But as Pope he claims to rule the universal Church equally.

The theory of this Church is that of a visible as distinct from an invisible society, and on that teaching the papacy is the principle of eccles. unity. All those in union with the Pope are regarded as members of the 'body of the faithful,' those not holding such communion with him being regarded as 'outside the Church.' He is the supreme legislator for the whole Church, and holds eccles. jurisdiction, immediate and personal, over every member individually, this position being held not to be inconsistent with the jurisdiction of a similar character enjoyed by bishops, each within the limits of his own diocese. He holds the plenitude of jurisdiction for all external government — legislative, executive, and judicial — his action being limited only by such provisions in the eccles. constitution as are taught to have been made by Christ.

Besides this jurisdiction in external matters, his Church claims for the occupant of the papacy jurisdiction in matters of conscience and the law of God—not to dispense from or alter the natural or divine positive law, but to forgive sins committed against God, if those sins are duly repented of and confessed. The plenitude of this jurisdiction resides in the papacy, and is derived therefrom directly or indirectly by all 'confessors' or priests holding faculties to hear confessions. This jurisdiction is known to Catholic writers as 'the power of the keys.'

It is also taught by the R.C. Church that in the papacy resides the prerogative of personal infallibility. By this prerogative the Pope is not declared to be inspired by God, nor does the claim extend to secular matters of any kind. It is also contended that no new doctrine is promulgated, but that when the Pope teaches, not in his private capacity, but *ex cathedra*, as it is technically termed—*i.e.*, when in the fullness of his apostolic authority, as father and teacher of the faithful, he proclaims a doctrine of faith or morals to be held by the universal Church—he is so guided by the Holy Ghost in his deliberations and judgments that his pronouncement is infallibly true and 'irreformable.' It is maintained that the whole deposit of Christian revelation is confided to him, and that in officially declaring a doctrine of revelation to be held by all he cannot err. This note of infallibility is not considered to attach to any disciplinary measure, to eccles. laws, or to political or social utterances as such, even when issued formally and officially in the plenitude of 'apostolic authority.' These must stand upon their own merits and the principles of authority and submission that underlie them, infallibility being restricted to a declaration that a certain point of faith or morals has been revealed or not revealed by God. Moreover, infallibility in teaching is not held to include impec-

cability in conduct. The Pope is held to be liable to the human frailty incident to a fallen race, to be exposed to sin like any of his subjects, and to stand in need of the same circumspection and means of grace as other men.

The third outstanding prerogative claimed for the papacy by its adherents is immunity from the control of all civil power. The spiritual sphere being held to be superior to the civil sphere, it is maintained by those who support the papacy as here understood that the occupant of the papal throne should be absolutely free from all secular control; that the 'Vicar of Christ' on earth should not be the subject of a temporal ruler; that this civic independence is necessary for the proper discharge of those duties belonging to the papacy, allegiance being owned to the spiritual power of Rome by millions of the subjects of various temporal rulers throughout the world; and that the free intercourse between the head of the Church and his subjects should be hindered if he himself were trammelled by civic subjection.

The Pope has been declared to be superior to a general council of bishops, and no appeal lies from him to such a council. This is the principle against which 'Gallicanism' contested, and which was upheld by the 'Ultramontanists.'

The Pope is regarded as the direct successor of St. Peter in the papacy, the bond of succession being the bishopric of Rome; so that the fact of being elected Bishop of Rome constitutes him head of the whole R.C. Church, and inheritor of all the powers and privileges of the papacy. These papal powers and prerogatives are proclaimed not to be devolved ministerially upon the Pope by the Church, but to be conferred directly on the papacy by Christ. It is also the teaching of this Church that the successor of St. Peter in the see of Rome can never fail in faith, and that the faith of that particular see is the criterion of the true faith of Christ. The Pope is elected by the College of Cardinals, seventy in number, composed of the six bishops of the suburban sees of Rome, called cardinal-bishops; the fifty priests of the Roman parishes, called cardinal-priests; and the fourteen deacons of old charitable institutions, known as cardinal-deacons. In order to give a wider representation in the election of a Pope, appointments to these titles are made from amongst ecclesiastics of high standing in different countries, those holding the titles constituting them cardinals being relieved from discharging the duties attached thereto. Any male member of the Catholic communion is constitutionally eligible for the papacy, but is bound on election to take episc. orders if he is not already a bishop. The insignia of office are the straight crosier, the pallium, and the papal tiara or triple crown.

The Pope is addressed as 'your Holiness,' and speaks of himself as '*Servus servorum Dei*,' 'the servant of the servants of God.'

Perrone, *De Romano Pontifici*; Wiseman, *Lectures on the Church*.

History.—Rome as the capital of the Roman Empire was the

natural centre of the early Christian organization, and the Bishop of Rome was at the time of the councils of Nicæa (325) and Antioch (341) recognized as metropolitan. From the removal of the imperial court to Constantinople Rome stood forth as the champion of orthodoxy, and the papal prerogatives were gradually formulated and recognized. The division of the empire in 395 assisted the firm establishment of the authority of the Bishop of Rome. Leo the Great (440–61) secured the general recognition of the supremacy of the Bishop of Rome, and asserted the right of bishops to appeal to him.

By the time of Gregory the Great (590–604) the Church had by bequests acquired a considerable amount of landed property, and its power was much enhanced by its friendship with the Frankish kings. By the close of the 7th cent. the theory of the primacy of the Bishop of Rome was accepted throughout the West, and after 800, while the popes claimed to crown the emperor, the emperors asserted their right to confirm the election of the Pope. During the 11th and early part of the 12th century the popes were controlled by the emperors. Gregory VII. (1073–85) insisted on administrative reforms in the Church, and on a reformation in the morals of the clergy, and attempted to secure the subordination of the State to the Church. This great improvement in the papacy coincided with the foundation of the religious orders, and with the outbreak of the Crusades. By them the prestige of the papacy was enhanced, while the growth of canon law, the victory in the investiture contest, and the influence of Bernard of Clairvaux, the firm advocate of the papal claims, did much to place the papacy in a position of independence. Victories in England over Henry II. and in Italy over Frederick Barbarossa served to prepare the way for Innocent III., whose rule (1198–1216) marks the culminating point of the papal power. His successors not only held their own against the Emperor Frederick II., but a few years after his death overthrew the Hohenstaufen power. Boniface VIII. (1294–1303) failed to recognize the growth of national feeling, and suffered defeat in attempting to force England and France to obey his mandates. From 1309 to 1377 the popes lived at Avignon, and during this 'Babylonian captivity' lost much of their power.

After the return to Rome the great schism broke out, a rival pope or antipope being installed at Geneva, and it was not till 1414–16 that this was ended and Martin V. placed on the papal throne. As a result of the inability of the popes to reform the Curia, and to amend many doctrines which had crept into recognition, the Reformation movement broke out in 1517.

The break of England and all N. Germany from Rome roused the papacy, and Paul III. (1534–49) began the task of reforming the Church. He recognized the spiritual needs of the time, and encouraged the reformation of the monastic bodies and the foundation of new orders such as the Capuchins, the Theatines,

and the Jesuits, who did so much in the work of revival. By the Tridentine decrees, ratified by Pius IV. on Jan. 26, 1564, the Church of Rome acquired a clearly and sharply defined 'body of doctrine,' and at the same time the discipline of the Church was fully reformed. The Catholic revival in France, which marked the reigns of Louis XIII. and to some extent that of Louis XIV., coincided with the great attempt made by the Emperor Ferdinand II. during the Thirty Years' War to regain all Germany to Roman Catholicism. Urban VIII. (1623–44) was unable, owing to Richelieu's firmness, to effect a complete Catholic restoration in France, and the peace of Westphalia ended the attempt to impose Catholicism throughout Western and Central Europe.

The 18th cent. was a time of trial for the papacy, owing to the spread of irreligion all over Europe, for which the R.C. Church was itself largely to blame. The enlightened reformers were for the most part opposed to the claims of the papacy, and the general attack on the Jesuits between 1758 and 1770 testified to the determination of most European rulers not to permit any interference by the papacy with their affairs. Joseph II. hoped at one time to found a national Church, and the whole course of the Fr. revolution was disastrous to the cause of Roman Catholicism. Napoleon I. did indeed restore in a very modified sense the papal authority in France; but it was not till after 1815 that a reaction in favour of the Church took place, and the Jesuits, who had been abolished by Clement XIV., were restored. During the pontificate of Pius IX. (1846–78) the papal position was further defined, and an Ultramontane attitude was taken up. In 1854 the bull *Ineffabilis Deus* declared the immaculate conception of the Blessed Virgin Mary to be a doctrine of the Church. In 1864 the encyclical *Quanta Cura*, and the Syllabus, giving a list of errors which were to be avoided, aroused considerable attention. The hierarchy in England had already been re-established, and a R.C. univ. in Ireland had been set on foot. In 1870 the papal infallibility was proclaimed; but the same year Victor Emmanuel, by the occupation of Rome, put an end to the temporal power of the popes, who have since resided in the Vatican.

Leo XIII. (1878–1903) restored the hierarchy in Scotland. He held firmly to his own rights, protested against heresy, and declared that in religion was to be found the only solution of socialistic problems. He issued the bull *Apostolicæ Curæ*, declaring the invalidity of Anglican orders. Leo XIII. was succeeded by Pius X., who showed his inflexible resolve to maintain the rights and liberties of the Church, as was evidenced by his attitude towards the Fr. Government's Separation Law of 1906. The present Pope, Benedict XV., was elected in 1914.

Pastor, *History of the Popes from the Close of the Middle Ages* (Eng. trans. 1891); M. Creighton, *History of the Papacy* (new ed. 1897): Döllinger, *The Church*

and the Churches (Eng. trans. 1862); Ranke, *The Popes of Rome* (Eng. trans. 1866); Mann, *Lives of the Popes in the Early Middle Ages* (1902, *sqq.*); R. de Cesare, *The Last Days of Papal Rome* (1909).

Papal States. See under ITALY (*History*).

Papaveraceæ, natural order of poppy plants; flowers, on long stalks, have two sepals and four petals; fruit is a capsule containing many seeds. *P. somniferum* is the opium poppy.

Papaverine. See OPIUM.

Papaw (*Carica papaya*), S. Amer. tree yielding melon-like fruit, which is used as a vegetable and digestive agent.

Papeete, tn., cap. Tahiti, Society Islands (17° 30′ s., 149° 28′ w.); fine harbour; palace, cathedral; pearls, mother-of-pearl; bombarded by German cruisers (Sept. 1914). Pop. 3,600.

Papen, FRANZ VON, Ger. diplomatist; was military attaché at Ger. embassy in Washington (1914); from commencement of Great War continually violated neutrality and hospitality of U.S., was connected with bomb plots, passport frauds, etc., and endeavoured to dislocate work in factories suspected by him of making munitions for Allies. Evidence against him accumulated in hands of Amer. Government, and his complicity in criminal offences revealed at trial of Hamburg-America line officials in New York (Nov. 1915) resulted in his expulsion.

Paper was probably first made in Egypt, China, and Japan. Egyptian paper was made from PAPYRUS. According to Chinese the manufacture of paper from cotton or other vegetable fibres commenced in 2nd cent. B.C. Paper making was introduced into Europe by the Moors, and paper was first made from cotton fibres in Spain about 11th cent. Later the manufacture was carried on in Germany, France, and Italy. Paper was imported in large quantities from France and Holland until John Tate in 1495 commenced its manufacture at Stevenage (Herts), and his mill was probably the first in England. Paper making was commenced in Scotland in 1685. Paper up to this time was made chiefly from cotton and linen rags, but since 1860 esparto grass, supplemented by straw, and more especially mechanical and chemical wood pulp, came into use as the basis. Four hundred varieties of woods and grasses are now used. *Esparto grass* abounds in N. Africa and S.E. Spain. The crop is plucked, not cut, and about 200,000 tons are imported into the U.K. annually from Spain, while close on 1,000,000 tons of wood pulp were imported in 1914, chiefly from Norway and Sweden. During and after the Great War the serious shortage and consequent high cost of paper gravely hampered publishing and largely raised the price of books.

Paper Making.—Wood is cut into small cubes, crushed by rollers and boiled under pressure in a solution of soda or bisulphite of lime. This resolves the non-cellulose portion of the wood into soluble substances, which are washed away, leaving *chemical wood pulp.* It is imported into

Britain in this form, resembling sheets of brown cardboard, and is thus received at the paper mill. *Mechanical wood pulp* consists of ground wood, the fibres being torn apart by friction on a grindstone flooded with water. As a paper made from such pulp gradually decays, it is used only for the cheapest qualities, such as newspaper. *Rags* are sorted, dusted, cut up into small pieces by machinery, boiled with caustic soda, and thoroughly cleansed before being reduced to a pulp. *Grass* is sorted and dusted and placed in boilers, which each hold about three tons of grass. Steam and caustic soda solution are then introduced for several hours, and the grass thus reduced to a pulp. Rag, grass, or chemical wood pulp after bleaching is subjected to a process of beating (the most important stage in the manufacture) to separate the individual fibres. During this operation, the loading, sizing, and colouring materials are added to the pulp. Sometimes each variety of pulp is mixed together in varying quantities, or they may be used separately—depending on the required quality of the finished paper. In machine-made paper the pulp next streams on to a wire cloth, giving a continuous sheet of paper; the drainage of the water from the pulp is hastened by two or three vacuum-boxes placed underneath the wire. The sheet of paper is then transferred to an endless felt and carried forward between heavy iron rolls, led over several drying cylinders, and finally polished or calendered. Glazing is done by cast-iron rollers, and the finished paper is wound on reels at the 'dry end' of the machine. Rags are used for high-class papers, such as are found in ledgers, etc.; paper required for magazines, fine printing, etc., use chiefly esparto and chemical wood pulp; while mechanical wood pulp is used in the production of tickets, wrapping paper, etc.

Paper Duty. See NEWSPAPER.

Paper Money. See MONEY.

Paper Nautilus. See under ARGONAUT.

Paper Textiles and Yarns. The yarn is made from paper run from reels and split into strips, which are damped and twisted. Clothing material has been made by alternating wool and paper yarns two by two. While such cloth may have been acceptable as a war-time substitute, opinion as to the permanent status of the industry is cautious. As a substitute for jute in twine, or carpet matting, there are greater possibilities.

Papier Mâché, substance manufactured from paper by pulping and drying, or by superimposing several sheets of paper one on another, and subjecting the whole to pressure; sometimes admixed with earthy substances; used for stereotyping, pilaster work, surface for gilding ornaments, masks.

Papilionaceæ (Lat. *papilio*, 'butterfly'), division which includes all the Brit. plants of order Leguminosæ; flowers have five petals, one of which, the *standard*, is superior; two inferior, forming the keel or carina; two lateral, forming wings or alæ; types are pea, bean, clover, broom, etc.

Papin, DENIS (1647–*c.* 1712),

Fr. physicist; prof. of maths., Marburg; settled in London in 1707; invented safety valve and the Papin digester; discovered principle of siphon; wrote *Manière pour lever l'Eau par la Force du Feu.*

Papua. See NEW GUINEA.

Papuans (from the Malay *papuwah*, 'woolly-haired'), a tall race, dark brown to black in colour. Their origin is still disputed. They dwell in village communities in New Guinea, without priests or hereditary chiefs. Except for the converts to Islam and Christianity they are spirit worshippers and pagan; great boat builders and house builders. Communal houses, 500 to 700 ft. long, are found in various parts of New Guinea, but generally each family has its own separate dwelling, 60 to 70 ft. long. Bows and arrows, stone and hardwood clubs and spears are the chief weapons. Stone axes are the commonest instruments used. The Papuans are akin both to E. Africans and aboriginal Australians in many customs and habits. Polygamy is common amongst them, but there are certain prohibited degrees of affinity.

Papyrus (*Cyperus papyrus* or *Papyrus antiquorum*), a reed allied to the sedges which grows abundantly along the banks of rivers in hot countries (*e.g.*, the Nile). The shoots attain a considerable height, and have an extremely graceful appearance, the leaves forming a pendent crown. The flowers are borne in spikelets enclosed by long bracts. The pith of the stem was utilized by the ancients in the manufacture of PAPER, being cut into strips, which, while still wet, were pressed together. See PALÆOGRAPHY.

Par, seaport town, Cornwall, England (50° 22′ N., 4° 42′ W.), 8 m. S. of Bodmin; large pilchard fishery. Pop. 2,000.

Pará, or GRÃO PARÁ, state, Brazil, S. America (0°–9° 20′ S., 46°–58° W.); bounded by three Guianas, Atlantic, and other Brazilian states; thickly wooded and well-watered region; communication carried on by rivers, chief of which is Amazon; principal towns, Pará (cap.), Alemaquer, Breves, Bragança, and Obidos; considerable stock raising; rubber is chief product; fruits and cacao are cultivated; rubber, gutta-percha, tonka beans, sarsaparilla, gums, and Brazil nuts exported. Area, *c.* 443,900 sq. m.; pop. *c.* 1,024,000.

Pará, BELEM, or BELEM DO PARÁ, city, port, cap. of above state (1° 28′ S., 48° 28′ W.), on Pará R.; well laid out with fine squares and gardens; 18th cent. cathedral, bishop's palace, episc. seminary, and museum; founded (1615) by Portuguese; scene of many revolts; connected with Bragança by rail; an entrepôt for Amazon river trade. Pop. 275,200.

Parable. The parable belongs to the class of metaphorical and fictitious utterances or narratives, of which we have other examples in the simile, the fable, the myth, and the allegory. In Scripture the name is given to (1) enigmatical sayings, as in Ps. 49 : 4; 78 : 2; (2) ornate and poetical discourses, as in Num. 23 : 7; Job 27 : 1; and (3) to stories founded upon common experi-

ence, and designed to set forth spiritual truths, as, for example, those told by Jesus.

Parabola, the curve of section of a cone by a plane parallel to a generating line of the cone; or the locus of a point which moves so that its distance from a fixed point (*focus*) equals its distance (*abscissa*) from a fixed straight line (*directrix*). Taking the axis of symmetry for Ox and the vertex of the curve for origin, the Cartesian equation is $y^2=4ax$, where a is the distance of both focus and directrix from the origin. See CONIC SECTION.

Paracelsus, or PHILIPPUS AUREOLUS THEOPHRASTUS BOMBASTUS VON HOHENHEIM (1493–1541), Swiss physician and naturalist, was born at Einsiedeln. After a period of wandering he was in 1526 appointed town physician at Basel, and lectured also in the univ., but was compelled to leave the city, and again led a wandering life until 1541, when he settled at Salzburg. He emphasized the importance of direct observation of nature, discovered hydrogen, and introduced many chemical remedies. The fullest ed. of his *Opera* appeared in 1589 in 10 vols.

Hartmann, *Life of Paracelsus* (1887); Strunz, *Paracelsus* (1903); *Life* by Anna M. Stoddart (1911); Browning's poem *Paracelsus.*

Parachute, a device shaped like an umbrella, by means of which aeronauts descend from a balloon. Blanchard made the first successful attempt with a parachute at Strasbourg in 1787. A circular parachute, having a diameter of 30 ft. and weighing with its load 225 lb., acquires a terminal velocity of about 13 ft. per second; and a person descending with it at this rate would receive the same shock on reaching the ground as if he dropped freely from the height of 2⅝ feet.

Paradise, BIRD OF. See BIRDS OF PARADISE.

Paradoxurus. See under CIVET FAMILY.

Paraffin, the name given to a series of saturated hydrocarbons having the general formula C_nH_{2n+2}, and constituted in open chains. They vary from gases, such as methane, through very volatile liquids like the pentanes and hexanes, to heavier and more viscid liquids, while the members of the series of highest molecular weight are solids at ordinary temperatures. Chemically they are extremely inert, being only acted on by the halogens with difficulty; but they are inflammable, and burn with luminous flames. In the popular sense, paraffin includes the burning oil and paraffin wax obtained by distillation of shale. Dr. James Young was the founder (1850) of the industry. See OIL.

The shale is placed in upright retorts and heated to a dull red heat by partial combustion, a current of steam being passed through the retort during the process. As a result, illuminating gas is given off, and ammoniacal liquor and an oily tar distil over. The gas is usually burned in the works, the ammonia water is turned into ammonium sulphate, while the oily tar is used for the production of solid paraffin and burning and lubricating oils. One ton of good shale usually furnishes from 33 to 35

gallons of crude oil. To purify it, it is again distilled, and the distillate agitated with strong sulphuric acid, allowed to settle, and then treated with a solution of caustic soda. It is again distilled in fractions.

Solid paraffin is a brilliant white solid, without taste or odour; it is somewhat hard, and rings when struck; is unacted upon by both acids and alkalis, and is insoluble in water. It is used for the manufacture of candles and vestas. See PETROL SUBSTITUTES.

Paraguay, inland republic, S. America (20°–26° s., 54°–62° w.), bounded N. by Bolivia and Brazil, E. by Brazil, S. and W. by the Argentina. Republic is divided from N. to S. by Paraguay R., eastern portion being larger and more important; large tract to W. of river unexplored. Surface consists of undulating plains, low hills, swamps, and dense forests; highest ground to be found in N. and E. The chief rivers are Paraguay, Pilcomayo, and Paraná. Soil is rich and fertile, vegetation luxuriant; leading industries are stock raising and cultivation of *yerba maté* (Paraguay tea), rice, sugar, tobacco, maize, and coffee; forests produce fine timber, gums, dyes, and oils. The chief articles of export are hides, timber, maté, tobacco, quebracho extract, cattle, and meat products. Principal towns are Asuncion (cap.) and Villa Rica; inhabitants chiefly Spaniards and Indians. President is elected for four years. Paraguay was visited in 1515 by de Solis, and in 1526 by Cabot; colonized by the Spanish; from 1608 progress made under administration of Jesuits until their expulsion (1768); declared independent (*c.* 1811); 1865–70, war against Brazil, Uruguay, and Argentina, resulting in complete defeat of Paraguay; frequent revolutions—*e.g.*, 1911–12. Area, *c.* 171,200 sq. m.; pop. *c.* 800,000.

La Dardye, *Paraguay* (Eng. ed. 1892).

Paraguay. See MATÉ.

Parahyba. (1) Mar. state, Brazil, S. America; surface elevated; chief products are cotton, coffee, cocoa, sugar, rubber, tobacco. Area, 28,850 sq. m.; pop. *c.* 757,400. (2) Tn., cap. of above (7° 6′ s., 34° 54′ w.); exports sugar and cotton; founded 1579. Pop. 32,000.

Paraldehyde ($C_6H_{12}O_3$), colourless liquid, with odour resembling ether and burning taste, obtained by the action of various acids or salts on aldehyde; used in med. as a hypnotic, especially to produce sleep in the insane and in patients with heart disease.

Parallax (Gr. *parallasso*, 'I vary'), the amount of apparent change in position of any distant object as seen from two points. Identical with parallax is *triangulation*, the former term being used in connection with astronomy. The two eyes of a human being (and animals) form a parallax, and so enable us to judge distances. Theoretically, two observers at different parts of the earth, working in conjunction, might take the altitude and azimuth of a given star and, knowing the distance between their two stations, apply triangulation, and thus measure the distance of the star from the earth. However, in practice it

is found that the distances of even the nearest stars are so vast that the diameter of the earth is useless as a base, and so observations are made after an interval of six months by the same observer, for in this time the earth will have made half a circuit of her orbit, which is thus used as a base. The majority of stellar distances are so immense, however, that even with this huge base (186,000,000 m.) it is impossible to obtain parallaxes for the majority of the stars.

Parallelepiped, a solid bounded by six faces, each of which is a parallelogram; the rectangular prism and cube are particular cases; the volume of any parallelepiped is obtained by multiplying the area of any face by the perpendicular distance between that face and the opposite one.

Paralysis, or PALSY, condition in which there is loss or impairment of the power of voluntary muscular contraction or movement, the loss being either generalized in the muscles all over the body, or localized to one or several muscles. If there is injury or disease of the part of the brain controlling voluntary movement or of the motor tracts of the spinal cord loss of voluntary muscular power results; while if there is injury or disease of the anterior horn of grey matter of the spinal cord, of the anterior nerve roots, or of the motor nerve fibres to the muscles, there is, in addition to loss of voluntary muscular power, atrophy of the muscles supplied by the fibres concerned. Besides being due to injury or disease of nervous structures (*organic paralysis*), paralysis may be due to functional derangement of the part of the brain controlling voluntary muscular movement, as in such mental conditions as hysteria, or *functional motor paralysis;* in addition, paralysis may be due to injury or disease of the muscles themselves.

Hemiplegia—paralysis affecting one side of the body—is due to a lesion of some part of the motor tract in the brain above the medulla oblongata. The chief causes are, when the onset has been sudden, injury, hæmorrhage, embolism (blocking of a cerebral artery), thrombosis (clotting of the blood in a cerebral artery, due usually to disease of its wall); and when the onset has been gradual, a tumour of the brain, altered states of the blood (*e.g.*, in anæmia, diphtheria), abscess, chronic cerebral meningitis, or chronic degenerations of the nervous system.

Paraplegia—paralysis of both legs—is due usually to disease or injury of the spinal cord. The more common causes are pressure on the spinal cord as a result of injury or disease of the spine (*e.g.*, fracture, curvature, or caries), and injury or disease of the cord itself (tumours, or acute or chronic inflammation).

Infantile Paralysis (*Acute Anterior Poliomyelitis*) is a form often occurring in young children, due to an acute inflammation of the anterior horn of grey matter of the spinal cord. The legs are usually first affected, but all the limbs or only a group of muscles may be implicated, and the muscles soon atrophy.

Progressive Muscular Atrophy

sthe result of chronic inflammation with sclerosis of the anterior horn of grey matter. It is a disease usually of adult life, in which there is slow and gradual atrophy of groups of muscles, commencing generally in one or both arms, at the muscles of the hand. A characteristic feature of the disease is the peculiar fibrillary twitchings of the affected muscles.

Bulbar Paralysis, due to disease of the medulla oblongata or bulb, occurs most often in old persons, and is frequently associated with chronic diseases of the spinal cord. It is characterized by gradual paralysis and atrophy of the muscles concerned in speaking, mastication, and swallowing (*i.e.*, of tongue, lips, pharynx, etc.), and is accompanied by difficulty in articulation, eating, swallowing, and sometimes in breathing. It invariably ends fatally, either from inanition or from pneumonia or similar complications.

Pseudo-hypertrophic Paralysis (*Progressive Muscular Dystrophy*) is a hereditary disease, usually affecting boys, transmitted through the females of a family who are not themselves affected. There is progressive weakness, with hypertrophy of some muscles and atrophy of others. Where the muscles are apparently enlarged there is really atrophy of muscle fibres, with increase of fibrous tissue and fat, the muscles of the calves and buttocks being those which are generally much hypertrophied. The essential changes are, therefore, not in the nervous system, but in the muscles themselves.

Parkinson's Disease (*Paralysis agitans*), is a chronic affection, usually occurring after the age of fifty, characterized by progressive weakness, rhythmical tremors of certain muscles, a distinctive attitude, the body being bent forward, and a peculiar gait, at first slow and then trotting. Believed to be due to senile condition of the brain cortex.

General treatment of paralysis includes rest in bed, maintaining the strength of the body, regulation of nutrition and of the excretions, careful attention to the action of the heart and of the lungs, regular sound sleep must be ensured, and for these purposes stimulants and other drugs are given as required. Massage and passive movement are of benefit after acute symtoms have disappeared, and electricity is often of value in maintaining the nutrition of atrophied muscles. See NEURASTHENIA; NEURITIS.

Paramaribo, tn., cap. Dutch Guiana, S. America (5° 50′ N., 55° 10′ W.), on Surinam R.; coffee, cocoa, rubber, sugar, rum exported. Pop. 36,700.

Paramatta, tn., New South Wales, Australia (33° 46′ S., 151° 2′ E.); fruit growing, especially oranges; tweed manufactured; kerosene and shale works; racecourse. Pop. 13,600.

Paramœcium. See INFUSORIA.

Paraná. (1) S. state, Brazil, S. America (24° S., 52° W.); extensive forests; coal deposits; exports tea. Area, 93,269 sq. m.; pop. *c.* 734,000. (2) Tn., cap. Entre Rios, Argentina, S. America (31° 48′ S., 60° 28′ W.), on Paraná R.; univ.; centre of

fertile dist.; was cap. of Argentina (1852–61). Pop. 36,100. (3) Riv., S. America, formed by junction of Rio Grande and Paranahyba (20° s., 51° 10′ w.); flows w. between Paraguay and Argentina, and receives largest trib., the Paraguay R.; continues s.w., and enters Atlantic through estuary of Rio de la Plata; navigable by steamers up to Brazilian frontier, with occasional interruption at Apipe rapids, 780 m. from Buenos Aires. Length, *c.* 2,100 m.

Paraplegia. See PARALYSIS.

Parasitic Diseases is a term now much more comprehensive than a few years ago. Many are caused by bacteria, others by vegetable parasites of a somewhat higher type, while others again are due to parasites which are low forms of animal life. In certain diseases, in all probability of parasitic origin, the precise etiology is still obscure; while there are other diseases, such as some forms of anæmia, which, while they may be the result of the presence of animal parasites in the intestine, can hardly be included under the heading.

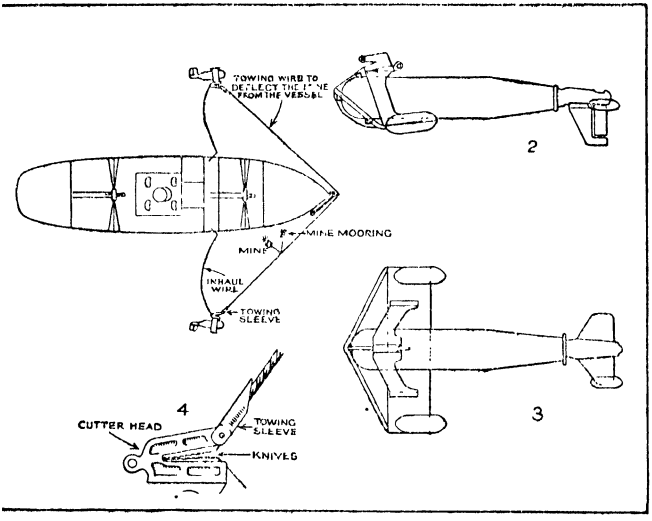
The diseases (dealt with under separate headings) may be arranged as follows: (*a*) those caused by vegetable parasites, including (1) those due to the pyogenic micrococci: ERYSIPELAS, GONORRHŒA, SEPTICÆMIA; (2) those due to specific bacilli: ANTHRAX, CHOLERA, DIPHTHERIA, LEPROSY, PLAGUE, PNEUMONIA, RELAPSING FEVER, TETANUS (which is indicated by a violent spasm leaving rigid many of the muscles—*e.g.*, lockjaw), TUBERCULOSIS, TYPHOID FEVER, YELLOW FEVER; (3) those due to higher forms of vegetable life: ACTINOMYCOSIS, Madura foot, occurring in India and characterized by enlargement of feet and hands, with suppuration and discharge—also known as fungus-foot, from its cause; (*b*) those caused by animal parasites, including (1) those due to protozoa: DYSENTERY, MALARIA, SYPHILIS; and (2) those due to higher forms of animal life; hydatids, or aqueous cysts, found usually on the liver and caused by the larval form of the liver fluke; (*c*) those infective diseases (1) in which, although a micro-organism has been found, it has not been absolutely proved to be the cause of the disease: HYDROPHOBIA, SCARLET FEVER; (2) those which have not been proved to be caused by micro-organisms, although in all probability caused by them: MEASLES, MUMPS, SMALLPOX, WHOOPING COUGH, TYPHUS FEVER. See under BACTERIOLOGY.

Parasitism, a type of interrelationship between plants or between animals, in which one of a pair nourishes itself at the expense of the other. The term has sometimes been used to designate such associations as that of the 'parasitic' sea-anemone with a hermit-crab, but this relationship is better described as COMMENSALISM.

There are several more or less perfect types of true parasitism, varying from the temporary association of some external parasites, such as fish-lice—the Copepod crustacean *Argulus*—which attach themselves to the skin of freshwater fishes and

suck their juices, or leave them and swim freely in the water at will, to the complete parasitism of internal parasites such as tapeworms and liverflukes, the adults of which can exist and feed only in the body of their hosts. Some parasites, again, pass their complete life-circle in parasitic stages: the larvæ (*glochidia*) of some bivalve molluscs are temporarily parasitic in the gills of sticklebacks.

Amongst animals, both external and internal parasites frequently possess hooks or suckers for attachment, and almost all parasites, plant and animal alike, exhibit



The Paravane.

1. Diagram showing paravanes in action. 2. Elevation of paravane. 3. Plan of paravane. 4. Details of cutting device.

the same host, while others pass through a series of hosts at different stages, sometimes with the intervention of non-parasitic periods; thus the fluke which causes liver-rot in sheep passes from them to water, hence to a water snail, from it to grass, and so to sheep again. Other non-parasitic animals may have traces of degeneracy from their nearest free-living relatives, many internal animal parasites losing eyes, mouth, digestive organs, etc., and indeed becoming little more than a sac which absorbs the juices ready prepared by the host.

Paravane, device adopted during Great War for (1) destruction of submarines, (2) protection of

vessels from mines. Several persons have claimed its invention or adaptation.

(1) *Destructive Paravane.*—A torpedo-shaped body carrying near its head large steel plane and near its tail horizontal and vertical fins. Plane set at small angle to central line of paravane and towed in approximately vertical position. Thrust of water on plane when vessel in motion carries it away from fore-and-aft centre line. A paravane is towed on either side of vessel, and thus a spread of some 200 ft. is attained. Charged with 300 lb. of T.N.T. and towed at depth of about 200 ft. When submarine encountered, charge is exploded by electric current along towing wires. Proved effective, but was greatly inferior in destructive power to depth-charges. See SUBMARINE.

(2) *Protective Paravane.*—Introduced into Grand Fleet in 1916, and subsequently as 'otter' system applied to merchant ships. Each paravane towed from point as far forward and as low down as possible by means of specially constructed steel wires. Paravanes fitted with hydroplanes, which exerted heavy pull on wires, and formed wedge kept in position by dynamic reaction of water. When mine moorings were struck by towing wires, mines deflected away from ship and, passing along wires to cutting jaws at head of paravane, were instantaneously severed. As sinker of mines dropped to bottom, mine floated and was destroyed by gun-fire. According to Lord Jellicoe (*The Crisis of the Naval War*) there were at least fifty cases during war in which paravanes fitted to warships cut moorings of mines. In many cases the bringing of single mine to surface revealed presence of a hitherto unknown minefield. 'Otter' system applied to 2,700 Brit. merchant vessels, and probably saved ships and cargoes to value of £200,000,000 as well as many lives; also extended to foreign merchant ships.

Parcel Post. See POST OFFICE.

Parchment, a writing material of great antiquity made from the skins of animals. See PALÆOGRAPHY.

Pard. See under CAT FAMILY.

Pardon is the prerogative of the crown, only exercised upon the advice of the home secretary—in Scotland, of the secretary for Scotland. It may be granted before or after trial and sentence, either absolutely or conditionally. A free pardon from the crown is given to release an innocent person from prison after a miscarriage of justice. Commutation of a death sentence to penal servitude is in form a pardon.

Pardubitz, town, Bohemia, Czecho-Slovakia (50° 4′ N., 15° 48° E.); ruins of 16th cent. castle; breweries, distilleries, sawmills, iron foundries; famous horse fairs. Pop. 20,400.

Paregoric, or PAREGORIC ELIXIR, a camphorated tincture of opium flavoured with aromatics. In Brit. Pharmacopœia there is another preparation, Scotch paregoric, which is considerably stronger. Both preparations are useful in cough mixtures, but should not be given to children.

Parenzo, seapt., Istria, Italy (45° 14′ N., 13° 36′ E.), 30 m.

s. by w. of Trieste; fishing, shipbuilding; has a fine 6th cent. cathedral; Roman remains. Pop. 12,400.

Pares, Sir Bernard, Eng. prof.; univ. extension lecturer, Cambridge, since 1895—at Oxford and Liverpool since 1902; prof. of Russian, univ. of Liverpool (1908–17), and univ. of London since 1917; ed. *The Russian Review* (1912–14); secretary to Anglo-Russian Committee in London (1909–14); attaché to Russian army (1914–16); attaché to Brit. ambassador in Petrograd (1917); knighted (1919); pub. *Russia and Reform* (1907), chapters on Russia in *Cambridge Modern History, Day by Day with the Russian Army* (1915), etc.

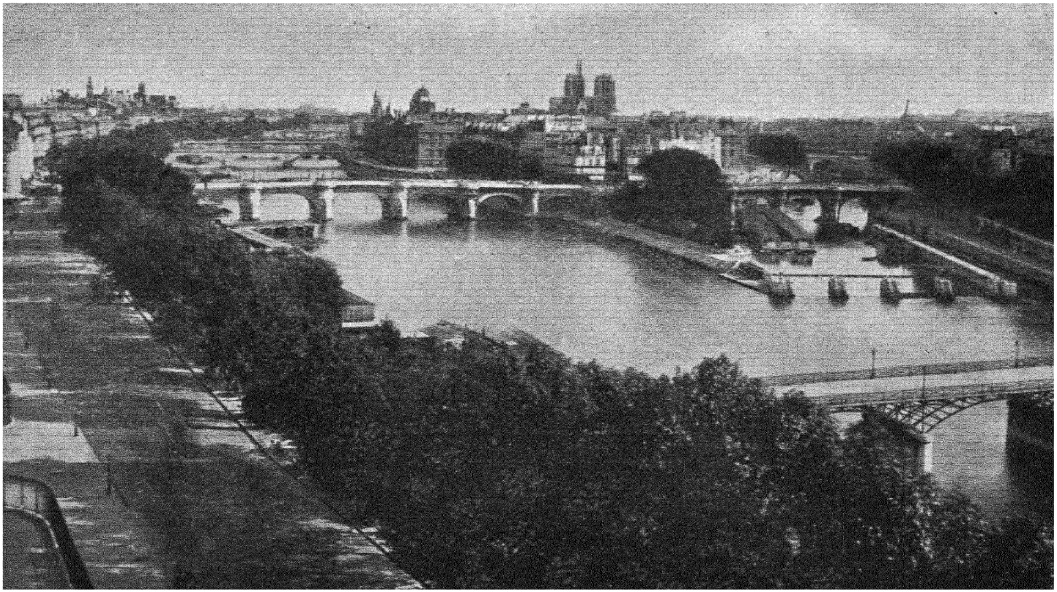
Pariah Dogs. See Dog Family.

Paridæ. See Tits.

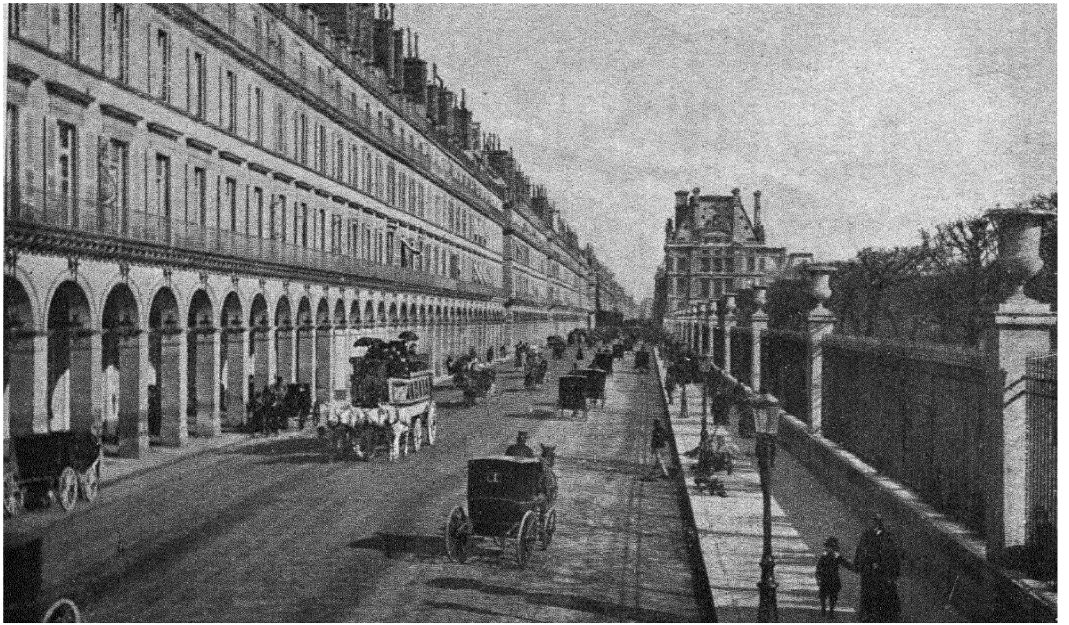
Paris, cap. of France and of Seine dep. (48° 50′ N., 2° 20′ E.); largest city of continental Europe; beautifully situated on both sides of Seine; fortress; important railway, river road, and canal centre; claims to be the world's most intellectual and artistic city; and its magnificent architecture, handsome streets, statues, art treasures, educational institutions, romantic history, places of entertainment, cafés, restaurants, and unique atmosphere give the city an irresistible appeal to people of all nations.

The Seine divides the city into two regions, the right and left banks—*Rive droite* and *Rive gauche*—and is crossed by thirty-two bridges—notably Pont Neuf (1578), Pont Notre-Dame, Pont d'Iéna, Pont d'Austerlitz, Pont de la Concorde, and Pont Alexandre III. (1896–1900). The heart of Paris is the Ile de la Cité, in midstream, with famous Gothic cathedral, Notre-Dame (13th cent.; two fine square towers, 225 ft. high, and central spire, 300 ft.; beautiful stained glass); here Napoleon was crowned emperor by Pope Pius VII. (1804); the palais de justice and exquisite Sainte-Chapelle (13th cent.); Hôtel-Dieu; prefecture of police. Paris proper is encircled by a wall (obsolete fortifications), built about 1840 and now in course of destruction, and the Ceinture Railway. The Boulevard St. Michel, continued by Boulevard de Sébastopol and Boulevard de Strasbourg, crosses Paris from S. to N.; this main artery is intersected at right angles by the Boulevard Montparnasse, Boulevard St. Germain, Rue de Rivoli, and the Grands Boulevards and other leading thoroughfares. City is comparatively flat, with exception of hill of Montmartre, with Sacré-Cœur and quaint artists' quarters of hill of Buttes-Chaumont and Montagne Ste. Geneviève, with univ. and Panthéon.

On r. bk. are many handsome squares, including Place de la Concorde at entrance to Champs Elysées, with famous obelisk of Luxor (73 ft. high) in centre, where Louis XVI., Charlotte Corday, Marie Antoinette, Robespierre, and many others were guillotined; Place du Carrousel, surrounded on three sides by Louvre, with Arc de Triomphe on w. forming entrance to Tuileries; Place Vendôme, with Napoleon column of victory; Place de l'Etoile, with beautiful Arc de Triomphe (1806–36), 150 ft. high,



PARIS FROM THE LOUVRE.



PARIS : THE RUE DE RIVOLI.

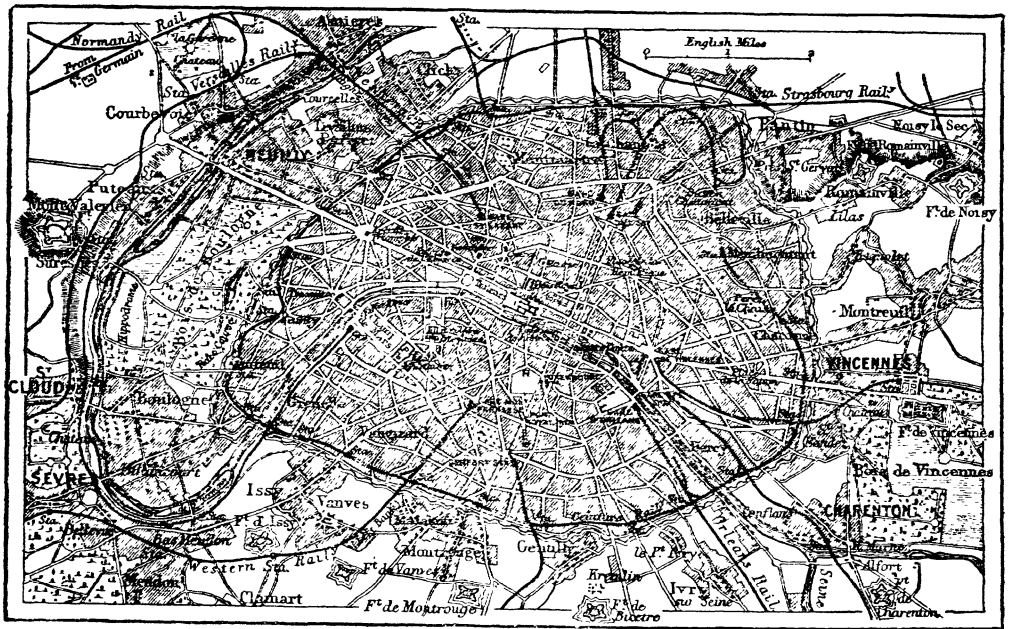
137 ft. broad, covered with fine reliefs: twelve avenues radiate from this magnificent square, including the Champs Elysées, the most fashionable promenade of Paris, with President's residence—L'Elysée; Place de la Bastille, with Colonne de Juillet. Other fine squares are Place de la Nation, Place de l'Opéra, Place de l'Hôtel de Ville, Place de la République, etc. On l. bk. is the large Champ de Mars, with Eiffel Tower (984 ft.).

Outstanding features on r. bk. of Seine are Palais du Louvre, extending about ½ m. along the river (built as fortress, 1204; rebuilt, 1541), with world-famous art collections—left wing contains the Treasury; site of Palace of the Tuileries (begun, 1564; burnt down by Communards, 1871), with fine Jardin des Tuileries; Palais Royal, built by Richelieu, the most fashionable promenade and shopping centre in 18th cent., now a deserted square; the churches St. Germain l'Auxerrois (12th–16th cent.), St. Eustache (16th cent.), St. Gervais (16th cent.), La Madeleine (1806–24), in Corinthian style, with sixty-two columns; Hôtel de Ville (munic. headquarters); Conservatoire des Arts et Métiers; the old Tour St. Jacques; Musée Carnavalet (historical museum); Porte St. Denis and Porte St. Martin; Halles Centrales (markets); Bourse; Bibliothèque Nationale; Grand Opéra (1861, largest in world); Opéra-Comique; Théâtre Français; Petit Palais and Grand Palais (exhibition buildings, built 1900); Trocadéro (1867, in Oriental style), with museums of sculpture and ethnography; Parc Monceau.

On l. bk., opposite the Ile de la Cité is the Latin quarter, with Sorbonne (univ., founded 1253), Collège de France, Ecole de Médecine, Ecole des Beaux-Arts, and other educational institutions; Musée de Cluny, with collection of antiquities; Panthéon (1764), with fine frescoes and tombs of Voltaire, Victor Hugo, Rousseau, etc.; St.-Etienne-du-Mont, a beautiful mediæval church; Luxembourg (1612–20), which includes the Palace of the Senate, a fine modern art gallery, and beautiful gardens; Odéon (theatre); St. Sulpice (16th cent.); Saint-Germain-des-Prés (1163); Hôtel des Monnaies (Mint); Palais de l'Institut; Palais-Bourbon (seat of Chamber of Deputies); Hôtel des Invalides, with tomb of Napoleon I.; Jardin des Plantes, with fine botanical and zoological gardens; Salpêtrière (famous hospital).

Chief cemeteries are Père Lachaise, Montmartre, Montparnasse; interesting catacombs and remarkable sewers. Round Paris lie beautiful wooded slopes, with suburbs of Versailles, Saint-Cloud, Meudon, Sèvres, Saint-Denis, Montreuil, Vincennes, etc.; the famous Bois de Boulogne, with Jardin d'Acclimatation and Longchamp (racecourse), and Bois de Vincennes.

For administrative purposes Paris is divided into twenty arrondissements, each comprising four quarters, each quarter is represented by one member in Conseil Municipal and Conseil Général of dep. of Seine: mayoral functions are shared by prefect



Paris and Environs.

of Seine and prefect of police. City has an extensive system of communications: suburban circular railway, underground electric railways (*Métropolitain*), motor buses, etc. Principal industries: ladies' clothes, hats, boots, shoes, furniture, jewellery, bronzes, mirrors, clocks, watches, decorative articles, scientific instruments, book publishing, objets d'art.

History.—In earliest times Paris was known as Lutetia; cap. of the Gallic tribe Parisii, on Ile de la Cité. Under Roman rule Lutetia became a prominent town. Christianity was established in 3rd cent.; in 4th cent. town took the name of Parisia or Paris. In 451 Ste. Geneviève preserved town from Huns. Clovis made it cap. of his realm (508); attacked by Northmen (9th cent.); became residence of Hugh Capet and permanent cap. of France (987); during reign of Philippe Auguste (1180–1223) Notre-Dame was begun, castle of the Louvre built, univ. founded, and city surrounded by strong wall; Charles V. (1337–80) erected Bastille; revolt of the Maillotins (1382); between 1412 and 1418 the government was alternately held by Burgundian party (known as Cabochiens) and Armagnacs; in 1420 crown of France passed to England, and city was held by English until 1436; unsuccessfully besieged by Joan of Arc (1429); massacre of St. Bartholomew (1572); besieged by Henry IV. (1594). Louis XIV., Louis XV., and Louis XVI. did much to beautify Paris, which became the centre of European civilization. Paris was chief scene of Fr. Revolution (1789); Bastille stormed (July 14); Allies entered Paris (1814); Napoleon I. resigned, and First Treaty of Paris signed, followed by Second Treaty of Paris (1815); fresh revolutions (1830, 1848). Peace of Paris (1856) ended Crimean War. During reign of Napoleon III. the city was richly adorned by avenues, squares planned by Haussmann, and handsome buildings; besieged by Germans (Sept. 19, 1870); capitulated (Jan. 28, 1871). During Commune (1871) numerous fine buildings were destroyed; great fire in Opéra-Comique (1887); Treaty of Paris (1898) ended Span.-Amer. War; International Exhibitions (1855, 1867, 1878, 1889, 1900); disastrous floods (1910).

The pop. of Paris, which was 2,846,000 in 1911, has very much increased since 1914, mostly owing to the thousands of refugees from the invaded provinces who have settled in the cap.; it is now well over 3,000,000 (no census taken since the war). The demolition of the fortifications will give more building space to the congested city.

During Great War (1914–18) Paris was frequently raided by aircraft. From March 1918 it was intermittently shelled by a Ger. long-range gun 75 miles distant. The damage done by all these bombardments was but slight, but casualties were fairly heavy, notably on Good Friday 1918, when a shell fell on the church of Saint-Gervais during a service, killing or injuring over a hundred people. In the course of the war projectiles thrown into the city totalled 1,049, causing 256 deaths and wounding 620

people. Frequent Allied war councils were held in the city, which was also the scene of the Peace Conference in 1919.

Belloc, *Paris* (1900); Baedeker, *Paris* (1907); *Mémoires du Général Gallieni: Défense de Paris, 25 Août–11 Septembre 1914* (1920).

Paris, DECLARATION OF. With the object of introducing uniformity into the usages of maritime warfare, the plenipotentiaries of the various powers who were parties to the Treaty of Paris of 1856, after the Crimean War, agreed on the following articles, known as the Declaration of Paris: (1) Privateering is, and remains, abolished; (2) the neutral flag covers enemy's goods, with the exception of contraband of war; (3) neutral goods, with the exception of contraband of war, are not liable to capture under the enemy's flag; (4) blockades, in order to be binding, must be effective—*i.e.*, maintained by a force sufficient really to prevent access to the coast of the enemy. The declaration was not acceded to by the U.S. or Venezuela, nor as to the first clause by Spain or Mexico; but in 1898, on the outbreak of war between Spain and the U.S., both belligerents bound themselves by the full terms of the declaration. See also BLOCKADE; CONTRABAND OF WAR; DECLARATION OF LONDON.

Bowles, *Declaration of Paris* (1901).

Paris, city, Texas, U.S. (33° 37′ N., 95° 31′ W.); important trade centre; undeveloped coal and oil fields in dist. Pop. 11,300.

Paris (class. myth.), son of Priam of Troy; awarded prize of beauty to Aphrodite, thereby offending Hera and Athene; stole Helen from Menelaus, causing Trojan War; killed Achilles by treachery.

Paris (LOUIS PHILIPPE ALBERT D'ORLÉANS), COMTE DE (1838–94), grandson of King Louis Philippe, and, in 1842, heir-apparent; he abandoned claim (1873) to Comte de Chambord, who died in 1883; lived and wrote a good deal in England.

Paris, PLASTER OF. See GYPSUM; CEMENT.

Paris Bordone. See BORDONE.

Parish, originally an eccles. area superimposed upon the anc. township, which was the oldest unit of civil administration. The eccles. parish sometimes included several townships and sometimes only a part of one. The parish was recognized as a civil unit when parish churchwardens were charged by statute with the relief of the poor in 1535. The existing parishes were often too large for poor-law purposes, and subdivisions were made. The modern poor-law parish is simply any area in which a separate poor rate is made and separate overseers appointed. The modern civil parish is either an urban or a rural parish, and its organization under the Ministry of Health varies accordingly. Scot. parishes were also originally eccles. areas; they are now either rural, burghal, or mixed. New parishes may be declared by the Court of Teinds to be parishes for all purposes or to be *quoad sacra* parishes—*i.e.*, for eccles. purposes only; but the Local Government Acts of 1889 and 1894 contained powers which have materially altered parishes

in many cases for purposes of local administration.

Parish Councils. See LOCAL GOVERNMENT.

Park, MUNGO (1771–1806), Scot. African explorer; sent by African Association to explore valley of the Niger (1795), and reached Silla; returning, settled as a surgeon at Peebles (1801), but undertook second W. African expedition (1805); drowned at Boussa; author of famous *Travels* (1799); his *Journal of a Mission to the Interior* was pub. in 1815.

Parker, EDWARD HARPER (1849–), Chin. scholar; prof. of Chinese in the Victoria Univ., Manchester (1901). His numerous works include *Comparative Chinese Family Law* (1879), *The Opium War* (1887), *China's Relations with Foreigners* (1888), *Up the Yangtsze* (1892), *Burma* (1893), *A Thousand Years of the Tartars* (1895), *China* (1901; enlarged ed. 1917), *John Chinaman* (1901), *China, Past and Present* (1903), *China and Religion* (1905), *Ancient China Simplified* (1908), *Studies in Chinese Religion* (1910).

Parker, SIR GILBERT (1862–), Eng. author and politician; born and educated in Canada; travelled widely in South Sea Islands and Near and Far East; joint editor, *The Sydney Morning Herald* (1886); M.P. Gravesend (1900–18); organized Imperial Universities Conference, London (1903); had charge of Amer. Publicity Department for two and a half years after outbreak of war; knighted (1902), baronet (1915); distinguished for his tales of Canadian life, past and present. His novels include *Pierre and his People* (1892), *When Valmond came to Pontiac* (1895), *The Seats of the Mighty* (1896), *The Weavers* (1907), *The Money Master* (1915), *The World for Sale* (1916), *Wild Youth* (1919), *No Defence* (1920). He has also written poems, *A Lover's Diary;* and plays, *The Vendetta* (1889), *No Defence* (1889).

Parker, SIR HYDE (1739–1807), Eng. admiral; served during Amer. and Fr. wars; commanded Baltic fleet (1801), and vainly gave Nelson signal to withdraw at Copenhagen.

Parker, JOSEPH (1830–1902), Eng. Congregational minister and author; pastor successively at Banbury (1853), Manchester (1858), and Poultry Chapel, London (1869), now the City Temple; great preacher and philanthropist; he pub. *City Temple Sermons* (1869–71), *The People's Bible* (1885), etc.

Parkersburg, city, W. Virginia, U.S. (39° 17′ N., 81° 34′ W.), on Ohio R.; petroleum dist.; oil refining, iron and steel works, lumber mills, furniture factories. Pop. 17,800.

Parkes, SIR HARRY SMITH (1828–85), Brit. diplomatist; consul at Amoy (1854), and helped to bring about treaty with Siam (1855); one of three commissioners placed in control of Chin. Government (1858); imprisoned in Peking (1860); consul at Shanghai (1864); minister to Japan (1865–83), and to China (1883).

Parkman, FRANCIS (1823–93), Amer. historian and horticulturist; studied Indian tribe life and wrote *The Oregon Trail* (1849); great aim to write the

history of Fr. power in America; travelled much to this end and produced *Pioneers of France in the New World* (1865), *The Jesuits in America* (1867), *La Salle and the Discovery of the Great West* (1869), *The Old Régime in Canada* (1874), *Montcalm and Wolfe* (1884), *A Half Century of Conflict* (1892); also *The Book of Roses* (1866), still valuable.

Parla Kimedi, munic. tn., Ganjam dist., Madras, India (18° 47′ N., 84° 5′ E.); trade in rice; natives make mats, baskets, etc., from reeds. Pop. 17,500.

Parliament (Fr. *parler*, 'to speak'), supreme legislative authority of U.K. Its legislative power is not subject to constitutional or statutory limitation, but Parliament cannot legislate in such a way as to bind its successors. Control of Parliament over executive derived from fact that ministers of crown, who form the heads of the administrative departments, are chosen from party or parties enjoying a majority in House of Commons and are themselves members of one of the Houses of Parliament. This control strengthened by the fact that departments are subject to laws made by Parliament, and that money required to meet their expenditure has to be voted annually by House of Commons and embodied in statute.

It cannot be stated with accuracy when representative principle was adopted in England, but traces are found in early times. Under Saxon kings undoubtedly a popular element in local government, but difficulties of distance and expense must have tended to discourage attendance of smaller men at *Witenagemot*, or national council, even if they had a legal right to be present. Normans gave feudal character to government of the country, and king's council consisted of spiritual lords and tenants in chief of crown who held by military service, together with other persons of importance summoned by king from time to time. In course of time practice grew up of lesser barons choosing certain of own number to represent them. In 1213 a writ of King John directed sheriffs of counties to send four discreet knights to confer concerning affairs of kingdom, and Magna Charta (1215) recognized that the archbishops, bishops, abbots, earls, and greater barons should be summoned personally, and that all tenants in chief under crown should be summoned by the sheriffs or bailiffs for purpose of assessing aids and scutages when necessary. Recently discovered writs show that Parliament of 1275 anticipated to great extent the development of representation which marked so-called 'Model' Parliament of 1295, famous as containing two knights from each shire, two citizens from each city, two burgesses from each borough, and representatives of cathedral and parochial clergy. In his confirmation of charters, and in *De Tallagio non concedendo*, Edward I. again recognized the necessity for the common assent of the realm to the grant of aids, etc., and this assent becomes from that time the assent of the three estates of the realm, signified in Parliament. During this and two succeeding reigns

Lords Spiritual and Temporal voted subsidies for their own order, and clergy and Commons determined their respective grants. Even after their separation from Commons (Edward II.), clergy in House of CONVOCATION continued to vote subsidies until reign of Charles II. By time of Henry IV. House of Commons was assuming the more important position in regard to taxation and supply, and was asserting the claim to include the Lords in the taxes levied upon subjects of the crown. Attempts of Tudor sovereigns to acquire money by forced loans and benevolences, and of Stewart kings by imposition of duties and votes by virtue of royal prerogative, were sternly resisted, and right of Parliament alone to levy charges on the subject was reasserted by Petition of Right (1629) and Bill of Rights (1689). Right of Commons to take part in legislation received statutory recognition in 1322, but not till reign of Henry V. did bills receive royal assent in form agreed to by Parliament; modern system may be said to date from Henry VI. Various dates have been assigned for formal separation of Lords and Commons, but there is little doubt that it took place not later than 1341. The Commons sat in the 'Painted Chamber' in 1343, and the Lords in the Chambre Blanche; Commons moved to St. Stephen's Chapel in 1547. First Speaker was Sir Thomas Hungerford in 1376.

A statute of 1331 enacted that Parliament should be holden every year once, and more often if need be, and thirty-two years later this was reaffirmed. Though the statute was constantly disregarded, annual sittings became the rule from the latter years of Edward I. until beginning of Henry VIII.'s reign. During this period of 213 years, 200 Parliaments were convened, the sittings lasting from four days to several months. Under Henry VIII. and Elizabeth Parliaments were short and held irregularly for purposes of taxation, but in latter reign Commons boldly claimed to discuss affairs of Church and State. The differences between the Stewarts and their Parliaments led to their less frequent assembly—a period of eleven years (1629–40) actually elapsing between the calling of two Parliaments by Charles I. The Triennial Act (1694) enacted that Parliaments should be holden once in three years at least, and this is the law at the present time; but the financial arrangements of the country and the annual voting of supplies necessitates a meeting of Parliament every year.

Prior to Triennial Act duration of Parliament not limited by statute. Septennial Act (1715) provided that Parliament should cease to exist in seven years from date of first meeting, and this period was reduced by Parliament Act (1911) to five years. Parliament which met on Jan. 31, 1911, extended its own life to period of six years and three months in consequence of the Great War.

Parliament of U.K. consists of sovereign and three estates of the realm. Lords Spiritual and Temporal sit together and form House of Lords, while elected representatives of the third estate of the realm constitute House of

Commons. In 1847 it was provided that the number of bishops entitled to sit in House of Lords should not be increased. Irish and Welsh bishops lost their seats at the disestablishment of the Irish and Welsh Churches respectively. Archbishops of Canterbury and York, Bishops of London, Durham, Winchester, and twenty others are entitled to sit in Lords. Lords Temporal are the dukes, marquesses, earls, viscounts, and barons. Sixteen peers of Scotland elected for each Parliament, and twenty-eight representative peers of Ireland, elected for life, also sit. In addition to hereditary and representative peers, there are Lords of Appeal in Ordinary (created under Judicature Acts 1876) who sit as life peers. Original number of four extended to six in 1913.

Number of members of House of Commons has increased from about 250 in Edward II.'s reign to 658 in 1832, 670 in 1885, and by the Representation of the People Act (1918) to 707. England and Wales now return 254 members in single-member constituencies for 58 parliamentary counties; 266 members in 255 divisions for 137 parliamentary boroughs; and 8 members for 12 universities (5 university constituencies)—making a total of 528.

Scotland returns 38 members in single-member constituencies for 21 parliamentary counties; 33 members in 32 divisions for 13 parliamentary burghs, and 3 members for 4 universities (1 university constituency)—a total of 74 members. Ireland still retains the 105 members which she received in 1832—viz., 80 for counties, 21 for boroughs, and 4 for universities.

The old practice of constituencies paying for the maintenance of their members during attendance upon Parliament had fallen into desuetude by the beginning of the 17th cent. Since 1911 members have been paid an annual salary of £400 from public funds. Minors, aliens (unless naturalized), persons attainted or adjudged guilty of treason and felony (unless sentence has been served or pardon received), or persons adjudged bankrupt (except in Ireland) are disqualified for membership, as are judges, clergy, government contractors, and holders of various offices under the crown (see CHILTERN HUNDREDS). Peers of England and Scotland (but not Irish peers, except representative peers) are incapable of serving in the House of Commons.

Parliament is summoned by king's writ or letter issued out of the chancery, and may be directed to meet at any time not less than thirty-five days from the date of proclamation. A Parliament so summoned may be prorogued by proclamation to a date not less than fourteen days from the proclamation. In event of demise of crown, Parliament, if prorogued or adjourned, meets at once without summons. If demise takes place after dissolution and before date fixed by writ for meeting of new Parliament, last preceding Parliament meets and sits for six months. Otherwise, new Parliament meets at once.

Parliament is prorogued by the king's command signified in Parliament at close of each session,

and at other times by proclamation. Prorogation puts an end to any business pending in Parliament, except an impeachment or appeals pending before House of Lords. It is dissolved by royal proclamation, usually after being prorogued to a certain day.

Commons claim access to person of king when occasion shall require, as a House; Lords possess privileges not only collectively but individually. Commons claim also the most favourable construction of their proceedings. Each House has power to compel persons to attend as witnesses either before House itself or its committees, to punish those who fail to obey its orders, to invoke civil power to enforce obedience to its directions, and to protect its officers in performance of their duties. Both Houses punish such offences as libels on House or its members, interference with witnesses, offer of bribes, improper publication of debates, etc. Commons can only keep a person in custody during continuance of session; Lords can impose imprisonment for stated period beyond its duration.

Privilege of freedom of speech essential for proper performance of a member's duty was only acquired after long struggle. Privilege embodied in Bill of Rights (1688). Member, however, is liable to censure of the House for improper language used by him there, and may be admonished, imprisoned, and, in case of House of Commons, expelled. Speeches made in Parliament are not actionable, and protection has been given by statute to statements made in parliamentary papers printed by order of either House. Freedom from arrest and from molestation during attendance upon Parliament and for a reasonable time before and after its sittings is a very ancient privilege. Time of privilege has never been settled by statute, but would appear to continue forty days after prorogation and for forty days before the next meeting of Parliament. Privilege has been held to extend to criminal matters, but no privilege in case of treason, felony, or breaches of the peace; and if member becomes bankrupt he is dealt with as though he had no privilege.

House of Lords is highest court of appeal from courts of law in U.K., and its hearing of such appeals continues during prorogation or dissolution. It has jurisdiction in trial of peers for treason and felony, and constitutes court before which persons impeached by Commons are tried. Under reference from crown it also decides claims to peerages.

On first day of session, Commons, headed by Speaker, proceed to House of Lords to hear King's Speech. Commons return to their own chamber, and both Houses suspend sittings. On resumption, after some formal business, including reading of a bill for first time, an address of thanks for speech is moved. This in Commons occupies several days; when agreed to is ordered to be presented to king, and normal business of session begins. If session is first of a new Parliament, King's Speech preceded by election of Speaker and taking of oath of allegiance. Speaker presented for king's approbation in

House of Lords on day following his election, and there lays claim to Commons' privileges.

House of Commons meets at 2.45 p.m. on Mondays, Tuesdays, Wednesdays, and Thursdays, and, unless previously adjourned, sits till 11 p.m. for opposed, and to 11.30 p.m. for unopposed business. Certain forms of business are exempted from such interruption by standing order, and House can also order any other business to be exempted at any sitting. If exempted business is under discussion at 11 or 11.30 p.m. it is not interrupted, but at its conclusion any other business is dealt with in accordance with ordinary rules for business taken after 11 p.m. On Fridays, House meets at 12 noon and sits until 5 p.m. for opposed business, and is adjourned not later than 5.30 p.m. Each sitting begins with prayers, followed by unopposed private business on all days but Fridays up to 3 p.m. Petitions may then be presented, unopposed returns may be moved, and notice given of motions. At 3 p.m. the Speaker calls upon members to ask the questions of which they have given notice. (See QUESTIONS.) Unless considered urgent by Speaker, questions are not continued after 3.45 p.m. Adjournment of House can only be moved by private member after questions. It must be for discussion of definite matter of urgent public business. If leave of House is signified, or if leave of House not being signified, not less than forty members stand up when Speaker asks whether member has necessary support, or if member obtains leave on a division, the motion stands over until 8.15 p.m. that evening, when it receives precedence over other business. The end of questions affords opportunity for communication of documents to the House by the Speaker, statements of public policy by members of government, and for certain motions. When these are disposed of clerk reads orders of the day, and public business begins.

Time available for unofficial members' business is limited to period from 8.15 to 11 p.m. on Tuesdays and Wednesdays before Easter, and Wednesdays between Easter and Whitsuntide, precedence being given over bills to notices of motion. Unofficial members may move bills on Fridays until Whitsuntide and on third and fourth Fridays after Whitsunday, but this time may be appropriated by government if House so orders. Government has precedence throughout every sitting during autumn session. Order in which unofficial members shall introduce bills is decided by ballot at the beginning of each session.

Process of Public Bill Legislation is usually as follows: motion for leave to introduce bill; this agreed to, bill read first time without debate. If principal object of bill is authorization of public expenditure, bill can only be introduced on resolution of committee of whole House authorizing expenditure. Such a bill must originate in House of Commons. Next important stage is second reading, when principles and objects of bill as whole are discussed. Question, 'That the bill be now read a

second time,' can be met by negative vote, or by amendment postponing for six months, or traversing principle of bill and advocating another course of procedure. If question carried, bill is ready for committee stage. Since 1907 bills, other than those imposing taxes or Consolidated Fund or Appropriation Bills, which are considered in committee of the whole House, are committed to a standing committee, but may be referred to committee of whole House. In committee stage bill is considered clause by clause. When amendments have been disposed of, question is that the clause, or clause as amended, stand part of the bill. The schedules of the bill and any new schedules can be dealt with in same way as clauses and new clauses. At conclusion of committee stage, chairman is ordered to report bill to the House, and it is considered by House as a whole. New clauses may be added, amendments moved, and new schedules proposed, as in committee, except that an amendment involving a charge on the Exchequer or votes is inadmissible. A power of selecting the amendments to be moved may be exercised by the chair. (See CLOSURE.) The final stage is its third reading, in which debate is largely confined to the proposals contained in the bill. A bill which has been read the third time in one House is sent to the other, where it passes through the same stages. If the second House agrees to the bill without amendment it is ready for the royal assent. If amendments are made by the second House, the bill is returned to the first House with the amendments, and a message asking the first House to agree with them. If the first House agrees, the bill is ready for the royal assent; but if it disagrees to any of the amendments made by the second House, the latter must either agree not to insist on its amendments, or if it insists on them, the first House must resolve not to insist upon its disagreement, or the bill cannot proceed. (See PARLIAMENT ACT.) When agreement is reached the bill receives the royal assent.

The granting of supply to the crown is based on the estimates and considered in Committee of SUPPLY.

See also CHAIRMAN; CONSOLIDATED FUND; PRIVATE BILL LEGISLATION; SPEAKER.

Parliament Act, passed 1911, enacted that the House of Lords shall have no right to interfere with any bill which the Speaker of the House of Commons certifies to be a money bill. The same Act also provides that if a bill be passed three times by the House of Commons, and on each occasion be rejected by the Lords, it may forthwith be presented to the king for his assent in spite of the Lords' opposition. Three years must, however, elapse between the first introduction of the bill and its final passage.

Parma. (1) Prov., N. Italy; traversed by Apennines in S.; N. is fertile plain watered by tributaries of Po; produces corn, wine, fruit, cheese, and silk; several mineral springs. Area, 1,258 sq. m.; pop. 340,000. (2)

Tn., cap. of above (44° 48′ N., 10° 19′ E.); cathedral (begun 1059), baptistery (12th cent.), San Giovanni Evangelista (with frescoes by Correggio), Madonna della Steccata, Palazzo della Pilota (containing fine picture-gallery with works by Correggio, Tintoretto, Tiepolo, and others), Palazzo Municipale, univ. (1512); flourished under Romans, and rose to great importance during Middle Ages; home of Correggio; chief industries, silks, iron-ware, pianos, tobacco. Pop. 54,600.

Parmenides. See ELEATIC SCHOOL.

Parnahyba. (1) Riv., N.E. Brazil; rises in Serra das Mangabeiras (10° s., 46° w.); flows N.E. and enters Atlantic by a delta. Length, 800 m. (2) Seapt., Brazil (3° s., 41° 41′ w.); in delta of above river; exports cattle, hides, cotton, tobacco. Pop. 10,000.

Parnassus (modern *Liakoura*) (38° 31′ N., 28° 37′ E.), mountain-ridge, Greece; sacred to Apollo and the Muses.

Parnell, CHARLES STEWART (1846–91), Irish politician; son of John Henry Parnell of Avondale, co. Wicklow; educated at Magdalene College, Cambridge; M.P. for co. Meath (1875–80); at once commenced policy of opposition to England; in first speech in Parliament advocated Home Rule and Irish nationality; joined Amnesty Association, for release of Fenians (1876); in 1877 developed Irish plan of parliamentary obstruction, causing record sitting of Parliament (July 31 to August 1); sought to win over Fenians and establish united Irish party, this union was largely brought about by agrarian distress; 'Ireland for the Irish' became general gospel of revolutionists; National Land League was founded (1879), of which Parnell became president. He visited America to win support of Amer. Fenians, and obtain funds for League (1880); represented Cork (1880–91); chairman of Nationalists in House of Commons (1880); founded *The Irish National Newspaper and Publishing Company*, and reissued *The Flag of Ireland* as *United Ireland* (1881); imprisoned (1881–82) at Kilmainham for speeches at League Convention in Dublin; while in jail is said to have made an agreement with Gladstone, known as the 'Kilmainham treaty'; acclaimed by his party as 'the uncrowned king of Ireland.' England began to see need of temporizing, but better feeling was killed by the Phœnix Park murders; Parnell's condemnation of the crime threatened him with loss of influence over party; refounded Land League as *Irish National League* (1883); Fenianism continued, and revolutionary crimes were repeated; attempts to blow up Tower of London and Houses of Parliament (1885). Parnell was bitterly attacked, but refused responsibility, and continued policy of obstruction; chairman of Irish Parliamentary party (1886), when Gladstone declared for Home Rule; the Bill of 1886 failed, but resulted in alliance of Irish Nationalists with Liberal party; Parnell had to face, in 1887, charge of having sympathized with Phœnix Park murders; a forged letter, by Richard Pigott, was pub. in *Times*

under heading 'Parnellism and Crime.' In 1891 he married Mrs. O'Shea, divorced from Captain O'Shea (1890) on ground of her adultery with Parnell. The Irish Parliamentary party re-elected him chairman, but Gladstone's letter to Morley, stating that he must 'resign, altered matters. The committee met, and Parnell refused a motion for his own deposition; forty-five members (the Anti-Parnellites) retired, and in another room decreed his resignation; the minority of twenty-six (the Parnellites) stood by him. See IRELAND (*History*).

Life, by T. P. O'Connor (1891), Walsh (1892), E. M. Dickinson (Parnell's sister; 1906).

Parnell, THOMAS (1679–1718), Eng. poet; Goldsmith wrote his life, and Pope pub. a selection of his poems, mostly translations and adaptations in fluent and elegant verse, in 1721.

Parody is a form of literary composition based imitatively upon another work upon which, or upon the author of which, it seeks to cast ridicule; in its highest form it is not merely an imitation of a given metre or style, but the humorous application of an author's methods to subjects quite foreign to those with which he usually deals. Among the best Eng. parodies are Horace and James Smith's *Rejected Addresses* (1812); Hookham Frere's *Anti-Jacobin* (1797–98); Calverley's *Verses and Translations* (1862), and *Fly Leaves* (1872); Sir Owen Seaman's *The Battle of the Bays* (1896), and *Borrowed Plumes* (1902); and Sir A. T. Quiller-Couch's *Green Bays* (1893). Sir F. C. Burnand's satirical versions of popular novels are pure burlesque, as are the writings of Stephen Leacock. In prose parody the best example is Bret Harte's *Condensed Novels* (1867). See also BURLESQUE.

Paros. See CYCLADES.

Parr. See SALMON FAMILY.

Parramatta. See PARAMATTA.

Parratt, SIR WALTER (1841–), Eng. musician; prof. of music, and organist, Magdalen Coll., Oxford (1908–18); prof. Royal Coll. of Music; Dean of Faculty of Music, London Univ., since 1916; was private organist to Queen Victoria; organist, St. George's Chapel Royal, Windsor; knighted (1892); contributor to Grove's *Dictionary of Music*.

Parrot-fishes (Scaridæ) are wrasse-like fishes having teeth fused into a parrot-like beak; mostly tropical.

Parrot Tribe (order Psittaciformes), an order of brilliantly coloured birds, containing almost 600 species, with large, strongly curved beak, fleshy tongue, and feet in which the first and fourth toes turn backwards, the second and third forwards. They are arboreal, feed mainly on fruits and seeds, live in companies, but pair in couples. The Nestor parrots (*Nestor*), found only in New Zealand and neighbouring islands, include the kea, which has gained an unenviable reputation on account of its habit of tearing open the backs of sheep in order to gorge upon the kidneys. The lories and loriquets (Loriidæ) have brush-tipped tongues, and are confined to Australia and islands near it. In cockatoos (Cocatuidæ) the tongue is simple, and the head is crowned by a

crest of feathers; whereas the true parrots have a smooth tongue, have no crest, and often have a metallic green colouring in their plumage. True parrots, of which there are about 440 species, are found in both Old and New Worlds. Familiar examples are the *grass parakeet* of Australia (*Melopsittacus*); the grey parrot of Africa (*Psittacus erithacus*), the most imitative, and best talker; the beautiful nimble Amer. love-birds or parakeets (*Psittacula*); the most showy of parrots, the large, long-tailed macaws (*Ara* and *Anodorhynchus*) of S. Amer. forests, brilliant in scarlet, blue, green, and yellow; and the peculiar winged, but flightless, nocturnal owl parrot (*Stringops*) of New Zealand.

Parry, Sir Charles Hubert Hastings (1848–1918), Eng. composer, and prof. of music, Oxford (1899–1908); was subsequently director of Royal Coll. of Music; wrote *Prometheus Unbound, Lotos Eaters*, and numerous symphonies, suites, overtures, chamber music, oratorios, anthems, and songs; also *Style in Musical Art* (1913), and other works. Bart. (1902).

Parry, Sir Edward Abbott, Eng. judge and author; called to the bar (1885); judge in the county court at Manchester (1894-1911), and at Lambeth (1911–20); appointed judge of the high court and knighted (1920); has won fame as author and dramatist; well known for his contributions to *Punch*; examples of his plays are *England's Elizabeth* (1901), *Katawampus* (1901), and *What the Butler Saw* (1905); has also written *Letters from Dorothy Osborne to Sir William Temple* (1887; rev. ed. 1903), *Life of Macklin* (1890), and numerous children's books; also *Judgments in Vacation* (1911), *What the Judge Saw* (1912), *The Law and the Poor* (1914), *The Law and the Woman* (1916), and, with Sir A. E. Codrington, *Pensions: Past and Present* (1918).

Parry, Sir William Edward (1790–1855), Eng. Arctic explorer, admiral, and author; accompanied Captain John Ross's first expedition for discovery of N.W. Passage (1818); commanded second successful expedition (1819), winning government reward of £5,000; after three more expeditions became controller, steam department of navy (1837–46); governor of Greenwich Hospital (1853); wrote *Narrative of an Attempt to reach the North Pole* (1828).

Parsees, a people originally in Persia, occupying the prov. of Farsitan (Farsees = Parsees = Persians), *c.* 558 B.C. Their religion was Zoroastrian and dualistic. Ormuzd, the 'Lord Wisdom,' the god of the sky, whose symbol is the sun, or fire, or light, is the creator, and against him Ahriman, the prince of darkness, wages war. In the 7th cent. A.D. the Parsees were practically exterminated by the Mohammedan invaders, save those who migrated to India, and whose descendants still live in the Bombay prov. They are now a rich merchant class, responsive to Brit. influence, and aloof from the Indians.

Parsifal. See Wagner.

Parsley (*Carum Petroselinum*), garden plant of order Umbelliferæ; seeds are sown in April; often found growing wild as a garden escape.

Parsnip (*Pastinaca sativa*), garden plant of order Umbelliferæ; cultivated for its root, which must not be cut before cooking; root of wild parsnip is not edible.

Parsons, city, Kansas, U.S. (37° 20′ N., 95° 15′ W.); railway workshops, foundry and machine shops, flour mills. Pop. 12,500.

Parsons, ALFRED WILLIAM (1847–1920), Eng. painter, chiefly in water-colour; his picture, *When Nature painted all Things Gay* (1887), was purchased by Chantrey Bequest; also did work in illustration (with E. A. Abbey, R.A.) of Herrick's *Poems*, *She Stoops to Conquer*, and *Old Songs;* (with F. D. Millet) *The Danube from the Black Forest to the Black Sea;* and alone, of Wordsworth's *Sonnets* and *The Warwickshire Avon.*

Parsons, HON. SIR CHARLES ALGERNON (1854–), Eng. engineer and inventor, son of the third Earl of Rosse; educated at Cambridge; famous as the inventor of the compound steam TURBINE bearing his name, which was first produced in 1884; first vessel to be built with turbine engines was an experimental torpedo boat, the *Turbinia;* turbine has now become the standard method of propulsion for warships; has also been adopted by the mercantile marine, and for electric generating plants. Made K.C.B. in 1911, and has been twice president of the Brit. Association.

Parsonstown, or BIRR, tn., King's co., Ireland (53° 5′ N., 7° 54′ W.); at Birr Castle is famous reflecting telescope, 52 ft. long, with speculum 6 ft. in diameter. Pop. 4,400.

Parthenogenesis. See under REPRODUCTION.

Parthenon. See ATHENS.

Parthia, mountainous country S.E. of Caspian Sea; was subject to Pers. Empire, and afterwards to Alexander the Great and to the Seleucid dynasty; became an independent monarchy under Arsaces (*c.* 250 B.C.), which eventually extended from Euphrates to the Indus and from Indian Ocean to Hindu Kush; waged many wars with Rome; overthrown by Persia (A.D. 226). The proverbial tactics of the Parthians were to retreat shooting arrows, hence a *Parthian shot.*

Partick, burgh, Lanarkshire, Scotland (55° 52′ N., 4° 18′ W.); suburb of Glasgow; on r. bk. of Clyde; shipbuilding yards, brass foundries, cotton factories, flour mills. Pop. 66,900.

Partinico, tn., Sicily (38° 3′ N., 13° 6′ E.), 15 m. W.S.W. of Palermo; manufactures silk and woollen goods. Pop. 24,000.

Partition. When lands are held by joint tenants or tenants in common, the lands are often partitioned so that each tenant may get the whole of a part of the estate instead of a share in the whole of the estate. Partitions can be carried out by the Chancery Division of the High Court, or by the Board of Agriculture; and under the Partition Acts (1833 and 1868) the court may order a sale instead of a partition at the request of an interested party.

Partnership is defined by the Eng. Act of 1890 as 'the relation which subsists between persons carrying on a business in common with a view to profit.' Each of the partners must be competent to contract, and, therefore, if an

infant enters into a contract of partnership, he is not responsible for the debts of the firm, and he may repudiate the partnership before or when he comes of age. A married woman can be a partner, but she cannot always be made a bankrupt with the rest of the firm. Apart from agreement, the death or bankruptcy of a partner puts an end to the partnership. The court may dissolve a partnership where a partner is found to be a lunatic, and for other reasons. A private partnership cannot be formed of more than ten persons for banking, or twenty for any other business. If that number is exceeded, such persons can only carry on business together legally when registered as a company. A partnership may be at will, or it may be for a definite period. No person may be introduced as a partner without the consent of all the existing partners. A *dormant* or *sleeping partner* is one who participates in the profits without taking any active share in the management, and without appearing before the world as a partner. Such a partner is, however, like any others, responsible for the debts of the firm. Every partner is an agent of the firm and of his other partners for the purpose of the business of the partnership, and his acts bind the firm and his partners, if they are performed within the usual course of the firm's business. Every partner is liable jointly with his copartners, and, in Scotland, severally also, for all debts of the firm incurred while he is a partner; and after his death his estate is also severally liable, but subject in England and Ireland to the prior payment of his separate debts.

Partridge. See under PHEASANT FAMILY.

Partridge, BERNARD (1861–), Eng. black-and-white artist; stained-glass designer and decorative painter (1880–4); joined staff of *Punch* (1891); leading cartoonist since retirement of Tenniel; paints occasionally in oil, water, and pastel; as actor has appeared in *New Lamps for Old, Arms and the Man, Under the Red Robe*, etc.

Pasadena, city, California, U.S. (34° 9′ N., 118° 8′ W.), 10 m. N.N.E. of Los Angeles; fruit packing and canning; Mt. Wilson with solar observatory (alt. 5,900 ft.), and Echo Mountain with Lowe Observatory, in vicinity. Pop. 30,300.

Pascal, BLAISE (1623–62), Fr. mathematician and author; *b.* at Clermont-Ferrand; at twelve years of age evolved, without books, first thirty-two propositions of Euclid; at sixteen wrote treatise on conic sections; invented several mechanisms. Delicate, and, after accident which brought him to death's door, retired to Port-Royal and embraced doctrines of Jansenists; wrote in their defence against the Jesuits the famous *Lettres Provinciales* (1656–7), supposed to be written by a man of the provinces to a Jesuit. First three letters defend Jansenists, rest attack Jesuits; novelty and literary merit is that they were in French, so that public — 'even women' — might take part in controversy; they are in turn vehement, jovial,

indignant, and disdainful. He wished to write an apology for Christian religion which would persuade the reader of its truth, and result was fragments which were collected as *Pensées*, another Fr. classic. His publishers thought fit to alter it for literary and religious reasons, but original text was *in extenso* (1844); a simple, graceful, dignified style.

Life, by Tulloch (1882), St. Cyres (1909); trans. of the *Letters* by M'Crie (1847).

Pasco. See CERRO DE PASCO.

Pas-de-Calais, mar. dep., N. France (50° 35′ N., 2° 10′ E.), formed out of Artois and Picardy; surface generally flat; very fertile; extensive coalfields and iron mines; large agricultural products; live stock, poultry, and fishing; sugar refining, distilling; glass, paper, pottery, leather manufactures. Cap. Arras. Area, 2,551 sq. m.; pop. 1,068,200.

In Great War the dep. suffered severely. Arras was reduced to ruins; Lens and its coal mines were destroyed; and large tracts of rich agricultural country in the S.E. were laid waste. Its chief ports, Calais and Boulogne, were bases of the Brit. armies, which ultimately held the whole front from Belgium to the Somme, with headquarters first at St. Omer and later at Montreuil. On its territory were fought the battles of Loos (1915), part of the Somme struggle (1916–17), Arras (1917), and the advance to the Hindenburg Line (1917–18). See, further, WAR, THE GREAT.

Pasig, tn., cap. Rizal, Luzon, Philippines (14° 38′ N., 121° 7′ E.), 8 m. E. of Manila; commercial centre. Pop. 12,000.

Passage West, seapt., Cork, Ireland (51° 52′ N., 8° 20′ W.), 6 m. S.E. of Cork, on Cork Harbour. Pop. 2,000.

Passaic. (1) City, New Jersey, U.S. (40° 52′ N., 74° 7′ W.); great manufacturing centre; it manufactures worsteds, cotton, silk, and rubber goods; submarine cables. Pop. 54,800. (2) Riv., New Jersey, U.S.; rises near Morristown, and flows N.E. and S. to Newark Bay (40° 43′ N., 74° 6′ W.); abundant water-power afforded by falls (70 ft.) at Paterson. Length, *c.* 100 m.

Passau, tn., Bavaria, Germany (48° 34′ N., 13° 27′ E.), 90 m. E.N.E. of Munich, at junction of Inn and Danube; tobacco, leather, china, paper, and graphite industries; made a bishopric (8th cent.); was secularized (1803), and united with Bavaria; treaty securing religious freedom to Protestants signed here (1552). Pop. 21,000.

Passchendaele, vil., W. Flanders, Belgium (50° 55′ N., 2° 54′ E.), 7½ m. N.E. of Ypres, on crest of slight straggling ridge some 200 ft. above sea-level, and extending from wooded heights near Gheluvelt on S. to Forest of Houthulst on N., last elevation before dead level of Flanders plain is reached. Was a valuable coign of observation over Ypres salient. Captured by Germans during first battle of Ypres (Oct. 1914), and held for nearly three years; strongly fortified with pill boxes; main Brit. objective of third battle of Ypres. Right of ridge seized at fifth attempt (Oct. 5, 1917), when advance made through quagmires amidst storm; ruins

of village captured (Oct. 6), by Canadians, but northern advance along ridge checked; positions lost during Ger. offensive beginning April 9, 1918; recovered by Belgians in victorious advance of Oct. 15, 1918.

Passer. See FINCH FAMILY.

Passion-flower (*Passiflora*), a genus of tendril-climbing plants, with peculiar pentamerous flowers, and elaborate corona with ovary at the apex; fruit, a berry.

Passion Play, a dramatic performance representing the last scenes of Christ's life; in many respects similar to the mystery or miracle plays; flourished towards the end of the Middle Ages, especially among the peasantry of Germany and Bohemia; in modern times chiefly represented by the Passion play of Ober-Ammergau (Bavaria).

Passover, a Jewish feast, observed in memory of the coming out of Egypt. The feast was instituted traditionally by Moses at the command of the Lord. A lamb was to be killed on the evening of the 14th of Nisan, and its blood sprinkled on the lintel and doorposts. It was to be roasted and eaten by the people, who were to be ready and equipped for a journey. For a week afterwards only unleavened bread was to be eaten. The origin and exact meaning of the feast are still obscure, and the different documents which compose the Pentateuch show varying versions of it. There are passages which suggest that the origin of the festival belongs to pre-Mosaic times. The Israelites in Egypt made repeated requests for liberty to sacrifice in the desert, and this may point to the primitive Passover, the desire to observe which would thus be the cause of the exodus. Wellhausen's view that this primitive Passover was the offering of the firstlings of the flock is that generally adopted; probably there came to be combined with the Passover the agricultural feast of unleavened bread, which the Israelites may have adopted in Canaan.

Passport. In time of peace a passport is granted by a government to its subjects who desire to travel in a foreign country. Prior to the Great War the system had been dropped in most European countries, but since then it has been revived, and a passport as well as the visa of a consular authority of the country for which it is made out are now generally necessary. In time of war, a passport is technically a written permission given by the government of a belligerent state to a subject of the enemy entitling him to travel in country under its control. It differs from a safe-conduct in that the latter is given by a military or naval officer with respect to some place within the district over which he has authority.

Pastes. See under GEM.

Pasteur, LOUIS (1822–95), Fr. chemist; first appointment was prof. of physics in the *lycée* at Dijon; deputy prof. and (1852) prof. of physical chem. at Strasbourg; dean of the faculty of science at Lille (1854). He held various appointments in Paris from 1857 till he became director of the Pasteur Institute; studied crystallography, and showed the

relation between optical activity and molecular asymmetry, thus laying the foundations of stereochemistry; best known for his work on micro-organisms; showed that alcoholic and acetic fermentation and putrefaction are caused by living organisms, and that when these are killed or excluded decay is prevented. Thus he opposed the idea of spontaneous generation, and introduced sterilization.

Studies on wine, beer, and the silkworm disease led to investigation of the cause and means of prevention and cure of virulent diseases (*e.g.*, hydrophobia), to the germ theory of disease, and the principles of preventive medicine, of which the Pasteur Institute is the enduring memorial. See BACTERIOLOGY. *Life* by René Vallery-Radot (1900).

Pasto, tn., Colombia, S. America (1° 12′ N., 77° 14′ W.), at foot of volcano of same name (14,000 ft.); woollen goods; wooden varnished ware. Pop. 13,000.

Pasture. See under GRASS.

Pasture, MRS. HENRY DE LA (LADY CLIFFORD), *née* Elizabeth Lydia Rosabelle, Eng. novelist and dramatist, eldest daughter of Edward Bonham; married first (1887) Henry de la Pasture, second (1910) Sir Hugh Clifford; pub. *The Little Squire* (dramatized in 1894), *A Toy Tragedy* (done into Braille), *Catherine's Child*, *The Lonely Lady of Grosvenor Square*, *Erica* (1912), *Michael Ferris* (1913); plays: *Peter's Mother* (100 nights), *Apollo*, *Deborah*, etc.

Pasuruan, or PASSOEROEAN, chief tn., residency of same name, Java, Dutch E. Indies (7° 38′ S., 112° 55′ E.), 30 m. S.S.E. of Surabaya. Pop. 25,000.

Patagonia, extensive region in S. of S. America (40°–52° S., 63°–75° W.), stretching from Rio Negro on N. to Straits of Magellan on S., and divided in two by Andes. Portion E. of Andes, recognized since 1881 as belonging to Argentina, consists of vast plateau region rising in succession of terraces occasionally crossed by valleys; these plains are covered mostly by shingle, stones, and rock, and are almost destitute of vegetation, except in some parts where coarse grass and bushes grow; in hollows lakes are frequent. Chief rivers are Rio Negro, Chubut, Chico, and Santa Cruz; most fertile and productive country to be found at base of Andes; gold, silver, copper, lead, coal abundant, but not worked; large tracts devoted to rearing of horses and cattle. Area, 320,800 sq. m.; pop. 90,000. To W. of Andes is Chilean Patagonia, strip of rugged mountainous country with luxuriant forests. Area, 75,000 sq. m.; pop. 107,000. Patagonia was discovered by Magellan in 1520, and explored by Gamboa and many others. Patagonians (now almost extinct) are very tall and uncivilized.

Skottsberg, *Wilds of Patagonia* (1911).

Patan. (1) Tn., Nepal, India (27° 41′ N., 85° 20′ E.), 4 m. S.S.W. of Khatmandu; has several fine old temples. Pop. c. 30,000. (2) Walled tn., Baroda, Bombay, India (23° 51′ N., 72° 10′ E.); manufactures swords and spears; has trade in silk and cotton goods. Pop. 32,000.

Pateley Bridge, mrkt. tn., W. Riding, Yorkshire (54° 5′ N., 1° 45′ W.); lead mines, stone quarries; cattle and sheep fairs; stalactite caverns in vicinity. Pop. 3,000.

Patella. See GASTEROPODA.

Patents. A patent in the U.K. is a grant from the crown by *letters patent* to the true and first inventor of some manner of new manufacture, conferring on him the sole right or monopoly of making, using, or selling it during the period for which the patent is granted. This prerogative of the crown was settled by Act of Parliament (22 James I.) in the 17th cent. In 1883 the control of such grants was transferred to the Board of Trade. By the Patents Acts (1907 and 1908), a limited examination into the novelty of the invention claimed is to be made at the time when a complete specification is deposited. But this investigation does not in any way guarantee the validity of any patent. The legal validity of a patent and the question of the possible infringement of some existing patent can only be determined in a court of law. A patent is granted for fourteen years on payment of prescribed fees, and is maintained in force by annual renewal fees after the end of the fourth year. A patentee may, however, before the expiration of his patent, present a petition to the king in council praying for an extension; and if the Judicial Committee of the Privy Council report that the patentee has been inadequately remunerated by his patent, the term may be extended for a further period of seven, or, in exceptional cases, fourteen years.

The essentials of the subject-matter of a valid patent are that it shall be an invention, new and useful. It may be something entirely new, as, for example, the telephone was, or it may be some new mechanical method of carrying out an old process. But novelty is essential, and if the invention has become known in this country by prior use or publication, even by the inventor himself, no patent can afterwards be granted—an exception being made where the prior use was in the nature of an experiment, or where the matter has been disclosed in confidence to assistants. Utility, though not necessarily commercial profit, is equally required for a valid patent. It must be shown that the purpose designed will be fulfilled by the patent. The first step in the application for a patent is to fill in a declaration, obtainable at any postal money-order office, and send it to the Patent Office with provisional or complete specifications. This latter specification must be filled in with great care, and a fee of £3 must be sent with it. A fee of £1 must also be paid for further investigation. Unless opposition is made within two months after the public advertising, the applicant duly receives his patent sealed. Patent agents are usually employed. A person representing an article to be patented when it is not is liable to a fine of £5. International conventions exist for protecting inventions patented

in the signatory countries, and several countries have separate arrangements with Great Britain.

Pater, WALTER HORATIO (1839–1894), Eng. critic; *b.* London; at an early age came under the influence of Keble and of Ruskin's *Modern Painters.* Educated at Oxford, he was elected fellow of Brasenose College, Oxford (1864). A visit to Italy (1865) led him to make a prolonged study of Ital. art and humanism, and this resulted in the publication of *Studies in the History of the Renaissance* (1873), a book which revealed him as a penetrating critic, and as a writer with a beautiful though highly elaborated style. He pub. several other books of criticism and critical romance, including *Marius the Epicurean* (1885), *Imaginary Portraits* (1887), *Appreciations* (1889), *Plato and Platonism* (1893), *The Child in the House* (1894), *Greek Studies* (1895), *Miscellaneous Studies* (1895), *Gaston de Latour* (1896).

Life by A. C. Benson (1906).

Paterno, tn., Sicily (37° 34′ N., 14° 54′ E.), on S.W. slope of Etna; mineral springs; olive oil and wine produced. Pop. 24,000.

Paterson, city, New Jersey, U.S. (40° 55′ N., 74° 8′ W.); chief centre of silk manufacture in U.S.; foundry and machine-shop products; falls (70 ft.) of Passaic R. are here. Pop. 125,600.

Paterson, WILLIAM (1658–1719), Scot. financier; projector of the Bank of England (1691); promoter of Darien colonization scheme (1698); supported parl. union of England and Scotland (1707); his proposals for the consolidation and conversion of National Debt (1717) embodied in Walpole's Sinking Fund.

Paterson, WILLIAM (1860–), Scot. theologian and author; parish minister, Crieff (1887–94); prof. of theol., Aberdeen Univ. (1894–1903); prof. of divinity, Edinburgh Univ., since 1903; Baird lecturer in 1905–6; minister, Scots Church, Melbourne (1912); chaplain-in-ordinary to the King in Scotland; pub. *The Rule of Faith* (1912), *In the Day of the Master* (1914), *German Culture* (1915), *In the Day of the Ordeal* (1917); joint ed. of *Social Evils and Problems* (1918); a contributor to *Hastings' Dictionary of the Bible.*

Pathans, original name of the Afghans; specially applied to tribes residing in India.

Pathfinder, Brit. light cruiser, 2,940 tons, 25½ knots, nine 4-in. guns; completed 1905; sunk by a Ger. submarine off the Firth of Forth (Sept. 5, 1914).

Pathology, the science which treats of the causes, nature, and results of diseases, generally divided into (a) *General Pathology;* (b) *Special Pathology.* General pathology includes *inflammation,* or the series of phenomena arising in normal tissues from the action of a chemical or physical irritant, the most common being the action of bacteria, and *repair,* the process of restoration of damaged tissues; *degenerations* and *infiltrations,* the former being the retrograde conversion of the complex protoplasm of a cell into a simpler substance—*e.g.,* fat or colloid material—and the latter being the deposition of a new substance—*e.g.,* fat, in an otherwise unaltered cell; *necrosis,*

cellular death in a part of the tissues, and *gangrene*, death of the tissues in mass; *pigmentation*, the abnormal deposition of colouring material in the tissues, usually in the cells; *atrophy*, abnormal decrease in the size and number or the size alone of the elements of a normal tissue, and *hypertrophy*, abnormal increase in the size of the elements of a normal tissue, the term *hyperplasia* being applied to increase in number; *malformations*, errors in development of various parts of the body—*e.g.*, hare-lip, due to incomplete development of the upper jaw; *tumours*, abnormal local growths of new tissue, with no physiological function, which may be either *innocent*—*i.e.*, resembling the tissue from which it springs, restricted in growth, and only harmful through pressure—or *malignant*, of more or less embryonic nature, irregularly invading the surrounding tissues and with a tendency to reproduce itself in other parts of the body, eventually causing death; *granulomata*, including those chronic infective diseases with a characteristic lesion resembling granulation tissue—*e.g.*, tuberculosis, syphilis, leprosy, glanders, actinomycosis; *diseases of the blood*—*e.g.*, pernicious anæmia, leucocythæmia; *œdema* and *dropsy*—the former being the undue accumulation of lymph between the cells of a tissue, causing it to swell, and the latter the accumulation of lymph in one or other of the body cavities; *thrombosis* and *embolism*—the former being coagulation of the blood in a part of the circulatory system, and the latter the impaction of a body, usually part of a thrombus or clot, in a vessel too small to allow it to pass further; *animal parasites* of the human body, tapeworms, threadworms, flukeworms, and protozoa. *Bacteria* are not generally included under the heading of general pathology, but under the special heading of *bacteriology*. Special pathology includes the different manifestations of diseases in the various organs, the results of a particular disease or morbid condition being naturally more or less widely divergent in different tissues and organs.

The modern science of pathology is founded upon the researches of Rudolf Virchow (1821–1902) and Sir James Paget (1814–99), the *Cellular Pathology* of the former being pub. in 1850, and the *Lectures on Surgical Pathology* of the latter delivered during the six years preceding publication in 1853. With the introduction of improved methods of experiment and investigation the science made rapid strides in the last quarter of the 19th cent., the discoveries of Koch, working on the lines initiated by Pasteur, of the bacillus of anthrax in 1876 and of tuberculosis in 1882, being perhaps the most notable and the most far-reaching in effect. At the present time considerable attention is being devoted by pathologists to investigation regarding the bacterial and parasitic origins of various diseases—cancer for instance, a subject engaging at present much patient and elaborate research, being attributed by some authorities, so far on insufficient grounds, to

such causes; while the pathology of the nervous system, including the localization of function on the cortex of the brain and cerebellum, and the pathology of the blood and blood-forming tissues, are also among the most important problems now in process of investigation.

See HEART; KIDNEY; SPLEEN, and other organs; also such articles as BACTERIOLOGY; PARASITIC DISEASES; RESPIRATORY SYSTEM; URINARY SYSTEM.

Adam, *Principles of Pathology* (1909); Woodhead, *Practical Pathology* (1910).

Patiala, or PUTTIALA. (1) State, Punjab, India; valuable forests of pine, oak, bamboo; slate, limestone, sandstone quarried; copper and lead mined; cotton, tobacco. The Maharajah is Sir Bhupindra Singh (1891–). Area, 5,951 sq. m.; pop. 1,407,700. (2) Tn., cap. of above (30° 20′ N., 76° 28′ E.); the centre of local trade. Pop. 53,500.

Patmore, COVENTRY KERSEY DIGHTON (1823–96), Eng. poet and critic; *b.* Woodford, Essex; in 1847 he became a librarian at the Brit. Museum. His poetry shows great depth and tenderness of thought, idealizing love, and giving fine pictures of Eng. scenery and of domestic life. The best of his poems is *The Angel in the House.* His chief prose works are a *Memoir of Bryan Waller Procter* (1877), *Principle in Art* (1889), and *Religio Poetæ* (1893).

Gosse, *Coventry Patmore* (1905).

Patmos, one of the Sporades islands, Ægean (37° 20′ N., 26° 33′ E.), belonging to Greece; here St. John lived in exile and, according to tradition, wrote the Apocalypse; site of monastery of St. John (11th cent.). Area, 20 sq. m.; pop. 4,000.

Patna. (1) Dist., Patna Div., Bengal, India; flat; watered by Ganges; wheat, tobacco, opium produced. Area, 2,075 sq. m.; pop. 1,625,000. (2) Tn., cap. of above (25° 35′ N., 85° 10′ E.), on Ganges, stretching almost 9 m. along r. bk.; government headquarters, college, and other educational institutions; famous for massacre of Patna (1763) and Sepoy mutiny (1857); important commercial centre; rice, opium, indigo, cotton, salt, oil seeds. Pop. 136,200.

Paton, SIR JOSEPH NOEL (1821–1902), Scot. Pre-Raphaelite painter, also poet; historical and Shakespearean, and, later, allegorical and religious subjects; R.S.A. (1850); Queen's limner for Scotland (1866); knighted (1867). His paintings include *Quarrel* and *Reconciliation of Oberon and Titania* (National Gallery, Edinburgh), *The Pursuit of Pleasure, Lux in Tenebris,* etc.; pub. *Poems of a Painter* (1862) and *Spindrift* (1866).

Patras, fort. tn., Greece (38° 14′ N., 21° 45′ E.), N. coast of Peloponnesus; one of chief ports of Greece; citadel, cathedral, castle; exports currants, wine, olive oil; was one of twelve cities of Achæan confederacy in anc. Greece. Pop. 37,700.

Patrick, ST. (*c.* A.D. 387–461), patron saint of Ireland; subject of many legends; born probably in Dumbarton, Scotland; carried off to Ireland by pirates about 405; escaped after six years, and fled to Lérins in Gaul. He

formed the idea of evangelizing Ireland. In 432 he was consecrated and went to Ireland, where Christianity had already some footing. He preached vigorously, and to him the real conversion of Ireland is due.

Bury, *Life of St. Patrick.*

Patricroft, tn., Lancashire, England (53° 29′ N., 2° 22′ W.), 5 m. W. of Manchester; iron-works, cotton mills, and machine shops. Pop. 15,000.

Patterdale, vil., Westmorland, England (54° 32′ N., 2° 56′ W.), at S. end of Ullswater; a well-known tourist resort.

Patti, ADELINA (BARONESS CEDERSTRÖM) (1843–1919), operatic singer; born at Madrid; appeared in New York (1859) and London (1861); equally successful in concert and opera; the favourite of two continents; married first Marquis de Caux (1868), divorced (1885), then M. Nicolini (1886), and, after his death, Baron Cederström (1899). Buried in England (1919), and her body was exhumed (1920) and taken to Père Lachaise, Paris.

Pattison, MARK (1813–84), Eng. scholar and author; at Oxford came under influence of Newman, and pub. a trans. of Aquinas on *St. Matthew* (1842), and two lives of Eng. saints—*Stephen Langton* and *St. Edmund*—in the series ed. by Newman; appointed college tutor (1843), and established a great reputation; became rector of Lincoln Coll. (1861). His writings, of which the best known is *Milton* (1879), included *The Present State of Theology in Germany* (1857), *Learning in the Church of England* (1863), and *Memoirs* (1885), as well as editions of Pope's *Essays, Satires, and Epistles* (1872), and Milton's *Sonnets* (1883).

Pâturages, tn., Belgium (50° 26′ N., 3° 52′ E.), 4 m. S.W. of Mons; has coal mines and manufactures steam engines; was occupied by Germans throughout Great War. Pop. 10,900.

Pau, chief tn., Basses-Pyrénées, France (43° 18′ N., 0° 22′ W.), on Gave-de-Pau; fine castle (14th cent.); former cap. of province of Béarn; birthplace of General Bernadotte; winter health resort; linen, chocolate, hams, Jurançon wine. Pop. 37,100.

Pau, PAUL (1848–), Fr. soldier; *b.* Montélimar; educated at Saint-Cyr (1867); fought in the Franco-Prussian War (1870–1), when he lost an arm; general of division (1903); commanded 16th Corps at Montpellier and 20th Corps at Nancy; at outbreak of Great War was in command of the abortive Fr. offensive into Alsace (Aug. 1914); subsequently superintended attack of 6th Fr. Army under Maunoury on the Ger. right flank at the battle of the Marne (Sept. 1914).

Paul, par. and tn., Cornwall, England (50° 6′ N., 5° 33′ W.), 2 m. S. of Penzance; fisheries. Pop. 6,000.

Paul, THE APOSTLE, greatest figure in the history of Christianity after Christ Himself. The sources of information for his life which we possess are Acts of the Apostles and his own epistles; some reliable information may be gained from early tradition. From these sources the following facts appear: he was born at Tarsus, his father being a Jew in the possession of Roman citizenship; he himself therefore

was free born. Of the tribe of Benjamin, he received the tribal name of Saul and also Roman name Paul; learned trade of tentmaker, and studied under Gamaliel at Jerusalem; showed strong Pharisaical tendencies; was a determined opponent of Christianity, believing it to be opposed to the will of God; considered it a sacred duty to persecute the Christians to the utmost; was appointed agent by the Sanhedrin to exterminate the Christian church at Damascus; on the way thither had the vision of Jesus which changed his career, and from being an opponent of Christianity became its strongest supporter; baptized by Ananias and began to declare that Jesus was the Son of God. The next three years were spent in Arabia; then he returned to Damascus, from which he had to escape owing to the opposition of the Jews; went to Jerusalem and preached the gospel, all suspicion of his genuineness being removed by the support of Barnabas.

The next seven years were apparently spent in Syria and Cilicia. He was invited by Barnabas to help him in superintending the revival which had taken place at Antioch, the outcome of which was the determination to begin the spread of the gospel throughout the Roman Empire; sent to Jerusalem with help to the church there, which was suffering from the famine of A.D. 44; commissioned by the leaders there as apostle to the Gentiles, along with Barnabas. A large part of Paul's life was taken up with missionary travels.

First Missionary Journey.—Accompanied by Barnabas and Mark, he went to Cyprus, visited Paphos, its chief town, converted the Roman governor, founded a Christian church, became known as Paul and acknowledged as head of the missionary movement; visited Perga, Pamphylia, Pisidia, and Lycaonia (at Perga deserted by Mark); went to Antioch in Pisidia, and Iconium, Lystra, and Derbe, and returned to the Syrian Antioch, which had been his starting-point. On this journey they were welcomed by Gentile proselytes, listened to by heathen Gentiles, opposed by Jews, rejected sometimes with violence by heathen people; yet their influence was felt, converts were made, and several churches founded. The success of this preaching tour lay not merely among the Jews, but also among the proselytes and adherents of Judaism from the heathen. As soon, however, as these converts were formed into Christian congregations along with Jewish converts, there arose difficulties of a practical kind. The synod at Jerusalem, however, was content to require from the new converts that they should abstain from things strangled and from blood; that they should refrain from eating food which had been offered to idols; and that they should abstain from fornication.

Second Missionary Journey.—As the result of a difference of opinion with regard to Mark, Paul and Barnabas separated, Paul undertaking to visit the churches on the mainland. Accompanied by Silvanus, he visited

the churches which were founded on his first missionary journey, and made known to them the decisions of Council at Jerusalem; at Lystra took Timothy as his assistant; as a result of a vision he visited Europe, travelled to Neapolis, Philippi, Thessalonica, Berœa, Athens, and Corinth. The superstition of the people was a constant source of trouble; the attitude of the civil authorities also created difficulties, while persecution proved a hindrance; nevertheless success attended the efforts of the missionaries. Returning to Jerusalem, Paul differed from Peter regarding status of the circumcised and uncircumcised, and he rebuked Peter for 'dissembling.'

Third Missionary Journey.— Visited Galatia, Phrygia, Ephesus; remained three years in Ephesus, where the temple of the goddess Diana was situated, but forced to leave owing to organized opposition; during his three years' visit Christianity was established in the city and in the towns in the neighbourhood; went to Troas, Macedonia, Illyria, and Greece; reached Corinth and set out for Jerusalem, and thus ended his third missionary journey.

At Jerusalem a tumult arose; he was attacked as an opponent of the traditions of the fathers; defended himself in address to the people and the Sanhedrin; taken under protection of Roman guards, transferred for safety to Cæsarea, under the care of the procurator Felix; left in prison for two years; brought before Festus, who succeeded Felix; appealed to Rome, and reached that city a prisoner, after an adventurous journey by sea and land; remained at Rome, a prisoner in his own hired house, for two years; tried and acquitted; travelled to Colossæ, Crete, Nicopolis, and went probably as far as Spain; second imprisonment took place, followed by trial, condemnation, and death (A.D. 64).

Paul was the author of thirteen epistles contained in the N.T.: 1 and 2 Thessalonians, 1 and 2 Corinthians, Galatians, Romans, Colossians, Philemon, Ephesians, Philippians, 1 and 2 Timothy, Titus. These letters or epistles are not systematic treatises, but were called forth by special occasions, such as the necessity for sending advice to his friends or to the churches under his care, and with the exception of Romans, which was meant to be an introduction of himself to Rome and a declaration of his message, were written rapidly as circumstances demanded; yet through them all there runs one great theme—the glory of God and the exaltation of Jesus Christ His Son, the Saviour. See articles under the name of epistles.

Conybeare and Howson, *Life and Epistles of St. Paul*; W. M. Ramsay, *St. Paul the Traveller and the Roman Citizen*; A. B. Bruce, *St. Paul's Conception of Christianity.*

Paul III., POPE. See FARNESE.

Paul V., POPE. See BORGHESE.

Paumotu Islands, native name for the Low Archipelago; consists of c. 80 low coral reefs in Pacific (14°–24° s., 135°–149° w.). Total area, c. 350 sq. m. Pearl fisheries. Officially annexed to France (1881). Pop. c. 3,000.

Pauncefote OF PRESTON, JULIAN, 1ST BARON (1828–1902), Brit. diplomatist; *b.* at Munich, Bavaria; became permanent under-secretary for foreign affairs (1882); first delegate to the Suez Canal International Commission at Paris (1885); appointed British minister to the U.S. (1889), an office which he held for thirteen years; several important events marked his ambassadorship, notably the Bering Sea fishery dispute and the Venezuela affair; was first Brit. representative at Peace Conference at the Hague, and was largely responsible for the establishment of the Hague Court of Arbitration (1899).

Pauper. See POOR LAW; VAGRANCY.

Pausanias (*d. c.* 470 B.C.), Spartan regent (479); joint commander of Greeks with Aristides at battle of Platæa (479); admiral (478) against Persia; relieved Cyprus and recovered Byzantium.

Pausanias (*fl.* 2nd cent. A.D.), Gr. writer and geographer; nothing known of his life except that he lived during the reigns of Hadrian, Antoninus Pius, and Marcus Aurelius; probably a native of Lydia; visited Syria, Palestine, Egypt, Byzantium, Epirus, Italy, and the greater part of Greece. His *Description of Greece* has often been printed; new Eng. ed. (1900), by Frazer, with trans. and commentary.

Pavia, anc. tn., N. Italy (45° 11′ N., 9° 9′ E.); cap. of prov. Pavia, on Ticino, near confluence with Po. Outstanding features are the churches of San Michele (11th cent.), S. Pietro in Ciel d'Oro (rebuilt *c.* 1132), S. Francesca (11th cent.), unfinished Renaissance cathedral (15th cent.), Castle of Visconti (1360), Palazzo Malaspina (now Museo Civico), univ. (1361), and 5 m. N. of Pavia the magnificent Certosa di Pavia (Carthusian monastery); chief industries, iron foundries, chemicals. Pavia (anc. *Ticinum*) was Lombard cap. (572–774); Francis I. of France here defeated and captured by Charles v. (1525); Austrian possession (1714); passed to Sardinia (1859). Pop. 40,700.

Pavlova, ANNA, Russian dancer; first appeared on the stage at the Imperial Opera House, Petrograd; came to London (1909), and appeared at the Palace Theatre, being assisted by Michael Mordkin; made an instantaneous success; remained in London for some years, and subsequently toured in U.S.; recognized as the finest dancer of the day.

Pavlovo, tn., Nizhni-Novgorod, Central Russia (55° 58′ N., 43° 6′ E.); important industrial centre; iron and steel foundries; cutlery, hardware; soap works, cotton and silk mills. Pop. 13,000.

Pavo. See PHEASANT FAMILY.

Pawnbroking is regulated in Great Britain by the Pawnbrokers Act of 1872. The pawnbroker must be a person of good character, and must take out a yearly licence. The maximum profit is fixed, and the pledge on which the money has been lent must not be sold till a year and seven days have elapsed after the transaction. The Act does not apply to loans above £10. A pawn ticket must be given to the borrower, and on this ticket

the conditions of the loan are stated. If not redeemed, the pledge, if pawned for ten shillings or under, becomes the property of the pawnbroker; if pledged for above ten shillings, it may be sold by auction, and if there is any surplus the pawner is entitled to it, while he is also liable for a deficiency. No licensed pawnbroker may take pledges from a young person under 12, or from a person intoxicated, may employ an assistant under 16 years, or do business on a public holiday. A stipendiary magistrate may at any time order a pawnbroker to produce his books and papers concerning any transaction where reasonable suspicion exists that stolen goods have been pawned. A pawnbroker is liable for damage by fire, or for deterioration through his fault or neglect of an article pawned.

Pawnees. See INDIANS.

Pawtucket, city, Rhode I., U.S. (41° 52′ N., 71° 23′ W.); manufactures cotton and silk fabrics, machinery, chemicals; first cotton-spinning works in U.S. established here (1790). Pop. 51,600.

Paxton, SIR JOSEPH (1801–65), Eng. architect and gardener; became manager of the Duke of Devonshire's estates in Derbyshire (1836); put forward a design for the Great Exhibition of 1851 which was accepted, and on its completion he was knighted (1851); also designed and had charge of the erection of the Crystal Palace, Sydenham (1853–4); ed. the *Horticultural Register* (1832–6), *Botanical Pocket Dictionary* (1840), and *Paxton's Flower Garden* (1850–3).

Paymaster-general, honorary official, changing with the government; head of Pay Office, through which all public money voted by Parliament is paid and funds of Supreme Court are managed.

Payn, JAMES (1830–98), Eng. novelist; *b.* Cheltenham; became ed. of *Chambers's Journal* (1858), and was ed. of the *Cornhill Magazine* (1883–96); wrote more than a hundred novels, of which the best is *Lost Sir Massingberd* (1864); others are *Married Beneath Him* (1865), *Gwendoline's Harvest* (1870), *By Proxy* (1878), *The Talk of the Town* (1885), *Disappearance of George Driffel* (1896); other books include *Some Literary Recollections* (1884), *Gleams of Memory* (1894), and *Backwater of Life* (1899).

Paysandu. (1) W. dep., Uruguay, S. America; traversed by Uruguay R.; gold, silver, copper, iron. Area, 5,120 sq. m.; pop. 42,300. (2) Tn., cap. of above (32° 20′ s., 58° w.); on Uruguay; important seaport; exports preserved meat, cattle, sheep, hides, wool. Pop. *c.* 20,000.

Pea (*Pisum sativum*), member of Leguminosæ, cultivated for its edible seeds; the plant is a tendril climber, the tendrils representing modified leaflets, but dwarf varieties are also grown; leaves pinnate and stipulate, with alternate phyllotaxis; inflorescence is racemose, the flowers being typically papilionaceous. See LEGUMINOSÆ; SWEET PEA.

Peabody, tn., Massachusetts, U.S. (42° 31′ N., 71° w.); birthplace of George Peabody, philanthropist; manufactures leather, machinery, and electrical supplies. Pop. 15,700.

Peabody, GEORGE (1795–1869), Amer. philanthropist, born in South Danvers (now Peabody), Massachusetts. In 1837 he settled in London as a banker and merchant, and in 1862 gave £500,000 to that city for the building of lodging-houses for the poor. His benefactions in Britain and America amounted to nearly two and a half millions.

Life, by Phœbe A. Hanaford (1882).

Peace, riv., Canada; rises in Brit. Columbia (56° N., 120° W.); breaks through Rocky *Mts.*; flows N.E. to near Lake Athabasca, then N. and N.W. as Slave R. to Great Slave Lake. Length, *c.* 1,100 m.

Peace Conferences. (1) OF PARIS. Preliminary arrangements made at Versailles by Inter-allied Council, which drew up Armistice terms. Further details arranged by representatives of Great Powers (Great Britain, France, U.S., Italy, and Japan) in Dec. 1918 and Jan. 1919. Twenty-seven allied and associated powers were invited to participate—viz., five Great Powers in addition to Brit. Dominions and India, Belgium, Brazil, China, Cuba, Greece, Guatemala, Haiti, Hejaz, Honduras, Liberia, Nicaragua, Panama, Poland, Portugal, Rumania, Serbia, Siam, Czecho-Slovakia, together with Bolivia, Ecuador, Peru, and Uruguay. Delegates of five Great Powers entitled to attend all meetings of Conference and its committees; delegates of other powers entitled to attend only those sessions at which matters concerning them were discussed. Each of five Great Powers represented by five delegates; three each to Belgium, Brazil, and Serbia; two each to Australia, Canada, China, Greece, Hejaz, India, Poland, Portugal, Rumania, Siam, South Africa, and Czecho-Slovakia; one each to other powers—seventy in all. First plenary session of Conference held Jan. 18, 1919, M. Clemenceau being chosen president, and M. Dutasta (French) secretary-general. Four vice-presidents also chosen, one from each of Great Powers (except Japan), who were also represented on the Secretariat-General of Conference. These officers, together with members of Committee on Credentials and Drafting Committee, formed bureau which was responsible not only for records but for general planning and organization of much of work. Each of commissions among which work of conference was subdivided had similar but simplified organization.

After formal opening of Conference on Jan. 18, it was decided that proceedings should be secret and no minutes kept. The body through which the Great Powers first functioned was the Council of Ten, but after Fr. press had boldly declared that an open rupture had occurred between the British and Amer. delegates, this council was superseded by the 'Big Four' (Lloyd George, Clemenceau, Wilson, and Orlando). Four plenary sessions were held up to May 7, on which day the completed draft of the treaty was handed to the Ger. delegates, but the main decisions were those of the Big Four. Serious deadlocks occurred in April over the

Fiume question (see ITALY), resulting in the secession of Orlando, and also over Japanese demand for statement in League of Nations Covenant affirming equality of all races. Nothing explains the delays and deadlocks of the Conference so obviously as the arguments over the LEAGUE OF NATIONS Covenant and the principle of self-determination—a cardinal feature of Wilson's 'fourteen points' (see WILSON), which was found to bristle with difficulties. Thus the deliberations were characterized by a strange conflict of new and untried theories with such age-old principles as the Balance of Power and 'Spoils to the Victor.' The covenant eventually found expression in first twenty-six articles of treaty. Much of the pioneer work that should in theory have been done by the League was in fact carried out by the SUPREME COUNCIL.

To speed up matters commissions were appointed to work out details of constitution and function of League of Nations, Responsibility for the War, Enforcement of Penalties, Reparation for Damages, International Control of Ports, Waterways, and Railways. Other commissions created later included those on Economics, Finance, Belgium, Schleswig, Alsace-Lorraine, Poland, Czecho-Slovakia; Rumanian, Gr., and other territorial claims. A commission of inquiry into the conditions of the employment ot labour from the international standpoint was also set up, but most of its recommendations remained a counsel of perfection. These commissions prepared sections of the treaty dealing with the subjects specially assigned to them. The representation of the different powers on the commissions was not unattended with difficulty. A brief summary of the principal provisions of the treaty follows.

I. *Covenant of the League of Nations.*—See LEAGUE OF NATIONS.

II. and III. *Boundaries of Germany, and Political Clauses for Europe.*—ALSACE-LORRAINE to be restored to France; ownership of coal mines in SAAR Basin to be vested in France, and government of region to be entrusted for fifteen years to Commission of League of Nations; thereafter plebiscite as to future destination. No fortifications to be maintained or troops assembled in Germany w. of line 50 kilometres E. of Rhine.

Belgium gains full sovereignty over neutral territory of Moresnet, over part of Prussian Moresnet, and over (subject to plebiscite) the circle of Eupen and Malmedy. Annexation to Denmark of whole or part of that portion of Schleswig N. of line running somewhat S. of Flensburg, to be determined by plebiscite.

Germany cedes to Poland nearly all prov. of Posen and nearly all W. Prussia w. of the Vistula. Plebiscites for part E. of Vistula, and for most of Upper Silesia (excluding small part given to Czecho-Slovakia). Memel dist. subject to future disposition.

DANZIG, with adjacent territory w. of the Nogat, a free city, Polish commerce being given special rights and privileges. Economic and political rights of inhabitants of ceded territories established by detailed provisions.

IV. *German Rights and Interests outside Germany.*—Germany gives up all colonies and renounces all extra-territorial rights enjoyed against Allied and Associated Powers—*e.g.*, in Equatorial Africa under treaties with France, in China, Siam, Liberia, and Morocco. She recognizes Brit. and Fr. protectorates over Egypt and Morocco respectively. Shantung renounced to Japan.

V. *Military, Naval, and Aerial Clauses.*—Ger. army limited to 100,000 men and officers; Ger. general staff dissolved; compulsory military service abolished; military training forbidden outside military schools necessary for permitted number of officers. Armaments and munitions definitely limited; poisonous gases, armoured cars, and tanks not to be made; no importation or exportation of war material. Naval forces limited to 6 battleships, 6 light cruisers, 12 destroyers, and 12 torpedo boats. No submarines to be built or acquired; personnel of navy not to exceed 15,000. No fortifications to be maintained between North Sea and Baltic; fortifications and naval harbours of Heligoland and Dune to be destroyed. No air forces to be permitted. All military and naval aeronautical material, as well as all war and naval material of every kind, to be given up. Three Interallied Commissions of Control to supervise execution of these clauses.

VI. *Prisoners of War and Graves.*—Provision made for repatriation of prisoners of war and identification of graves.

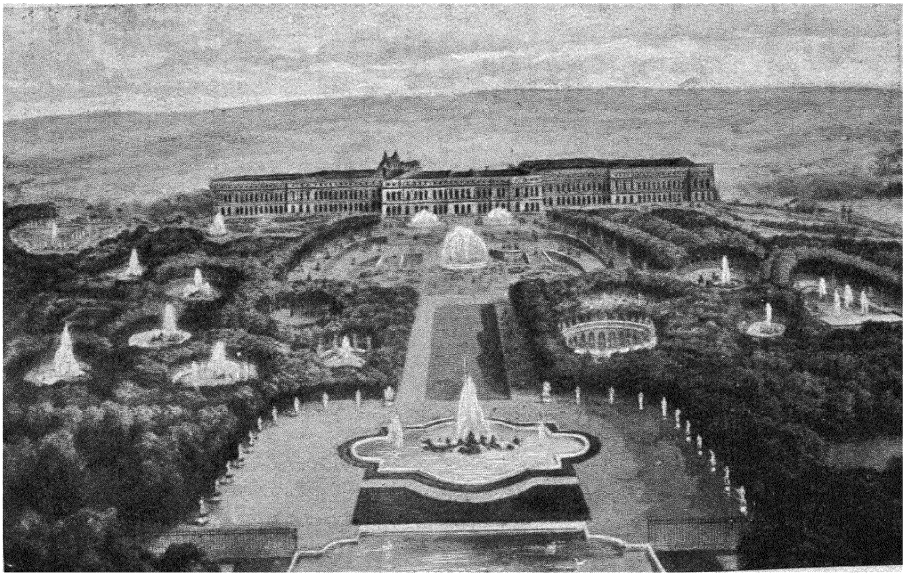
VII. *Penalties.*—Five judges appointed by Great Powers to try Ger. emperor. All persons accused of war crimes to be given up for trial and possible punishment.

VIII. *Reparation.*—Compensation may be claimed for injuries to civilians through acts of war or maltreatment; for maltreatment of prisoners of war, naval and military prisoners, etc.; for forced labour; for destruction, injury, and seizure of non-military property; for fines and similar exactions imposed on civilians. Germany specifically undertakes to pay 20,000,000,000 gold marks within two years, followed by 1,000,000,000 marks per year for five years, and then 2,400,000,000 marks per year (2,000,000,000 marks being regarded as interest on principal sum of 40,000,000,000 marks, balance being credited towards amortization). First payments must also be charged with expenses of maintaining armies of occupation and cost of necessary imports of food and raw materials, but are in addition to Germany's obligation to repay sums lent to Belgium by Allied governments and to restore property seized or sequestrated. Against these obligations Germany to be given credit on account of her mercantile marine, Saar coal mines, and other transferred public property. She must transfer all her ships over 1,600 tons, also many of her smaller vessels, and build ships for the Allied governments. Options are also given for delivery of coal, coke, coal-tar products, dyestuffs, and other chemicals. Large powers vested in Reparation Commission.

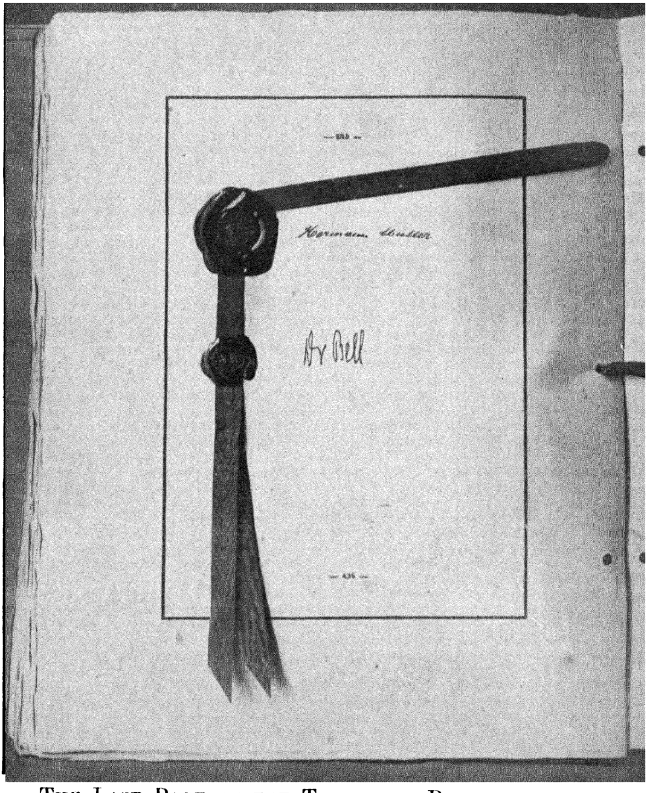
The remaining clauses deal with finance, economic questions, aerial navigation, ports, waterways, and railways, labour, guarantees, and miscellaneous questions. Elbe, Oder, Niemen, and Upper Danube (from Ulm) to be internationalized under control of commissions. Rhine to be controlled by joint commission. Kiel Canal to be open on equal terms to the trade of all nations at peace with Germany.

(2) CONFERENCES SUBSEQUENT TO RATIFICATION OF TREATY OF VERSAILLES BY GERMAN GOVERNMENT, JAN. 1920. Ger. Government signed Peace Treaty, June 29, 1919, but by beginning of 1920 it was abundantly clear that, in many important particulars, she was not carrying out her treaty obligations, especially in matter of disarmament and reparation. Allies met on April 26, at *San Remo*, to deal with Germany's request, in face of great unrest and specially of seizure of Ruhr valley by communistic troops, for permission to maintain army of 200,000 instead of 100,000 according to treaty. Stern note, embodying statement of views as to Germany's shortcomings in respect to execution of treaty, sent in reply, declining to examine question until Germany showed she was honestly carrying out the treaty. Conference decided to summon Ger. delegates to Spa on May 25, for discussion of practical application of reparation clauses. It also dealt with Adriatic problem. (See ITALY.) The general decisions at San Remo may be summarized as follows: Duty of restoring order in Ruhr valley to be left to Germans, who might, under guarantees, occupy district for suppression of rising. Declaration that Allies had no intention of annexing any portion of Ger. territory. This was necessary in view of Fr. press campaign urging annexation of Rhineland and coal measures. Delegates to be summoned to Spa to make definite proposals in regard to sums payable as reparation. Necessity for this step arose out of Germany's failure to comply with proposal embodied in letter of June 28, 1919, requiring that, within three months of signing peace, Germany should submit proposals in settlement of her liability as defined in Article 232. Mandates for Syria given to France; for Mesopotamia, including Mosul (subject to agreement with France as to oil distribution), to Great Britain; for Palestine, with full recognition as to the Balfour declaration in respect of Jews, to Great Britain. Pending signing of peace treaty with Turkey, the duty of guarding Dardanelles to be assigned to Great Britain; protection of Cilicia to France; of district of Adana to Italy. An appeal on behalf of Supreme Council to be made to U.S. to undertake mandate for Armenia; in event of refusal, Wilson to arbitrate as to boundaries. A reaffirmation of decision previously arrived at, that trade relations should be opened up with Russia.

On May 15–16, 1920, as a kind of corollary to San Remo, Lloyd George and Millerand, acting for all the Allies, met at Hythe, and decided as follows:



THE PEACE CONFERENCE: THE PALACE OF VERSAILLES FROM THE GARDENS.



THE LAST PAGE OF THE TREATY OF PEACE, BEARING THE SIGNATURES AND SEALS OF THE GERMAN DELEGATES, JUNE 28, 1919.

Treaty of Versailles to be enforced in all its details, especially disarmament clauses. Experts to be appointed for purpose of (*a*) preparing proposals for fixing minimum total of Ger. debt, compatible with her capacity to pay; (*b*) methods of payment and of capitalization of said debt to be determined in manner best calculated to ensure Germany's restoration to financial autonomy by speedy fulfilment of her obligations; and (*c*) proportionate divisions between Allies of payments to be made by Germany. Further, it was agreed that Allied indebtedness to Great Britain should be paid off *pari passu* with Germany's payments.

After more than one postponement, *Spa Conference* met in June 1920—the first occasion on which Ger. representatives met Allies in unfettered discussion. General impression left on minds of Allies was that the Ger. chancellor and Herr von Symons, his colleague, were perfectly honest men, doing their best to cope with the gigantic task of carrying out the treaty. Decisions arrived at were as follows: in distribution of reparation funds Brit. interests to get 22 per cent.; France, 50 per cent.; Italy, 10 per cent.; remainder to Belgium and other Allies. The 2,000,000 tons of Ger. shipping surrendered to Great Britain since the Armistice to be sold, and proceeds, together with freights earned, to be credited first to cost of Brit. army of occupation, and secondly, to Brit. share of reparation, including advances to Belgium. Germany undertook to deliver 2,000,000 tons of coal to the Allies per month, 1,500,000 tons to go to France. On this matter the Conference nearly broke down. The treaty provided that in fixing Germany's contribution of coal, Allies should take into account needs of Ger. industry. The question for Germany was whether she should be credited with export price or inland price; if latter, her only means of buying food would be taken from her. Allies stipulated that difference between two prices, as to five marks per ton, should be paid in cash to Germany, and balance advanced to her for purpose of buying food and clothing for the miners. As to the indemnity, Germany submitted schemes for arriving at the amount, and enabling her to liquidate her obligations; whereupon Allies decided to appoint small commission of experts to discuss scheme with the Germans in detail. As to punishment of war criminals, Allies realized that Germany was not solely to blame for delay. Naval disarmament was considered satisfactory, but the delay in military disarmament, notably in matter of surrender of rifles, was considered a grave menace, 600,000 rifles being in possession of the Einwohnerwehr (civil guards). Allies insisted on issue of proclamation demanding all rifles to be given up by Sept. 1920.

In regard to *Turkey*, Allies decided to adhere substantially to terms already submitted to that country, with one important alteration—viz., that Turkey should have a representative on

the Straits Commission. Just before the Conference, nationalists under MUSTAPHA KEMEL (see also TURKEY) had broken out in rebellion, and small Brit. force at Ismid was threatened. Venizelos agreed to dispatch Gr. army to Smyrna to restore order. Turkey was given ten days in which to sign treaty of peace. The suicidal war between Poland and the Russian Bolsheviks came up for consideration, and the conference decided Allies must stand by Poland. This decision was communicated to Russia, and Lenin and Trotsky replied with evasive propagandist document intimating willingness to negotiate directly with Poland, but declaring that they were prepared only to discuss Polish boundaries with a proletarian government. Reply regarded as profoundly unsatisfactory, and France and Great Britain at once sent special envoys to Poland to report as to steps necessary to enable Poles to defend their territory. For subsequent history, see POLAND and RUSSIA.

Peace Movement. Peace congresses began in 1843, and were held in different countries in rotation. The tendency to submit various international questions to arbitration increased, but these were not basic to national freedom, safety, honour. In 1899, however, the Tsar Nicholas II. suggested an international meeting at the Hague which should attempt to abolish war. Peace conferences were held there in 1899 and in 1907, and conventions were drawn up and signed by various powers, but they had no real sanction. Great Britain agreed to chief conventions (*i.e.*, that arbitration should be accepted in international disputes, and that laws of war by land and sea should be ascertained and insisted on), but not to declarations against the use of asphyxiating gases and expanding bullets; a proposal for the reduction of armaments was not carried, being regarded with disfavour by Germany and other powers. The most important conclusions regarded the definition of contraband of war (see DECLARATION OF LONDON). In 1910 Mr. Andrew Carnegie placed sum of $10,000,000 in hands of trustees to be used for abolishing war. Germany's deliberate initiation of the Great War showed that civilization was still exposed to perils of destruction. But her action profoundly stirred the universal conscience, and in President Wilson's phrase, 'to make the world safe for democracy' became the peace aim of the Allied and Associated Powers. With this object the Covenant of the League of Nations was embodied in the Peace Treaty of Versailles (1919). See LEAGUE OF NATIONS.

Peach (*Prunus persica* or *Amygdalus persica*), rosaceous tree grown for its fruit; allied to apricot, cherry, plum, and almond.

Peacock. See under PHEASANT FAMILY.

Peacock, THOMAS LOVE (1785–1866), Eng. writer; friend of Shelley, who persuaded him to abandon business for letters and aided him financially; eventually obtained government post; father-in-law of George Meredith. Poems include ***Palmyra,***

Philosophy of Melancholy, and *Rhodadaphne*; his best novels are *Melincourt*, *Nightmare Abbey*, and *Maid Marian*. Ed. by Prof. Saintsbury (1895).

Peak, THE, mountain mass, Derbyshire, England (53° 24′ N., 1° 50′ W.); S. extremity of Pennine Chain; highest point, Kinder Scout (2,088 ft.); ruins of Peveril Castle in vicinity.

Peake, ARTHUR SAMUEL (1865–), Eng. theologian; Rylands prof. of Biblical exegesis, Victoria Univ., Manchester, since 1904; became editor of the *Holborn Review* (1919); his numerous works include *The Religion of Israel* (1908), *Christianity: its Nature and its Truth* (1908), *Faded Myths* (1908), *Critical Introduction to the New Testament* (1909), *Heroes and Martyrs of Faith* (1910), *The Bible: its origin, its Significance, and its Abiding Worth* (1913), *Prisoners of Hope* (1918), *The Quintessence of Paulinism* (1918), *The Revelation of John* (1919), and *Commentary on the Bible* (1919).

Peal. See SALMON FAMILY.

Pea-nut. See GROUND NUT.

Pear (*Pyrus communis*), member of Rosaceæ, indigenous to temperate Europe; cultivated for its fruit (known botanically as a pseudocarp, the edible portion representing the enlarged apex of the receptacle, whilst the fruit proper constitutes the core); requires a deep, fairly moist, clayey loam, with good drainage, and a southern outlook.

Pear, PRICKLY. See CACTUS.

Pearl, a globular concretion found in shells of certain bivalve molluscs; highly valued for ornamental purposes, and classed among gems. The principal sources of pearls are the pearl oyster (*Meleagrina margaritifera*) found throughout the Pacific; pearl mussel (*Avicula margaritifera*), and freshwater mussel (genus *Unio*) of Brit. rivers. The formation of pearls used to be explained as due to an additional secretion of nacreous matter (calcium carbonate), owing to irritation set up by a particle of foreign matter, such as a grain of sand. In some cases it has been shown that their formation is due to the presence of minute parasitic animals, which attach themselves to a few hosts in their life history, one of these being the pearl-producing mollusc.

The chief pearl fisheries are those of Ceylon, carried on principally in the Gulf of Manaar. Those of the Persian Gulf were known to the ancients. Pearls are also obtained from the Sulu Archipelago, N.E. Borneo, New Guinea, Gulf of Mexico, and Australia. Native divers descend 60 or 70 ft., weighted by a stone and lowered from a boat by a rope. They carry a net and gather the pearl oysters in it from the sea-floor. They remain below for perhaps 30 or 40 seconds at a time, and are hoisted to surface after signalling with a rope. The oysters are allowed to rot on the beach in sun's rays. Then in seven or ten days they are searched for pearls.

Artificial Pearls are largely made in France, Germany, and Italy by blowing a thin globe of glass and filling it with a solution of ammonia and fish scales.

Kunz and Stevenson, *Book of the Pearl* (1908).

Pearl Ashes, a refined form of crude pot-ashes obtained from wood ash, and consisting chiefly of potassium carbonate, K_2CO_3. They are prepared by extracting the pot-ashes with water, evaporating the solution, and calcining the product.

Pearl Harbour, port, Oahu, Hawaiian Islands (21° 30′ N., 157° 30′ W.), 6 m. w. of Honolulu; landlocked harbour, with narrow entrance guarded by coral reef. Attention has been directed to its utilization as a coaling station since 1884. In 1909, U.S. government announced that repair shops and dry dock would be constructed and extensive fortifications undertaken.

Pearl Oysters. See PEARL.

Pearl Spar. See DOLOMITE.

Pears, CHARLES (1873–), Eng. artist who has specialized in the painting of sea scenes; has done much work in illustration of various books, notably Dana's *Two Years before the Mast,* Masefield's *Salt-water Ballads,* and Dickens's works; appointed official naval artist, he has painted many pictures illustrative of naval incidents in the Great War.

Pearse, MARK GUY (1842–), Eng. Wesleyan minister; has written more than thirty books, the best known of which are *Daniel Quorm and his Religious Notions* (1st and 2nd series; 1875–9), and *Cornish Stories* (1883); his more recent works include *The Gentleness of Jesus* (1898), *The God of our Pleasures* (1898), *The Story of a Roman Soldier* (1899), and *West Country Songs* (1902).

Pearse, PATRICK H. (1880–1916), Irish rebel; *b.* Dublin; associated from his earliest years with the literary side of the extreme Nationalist movement; became a member of the Irish bar, and, later, founded St. Enda's Coll., a secondary school for boys, where Irish nationalism was fostered; founded the New Ireland Soc. (1897); was elected to the executive of the Gaelic League and ed. its weekly journal. On the outbreak of the rebellion (1916), he became 'Commandant-General of the Army of the Irish Republic and President of the Provisional Government,' and was one of the signatories of the declaration of the Irish Republic; held out against government troops for a week, then surrendered unconditionally; was tried by court-martial, and executed (May 3, 1916). Since his death, his *Collected Works* have been pub. in two vols. (1917 and 1918), chiefly plays and poems, remarkable for literary beauty.

Pearson, SIR ARTHUR (1866–), Eng. publisher and philanthropist; founder and chairman of C. Arthur Pearson, Ltd.; proprietor of various newspapers until failure of sight; president National Institute for the Blind, and Fresh Air Fund; vice-president Tariff Reform League, and vice-chairman Tariff Commission (1903); joint hon. secretary National Relief Fund (1914); chairman Blinded Soldiers' and Sailors' Care Committee (1914); baronet (1916); he founded St. Dunstan's, for blinded soldiers.

Pearson, KARL (1857–), Eng. scientist; Galton professor of eugenics and director of the

Laboratory for National Eugenics, London Univ. (1911); publications include *The Ethic of Free Thought* (1887 and 1901), *The Chances of Death, and other Studies in Evolution* (1897), *Grammar of Science* (1899, 1900, and 1911), *National Life from the Standpoint of Science* (1901), *The Life and Letters of Francis Galton* (1915), *Tables for Statisticians* (1914); was ed. of *Biometrika* (vols. i.–xi. 1902–17).

Peary, ROBERT EDWIN (1856–1920), Amer. Arctic explorer; entered Amer. navy (1881), and spent some years as assistant engineer on the Nicaragua Ship Canal; led an expedition to N. Greenland (1891–2); in an expedition to the same country (1893–95), made a detailed survey of the region, and discovered the great Cape York meteorites; commanded expedition of the Peary Arctic Club, New York (1898–1902), and determined the northern limit of the Greenland archipelago, or land group, and practically connected the coast S.E. to Independent Bay; led fresh expeditions (1905–6, and 1908–9), in the former of which he reached 87° 6′, a point farther N. than had been reached by any other explorer, and in the latter of which he reached the Pole itself (April 6, 1909).

See his *Northward over the Great Ice* (1898), *Nearest the Pole* (1907), and *The North Pole* (1911).

Pease, RT. HON. HERBERT PIKE (1867–), Eng. politician; M.P. for Darlington since 1898; Unionist whip (1906–15); assistant postmaster-general (1915), and again in 1919; became president of the Church Army (1917).

Peat, remains of bog-moss, *Sphagnum*, together with partially preserved remains of vegetation swamped and killed by its overgrowth; owes its preservative power to presence of humic acid. Peat-bogs are found in many parts of England, are more common in Scotland, and still more numerous in Ireland. Various attempts have been made to compress peat, and so make it commercially available as fuel, but no satisfactory system has yet been produced. It is, however, used as fuel by peasants. During the latter part of the Great War, and since its termination, peat has come into greater use as a fuel, owing to the scarcity and cost of coal. (See SPHAGNUM.) In 1915 Prof. W. R. Bottomley published the results of a series of apparently successful experiments on the use of bacterized peat as a stimulant to growth of vegetables and flowers, but failed to receive support from the Board of Agriculture in its practical development. Now manufactured into blankets, carpets, rugs, wadding, paper, cardboard, etc., and peat gas for power purposes. Largely used in cultivation of bulbs and other plants.

Peccary (*Dicotyles*), a genus and family of swine, with five species confined to the New World, in the forests of which they wander in large herds. They possess slender limbs, small ears, and a long and mobile snout; tail absent; hair, which forms a mane, thick and bristly. In some respects they are more specialized than true pigs.

Pe-chih-li. See CHI-LI.

Pechora, riv., N.E. Russia;

rises in Ural Mts.; flows N., S.W., and N. to enter Gulf of Pechora by a broad delta (68° N., 54° E.); chief trib., Ussa; length, 983 m., 700 m. navigable; basin covered with forests and marshes.

Pecora, or true Ruminants, a group of Artiodactyle Ungulates (see ARTIODACTYLA), including deer, giraffe, cattle, and sheep. Most interesting is their habit of *ruminating* or chewing the cud, associated with the presence of a four-chambered stomach, known as (1) the *paunch,* (2) the *honey bag* or *reticulum,* (3) the *many-plies* or *psalterium,* and (4) the *reed* or *abomasum.* The food passes into (1), is softened, regurgitated, rechewed, and now passes along (2) into (3); filtered here, it finally passes to (4), where it is digested.

Pécs. See FÜNFKIRCHEN.

Pectin and PECTIC ACID, complex jelly-like compounds, allied to the carbohydrates, and obtained from juice of unripe fruits and roots, such as pears or carrots. The former is prepared by precipitation by alcohol after removal of the albuminoids, and is changed into the latter by the action of an enzyme, or by boiling alkalis. Pectin is converted into mucic acid on oxidation with nitric acid, and pectic acid yields arabic acid on hydrolysis with dilute acids.

Peebles, town, Peeblesshire, Scotland (55° 39′ N., 3° 12′ W.), on riv. Tweed; tweeds and woollens; tourist resort; Neidpath Castle; formerly an occasional residence of Scot. kings. Pop. 5,600.

Peeblesshire, inland co., Scotland (55° 35′ N., 3° 20′ W.), bordered N. by Edinburghshire, W. by Lanarkshire, S. by Dumfriesshire, E. by Selkirkshire; drained by Tweed; country rough and hilly, rising to 2,745 ft. (Broad Law); agriculture and sheep farming are pursued; coal is mined, while wool manufacturing is an important industry. Area, 348 sq. m.; pop. 15,300.

Peekskill, tn., New York, U.S. (41° 17′ N., 73° 52′ W.), on Hudson R.; ironworks; boilers, stoves, bricks. Pop. 15,200.

Peel, tn., Isle of Man (54° 13′ N., 4° 42′ W.); fishing; bathing resort; ruins of Peel Castle (15th cent.), and 12th cent. cathedral. Pop. 3,300.

Peel, ARTHUR WELLESLEY, VISCOUNT PEEL (1829–1912), Brit. Liberal statesman; son of Sir Robert Peel; Speaker of the House of Commons from February 1884 to May 1895; parl. secretary to Poor Law Board (1868–71); parl. secretary to the Board of Trade (1871–3); patronage secretary to the Treasury (1873–74), and under-secretary to the Home Office (1880); cr. viscount on resignation (1895); chairman of Commission on Licensing Laws (1896–9), and trustee of the Brit. Museum (1898–1907).

Peel, SIR ROBERT (1788–1850), Brit. statesman; son of wealthy Lancashire cotton manufacturer; Tory member for Cashel (1809); under-secretary for colonies (1811); secretary for Ireland (1812–18); home secretary (1822), with Liberal Canning as foreign secretary and chief influence; disliked Canning's assistance of revolution abroad and support of Catholic emancipation at home; with Wellington and

Eldon, resigned when Canning became first lord of Treasury (1827). Canning died the same year, and Wellington formed a purely Tory ministry, in which Peel was again home secretary; compelled by expediency to pass Catholic Emancipation Bill (1829), owing to agitation of country, but steadily resisted outcry for parl. reform; Tories were forced to resign (1830). Peel had reorganized the London police (hence slang terms, *peeler, bobby*); member for Tamworth (1833–50); led opposition in ministries of Grey (1832–4) and Melbourne (1834). He became prime minister (Nov. 1834); was forced to resign (April 1835). The restored Whigs continued sweeping reforms, but lost favour through distress of country, misfortunes abroad, and fear of Irish secession. Conservatives returned (1841) with Peel as prime minister. He restored order in finances, imposing income tax. Famous free trade measures (1842) show new strength of manufacturing as opposed to landed interest; great Irish agitator O'Connell imprisoned; revolts in India crushed and Sind annexed; retired before new Liberal wave (1846); killed by fall from horse.

Peel, from his Private Papers, ed. by Parker (1899); *Private Letters*, ed. by G. Peel (1920).

Peele, GEORGE (*c.* 1558–*c.* 1597), Eng. dramatist, a composer of masques and pageants; wrote *Arraignment of Paris, Old Wives' Tale*, etc.

Peerage, upper ranks of Brit. society, possessed of legal and social privileges usually hereditary. It might be defined as consisting of the temporal members of the House of Lords, spiritual lords of Parliament being no longer considered to be peers, and life peers having no right to legislate *ex honore*. Term 'peers' (*pares*) first used in its special sense in Act of 1322.

In England, as in France, tenants-in-chief, or 'barons,' did sit at the lords', that is, the king's court, and chief barons acquired title of peers. Stubbs fixes 1295 (Edward I.) as the time 'from which the regularity of the baronial summons is held to involve the creation of a hereditary dynasty, and so to distinguish the ancient qualification of barony by tenure from that of barony by writ.'

The peerage is divided into successive ranks of duke, marquess, earl, viscount, baron, possessing the same privileges and divided only by order of precedence (fixed by statute, 1539). The family of a peer do not share his privileges and are not considered to have 'nobility of blood.' No claim can now be made to *peerage* on plea of barony by tenure; baronies are either by writ or (more usually) letters patent, but writ to ancestor is not sufficient proof of right to barony if it cannot be established that he actually sat in Parliament as baron by writ.

The first creation of barony by patent was 1387. Earls existed before the Conquest, though the legal status of dignitaries holding that title is obscure, as is that of immediate post-Conquest earls. The earl took a baronial character under the feudal system, and represented the highest rank in the peerage until dukedom was

created (1337) for the king's son. The first marquessate created in the realm was in 1385; first viscounty in 1440. The crown has the prerogative of creating peers. Peeresses are either so *jure suo*, by descent or creation, or as wives of peers, and have, like peers, the right to appear before no law court but House of Lords, but have not right to sit in the House of Lords. Life peers —*i.e.*, lords of appeal who sit as assessors with judicial functions —were first created in 1876.

Peewit. See PLOVER FAMILY.

Pegasus (class. myth.), winged horse which sprang from the slain Medusa's blood; Bellerophon mounted him and slew the Chimæra.

Pegasus, Brit. light cruiser, 2,135 tons, 20 knots, eight 4-in. guns, completed 1899, was sunk by the Ger. cruiser *Königsberg* at Zanzibar (Sept. 20, 1914). See KÖNIGSBERG.

Pegmatite, coarse granite rocks occurring in veins in diorites, gabbros, and syenites, and associated with plutonic and intrusive rocks; composed of alkalis, felspar, and quartz, often with numerous accessory minerals; irregularly distributed; some varieties rich in mica; used in porcelain manufacture.

Pegswood, par., vil., Northumberland, England (55° 11′ N., 1° 38′ W.); coal mines. Pop. 2,600.

Pegu, tn. and seapt., cap. Pegu dist., Lower Burma (17° 20′ N., 96° 29′ E.), on Pegu R.; rice is chief product of dist.; large pagoda (320 ft. high); founded 573; captured by British (1852). Area (dist.), 4,280 sq. m.; pop. of dist., 350,000; of tn., 14,000.

Peihai. See PAKHOI.

Pei-ho, riv., Chi-li, China; rises on slopes of Mongolian Mts., near Great Wall, flows S.E. to enter Gulf of Chi-li (39° N., 117° 40′ E.) near Taku forts; navigable by steamer to Tien-tsin, and by boat to Tungchau. Length, 285 m.: connected by canal with Hoang-Ho and Yang-tse-Kiang.

Peine, tn., Hanover, Prussia (52° 20′ N., 10° 14′ E.), 20 m. E.S.E. of Hanover; iron industries; manufactures sugar and jute. Pop. 16,700.

Peipus, lake, N.W. Russia (58° 30′ N., 27° 30′ E.), three basins—Great Peipus, Little Peipus or Pskov Lake, and Lake Teploe; important fisheries, especially sprats. Length, 90 m.; breadth, 29 m.

Peiræus. See PIRÆUS.

Peisistratus (*c.* 600–527 B.C.), tyrant of Athens; relation of Solon; of great wealth and influence. Having seized the acropolis (560), he was expelled by Lycurgus and Megacles, but later restored (555 or 554); again expelled (552); remained in exile till 541. Returning with an army he ruled till 527, when his sons Hippias and Hipparchus succeeded him; ruled as a benevolent despot, building public works and protecting democrats against aristocrats.

Peking, cap. of China (39° 53′ N., 116° 29′ E.), between Peiho and Hun-ho, Chi-li prov. It consists of two cities, each surrounded by high walls with numerous towers and gates. The Tatar or Manchu city in N. includes Hwang-cheng (old imperial city), with military arsenal, public offices, univ., astronomical and

magnetic observatory (founded 13th cent.), residences of nobles, etc., and Tsze-kin-cheng (Forbidden City), with palaces and parks. The Chin. city on S. has Temple of Heaven and Agriculture, warehouses, theatre, etc.; summer palaces, several temples, and convents within vicinity. City is connected by rail with Kalgan, Tien-tsin, Hankow, and Mukden. Peking was imperial cap. under various names for centuries; siege of foreign legations, during which many fine buildings were destroyed (1900). Pop. 1,000,000.

Pelago, comm., Tuscany, Italy (43° 46′ N., 11° 29′ E.), 10 m. E. of Florence; mineral springs; manufactures pottery, woollen stuffs; Benedictine convent in vicinity. Pop. 12,000.

Pelargonium, genus of plants, order Geraniaceæ; the garden pelargoniums are hybrids. See GERANIUM.

Pelecanidæ. See PELICANS.

Pelée, MONT, active volcano, Martinique, W. Indies (14° 50′ N., 61° 10′ W.); eruptions occurred in 1762, 1851, and 1902 (two); in the latter year the towns of St. Pierre, Morna Rouge, and several villages were destroyed. Height, *c.* 4,400 ft.

Pelew Islands, westernmost group, Micronesia, W. Pacific (7° 30′ N., 135° E.); mountainous; surrounded by coral reefs; produce bread-fruit, bananas, sugar-cane, tortoise-shell, mother-of-pearl, timber; chief island, Babel-Thaob; formerly included in Ger. New Guinea Protectorate, now under mandate of Japan. Area, *c.* 180 sq. m.; pop. 3,100.

Pelicans (Pelecanidæ), family of swimming birds, with four webbed toes, found near lakes and swamps all over the world, except in polar areas. They have short legs, huge bill with large pouch, long neck, and large heavy body. They are awkward on land, but strong in flight, and very agile in water.

Pelion, mountain, Magnesia, E. Thessaly (39° 26′ N., 23° 7′ E.); celebrated in Gr. myth.; modern Zangora or Plessidi is chief summit (5,308 ft.).

Pellagra, an endemic disease occurring in Italy, Spain, Egypt, as well as in several other widely separated parts of the world, characterized by a burning of the skin, a red rash, pigmentation, nervous disorders, muscular wasting, and progressive general weakness; formerly believed to be due to eating diseased maize, but now attributed to a protozoon communicated by sand flies. Arsenic has a beneficial effect. In recent years pellagra has appeared in U.S. and Britain; investigations by tropical medicine schools are in progress.

Pellegrini, CARLO (1839–89), Ital. caricaturist in England; over signature 'Ape' won fame by caricatures in *Vanity Fair*.

Pellew. See under EXMOUTH, VISCOUNT.

Pellico, SILVIO (1788–1854), Ital. writer and patriot; best known work, *Le mie Prigioni*, describes his imprisonment in Brünn by the Austrians; trans. Byron's *Manfred*; chief play *Francesca da Rimini*.

Pellitory (*Parietaria*), genus of plants, order Urticaceæ; the common pellitory (*P. officinalis*) has reddish stem, narrow leaves, and

small flowers. Name sometimes applied to *Pyrethrum parthenium*, a herbaceous plant.

Peloponnesian War. See under GREECE (*History*).

Peloponnesus, anc. name of peninsula forming the s. part of Greece; the modern Morea. See GREECE.

Pelops (class. myth.), grandson of Zeus and son of Tantalus, who killed him and presented him as a dish at an entertainment given to the gods. He was restored to life, however, by Hermes, and is credited with reviving the Olympic games.

Pelota, Span. national ball game; popular also in S. America; resembles fives, only that players strike ball with *chistera*, a wicker-work arrangement strapped to the arm.

Pelotas, tn., Rio Grande do Sul, Brazil (31° 49′ S., 52° 29′ W.); trade in cattle; meat-preserving works; flour mills, glass factories. Pop. 20,000.

Pelvis. See SKELETON.

Pemba, Brit. isl. off E. coast of Africa (5° 12′ S., 39° 48′ E.); N. of Zanzibar; coral formation; very fertile; produces cloves, cocoa, chillies, rubber, oil; wireless station. Area, 380 sq. m.; pop. 83,100.

Pemberton, par., tn., Lancashire, England (53° 32′ N., 2° 40′ W.); cotton mills, brickworks, coal mines. Pop. 22,000.

Pemberton, MAX (1863–), Eng. author; *b.* Birmingham; educated at Cambridge Univ.; was editor of *Chums* (1892–3), and of *Cassell's Magazine* (1896–1906); has written many historical adventure novels, including *The Iron Pirate* (1893), *The Sea Wolves* (1894), *The Impregnable City* (1895), *Kronstadt* (1898), *The Hundred Days* (1905), *My Sword for Lafayette* (1906), *Wheels of Anarchy* (1908), *War and the Woman* (1912); has also written plays.

Pembroke, munic. bor., chief tn., Pembrokeshire, Wales (51° 40′ N., 4° 55′ W.); has mediæval castle; remains of Monckton Priory. Pembroke Dock, 2 m. distant, is naval dockyard and garrison town. Pop. 15,700.

Pembrokeshire, most westerly co., Wales (51° 50′ N., 4° 55′ W.); bounded N., W., and S. by sea, E. by Cardigan and Carmarthen. Coast is wild and rugged; chief inlets, Milford Haven and St. Bride's Bay; islands of Ramsey, Grassholm, Skomer, and Caldy lie off coast. Inland are fertile hills and valleys; in N. is Precelly Range (1,764 ft.). Agriculture is chief industry; stock raising; deep-sea fishing; coal, lead, iron, zinc, copper, and slate worked. Chief towns are Pembroke, Haverfordwest, and Tenby. Pembrokeshire is celebrated for castles; also contains cathedral at St. Davids, some interesting churches, British encampments, and cromlechs. Owing to settlement of Flemings (12th cent.), who adopted Eng. language, population is mostly English-speaking. Area, 558 sq. m.; pop. 84,900.

Pemphigus, a disease of the skin, characterized by the appearance of large bullæ, or blisters, of which fresh crops may continue to come out for several months; these burst, leaving a raw, ulcerated surface. It is sometimes due to septic poisoning or to syphilis. The treatment is general,

warm baths, tonics, and plenty of nourishing food being given, while arsenic and an antistreptococcic vaccine have both proved beneficial in certain cases.

Pen. The first metal pen was made in 1803, but steel pens did not come into general use until about thirty years later, when they were made by machinery at Birmingham. The chief material used in making pens is steel, along with aluminium, copper, and gold. Fountain pens usually have a gold iridium—or osmiridum—pointed nib. A steel pen, in the making, passes through about sixteen processes.

Penang, isl., N. of Straits of Malacca, off W. coast of Malay Peninsula (5° 23′ N., 100° 15′ E.); with prov. of Wellesley and the Dindings (on mainland) it forms one of Brit. Straits Settlements; surface generally flat; pepper and other spices, betel nuts, rice, sugar, rattans; tin produced; cap. Georgetown. Area, 270 sq. m.; pop. 278,000.

Penarth, seapt., wat.-pl., Glamorganshire, Wales (51° 26′ N., 3° 10′ W.); on Bristol Channel; exports iron and coal. Pop. 15,500.

Pencils. The term pencil was originally applied to a small fine brush, still used by artists under the same name. The first pencils consisted of metallic lead, shaped and wrapped in paper holders. The mixture of graphite and clay encased in wood was invented by Conté of Paris in 1795, although the Faber factory was established at Nuremberg as early as 1761. The modern pencil contains wax incorporated with the graphite and clay. At first, the graphite supplies were obtained at Borrowdale (Cumberland); but after 1869, when they were exhausted, supplies have come from Siberia, Bavaria, and the U.S. The cedar wood for casing comes largely from Florida. Copying pencils contain an aniline product, while other coloured pencils contain tallow and wax suitably treated.

Pendleton, suburb of Salford, Lancashire, England (53° 29′ N., 2° 18′ W.); manufactures silk and cotton. Pop. 64,400.

Pendulum—two varieties: (1) simple—*e.g.*, thread with weight at end suspended from point; (2) complex—*e.g.*, in all forms of clock-work where balance wheel is dispensed with (see CLOCKS). If length of swing is short two important results follow: (1) as long as length of thread is constant, time of oscillation is uniform (isochronism or equal-timeness); (2) length of thread varies inversely as square of number of oscillations made in given time. These and other properties wrapped up in the following formula: $t^2 : \pi^2 :: l : g$ (t = time in seconds of one oscillation; l = length, in feet, of thread; $\pi = 3{\cdot}1415927$; g, acceleration due to gravity). From this formula it is deduced that the force of gravity slightly and gradually increases as we travel from equator to poles (see GRAVITATION). Pendulum not only universally employed for time-measurement and ascertaining local value of gravity, but for estimating earth's mean density (Sir G. H. Airy's observations in coal pit near South Shields: result 6·565). FOUCAULT utilized the pendulum to

prove perpetual rotation of earth. In accurate time-keeping in horology proper length of pendulum must be preserved (see CLOCKS — *Compensating Pendulums*). Benjamin Robins, the founder of the science of gunnery, invented a ballistic pendulum which enabled the velocity of a cannon ball to be measured; superseded by Navez's electro-ballistic pendulum, which, in time, gave way to the chronograph (see GUNNERY).

Penelope (Gr. myth.), wife of Odysseus (Ulysses), during whose absence at Trojan War many suitors sought her hand; she put them off on the pretence that she was weaving a robe for Laertes, her father-in-law, unravelling by night the web she had woven during the day; Odysseus returned to her after twenty years' absence; Homer's type of constancy in woman.

Penge, par., urb. dist., Kent, England (51° 25′ N., 0° 3′ W.); 7 m. S. by E. of St. Paul's, London. Pop. 22,300.

Penguin (Spheniscidæ), interesting order of flightless birds, confined to Antarctic and Southern Oceans; good swimmers and divers, using their wings, totally devoid of quills, as paddles, while on land they walk erect, but awkwardly, only coming on shore for breeding purposes, when large companies form rookeries.

The king (*Aptenodytes pennanti*) and emperor penguins (*A. forsteri*) are two of the largest species, the latter nesting and hatching its eggs in mid-Antarctic winter.

Penicuik, tn., par., Midlothian, Scotland (55° 49′ N., 3° 14′ W.), 10 m. S. of Edinburgh; large paper works; iron foundry; Romanesque tower of old parish church of St. Kentigern. Pop. 2,700.

Peninsular War (1808–14), war in which Britain assisted Spain and Portugal in driving French from Iberian Peninsula. Portugal appealed to Britain for aid against Fr. general Junot, and Sir Arthur Wellesley was sent with troops (1808); won decisive battle of Vimiera (1808), and Convention of Cintra was made, by which French evacuated Portugal; this constituted the first successful opposition to Napoleon on land. Napoleon made his brother Joseph King of Spain (1808), with consent of its king, Charles IV., but people revolted and forced Dupont to make Capitulation of Baylen (1808), by which 18,000 Fr. soldiers surrendered; every town which the French retained had to be garrisoned; Napoleon himself led army of 135,000 men, and occupied Madrid (Dec. 13), his marshals winning the battles of Burgos, Espinosa, and Tudela.

Sir John Moore, who had superseded Wellesley, made sortie from Portugal to divert Napoleon from Andalusia; when Napoleon turned to attack, Moore made famous retreat, fighting as he went; Napoleon, recalled to France, left Soult in command; Soult overtook British at Corunna, and Moore was killed, in great battle which covered embarkation of his troops (Jan. 16, 1809). Soult then invaded Portugal and captured Oporto, while other Fr. armies busily reduced Spanish fortresses; Brit. reinforcement, sent under Wellesley, expelled French and invaded Spain, win-

ning battle of Talavera (July 28); French succeeded in capture of Andalusia.

Napoleon dispatched Masséna to conquer Portugal (1810); he entered from N.E., while Soult attacked from Andalusia, a plan which failed from disagreement of the two generals. Wellesley, now Viscount Wellington, was at first compelled to retreat before Masséna, and took up position behind Torres Vedras, near Lisbon. Masséna, who received no help from Soult, was not strong enough to attack separately, and endured great hardships, as the Portuguese had laid waste the country; he retreated into Spain (1811), but returned and was defeated by Wellington at Fuentes d'Onor (May 5, 1811); Beresford won battle of Albuera against Soult's invading army (May 16). Wellington then invaded Spain, and Masséna, out of favour, was recalled; France remained successful in E., and defeated British force under Blake.

Under Marmont, Masséna's successor, France lost Ciudad Rodrigo (Jan. 1812), and Badajoz (April), thus opening Spain to Port. attack; by great victory of Salamanca (July 22), Wellington compelled Joseph Bonaparte to fly from Madrid and evacuate Andalusia; Wellington occupied Madrid (Aug. 12), but was forced to retire; Brit. troops sent to make diversion on E. coast signally failed. While Napoleon was fighting life and death struggle in Germany (1813), Wellington succeeded in establishing himself between Madrid and France, and prevented Joseph Bonaparte crossing the Ebro, defeating his general, Jourdan, at Vittoria (June 21, 1813). Wellington then assisted Spanish in expelling French, fought several engagements in Pyrenees, and invaded France (Oct. 1813); victories of Orthes and Toulouse (1814); Peace of Paris (1814).

Napier, *History of the Peninsular War* (1828-40); Oman, *The Peninsular War* (1902-3); Hutchinson, *Operations in the Peninsula, 1808-9* (1905).

Penistone, par. and mrkt. tn., W. Riding, Yorkshire, England (53° 32′ N., 1° 38′ W.), on Don, 12 m. N.W. of Sheffield; steel works and coal mines. Pop. 3,400.

Penkridge, par. and tn., Staffordshire, England (52° 44′ N., 2° 7′ W.), 6 m. S. of Stafford; said to be Roman *Pennocrucium*, on Watling Street; coal mines. Pop. 2,300.

Penmaenmawr, wat.-pl. on N. coast, Carnarvonshire, Wales (53° 16′ N., 3° 55′ W.), 4 m. S.S.W. of Conway; to W. rises Penmaenmawr, with quarries and prehistoric remains. Pop. 4,000.

Penn, UPPER and LOWER, two pars. and vil., Staffordshire, England (52° 34′ N., 2° 10′ W.), 3 m. S.S.W. of Wolverhampton; hardware. Pop. (Upper) 3,100; (Lower) 300.

Penn, WILLIAM (1644–1718), Eng. colonizer; founder of Pennsylvania; son of Admiral Sir W. Penn; became a Quaker (1667); imprisoned (1668–9) for publishing *Sandy Foundations Shaken*, and again in 1670–1; obtained grant of land in America as quit-claim for crown debt (1680–1); became governor as well as proprietor of new prov., called Pennsylvania, after his father, and made it a haven

for persecuted Quakers; he proclaimed religious toleration, founded Philadelphia, and promulgated 'Great Law' (1682), which made drunkenness, swearing, etc., punishable offences; remarkable for his equitable treatment of neighbouring Indian tribes; visited England (1686) and obtained from James II. release of religious prisoners; deprived of governorship for suspected Jacobitism (1692), but restored (1694); imprisoned for debt (1707), and mortgaged the colony; lacked administrative talents, but was an incalculable moral force; wrote *The Great Cause of Liberty of Conscience; No Cross, No Crown*, etc.

Penna. See PALÆOGRAPHY.

Pennell, JOSEPH (1860–), Amer. etcher, illustrator, and author; produced a series of etchings of old Philadelphia, etc.; author—sometimes jointly with his wife (Elizabeth Robins)—and illustrator of *A Canterbury Pilgrimage, To Gipsyland, Lithography and Lithographers* (1900), *Life of James M'Neill Whistler* (1907), *Pictures of the Panama Canal* (1912), *The Wonder of Work* (1916), etc.

Pennine Alps. See ALPS.

Pennine Chain, highland tract, England, extending N. and S. from the Tyne in Northumberland to Derbyshire and Staffordshire. Highest summits include Cross Fell (2,930 ft.), Mickle Fell (2,591 ft.), Whernside (2,414 ft.), Ingleborough (2,373 ft.), and Kinder Scout (2,088 ft.).

Pennon. See FLAG.

Pennsylvania, a N.E. state of U.S. (39° 43′–42° 15′ N., 74° 43′–80° 31′ W.), with an area of 45,126 sq. m., of which 294 sq. m. are water. Its extreme length (E. to W.) is 302 m., and width between the parallel N. and S. boundaries 158 m. It was one of the thirteen colonies, and an original state. The surface is varied. The S.E. is rolling, and drained mainly by the Delaware and Susquehanna rivers; farther N. and W. rise the parallel ridges and valleys of the Appalachians. Then succeeds the Alleghany front, from whose summit (3,000 ft.) the Alleghany plateau slopes N.W., deeply scored by streams. The highest peak is Blue Knob (3,136 ft.). The W. contains the Allegheny and Monongahela rivers, which unite at Pittsburg to form the Ohio. The state is fairly wooded. The cap. is Harrisburg, on the Susquehanna; other chief cities are Philadelphia, Pittsburg, Allegheny, Reading, Erie, and Scranton. The univ. of Pennsylvania is situated at Philadelphia, and the univ. of Pittsburg (till 1908 the Western Univ. of Pennsylvania) at Pittsburg. Although manufacturing and mechanical industries are pre-eminent, farming is of great importance. The principal crops are Indian corn, oats, wheat, rye, buckwheat, and tobacco. The manufactures are second only to those of New York; while in certain branches—notably in iron and steel—this state is the most important. The leading branches are iron and steel, textiles, foundry and machine-shop products, cars, leather, flour, printing and publishing, sugar and molasses refining, lumber, petroleum refining, clothing, and tobacco. Pennsylvania contains

a vast amount of bituminous coal, including a fine coking coal in the Connellsville district. The Alleghany plateau is to a great extent underlain by coal beds. It contains almost the only deposits of anthracite coal in the country. In the W. of the state petroleum and natural gas are abundant, and iron ore is found in many localities. The extraction of coal in 1918 reached 276,663,088 short tons, produced by 329,904 miners; the Connellsville region produced 26,723,645 tons of coke. In 1918 the output of iron ore was 515,845 long tons; of pig iron, 14,701.252 long tons; while the yield of petroleum was 7,407,812 barrels of 42 gallons each. Iron smelting is carried on mainly in and around Pittsburg. Pop. 7,665,100.

S. G. Fisher, *Making of Pennsylvania* (1896).

Penny, FANNY EMILY, Eng. author, wife of Rev. Frank Penny, Madras chaplain, retired; resided in India (1877–1901); works include *History of Fort St. George, Madras; Caste and Creed, The Tea Planter, Love in the Hills, Missing* (1917), *A Love Offensive* (1918), *Desire and Delight* (1919).

Pennyroyal (*Mentha pulegium*), a species of mint; grows on damp moors, and has a characteristic scent; flowers, purple and labiate.

Pennywort, or PENNYLEAF, popular name applied commonly to *Cotyledon umbilicus*, British succulent wall-plant (order Crassulaceæ; thick, shining, green leaves, attached to leaf-stems by centres; spike-like clusters of greenish tubular flowers appear in summer.

Penrhyn. (1) Locality near Bangor, Carnarvonshire, Wales (53° 14′ N., 4° 6′ W.); modern castle; slate quarries, largest in Wales (5 m. S.S.E. of Bethesda); great strike (Dec. 1900 to Nov. 1903); on coast is Port Penrhyn, shipping point for slates. (2) Or TONGAREVA, pearl atoll in S. Pacific (9° S., 158° W.), about 1,650 m. E.N.E. of Fiji group. Discovered in 1788; included in New Zealand (1901).

Penrith. (1) Tn., Cumberland, England (54° 41′ N., 2° 45′ W.); ruined castle; old grammar school; agricultural centre; on borders of Eng. Lake district. Pop. 9,000. (2) Munic. township, Cumberland co., New South Wales (33° 45′ S., 150° 44′ E.), 34 m. W. by N. of Sydney. Pop. 3,000.

Penrose, J. DOYLE (1862–), Brit. painter; R.H.A. His works include portrait of Lord Russell of Killowen, *The Last Chapter, The First Easter Morn, The Presence in the Midst,* etc.

Pensacola, city and seapt., Florida, U.S. (30° 27′ N., 87° 10′ W.), on Pensacola Bay; fine land-locked harbour; navy yard; naval hospital and aeronautic school; many noteworthy public buildings; trade in timber, fish, naval stores, tallow, hides, wool, cotton, and fertilizers; paper, cotton-seed oil, and lumber mills. Pop. 23,000.

Penshurst, vil., Kent, England (51° 12′ N., 0′ 12′ E.), 5 m. W.S.W. of Tunbridge; Sir Philip Sidney born at Penshurst Place (1554). Pop. 1,700.

Pensions, annuities granted in return for services rendered, are of various kinds:

(1) *Perpetual Pensions* and sinecures were reported against

in 1887, and 330 of them commuted for £527,933. The largest existing pension of this class is £5,000 per annum, paid to Earl Nelson.

(2) *Pensions to ex-Ministers of State.*—Granted on application at option of sovereign, by warrant signed by two or more commissioners of the Treasury. Class I., for ex-ministers who have held office of first lord of the Admiralty or a political office with yearly salary of not less than £5,000: pension not exceeding £2,000 a year in respect of a service of not less than four years, or its equivalent. Class II., for ex-ministers with less salary than £5,000 a year, and not less than £2,000: pension not exceeding £1,200 in respect of service not less than six years, or its equivalent. Class III., for ex-ministers with less than annual salary of £2,000 and more than £1,000: pension not exceeding £800 in respect of a service not less than ten years. There are rules as to equivalency of service in lower grades. No pensions can be granted in any class while four pensions of that class subsist; nor can more than one pension in all classes be granted in any one year. The following ex-ministers are in receipt of pensions: Lord Balfour of Burleigh, Lord George Hamilton, and Lord Chaplin.

(3) *Civil List Pensions*, the amount being limited to £1,200 in one year, are granted to deserving literary persons or their relatives in straitened circumstances.

(4) *Miscellaneous Pensions.*—There are also Superannuation Acts for the permanent civil service; special provision for colonial governors and for persons in the diplomatic service; police; poor-law officers and school teachers (recently largely augmented). See also OLD AGE PENSIONS.

(5) *Army and Navy Pensions.*—These are regulated by various Acts, and in the case of service in the Great War are as follows, the present scale marking a very substantial increase on the scale set out in the previous warrant of May 1918.

Flat Rate Pension for Men (total disablement, 100 per cent.).—Private:

	Per Week. s.	d.
If single	40	0
Married, with wife but no children . .	50	0
With one child . .	57	6
With two children .	63	6
With three children .	69	6

and 6s. additional for each subsequent child. It should be noted that the wife's allowance is not payable where marriage took place: (*a*) after the man's discharge; (*b*) after the end of the war; or (*c*) if during the service of the man, after the receipt of the wound or injury, or after his removal from duty on account of the contraction or aggravation of the disease for which he receives pension.

The wife's allowance will not be paid to men who are receiving a final weekly allowance granted under the warrant of May 1918.

A man whose disability has been fixed at 50 per cent. would receive a pension of 20s. per week, with 5s. per week for wife, if the conditions as to date of marriage are fulfilled. Increased amounts are paid according to rank.

The totally disabled man in the U.K. receives 40s. under this warrant; in Italy, 19s. 4d., and in the U.S., 28s. 10d., although where there are children the amounts in these countries approximate to the Brit. standard.

Where men are placed under treatment in a public institution by the Local Pension Committee allowances are paid, if the man was a private, of 21s. per week, with 20s. for the wife and 7s. 6d. for the first child and 6s. for each additional child under the age of 16.

Alternative Pensions (Men).—Alternative pensions are granted, based on the soldier's pre-war earnings. The increase under the new warrant is dealt with by loading up 60 per cent., or $\frac{3}{5}$ths; for example, if a man earned 50s. per week during the year preceding the war, he would be deemed to have earned 50s. plus 60 per cent., which equals 80s.

The maximum alternative pension for men will be £5 instead of 90s. under the 1918 warrant. The necessary forms of application for alternative pension can always be obtained from the Local Pensions Committees.

Additions to Disability Pensions for Long Service.—The following rates have been granted as concessions to long service men, in addition to their disability pensions, if they come within the following categories:

(1) Men discharged as medically unfit for further service, during or in consequence of service in the Great War, before completing 21 years' service, who

(*a*) Re-engaged to complete 21 years, and were discharged with not less than 14 years' total service, and not less than 10 years' unforfeited colour service rendered after the age of 18; or,

(*b*) Re-enlisted for the purpose of completing a term of service, which with former service makes up a total of at least 21 years, and were discharged with not less than 14 years' total service, and not less than 10 years' unforfeited colour service rendered after the age of 18; or,

(*c*) Were discharged with 14 years' continuous unforfeited colour service rendered after the age of 18.

These additions to disability pensions are dealt with by the Ministry of Pensions, and applications should not be made to the Chelsea Commissioners, who only administer ordinary service pensions.

Rates—

	Per Week. s.	d.
Over 10 years . .	7	0
„ 14 „ . .	8	0
„ 15 „ . .	9	0
„ 16 „ . .	9	0
„ 17 „ . .	9	0
„ 18 „ . .	10	0
„ 19 „ . .	10	0
„ 20 „ . .	11	0

The usual additions for rank will be made by the Admiralty and War Office according to the new service scale.

(2) Men discharged during the war for disabilities not attributable to service. The basic rate for the army is as follows, where the above conditions are fulfilled:

	Per Day. s.	d.
Over 10 years . .	1	0
„ 14 „ . .	1	6
„ 16 „ . .	1	9
„ 18 „ . .	2	0
„ 20 „ . .	2	6

These rates are granted in the navy only if the service is continuous to over 10, 14, or 16 years. Non-continuous service men and marines with over 18 or over 20 years' service are eligible for the grants.

Disability pensions for sailors, marines, their widows and dependents are practically identical with the soldier's warrant, except that the scale is the same for all ratings, additions to pension being made, in accordance with regulations, for the possession of good-conduct badges or medal for long service and for time in ranks above that of able seaman or private in the Royal Marines.

Widows' Pensions.—The widow of a soldier who is killed in military service or who dies within seven years as a result of wounds or injuries due to, or of disease contracted or commencing on, or aggravated by, active service receives a full pension on the following scale (with addition for rank):

	Per Week. s.	d.
If under 40 without children . . .	20	0
If over 40 without children . . .	26	8
Allowance for first child (if under 16) .	10	0
Allowance for second child (if under 16) .	7	6

and 6s. for each other child.

Alternative pensions are also granted to widows based on the pre-war earnings of the soldier. In the case of a widow under 40 without children the amount is one-half of her husband's pre-war earnings, increased by 60 per cent., and if over 40, or under 40 with children, the amount is two-thirds, increased by 60 per cent. Application for alternative pension must be made before Dec. 6, 1920, or within one year after notification of the award of full pension.

If a widow remarries she may be granted one year's pension as gratuity of not less than £35, 15s. or more than £58, 10s.

The royal warrant of 1919 also sets out the special conditions under which pensions for smaller amounts may be given to widows.

Dependents.—A flat rate pension of five shillings weekly may be paid to the parent of a soldier, without proof of dependency, if he was over 18 and under 26 at the time of joining the forces. It is only payable from the date of application. In cases where dependency on the soldier can be proved, pensions may be granted ranging from 4s. 2d. to 20s. per week.

Appeals.—An important alteration has been the setting up of Statutory Pension and Appeal Tribunals instead of the Pensions Appeal Tribunals. They consist of one legal representative, a disabled officer or a disabled man, and a duly qualified medical practitioner.

Men can appeal—

(1) Where the claim to pension is rejected by the Ministry on the ground that the disability on which the claim is based (*a*) is not attributable to or aggravated by service in the war; or (*b*) is due to the serious negligence or misconduct of the claimant; or (2) where such disability, although admitted to be aggravated by, is certified not to be attributable to, such service.

Officers.—It is not possible to set out the details of officers' and nurses' pensions given in the new warrant, but the following addresses may be useful:

Officers' Branch, Cromwell House, Annexe, Millbank, London, S.W.1. Dealing with awards for officers and nurses.

Officers' Branch, Chester Gate Huts, Regent's Park, London, N.W. Dealing with awards for dependents of officers.

All communications relating to ordinary service pensions should be addressed to secretary, Royal Hospital, Chelsea, London, S.W.3.

Pensnett, tn., Staffordshire, England (52° 29′ N., 2° 7′ W.), 2 m. S.W. of Dudley; coal mines, ironworks; glass and hardware. Pop. 5,400.

Pentameter, verse with five metrical feet (*e.g.*, blank verse or *iambic pentameter*), as—

'The qual | ity | of mer | cy is | not strained.'

Pentane, C_5H_{12}, a hydrocarbon of the paraffin series, existing in three isomeric modifications—viz., normal pentane, $CH_3CH_2CH_2CH_3$; isopentane, $(CH_3)_2CHCH_2CH_3$; and tetra-methyl-methane, $C(CH_3)_4$. The first two occur in Amer. petroleum and in the product of distillation of shale. The pentanes are very volatile, inflammable liquids, which are of low density and very resistant to chemical action. Commercial pentane, which contains the normal and iso varieties, together with more or less of the higher homologues, is the combustible employed in Harcourt's pentane lamp, which is used as a standard of luminosity. It is also one of the chief components of the mixtures which under the names of petroleum ether, petrol, rhigolene, gasolene, are used in internal combustion motors, for lamps of the 'Notkin' type, and as a solvent for fats and resins.

Pentateuch. See HEXATEUCH.

Pentecost, anc. Jewish festival in celebration of ingathering of harvest, observed fifty days after the Passover, sometimes called the feast of harvest and the feast of weeks. The later Jews associated the feast with the deliverance of the law at Sinai; the festival has passed into the Christian Church as commemorative of the descent of the Holy Ghost.

Pentland OF LYTH (JOHN SINCLAIR), BARON (1860–), Brit. Liberal statesman; served in Sudan expedition (1885); A.D.C. to the lord-lieutenant of Ireland (1886); M.P. Dumbartonshire (1892–5); secretary to the gov.-gen. of Canada (1895–7); M.P. Forfarshire (1897); secretary of state for Scotland (1905–12); governor of Madras (1912).

Pentland Firth, strait between Orkney Islands and Caithness, Scotland (58° 42′ N., 3° 0′ W.), 14 m. long and from 6 m. to 8 m. broad; has rapid tidal currents and dangerous whirlpools. Pentland Skerries, 4 m. N.E. of Duncansby Head, comprise several islets or rocks.

Pentland Hills, range running S.W. through counties of Edinburgh, Peebles, and Lanark, Scotland (55° 50′ N., 3° 20′ W.), for 16 m., with breadth of from 4 m. to 6 m. Highest summits, Scald Law (1,898 ft.) and Carnethy (1,890 ft.). At Rullion Green, on N.E. side, Covenanters were routed (1666).

Pentstemon, genus of plants, order Scrophulariaceæ; native of America, but cultivated in Brit. gardens. *P. Hartwegi* has a scarlet flower.

Pentyrch, par. and vil., Glamorganshire, Wales (51° 32′ N., 3° 18′ W.), 7 m. W.N.W. of Cardiff; has coal mines and ironworks. Pop. 2,000.

Penwortham, par. and vil., Lancashire, England (53° 45′ N., 2° 44′ W.), 1 m. S.W. of Preston. Pop. 2,500.

Penza. (1) Government, E. Russia (*c.* 53° 45′ N., 44° 30′ E.), watered by tributaries of Don, Oka, and Volga; produces grain; manufactures flour, leather, woollens. Area, 15,000 sq. m.; pop. 1,940,000. (2) Chief tn. of above, at junction of Sura and Penza; bishop's see; paper and flour mills; soap, candles, cloth, and camel's-hair stuffs; has horticultural, technological, and art schools. Pop. 83,000.

Penzance, munic. bor. and seapt., Cornwall, England (50° 7′ N., 5° 33′ W.), on Mount's Bay, nearly opposite St. Michael's Mount; has mild climate, and is winter invalid resort and summer bathing place. Near town are tin smelting works; was made a stannary town by Charles II. (1663). Pop. 13,500.

Peony. See PÆONY.

Peoria, city, Illinois, U.S. (40° 50′ N., 89° 45′ W.), co. seat Peoria co., 130 m. S.W. of Chicago; manufactures agricultural implements, starch, and glucose, and has distilleries and trade in grain. Pop. 67,000.

Pepin (or PIPPIN), name of several Carolingian rulers. P. I. (*d.* 640), mayor of palace to Dagobert I.; canonized; day, February 21. P. II. (*d.* 714), grandson of above; defeated the Neustrians at Testri; favoured Christianity. P. III., *The Short* (714–68), King of the Franks, younger son of Charles Martel; deposed Childeric and was crowned in 751; crossed Alps and forced Lombards to give up Ravenna and other cities to the Church, known as 'donation of Pepin,' the foundation of temporal power of the Papacy; father of Charlemagne.

Pepper is, properly speaking, the product of unripe berries of *Piper nigrum,* a tropical shrub of climbing habit. Both black and white pepper of commerce are derived from the same plant, the latter's loss of colour being due to removal, by maceration, of dried skin. The leaves of an allied form, *P. betle,* are chewed by Asiatics, with areca-nut and a little lime, as a preventive of dysentery. Cayenne pepper comes from a species of *Capsicum.*

Peppermint (*Mentha piperita*), member of Labiatæ, with smooth stem and stalked ovate leaves, yielding, on distillation, an oil used medicinally and also in flavouring. For this purpose the upper parts of the plant, including the flowers, are cut in August, and left to dry on the ground before treatment. The cheaper kinds of peppermint cordial are not prepared from the plant extract, but are derived from an artificial substitute with similar properties.

Pepsin, a ferment or enzyme obtained by drying the fresh stomach of a pig, sheep, or calf; consists, as medically employed,

of a pale yellow-brown powder or translucent scales; used to assist gastric digestion in debilitated conditions or to predigest albuminous food. See DIGESTION.

Peptones. See DIGESTION.

Pepys, SAMUEL (1633–1703), Eng. diarist; *b.* London (probably); educated at Huntingdon, St. Paul's, Cambridge Univ.; married Elizabeth St. Michel, a young girl (1655); appointed clerk of the Acts of the Navy (1660), and secretary to the Admiralty (1673). He was imprisoned in Tower (1679) on charge of selling information to French. Though acquitted, he lost his post. Reappointed 1684, he held his office till 1689. His *Diary,* begun in 1659, was in cipher, and was probably never intended for publication. Hence he wrote freely of his thoughts, his vices, his domestic affairs; he noted down all the scandal he heard. It is invaluable as a source of information concerning 17th cent. manners. It stops short at May 1669. It was deciphered by Smith and pub. in 1825. Pepys also wrote *Memoirs of the Navy* (1690).

Lord Braybrooke, *Memoirs of Pepys* (1825); J. Smith, *Life, Journals, and Correspondence of Pepys* (1840); Wheatley, *Samuel Pepys and the World he lived in* (new ed. 1905), *Samuel Pepys, Citizen and Clothworker* (1897); Moorhouse, *Life* (1909).

Pera. See CONSTANTINOPLE.

Perak. See MALAY STATES.

Peramelidæ. See BANDICOOT.

Perches (Percidæ) include about ninety forms, confined to the fresh waters of the northern hemisphere; are excellent game fishes, highly esteemed as food. The common perch (*Perca fluviatilis*) is the best known of the two Brit. species. The large pike-perch or zander (*Lucioperca*) is a central European food fish.

Perchloric Acid, $HClO_4$, is prepared by distilling potassium perchlorate with concentrated sulphuric acid; is a fuming, volatile, colourless liquid, which dissolves in water with evolution of heat, and is a violent oxidizing agent, usually acting explosively. The aqueous solution is much more stable. The acid is monobasic, forming a series of salts, the perchlorates, chief of which is potassium perchlorate, used in explosives.

Perdrix. See under PHEASANT FAMILY.

Pereda, JOSÉ MARIA DE (1833–1906), Span. novelist, of realistic school; excelled in descriptions of fisher life—*e.g.,* *Sotileza* and *La Puchera.*

Peregrine. See HAWK FAMILY.

Perekop, tn., Taurida, Russia (46° 8′ N., 33° 40′ E.), on Isthmus of Perekop, which joins Crimea to mainland; anc. Gr. fortifications; was scene of considerable fighting during post-revolution war in Russia; captured by Bolsheviks (April 1919, and again in 1920); was later occupied by General Wrangel, who enormously strengthened the fortifications of the isthmus. Pop. *c.* 5,600.

Pereyaslav, town, Poltava, Ukraine (50° 5′ N., 31° 26′ E.); tobacco, candles, tallow, and shoes. Pop. *c.* 15,000.

Perfumes, fragrant odours or substances which are manufactured to emit them. They may be natural or artificial. Natural

perfumes are plant products, except musk, ambergris, and civet. Flowers for perfumes are grown at Grasse near Cannes—*e.g.*, violets, jonquils, roses, orange-flowers, thyme, rosemary, myrtle, tube-roses, jasmine, lavender, geranium. The 'otto' or fragrant principle is obtained by pressing, extraction with a solvent, distillation, maceration in melted fat, or 'enfleurage'—*i.e.*, absorption by cold fat.

Analysis of perfume essences has been followed by the artificial compounding of perfumes; thus essence of jasmine has been made. Partially or wholly synthetic perfumes are now elaborated—*e.g.*, oil of bitter almonds is benzaldehyde; oil of wintergreen is methyl-salicylate; white lilac scent is terpineol, made from oil of turpentine; artificial violet perfume is ionone, made from oil of lemons.

Perga, anc. ruined city of Pamphylia, Asia Minor (37° N., 30° 55′ E.); celebrated for worship of Artemis; was first town in Asia Minor visited by St. Paul on missionary journeys.

Pergamos, or PERGAMUM. See BERGAMA.

Pergolesi (or PERGOLESE), GIOVANNI BATTISTA (1710–36), Ital. composer, of striking originality and charm; wrote operetta *La Serva Padrona*, cantata *Orfeo e Euridice*, and celebrated *Stabat Mater*.

Perianth. See FLOWER.

Pericardium. See HEART.

Pericentre. See ANOMALY.

Pericles (*c.* 500–429 B.C.), Athenian statesman of 'Golden Age'; descendant of Alcmæonidæ; attended lectures of Anaxagoras, Damon, and Zeno, and acquired powers of oratory and cultivated well-balanced mind. On death of Aristides (*c.* 468), Pericles assumed leadership of democrats against oligarchic party under Cimon, but stooped to no demagogic arts; supreme after banishment of Cimon (461). He and Ephialtes took judicial power from Areopagus and council of 500 and gave it to *dicastai*, chosen from citizens, who received small payment. The 'age of Pericles' was a time of tremendous activity: Athenian Empire was extended; seat of Delian League was transferred from Delos to Athens, but in 445 Athens was forced to abandon to Sparta claim to hegemony over Greece on land; Thucydides was exiled (444) for attack on imperial policy; a new town was built at Piræus; glorious temples and theatres (Parthenon, etc., see ATHENS) were raised by architects Ictinus, Callicrates, Corœbus, and Mnésiclès, and adorned by Phidias the sculptor and Polygnotus the painter; Sophocles and Euripides wrote their plays. The terrible Peloponnesian War broke out (431); already the threat of storm had caused exile of Anaxagoras and death of Phidias and of Aspasia, Pericles' brilliant mistress; nevertheless he conducted resistance to siege (431–430); one of the world's greatest and noblest statesmen.

Evelyn Abbot, *Pericles* (1891).

Peridote, gem-stone, variety of green olivine; transparent; shades of olive or leek green; found in Brazil, Ceylon, and Egypt; soft and difficult to polish.

Peridotite, group of basic plutonic rocks of deep-seated origin; colours—mostly dark; several varieties, including dunites (which contain a large proportion of olivine, and are of granular structure); others contain augite, hornblende, or biotite, and are all generally referred to by compounding name of mineral they contain—*e.g.*, hornblende-peridotite.

Périer, CASIMIR PIERRE (1777–1832), Fr. statesman and banker; he effectively criticized financial policy at Restoration; minister (1831), and established the *juste milieu* between conservatism and democracy; foreign policy also successful; his descendants took name Casimir-Périer.

Perigee. See APOGEE.

Périgueux, chief tn., Dordogne, France (45° 11′ N., 0° 44′ E.); was the Roman *Vesunna*, and has large amphitheatre, etc.; contains remarkable cathedral of St. Front in Byzantine style (984–1047); famous for its *pâtés de foie gras* and truffled partridge; china ware, iron, and woollens. Pop. 33,500.

Perigynous. See FLOWER.

Perihelion. See ANOMALY.

Perim, isl. in Strait of Bab-el-Mandeb, at S. end of Red Sea (12° 38′ N., 43° 20′ E.); Brit. coaling station; is a dependency of Aden. Area, 5 sq. m.

Periodicals. While newspapers are concerned with the news of the moment, periodicals, which include magazines and reviews, are chiefly devoted to reading for the entertainment or instruction of their readers. The *reviews*, one of the earlier forms of the magazine, are mainly of a literary, political, and critical character. In the pioneer journals, as in those of the present day, were found the contributions of eminent writers who found in their pages a convenient medium for the expression of their views. Reviews stand in a class by themselves, and as a rule leave the lighter forms of literature to the magazines. In the latter a great development has taken place. At one time Brit. magazines were pre-eminent on both sides of the Atlantic, but there came a period when the best of the magazines in the U.S. surpassed those of the U.K. in enterprise, in excellence of typography, and in beauty of illustration. That superiority is now more disputed, not because Amer. publications have become less attractive, but because Brit. publishers have responded to the stimulus of powerful competition.

Most of the first attempts to establish reviews and magazines met with small success. The cost of production was high, the machinery crude, and the readers few. The *Weekly Memorials for the Ingenious*, dated 1681, existed only for a year, and its immediate successors were not more fortunate. There were also the *Gentleman's Magazine*, founded in 1731, the *Scots Magazine* (afterwards the *Edinburgh Magazine*), and the *British Critic*, which managed to keep alive from 1793 to 1843. But it was not till the beginning of the 19th cent., when the *Edinburgh Review* (1802), and its great rival, the *Quarterly Review* (1809), first appeared, that a new era in magazine history began. The *Edinburgh* stood for

OSMANIA UNIVERSITY

Whig principles, and the *Quarterly* was the organ of the Tories. Another journal, the *Westminster Review*, was founded in 1824 to represent Radicalism. The *Fortnightly Review*, founded in 1865, is pub. monthly. The *Contemporary Review* first appeared in 1866, and the *Nineteenth Century* in 1877.

Blackwood's Magazine, founded in 1817, set up a new ideal, and demonstrated the possibilities of this form of publication by opening its brilliant pages to fiction, verse, travel, and adventure, as well as to combative politics. Other notable ventures were *Fraser's Magazine* (afterwards *Longman's*), *Tait's Edinburgh Magazine*, and *Bentley's Miscellany*, which was incorporated with *Temple Bar*. *Cornhill*, *Country Life*, *The Field*, *Engineering*, *Badminton*, and *Cassell's* are typical of various classes.

No more remarkable departure took place than that represented by the production of *Chambers's Journal* (1832), pub. weekly, and also in monthly parts. That and similar journals provided general reading of the highest class and at a popular price.

In the early eighties the illustrated magazines began to appear. The *English Illustrated Magazine* (1883) was the first to challenge Amer. supremacy in this department. Among others the *Strand Magazine* (1891), offering light and attractive fiction and profusely illustrated, produced a crowd of imitators. Several magazines now devote themselves entirely to fiction.

The success of *Tit-Bits*, started in 1881, led to the foundation of numerous penny weekly journals, which deal in interesting scraps. A later development for the increase of circulations has been the conduct of guessing, verse-making, and other competitions, in which large sums are given as prizes, usually made up by the entrance money.

Of the thousands of Amer. periodicals and magazines the best known in Britain are *Harper's*, *Scribner's*, *M'Clure's*, *Munsey*, and the *Century*.

Probably the most famous foreign magazine is the Fr. *Revue des Deux Mondes*.

Periodic Law. See CHEMISTRY.

Periosteum. See BONE.

Peripatetics, a philosophical school founded by Aristotle, supposedly so called from his habit of walking to and fro as he lectured; among succeeding Peripatetics were Theophrastus (322 B.C.), Strato of Lampsacus (who maintained pantheism rather than duality), Andronicus of Rhodes (60 B.C.), and Alexander of Aphrodisias (A.D. 200).

Peripatus (class Onychophora, amongst Arthropods), caterpillar- or worm-like Arthropods, with brown or dark green velvety skin and long body borne on from seventeen to forty-three pairs of dumpy, unjointed legs; interesting as forming a link between Arthropods and worms. The head, which is not marked off from the body, bears two exceedingly mobile and sensitive antennæ, at the bases of which lie the eyes; respiration is carried on by tracheæ with scattered openings to the exterior, and the rejection of waste products by paired nephridia segmentally ar-

ranged, although there is no trace of segments on the exterior of the plump body.

All the species of Peripatus are shy and night-loving, and during the day lurk beneath stones, bark, etc., where there is sufficient moisture. They move slowly, sensing every step of the way with their antennæ. They feed on insects, which they capture with a gummy substance secreted in a pair of oral papillæ. The fifty or sixty species of Peripatus are found only in the southern hemisphere, and there in far separated groups, each group showing similarities within its own limits; S. America has many species widely spread; Africa has representatives in Cape of Good Hope and on the Congo; others occur in Australasia from Malay Archipelago to New Zealand; and one has recently been discovered on the N.E. frontier of India.

Perissodactyla, or ODD-TOED UNGULATES, a sub-order of Ungulata, comprising tapirs, horses, and rhinoceroses. They are characterized by the presence of an odd number of toes in each foot, except in the fore-feet of tapirs, where there are four digits; but in all cases the middle or third digit is larger than the others, and lies in line with the central axis of the limb as a whole. The middle digit is usually accompanied only by the second and fourth; the first is never present in living forms. All the back teeth are similar, and there are never less than twenty-three dorso-lumbar vertebræ; horns, if present, are not paired, but in the median line of the skull. There are many fossil forms dating from earliest Tertiary times.

Peritonitis, inflammation of the peritoneum, or lining membrane of the abdominal and pelvic cavities, which may be localized or diffuse. It is caused by various micro-organisms, and an attack is usually brought on by exposure to cold or wet, general debility, or is associated with injury or disease of some abdominal organ. *Acute diffuse peritonitis* is characterized by persistent vomiting, pain and tenderness in the abdomen, which is usually swollen because of the distended intestines, while there is generally constipation. The temperature is raised and the pulse rapid. The abdominal muscles are rigid, and the patient lies with an anxious expression and his knees drawn up. If peritonitis is due to sudden perforation of a hollow organ there is profound shock at first, recovered from three or four hours later. The only treatment of any value is by surgical interference, the abdomen being opened, irrigated, and drained.

Acute localized peritonitis may be suppurative or non-suppurative, and occurs in lesions when the peritoneal cavity has been shut off by fibrinous adhesions between the intestines and other parts. The symptoms resemble diffuse peritonitis, if somewhat less severe, and a distinct tumour can be felt at the affected part. The treatment is rest, sips of hot water, and the application of hot fomentations. Incision into the abdominal cavity and drainage may be necessary. *Tuberculous peritonitis* is more common

in children; the general health is low, there is wasting, and constipation alternates with diarrhœa. The treatment is by general hygiene, and feeding up with cod-liver oil, malt extract, and the like. Incision into the abdomen, without any drainage or irrigation, often cures all but the advanced ulcerous type.

Periwinkle. See under GASTEROPODA.

Perizzites, tribe, probably occupying central and S. districts of Canaan before Israelite invasion, either as agriculturists among a warlike clan or as semi-enslaved aborigines.

Perjury is an assertion upon oath or affirmation at a judicial proceeding, and before a competent authority, by a person who does not believe it to be true. It must be material to the question at issue in the case. The maximum punishment for perjury, or for suborning a person to commit perjury, is seven years' penal servitude. In Scotland falsehood is essential to perjury, and 'prevarication on oath' is a separate offence.

Perkin, SIR WILLIAM HENRY (1838–1907), Eng. chemist; pupil of Hofmann; when eighteen prepared aniline black and mauve (1856) by oxidizing aniline, laying foundation of coal-tar colour industry; also discovered a process of manufacturing alizarin, with the result that its extraction from madder has been practically abandoned; by 'Perkin synthesis' he prepared coumarin, the first artificial perfume from coal-tar, and artificial indigo. Retired from his dye factory (1874) and devoted himself to research. Condensed aldehydes with fatty acids; studied magnetic rotation. Fiftieth anniversary of discovery of mauve (1906) celebrated by homage of chemists from all over the world.

Perlite, or PEARLSTONE, glassy volcanic rock of pearly lustre; consists of silicate of aluminium, iron, lime, and alkali in varying quantities; occurs in spherules. This structure is common to many volcanic rocks.

Perm. (1) Government, E. Russia, bounded on N.E. and E. by Tobolsk, Siberia; consists of hilly central zone (Urals), eastern plain, and western region of rolling downs; in basins of Ob, Volga, and Petchora; many lakes; severe but variable climate; forests cover 70 per cent.; agriculture backward; richest prov. in minerals (gold, silver, copper, iron, lead, platinum, nickel, manganese, coal, salt, etc.); gems in profusion; many and varied industries. Area, 128,211 sq. m.; pop. 3,000,000. (2) Chief tn. of above government and port on Kama R. (58° 1′ N., 56° 32′ E.); cathedral; tanneries, brick fields, machinery. Pop. 45,400.

Permanganates. The principal salt, potassium permanganate, $KMnO_4$, is prepared by acidifying the green solution of potassium manganate, obtained by fusing manganese dioxide and caustic potash in air, when the liquid turns red, and on evaporation yields purple crystals. Potassium and sodium permanganates are used technically for the oxidation of compounds in organic preparations. They are also to a large extent employed in anal-

ysis for the estimation of iron and oxalic acid, the pink colour of the solution readily indicating the presence of an excess of the reagent. They are also used as disinfectants.

Permian, series of strata which, in U.K., rest unconformably on the Carboniferous system. See GEOLOGY.

Permutations and Combinations. See COMBINATIONS AND PERMUTATIONS.

Pernambuco, state, Brazil (9° s., 39° w.), on Atlantic coast; mountainous interior; its coast lands (Mata) produce sugar-cane, cotton, coffee, tobacco, and rice; famous for fruits. Recife is cap. Area, 49,570 sq. m.: pop. 1,100,000.

Pernau. See PERNOV.

Pernis. See HAWK FAMILY.

Pernov, or PERNAU, tn. and harbour, Latvia (58° 22′ N., 24° 34′ E.), 100 m. N. by E. of Riga, close to Gulf of Riga; oil wells and tobacco factory; exports timber, wood pulp, grain, flax, linseed. Pop. 20,000.

Péronne, tn., Somme, France (49° 55′ N., 2° 56′ E.), 22 m. S.S.W. of Cambrai. Charles the Simple imprisoned in the castle (923–9); Louis XI. forced to sign treaty with Charles the Bold (1468); captured by Wellington (1815), and by Germans (1817). In the Great War was occupied by Germans during race to the sea (Sept. 1914). In first battle of Somme the French came within 2 m. of it on the W.; but on the N., where the town is guarded by Mont St. Quentin, they were held up beyond the Tortille stream. Occupied by Allies during Ger. retreat to Hindenburg Line (March 1917); recovered by enemy in great Ger. offensive of March 1918; finally captured by Australians, who brilliantly stormed Mont St. Quentin during Allied advance (Sept. 1918). Pop. 4,600.

Perosi, LORENZO (1872–), Ital. priest and musical composer; choir director, St. Mark's, Venice, and hon. director, the Vatican, Rome; most famous works, *Resurrection of Lazarus* and *Passion of Christ*; also numerous masses, psalms, and motets.

Perowne, JOHN JAMES STEWART (1823–1904), Eng. theologian and Heb. scholar; Bishop of Worcester (1890–1901); member of O.T. Revision Committee; ed. *Cambridge Bible for Schools.*

Perpendicular. See ARCHITECTURE (*Gothic*).

Perpetual Motion, generally used with reference to a machine which, when once set in motion, will continue moving for ever without assistance from any outside source of energy. Much ingenuity has been expended upon the problem of constructing such machines, but with establishment of the principle of the conservation of energy the impossibility of a perpetual motion has been realized. The initial energy of a perpetual motion machine is gradually used in overcoming resistance and friction, and therefore the machine must stop after a time if no further energy is imparted to it. If all friction and resistance could be avoided, a body such as a simple pendulum or a spinning top would retain for ever motion given to it, but only on condition that it was not made to act on other bodies—that is, to do any

work; so that even if practicable, it would be of no utility.

Perpignan, chief tn., Pyrénées Orientales, France (42° 43′ N., 2° 53′ E.), 34 m. S. of Narbonne; strongly fortified; 14th cent. cathedral; trades in wine, brandy, silk, and wool. Pop. 39,500.

Perrault, CHARLES (1628–1703), Fr. author; secretary and protégé of Colbert; his poem *Siècle de Louis le Grand* gave rise to famous dispute of the ancients and the moderns; best known for his *Contes*, including those trans. into English as *Tom Thumb*, *Puss in Boots*, *Blue Beard*, *Little Red Riding Hood*, *Cinderella*, *The Sleeping Beauty*, with frontispiece, 'Contes de ma Mère l'Oie'; exquisite prose—simple, sententious, witty.

Perry, or PEAR WINE, fermented liquor made from pears or mixture of pears and crab-apples; pale coloured, sweet, with peculiar aroma and flavour; 5 to 9 per cent. of alcohol. Chief perry-producing counties of England are Worcester, Hereford, Gloucester, Somerset, and Devon.

Perseid Meteors. See METEOR.

Persephone. See PROSERPINE.

Persepolis, anc. city, former cap. of Persia, situated in the valley of Mervdasht (as it is now called), *c.* 40 m. from Shiraz; now a great series of ruins. See PERSIA (*Architecture*).

Perseus (Gr. myth.), son of Zeus and Danaë. Polydectes of Seriphus, in love with Danaë, sent Perseus for the head of the Gorgon Medusa; with the enforced aid of the Grææ and nymphs he accomplished the quest, thereby rescuing Andromeda, whom he married; worshipped as a hero.

Pershing, JOHN JOSEPH (1860–), Amer. soldier; *b.* Linn co., Missouri; educated at U.S. Military Academy; assigned to 6th Cavalry (1886) and served in Apache Ind. campaign (1886), Sioux campaign (1890–1), and Span.-Amer. War (1898), when he was promoted for gallantry at El Caney; chief of Bureau of Insular Affairs, War Dep. (1899); military attaché at Tokio (1905–6); military governor of Moro prov., Philippines (1909–13), where he finally destroyed the power of the Moros at battle of Bagsag (1913); was brigadier-general of the 8th Brigade at the Presidio, California, where his wife and three daughters lost their lives in the burning of the Presidio (Aug. 27, 1915); commanded Amer. troops sent into Mexico in pursuit of Villa (1916–17), and was promoted major-general; when the U.S. entered the Great War was placed in command of the expeditionary force in France (June 1917), and carried out their offensive in the Meuse sector (1918). See under UNITED STATES (*Great War*).

Pershore, tn., Worcestershire, England (52° 7′ N., 2° 5′ W.), 8 m. S.E. of Worcester; jam factories; agricultural implements. Pop. 2,500.

Persia, or IRAN, country, S.W. Asia (25°–40° N., 44°–63° E.); bounded N. by Turkestan, Caspian Sea, Azerbeijan, and Armenia, E. by Afghanistan and Baluchistan, S. and S.W. by the Gulf of Oman and the Pers. Gulf, and W. by Mesopotamia and Kurdistan.

In the N. is the great range of the Elburz, with many peaks

over 12,000 ft. high (Demavend 18,600 ft.); along the S.W. are a series of parallel ranges, the Zagros Mts., running N.W. and S.E., with peaks of from 10,000 to 13,000 ft.; the rest of the surface, in the centre and also the W., is dry, barren plateau of Iran (6,000 to 8,500 ft.). The whole district from mountains to mountains, S.E. of Teheran, forms the Dasht-i-Kavir or Great Salt Desert and Dasht-i-Lut, of height of *c.* 2,000 ft., and covered with thin deposits of saltpetre. In parts of the vast waste (*e.g.*, Seistan) the soil is excellent, and, were irrigation possible, would produce good crops. More than half the entire area is drained towards the interior to salt marshes or lakes, more than one-fourth to inland seas and lakes (Caspian, Aral, etc.), less than a quarter to the open sea; and that portion, owing to the position of the mountains, sends merely short streams, the chief being the Karun, flowing to the Shat-el-Arab, at N. of Pers. Gulf.

Geologically the land has not been extensively surveyed, but Lower Oolite, Cretaceous, volcanic, and metamorphic rocks have been observed. The climate varies extremely, but on the plateaus is generally one of extremes, very hot from May to Oct., very cold during other months. The low strip in the N. is damp and excessively hot in summer and mild in winter; in the S.E., winter and spring are temperate, summer warm, autumn oppressively hot. The rainfall is 5 to 10 in. on the plateaus; it occurs mostly in winter, and is entirely absent in summer, but the snow of the hills provides, in many of the districts in their neighbourhood, summer supply that can be used for irrigation. The fauna includes lions, leopards, bears, wolves, jackals, hyenas, antelopes, wild sheep and swine, the wild ass, and mountain goat; the Pers. horse (especially when crossed with the Arab) and the camel are valuable. Vegetation is most luxuriant on the coast, where flowers, especially roses, grow in great profusion, and the date palm is widely spread. There is little timber, the forest district being mainly confined to N. slope of the Elburz, but there are numerous varieties of shrubs. The orange, lemon, olive, almond, gum-trees, pomegranate, fig, mulberry, vine, rice, cotton and tobacco plants, sugar, a much-valued wheat, and the usual cereals are found.

The inhabitants are chiefly agricultural and pastoral, and are very thinly distributed. Large quantities of wheat, barley, rice, fruits, asafœtida, gums, hashish, tobacco, opium, silk, wool, lambskins, goat's hair, and cotton are produced. The wool of Khorassan is equal to that of Astrakhan. Hand-manufactures of carpets, felts, shawls, silk, cotton, prints, leather, copper, brass-ware, enamelled work, pottery, glazed tiles, and attar of roses, and dealing in pearls and pearl-shell are important. Minerals are abundant, but most of them are still unworked, the distance from markets and the bad communications rendering the transport of them unwrought impossible, while scarcity of fuel prevents


TURKESTAN
PERSIA
Sandy Desert of Roba-el-Khali
ARABIA
or Dahna
Hadramaut
ARABIAN SEA
Gulf of Oman
Persian Gulf
CASPIAN SEA
Aral Sea
Khiva
Bokhara
Merv
Askabad
Meshed
Maimana
Herat
Khorassan
Irak Ajemi
Persian Mekran
Beluchistan
Kerman
Yezd
Ispahan
Shiraz
Arabistan
Basra
Bagdad
Tabriz
Azerbijan
Teheran
Kasvin
Hamadan
Kermanshah
Mosul
Van
Tiflis
Derbent
Baku
Krasnovodsk
Chardjui
Bander Abbas
Ormus I.
Jask
Muscat
Tropic of Cancer
Ras el Hadd
Masandam
Ras Madrakh
Mosseirah I.
Kuria Muria Is.
Nejran
Jauf
Hasa
Riyadh
Katif
Bahrein
Lingah
Kishm I.
Sharjah
Dubai
Persian Gulf
English Miles
0 100 200 300
PERSIA

treatment on the spot. Lead, copper, and turquoise (near Nishapur) are worked; silver-lead, iron in large quantities, coal (especially in the S.E.), tin, antimony, manganese, borax, salt, and naphtha (all along W. and in part of N.) are found. Oil worked by the British promises to bring much profit. The imports are chiefly cottons, sugar, tea, iron and steel goods, yarn, petroleum, rice, and flour.

Inhabitants. — Native elementary education is poorly supplied by the schools of the larger towns, but secondary instruction is fairly good; westernization commenced with the polytechnic established in Teheran in 1849; majority of pop. learn only to read the Koran. There are about 8,500,000 Shiite Mohammedans, about 850,000 Sunnites, 50,000 Armenians, 40,000 Jews, 30,000 Nestorians, and 10,000 Parsis. The principal ecclesiastic, the Mujtahid of Kerbela, has great authority under the Shiite creed; all the chief priests are called mujtahids, the simple priests mullâs; their appointment belongs to the Church, but the state elects the Church officials, Sheikh-ul-Islâm and Imâm-i-Jum'ah. Persians are usually tolerant to non-Mussulmans, but are subject to fanatical outbursts. About a quarter of the inhabitants are nomads, the chief nomadic tribes being Turks, Kurds, Leks, Arabs, Lurs, Baluchis, and gipsies.

The chief towns are Teheran (cap.), Tabriz, Ispahan, Meshed, Kerman, Yezd, and Shîraz; the principal ports, Bander Abbas, Bushire, Lingah, and Mohammerah on the Pers. Gulf, Astara, Bender-i-Gez, Enzeli, and Meshed-i-Sar on the Caspian Sea. There is a railway from Teheran to Shah Abdul-azim (6 m.), and one constructed by a Russian company from Julfa (Perso-Russian frontier) to Tabriz (97 m.). Under the new Anglo-Pers. agreement (see below) Brit. experts are to co-operate in the development of transport. Road-making has been busily carried on in recent years, with the result that, beside the caravan routes and old roads from Teheran to Kom and Resht, there are now roads from Tabriz to the N. border, Kazvin to Hamadan, Meshed to Askabad, etc. The Pers. Road and Transport Co., a Brit. firm, was formed in 1903. A state Dep. of Posts and Telegraphs originated in 1909; there are 6,312 m. of telegraph line. Area, 628,000 sq. m.; pop. (est.) 10,000,000.

Government of Persia was until 1906 a despotism exercised by the Shahan or Shahin Shah (Pers. 'king of kings'), who was, however, unable to act against the precepts of the Koran or the traditions of Shiite Mohammedism. The Great Council, or Mejlis, has ceased to exist as a legislative or administrative body since 1915. The government is in hands of the cabinet of eight ministers. Gov.-generals (Hâkim, Wâlî, etc.), always royal or noble, govern the provs. (33 in number) and appoint their own deputy-governors in the subdivisions of the same. The municipalities have a chief official known as Beglerbegî, Darogha, or Kalântar; the village reeves are called Kedkhodâ. A law of May 1907

provides for the election of rural and town councils. The nomad tribes are outside this system, but their chiefs are accredited officials of the central government. Justice is based on the Koran, and is carried out by the Hâkim (who are reputed extremely unjust and extortionate) assisted by the priests.

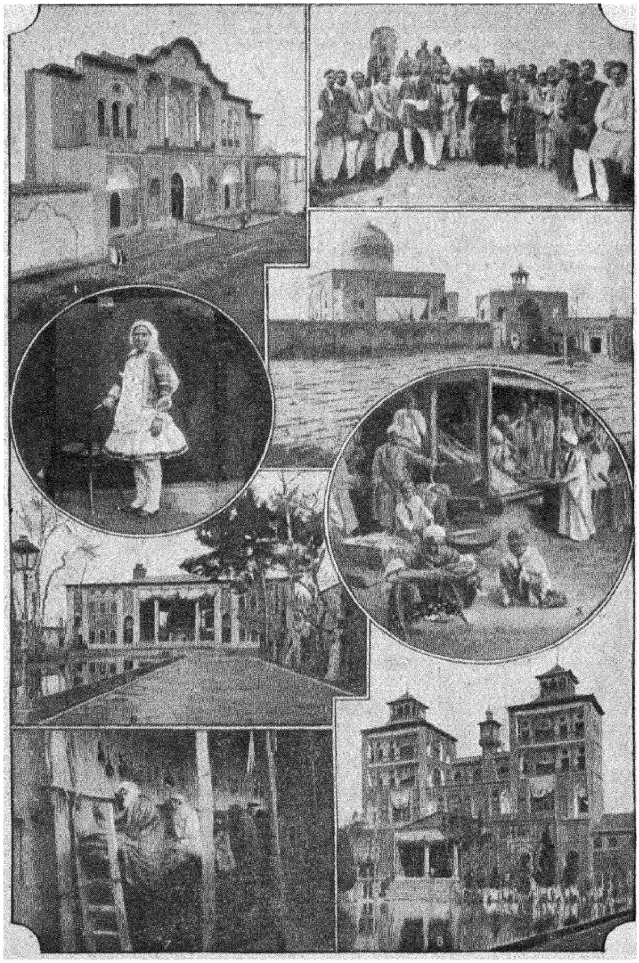
History.—Our knowledge of early Pers. history is mainly derived from the Greeks. An agricultural and pastoral Aryan race, Zoroastrians and fire-worshippers, seems to have settled in Persia (Pers. *Fârs*) S.W. of the Iranian plateau. The N.W. was occupied by the kindred race of Medes, and the Persians probably underwent Assyrian and Babylonian subjugation before becoming vassals of the Medes *c.* 720 B.C. Nearly three centuries later Cyrus the Great (Pers. *Kai-Khusru*) overthrew the Median yoke, and after defeating King Astyages (*c.* 550) founded the famous Pers. dynasty of the Achæmenides, which lasted until 330 B.C. Their cap. was first Pasargadæ, then Persepolis. His son Cambyses (529–522) conquered Egypt; Darius I., *Hystaspes* (521–485), conquered Babylon (517). Under Darius one of the greatest conflicts between E. and W. commenced. Darius conquered Ionia, Thrace, and Macedonia, and threatened Greece, but was forced to retreat after his repulse at Marathon (490). His son, Xerxes I. (485–464), after recovering Egypt, for long henceforward a Pers. prov., in 484 again invaded Greece, and was defeated at Thermopylæ and Salamis (480), Platæa (479), and lost many of his Ionian towns. Artaxerxes I. (464–424) was succeeded by his son, Xerxes II., under whom the satraps who governed the various Pers. provs. began to assert their independence. He was deposed by Darius II. (424–404), no more successful than himself. His son, Artaxerxes II. (404–361), won a great victory over his insurgent brother Cyrus, the younger, at Cunaxa (401), after which the 10,000 Greeks who had aided Cyrus made their famous retreat under Xenophon; the long, terrible journey through hostile country is immortalized in Xenophon's *Anabasis*. Artaxerxes III. (361–337) recovered Egypt, which had again seceded.

The empire was overthrown under Darius III. (336–331) by Alexander the Great, who won great victories at the river Granicus (334) and Issus (333), where Darius and his queen were captured, crossed the Tigris and Euphrates, won the battle of Arbela (331), and overthrew for ever the empire of the Achæmenians. Over all this region, as far as India, Hellenic influence was established, and can still be traced. Darius was murdered by Bessus in 330. His realm, which had become a prov. of the Macedonian Empire, broke away again after Alexander's death (323).

Persia without Egypt was assigned to the satrap Seleucus Nicator, founder of the Seleucid dynasty, who ruled over nearly the whole realm of the old Achæmenides. In the middle of the 3rd cent. B.C., however, Bactria (which is said to have included a large part of India) and Parthia broke away, becoming independ-



THE FAMILY OF DARIUS BEFORE ALEXANDER.
(From the painting by Paul Veronese in the National Gallery.)



SCENES IN PERSIA.—1. Entrance to the Palace of Zelim Sultan, Teheran. 2. Luis of Luristan. 3. Tomb and graveyard at Kazim. 4. Persian lady in indoor costume. (*Photo by N. P. Edwards.*) 5. Bazaar at Resht. 6. The Marble Throne, Teheran. 7. Carpet weavers, Kurdistan. 8. Palace of the Sun, Teheran.

ent states, and Parthia under Arsaces I. subjugated Persia. The Arsacid dynasty, hated by the Persians, was overthrown by the native Sassanid line. Ardashir Babegan, grandson of Sassan, won Fars, Kerman, and part of Irak, and the final victory of Hormuz (A.D. 218). The Middle Pers. dynasty of the Sassanidæ protected the country for long against her two chief enemies—Rome on the W., Turkey on the E.,; and Persia was prosperous and renowned under Sapor I. (240–71), Sapor II. (309–80), who showed great rigour towards Christians; Chosroes I. (531–78) and Chosroes II. (590–628), who conquered Syria (storming Jerusalem in 614), subdued Asia Minor and Egypt, and threatened Constantinople, saved by the victory of the Emperor Heraclius in 628. After his murder, by his son Siroes, the realm fell into disorder. The last Sassanid king, Yazdigird III., lost Persia to the Arabs by battle of Kadisiya (635).

Persia then became a prov. of the caliphate, and when Bagdad was built, in the middle of the 8th cent. by Al-Mansur, it became the cap. of the Abbasid Empire. Under the nominal suzerainty of the caliphs the local dynasties of Taharides (820–72), Saffarides (869–903), Samanides, and Ghaznevids won fame. Finally, in 1055 the Seljuk Turks under Togrul Beg united Persia under one rule. After their decline it was conquered by Mongols under Jenghiz Khan (1223), and experienced great miseries under Hulagu Khan and his successors the Ilkhanians (1256–1366). In 1399 the Mongols were driven out by Timur and his Tatars, who, a hundred years later, were expelled by the Uzbeg Turks.

The Shiite dynasty of Sufi was established in 1499, and lasted until 1735. Ismail I., who introduced Shiism as the state religion, drove the Uzbegs back beyond the borders of Khorassan and conquered Georgia, but was defeated in his attempt at a holy war against Turkey. The greatest of the line was Abbas I. (1586–1628), under whom Ispahan was made the capital. He defeated Uzbegs, Turks, and Mongols, extended his rule W. over Kurdistan and E. over Kandahar, built towns and roads, and set an example of Western culture. The preponderance of religion, however, in the Shiite system, proved in the end fatal to the Sufides. Afghanistan was driven by persecution to revolt (1709); in 1722 the Afghans captured Ispahan; and in 1736 the Turks deposed the last shah (Pers. king) of this line. The Turk. Nadir Shah (1735–47) ruled tyrannically over Persia, and under his successors the various states revolted, Afghanistan and Baluchistan becoming finally independent.

The rest of Persia was reunited in 1795 by Aga Mohammed, a Turkoman eunuch, who deposed Lutf Ali Khan and founded the Kajaran dynasty, Teheran becoming the new capital. After his death, in 1797, Georgia was again separated, becoming in 1802 a Russian prov., and Persia was forced (1813 and 1829) to cede to Russia everything N. of the Aras, the present boundary. Attacks on Brit. power in N.W.

India (1836–8 and 1856–7) signally failed, and Persia has since sunk into a protected state. The boundary with India was fixed by a Brit. commissioner in 1872.

During the reign of Muzaffaruddin (1896–1907) court corruption and misrule led to the demand for a constitution, which was granted in 1905, and guaranteed by Mohammed Ali Mirza, who succeeded. The new shah soon came to blows with the nationalist party. In 1908 martial law was proclaimed and the constitution abolished; but the nationalists took to arms, wrested from the monarch a new constitution, and deposed him in 1909 in favour of his son, Ahmed Mirza (*b.* Jan. 20, 1898). Meanwhile Persia was distracted by attacks of Turks and Russians, and revolts within her own frontiers. In 1907 Russia and Great Britain made a treaty, marking out their respective spheres of influence, and guaranteeing Persia's independence and integrity. The Shah was crowned on July 21, 1914. The weakness of Persia prior to the Great War made the country a happy hunting-ground for Ger. intrigue. Until the collapse of Russia, Russian troops operated in Persia and saved Teheran and the Shah's throne. In March 1916 Sir Percy Sykes landed at Bandar Abbas for the purpose of raising a force to replace the mutinous gendarmerie, which was officered by Swedes, many of whom joined the Germans. Within two years he raised a force of 6,000 men (S. Persian Rifles), under Brit. officers and N.C.O.'s. With this force and Ind. troops, despite innumerable difficulties, including a siege of four weeks' duration by the Kashgai under Ismail Khan, he preserved S. Persia from anarchy, and maintained Brit. prestige. At the Peace Conference Persia made extravagant territorial claims, which included half Transcaucasia and the guardianship of the Shiite holy cities of Mesopotamia. In Aug. 1919 a new treaty was arranged between Britain and Persia: Britain respects the integrity of Persia, and provides a loan of £2,000,000 to secure development of the country under Brit. expert advisers, who also will reorganize army. In Nov. 1919 the Shah visited Great Britain. Bolshevist invasion menaced the country (1920).

Language and Literature.—Persian belongs to the Iranian group of languages, closely allied to Indo-Aryan languages, and forming with latter an important section of the Indo-European family. Language and literature fall into four periods.

(1) Zend or Old Iranian.—Extends from *c.* 6th cent. B.C. to *c.* A.D. 300; is represented by *Avestâ*, sacred book of modern Parsees, which is ascribed to religious lawgiver Zarathushtra (Zoroaster), who flourished between 7th and 6th centuries B.C. Language is archaic and closely related to Vedic Sanskrit. *Avestâ* was collected under Sassanian kings, 3rd cent. A.D.

(2) Ancient Persian.—Represented by inscriptions of Achæmenian dynasty, consisting of about a thousand lines of texts in cuneiform writing carved upon face of great rock at Behistun. After fall of Achæmenians no

literature was produced for five centuries.

(3) Pahlavi (Middle Persian). —About a hundred works have survived, chiefly religious and in Zoroastrian spirit.

(4) Modern Persian. — Begins with conversion of Persia to Islam by Arab conquest, resulting in enormous Semitic admixture in thought and language, and adoption of Arabic writing. Literature really begins with death of caliph Haroun-al-Raschid, and consists chiefly of poetry. Firdausi (A.D. 940–1020), whose *Shâhnâmah* is Persia's great national epic, was first great poet, whose work had many imitators, and led to development of romantic, mystical, and didactic poetry. Passing over Rudagi, lyric poet, 10th cent., and Anvari (*d.* 1190), satirist, we come to Omar Khayyám (*d.* 1123), whose *Rubáiyát* or Quatrains have obtained disproportionate popularity in Europe through Fitzgerald's translation; Nizámi, epic poet (1141–1203), author of *Khusrau and Shirín*, *Iskandar Námah*, and *Laili and Majnun* (beautiful pathetic tale); Jelal-ud-dín-Rúmi, greatest Sufi or mystic poet, author of *Masnavi* (6 vols.); Sheikh Sa'di, great novelist and poet (*b.* Shiráz *c.* 1176), author of *Divan* or collection of lyrics, and famous *Bustân* (Garden of Perfume) and *Gulistân* (Rose Garden); Hafiz (*d.* 1389), pseudonym of Persia's greatest lyric poet, Shems-ud-din Muhammad; and Jámi (*b.* 1414), last of classic poets and Sufis. After Jámi, literature declines and becomes chiefly historical. No drama appears till beginning of 19th cent., when great national passion play *Tázieh* was produced, dealing with massacre of Hussain and his family. Among modern poets best are Kááni Shirázi, Yaghma Khorásáni, and Mirza Serúh Ispaháni.

Browne, *Literary History of Persia* (2 vols.; new. ed. 1906).

Architecture and Archæology.— Persia learned much from the Assyrians. The difference of material brought constructional differences, the sun-dried brick and alabaster of Assyria being unsuitable for forms which could be carried out with the stone of Persia; but the platform by which Assyrian palaces were raised above the clay soil, and consequently the steps leading up to them, and the winged bull with human head which was an Assyrian architectural ornament, were repeated in Persia. The columnar feature is supposed to have been learned from the Medes. Of the brickwork of these empires and the Babylonian little remains, and much that has been learned of their architectural styles is deduction from buildings raised in Persia while under their rule. The columns of the palace of Cyrus and Cambyses at Pasargadæ are still to be traced; the tomb of Cyrus here is also on a terrace after the Assyrian fashion.

The chief remains are at PERSEPOLIS, which Darius Hystaspes made the capital. Here are to be traced the palace of Darius, the two palaces of Xerxes, the palace of a hundred columns, and other buildings all on the same platform, to which a broad flight of steps ascends. The palaces were raised by separate plat-

forms; they were square in plan, with many rows of columns supporting the roof, and long porticoes on three of the four sides. The largest was the palace of Xerxes, which was 350 by 300 ft. in area, and apparently the largest building of antiquity. Characteristic capitals to the columns were bulls' heads back to back, giving the impression of Ionic volutes; some of the capitals consist of Ionic volutes. There are also remains of the pre-Moslem period at Susa, Ecbatana, and Teheran.

The Mohammedan art of Persia is famed. The tomb of Zobeide (8th cent.) at Bagdad is interesting for its stalactite vaulting. The mosque at Tabriz ascribed to the Ilkhanians shows beautiful decoration of glazed tiles, brightly coloured and adorned by characteristic Arabic interlaced ornament. The mosque of Masjid Shah at Ispahan, built by Abbas Shah (1585–1628), has between its minarets a noble gateway, the squareness of which forms a fine contrast to the beehive-shaped dome behind; but it is its interior which has made this mosque famous, having, besides gay decoration, memorable perspective effects. The designs of architectural ornament, Pers. pottery, carpets, etc., are largely dependent for their effect on arrangements of lines, Persia having acquired great art in this direction through being restrained by the Mohammedan religion from using animal and plant motifs in eccles. ornament. The rosette, however, figures largely in antique sculptures of dresses and in wall decoration; the Pers. rose is frequent in modern pottery design.

Benjamin, *Persia and the Persians* ('Story of the Nations' Series, 1888); Curzon, *Persia and the Persians* (1892); Browne, *The Revolution in Persia* (1910); Shuster, *Strangling of Persia* (1912); Sykes, *A History of Persia* (1915).

Persian Gulf, inlet of Indian Ocean, running N.W. from Strait of Ormuz between Persia and Asia. Area, *c.* 75,000 sq. m. Shores sterile. Shatt-el-Arab (formed by union of Euphrates and Tigris) and Karun R. enter head of gulf. Bahrein, Kishm, and Ormuz are chief islands; Bushire chief port. Gulf is Brit. sphere of influence. See BAGDAD RAILWAY; MESOPOTAMIA.

Persimmon, or VIRGINIAN DATE-PLUM (*Diospyros virginiana*), tree *c.* 60 ft. high; yields plum-like fruit containing eight to ten seeds; a native Jap. variety (*D. kaki*) yields large fruits, sometimes more than 1 lb. in weight.

Personal Property, originally distinguished from 'real' property by the fact that in the case of *realty* the thing itself could be recovered, but in *personalty* only damages could be recovered. Freehold land is 'real' property, the leasehold is 'personal.' Furniture, money, assurance policies, stock in public companies, are all personal property, which, unlike real property, is the subject of absolute ownership. On intestacy it is divided among the next of kin according to the Statutes of Distribution.

Perspective, the art of representing, by a drawing on a flat surface, solid objects or surfaces in such a way that the drawing appears to the eye in the same

manner as the object itself. The eye is supposed fixed at a point called *centre of perspective*, the picture being drawn in a plane (*picture plane*) perpendicular to the line of vision. If now straight lines be drawn from every point of the object to the eye, the point where each of these lines cuts the picture plane is the corresponding point of the picture. The foot of the perpendicular from the eye on the picture plane is the *centre of vision*, and all lines of the object perpendicular to the picture plane appear to *vanish* at this point. Other sets of parallel lines inclined to picture plane have *vanishing points* at other points of the horizontal line through the centre of vision.

Perspiration. See SKIN.

Persulphuric Acid, $H_2S_2O_8$, obtained at anode when 50 per cent. H_2SO_4 is electrolyzed at low temperature. The potassium salt is source of other persulphates which are strongly oxidizing and are therefore used technically. Ammonium persulphate is used to reduce the density of photographic negatives. Monopersulphuric acid (H_2SO_5) or Caro's acid is formed by the action of sulphur trioxide on hydrogen peroxide.

Pertab Singhji, SIR (1845–), Ind. soldier and administrator; was placed at the head of the administration of Jodhpur by his brother Maharajah Sir Jaswantsingh. He proved himself an able administrator; was a member of the Kabul mission of 1878, served in the Mohmand expedition of 1897 and in the Tirah campaign of 1898, and accompanied the Brit. force to China in 1900, in command of the Jodhpur Imperial Service troops; appointed ruling chief of Idar state in Gujarat in 1902, but abdicated in favour of his son; promoted lieut.-colonel and subsequently lieut.-general in the Brit. army; served in the Great War (1914–15), and was mentioned in dispatches; throughout his whole career has rendered conspicuous service to the Brit. crown.

Perth, royal and parl. burgh, chief town of Perthshire, Scotland (56° 24′ N., 3° 27′ W.), on Tay, 33 m. (direct) N.N.W. of Edinburgh; the 'Fair City'; till the assassination of James I. (1437) the seat of Scot. king and Parliament. North Inch was the scene of encounter between Clans Chattan and Quhele (see Scott's *Fair Maid of Perth*); 13th cent. church of St. John (restored 1891); episc. cathedral (1850–90); large prison and new city hall (1911). Industries include linen, iron, carpets, glass, and ink; dye works, whisky distilleries; cattle markets; valuable salmon fisheries in Tay. Pop. 35,800.

Perth, tn., cap. W. Australia (31° 57′ S., 115° 54′ E.), on Swan R., 12 m. N. of Fremantle; fine buildings, including Anglican and R.C. cathedrals, council chambers, banks, museum, library, and art gallery; fine parks and observatory; three racecourses. Pop. (with suburbs), 52,000.

Perth Amboy, city, New Jersey, U.S. (41° 31′ N., 74° 20′ W.), on Raritan Bay; connected with South Amboy by bridge; shipyards and dry docks; terra cotta, lead, copper, steel, emery, and chemicals; coal is shipped,

and clay is mined in district. Pop. 32,100.

Perthshire, inland co. of Scotland (56° 30′ N., 4° W.), bounded by Inverness, Aberdeen, Forfar, Fife, Kinross, Clackmannan, Stirling, Dumbarton, and Argyll. Almost completely mountainous, with many beautiful rivers, lochs, forests, and passes. In N. are Grampians (peaks: Ben More, 3,843 ft.; Schiehallion, 3,547 ft.). To S.W. and S. are Sidlaw and Ochil Hills. TROSSACHS and Pass of Killiecrankie are in county. Riv. Tay (tribs. Garry, Tummel, Earn, etc.) drains almost whole county; S. watered by Forth and Teith. Largest lochs are Tay, Earn, Rannoch, Katrine, Vennachar, and Achray. Chief towns: Perth, Crieff, Blairgowrie, and Dunblane. Roman camps and standing stones; cathedrals at Dunblane and Dunkeld: interesting palace at Scone. Agriculture, sheep farming, fruit growing; coal and iron in the Ochils; woollen, cotton, and linen industries. County returns one M.P. Area, 2,494 sq. m.; pop. 124,300.

Peru, republic, S. America (1° 32′–19° 13′ S., 69°–81° 30′ W.); bounded N. by Ecuador, E. by Brazil and Bolivia, S. by Chile, S.W. and W. by Pacific; area, 695,733 sq. m.; coast-line, *c.* 1,400 m. Surface has a narrow coastal strip rising rapidly to the Andes, which here form three or more parallel chains with a width of *c.* 250 m., running in same direction as coast and having great fertile valleys and tablelands spread out among them. Mountains reach height of 21,000 to 22,000 ft., the highest peaks being Huascan (*c.* 22,050 ft.) and Huandoy (*c.* 21,090 ft.), while there are many volcanic peaks over 19,000 ft. in height. The plateaus attain a height of from 12,000 to 13,000 ft. above sea-level. To the E. of Cordilleran ranges is region of forest and pampas sloping to Amazon basin. Drainage of this region, as well as of the northern and central tableland, is carried off by headwaters of Amazon (Marañon) and of its great tributaries, Huallaga, Ucayale, and Javari, and by the upper streams of the Jurua, Purus, and Madeira farther S. The rivers of the coastal strip are unimportant. In extreme S.E. is Lake Titicaca, the largest lake in S. America, at a height of 12,600 ft. above the sea. The largest towns are the capital, Lima (140,000), and La Paz (80,000). Climate varies with elevation; temperature on coast, 60° to 80° F.; on tablelands, 40° to 60° F.; in W. districts, 64° to 86° F. No rain falls on a coastal strip, where there is, however, much cloud.

History.—In very early times a considerable degree of civilization was attained by various peoples in Peru. About the 12th cent. the Incas established themselves in the country, and, making Cuzco their seat of government, gradually increased their dominions until the whole region from Ecuador to Chile was under their sway. Their rule continued for over three centuries, during which they developed a fairly successful system of socialism and carried out magnificent building and engineering works. The Span. conquest of Peru was carried out by Francisco Pizarro,


ECUADOR
PERU
BRAZIL
BOLIVIA
SOUTH PACIFIC OCEAN
English Miles
0 50 100 200 300
Quito
Cuenca
Loja
Guayaquil
Tumbez
Payta
Piura
Chiclayo
Lambayeque
Trujillo
Guanape Is.
Chimbote
Huarez
Huanuco
Cajamarca
Moyobamba
Chachapoyas
Balsapuerto
Iquitos
Nauta
Barranca
Callao
Lima
Chincha Is.
Pisco
Ica
Cerro de Pasco
Huancayo
Ayacucho
Huancavelica
Abancay
Cuzco
Arequipa
Mollendo
Moquegua
Tacna
Arica
Iquique
Tocopilla
Pt. Chandless
Rio Madre de Dios
Rio Beni
Rio Purus
Rio Jurua
Rio Javari
Rio Ucayali
Rio Huallaga
Rio Marañon
Rio Pastaza
Rio Napo
Rio Putumayo or Iça
Rio Coca
Rio Zamora
Rio Chinchipe
Rio Huancabamba
Rio Chira
Rio Piura
Rio Santa
Rio Pativilca
Rio Chancay
Rio Rimac
Rio Mantaro
Rio Apurimac
Rio Pachachaca
Rio Vilcanota
Rio Desaguadero
Rio Loa
Rio Camarones
Rio Lluta
Rio Sama
Rio Caplina
Rio Tambo
Rio Ilo
Lake Titicaca
Lake Poopo
Cordillera Occidental
Cordillera Oriental
Cordillera Real
Cordillera Blanca
Cordillera Vilcanota
Cordillera Huayhuash
Cordillera Huanzo
Cordillera Huanuco
Cordillera Huallanca
Cordillera Huaytapallana
Cordillera Vilcabamba
Cordillera Huanchaca
Cordillera Apolobamba
Cordillera Carabaya
Cordillera Chichas
Cordillera Lipez
Cordillera Tres Cruces
Cordillera Sajama
Cordillera Quimsa Cruz
Cordillera Tunari
Cordillera Cochabamba
Cordillera Mizque
Cordillera Aullagas
Cordillera Azanaques
Cordillera Frailes
Cordillera Chocaya
Cordillera Chocloca
Cordillera Cochinoca
Cordillera Aconquija
Cordillera Zapaleri
Cordillera Tatio
Cordillera Domeyko
Cordillera Sierra Gorda
Cordillera Sierra Negra
Cordillera Sierra Blanca
Cordillera Sierra Vicuña Mackenna
Cordillera Sierra Varas
Cordillera Sierra Moreno
Cordillera Sierra Tarapaca
Cordillera Sierra Pica
Cordillera Sierra Iquique
Cordillera Sierra Patillos
Cordillera Sierra Iquiuca
Cordillera Sierra Iquiuca
Cordillera Sierra Iquiuca

between 1531 and 1541 when he was murdered by the followers of Almagro, the Inca prince. Peru became a Span. viceroyalty (1542), and so remained until rebellion of the Span. colonies against mother country early in 19th cent.

Peru was the last of the colonies to attain independence. It became a republic only in 1824, after defeat of Spaniards at Ayacucho; ruled by the liberator, Bolivar, until 1826. During next two decades various revolutions occurred and several new constitutions were drawn up, but under Ramon Castillo, president in 1845–51 and 1855–62, the prosperity of the country increased. A boundary dispute with Brazil was settled in 1876; and in 1879 occurred the war with Chile, which ended in 1883 with the Treaty of Ancon, whereby Chile obtained Tarapaca and the right to hold Arica and Tacna for ten years, after which a popular vote was to decide to which state these two provinces should belong. This question, however, still remains open, and the coastal territory between 17° 47′ s. and 19° 13′ s. is still occupied by Chile. Another revolution took place in 1894–5. Boundary disputes have also occurred with Bolivia, Colombia, and Ecuador. That with Bolivia was settled by negotiations between the states concerned; that with Colombia and Ecuador was referred to Alfonso of Spain, who in 1910 refused to act further in the matter, which was then referred to the mediation of U.S., Argentina, and Brazil. Boundary disputes with Brazil were settled in 1910. Peru severed relations with Germany (Oct. 1917).

Government is republican; executive power vested in president (elected for four years by popular vote), two vice-presidents (similarly elected), and cabinet of six ministers. Legislature consists of Congress of two houses—Senate (52 members) and House of Representatives (116 members), both senators and representatives being elected by popular vote. Peru is divided for administrative purposes into 18 departments and two provinces. Primary education is gratuitous and nominally compulsory. The state religion is Roman Catholicism; other religions are tolerated in practice, although prohibited by the terms of the Constitution of 1860. The army numbers about 5,000 in all, and military service is obligatory. The majority of the population are Indian; whites, chiefly Spanish, form about one-seventh and half-breeds about one-fourth, while there are smaller proportions of negroes and Chinese. Pop. *c.* 3,000,000.

Resources.—Mineral resources are enormous, but the difficulty of transport has arrested development. Silver occurs in vast quantities, and gold, copper, lead, quicksilver, antimony, iron, sulphur, and other minerals are produced. The forests of the eastern slopes produce valuable timber, in addition to cinchona, coca, cacao, rubber, sarsaparilla, and vegetable ivory. Bananas, vines, olives, cotton, tobacco, coffee, sugar-cane, and cacao are cultivated, and various cereals are grown. Llamas and cattle are raised. Sugar is the principal crop; annual export, about 150,000 tons. Exports in-

clude minerals, cotton, wool, gums, etc.; imports, textiles, machinery, provisions, and general goods. Railway mileage in 1915, 1,724.

M. R. Wright, *The Old and New Peru* (1909); P. Martin, *Peru of the Twentieth Century* (1911).

Peru, city, Indiana, U.S. (40° 46′ N., 86° 1′ W.), on Wabash R., 70 m. N. of Indianapolis; woollens, bagging, furniture, etc.; railway workshops; grain largely grown in district. Pop. 10,900.

Perugia, cap., prov. Perugia, Italy (43° 7′ N., 12° 23′ E.), on r. bk. of Tiber, 126 m. by rail N. of Rome; 15th cent. Gothic cathedral and other interesting churches; Etruscan tombs in vicinity; univ. (founded 1308); observatory; botanical garden, museum, and library; old gateways; anc. *Perusia*, one of the twelve Etruscan cities; captured by Romans (310 B.C.); incorporated with papal states (1512); annexed to Italy (1860). Was centre of Umbrian school of painting (15th cent.); woollens, silks, liqueurs. Pop. 66,000. For prov., see UMBRIA.

Perugino, properly PIETRO VANNUCCI (1446–1524), Italian painter, head of Umbrian school, master of Raphael; lived in Florence, Rome, Venice, Cremona, and Perugia (his adopted city); great work, the beautiful frescoes adorning the Hall of Cambio, Perugia; assisted in decoration of the Vatican, and painted *Christ giving the Keys to Peter*, Sistine Chapel, Rome; painted in tempera till 1493, and thereafter in oils; died of plague; National Gallery, London, has his *Virgin, Child, Michael, and Raphael.*

Peruvian Bark, dried bark of CINCHONA. See also QUININE.

Pesaro, tn. and episc. see, cap. Pesaro e Urbino, Italy (43° 55′ N., 12° 53′ E.), on Adriatic, 37 m. N.W. of Ancona; walled and fortified; two cathedrals and several palaces; exports figs, wine, oil, silk, soap, wax, lead, and iron. Pop. 27,300.

Pescadores, or HOKOTO, group of about twelve islands, W. coast of Formosa, China Sea (24° N., 119° 40′ E.); ceded by China to Japan (1895); fish, ground nuts, rice, millet. Pop. 60,000.

Pescia, tn., Tuscany, Italy (43° 53′ N., 10° 42′ E.), 30 m. N.W. of Florence; silk, olive oil, paper, leather. Pop. (comm.) 18,000.

Peshawar, or PESHAWUR, cap. N.W. Frontier prov., India (33° 59′ N., 71° 30′ E.), near the Khaibar Pass, 20 m. from Afghan frontier; railway terminus; commands caravan route between Afghanistan and India; Christian mission. Pop. 98,000.

Pest, or PESTH. See under BUDAPEST.

Pestalozzi, JOHANN HEINRICH (1746–1827), Swiss educational reformer; dwelt with waifs at his farm, Neuhof, but failed owing to lack of business ability; kept school at Yverdon (1805–25); wrote novels on educational themes: *Lienhardt und Gertrud* (1781); *Wie Gertrud ihre Kinder lehrt* (1801); taught by intuitional method, making psychology his foundation, and combining manual with mental exercises.

Pétain, HENRI PHILIPPE (1856–), Fr. soldier; *b.* at Cauchy-à-la-Tour, Pas-de-Calais. He belongs to the infantry, and became colonel in 1910. His

skilful command of his troops in the Charleroi retreat (Aug. 1914) led to his promotion to rank of brigadier-general. In Artois he showed himself one of the most successful exponents of trench warfare tactics, and was largely responsible for the successes of that campaign. He succeeded Castelnau in command of 2nd Army, and in Champagne offensive (1915) again distinguished himself; and when Castelnau became chief of the General Staff, replaced him as commander of the centre group of armies. In 1916 he was given command at VERDUN, and his defence of that place is one of the epics of the war. In 1917 he succeeded Nivelle as commander-in-chief of the Fr. Armies of the North and North-East, his thorough knowledge of the Fr. soldier enabling him to restore the *moral* of the army after the crisis which followed the great Ger. offensive of April. He was made a Marshal of France on the day he led the Fr. troops into Metz (Nov. 1918). Married Madame Hardon (Sept. 1920).

Petaurus. See MARSUPIALS.

Peter, one of the disciples of Jesus, original name Symeon, for which Gr. name Simon was often used; surname Peter, 'a rock,' was given to him by Jesus. He was a fisherman on Lake of Galilee; belonged to Bethsaida, but during ministry of Jesus lived at Capernaum. He seems to have been married, and was accompanied by his wife in some of his later travels. He was called by Jesus along with his brother Andrew to be His disciple, and after period of discipleship took up the work of an apostle; with John and James formed a group admitted to more intimate relation with Jesus; confessed that Jesus was the Christ; was full of loyalty, devotion, and impetuosity of heart; affirmed his adherence to Jesus, yet at a critical moment denied Him, but afterwards bitterly repented; was accorded special privileges in connection with appearance of Christ after the resurrection; took a leading place in Christian community after Pentecost; spoke on behalf of the others when brought before the Council; condemned Ananias and Sapphira; took part in council at Jerusalem; worked with Paul, with whom he differed regarding status of the circumcised and uncircumcised. According to tradition, he was the organizer of the Church in Antioch, and spent his last years in Rome, suffering martyrdom there about A.D. 64; was the author of the first epistle which bears his name.

Farrar, *Life of Christ*, and *Early Days of Christianity*.

Peter, FIRST EPISTLE OF, one of the catholic or general epistles, written by Peter, most likely from Rome to the Christians who dwelt in Asia Minor, the object being to warn them that the persecutions which had taken place in Rome might spread throughout the empire, and to encourage them to bravery and endurance should such expectations be realized, the persecutions referred to most likely being those instigated by the Emperor Nero. The trend of thought is obviously influenced by the Epistle to the Romans and that to the Ephesians.

Peter, SECOND EPISTLE OF, is addressed to the Christian Church in general, and consists chiefly of warnings against heretical teachers, and exhortations to growth in Christian knowledge and character; its genuineness has been questioned on various grounds, and most scholars reject the Petrine authorship. No external evidence of its use is earlier than the 3rd cent. Its affinities with the Epistle of Jude are explained as borrowings from the latter; it was probably composed about the 2nd cent. The epistle may be divided into three sections: (1) introduction; (2) warning against false teachers; (3) a reply to those who deny the second coming of Christ.

Peter I., THE GREAT (1672–1725), Emperor of Russia; succeeded in 1682; sole ruler on death of brother Ivan (1696); attacked Turkey and captured Azov (1696), thus obtaining a port on Black Sea; travelled in Europe for two years, learning shipbuilding in Holland and England, and realized advantages of civilization of Western Europe, which he thereafter laboured to introduce; was recalled by the revolt of Streltzi or 'soldiery,' which he ruthlessly suppressed (1698); was defeated by Charles XII. of Sweden at Narva (1700), in attempt to partition Sweden with Poland and Denmark, but captured part of Ingria, and founded new cap., Petersburg, there (1703); defeated Swedes at Poltava, and seized Baltic provinces and part of Finland (1709), thus acquiring wide seaboard; coalition of Sweden and Turkey compelled restitution of Azov (1711); married his mistress (afterwards famous Catherine I.) in 1712; Finland wholly conquered (1713), but restored to Sweden (1721) for quitclaim of Baltic provinces, etc.; Caspian provinces wrested from Persia (1722); law passed (1722) empowering tsars to nominate successor. His reign was marred by acts of great cruelty, as exemplified in the execution of his son Alexis; yet owing to his genius Russia made enormous strides during his reign.

Life, by Barrow, Browning, Schuyler, Ragozin, Waliszewski.

Peter I., KARAGEORGEVITCH (1844–), King of the Serbs, Croats, and Slovenes; succeeded to throne of Serbia after assassination of Alexander I. (1903). Shortly after his accession he restored the constitution of 1889, which had been abrogated in 1894. In the Franco-Prussian War he fought for the French. Before the outbreak of the Great War, on account of his health, he handed over much of his power to his younger son Prince Alexander, his elder son having renounced his right of succession. He retreated from Serbia with his troops in Nov. 1915, and established government at Corfu. Restored to his kingdom in Oct. 1918, he was in same year proclaimed king of the newly formed state of Serbs, Croats, and Slovenes.

Peterborough. (1) City, Northamptonshire and Hunts, England (52° 35′ N., 0° 16′ W.), on riv. Nen; grew up around Benedictine monastery destroyed by Danes (870), rebuilt (970), burnt

(1116), and refounded (1117); cathedral has magnificent w. front (1200–38); other noteworthy buildings include episc. palace, deanery, museum, Young Men's Institute, town hall, and corn exchange; agricultural produce, bricks; railway workshops (G.N.). Pop. 33,600. (2) Tn., Ontario, Canada (44° 17′ N., 78° 24′ W.), 69 m. N.E. of Toronto; electrical machinery, breakfast foods, flour, lumber; in stock and agricultural dist.; iron, gold, mica in vicinity; only hydraulic lift lock in America is on the Trent waterway; popular resorts in vicinity. Pop. 18,300.

Peterhead, port, Aberdeenshire, Scotland (57° 30′ N., 1° 46′ W.), 44 m. N.N.E. of Aberdeen; herring and other fisheries; large red granite quarries and polishing works; harbour of refuge; convict station. Pop. 13,600.

Peterhof, tn., N.W. Russia (59° 50′ N., 29° 53′ E.), on Gulf of Finland, 19 m. W.S.W. of Petrograd; gem-cutting; agricultural implements; Great Palace of Peter I. (1720) with relics. Pop. 12,000.

Peters, KARL (1856–), Ger. explorer; founded the Ger. Colonization Soc. (1884); director Ger. E. Africa Co. (1885), but dismissed on charges of cruelty to natives (1896); led expedition for relief of Emin Pasha (1888–90); commissioner for settling Anglo-Ger. frontier in E. Africa (1892); explored country of the Zambezi (1899 and 1905); pub. *The El Dorado of the Ancients* (1902), etc.

Petersburg, city, Virginia, U.S. (37° 10′ N., 77° 22′ W.), 22 m. S. of Richmond, at head of tide-water on Appomattox R. Harbour accessible to coastwise steamers; town contains several educational and philanthropic institutions; tobacco, trunks, cotton goods, etc.; exports peanuts, tobacco, and cotton. Scene of heavy fighting during the Civil War. Pop. 24,000.

Petersfield, mrkt. tn., Hampshire, England (51° N., 0° 57′ W.), 17 m. N.N.E. of Portsmouth; church of St. Peter (partly Norman). Pop. 4,000.

Peter the Hermit, priest associated with First Crusade, which he preached and helped to lead in 1096; his army was destroyed by Turks; date of death uncertain; importance of his work exaggerated.

Peterwardein, strongly fortified tn., E. Slavonia, Jugo-Slavia (45° 17′ N., 19° 51′ E.), on Danube, opposite Neusatz; Turks defeated here by Prince Eugène (1716). Pop. 4,000.

Petiole. See LEAF.

Petition. The subject's right of petitioning has from early times been a fundamental part of the Brit. Constitution. Petitions—*i.e.*, formal requests and applications—may be addressed to the sovereign, to either House of Parliament, or to a court of law. In 1689 the Bill of Rights finally confirmed the right of petitioning the crown. Bills of Parliament used to be presented in the form of petitions to the king—*e.g.*, Petition of Right (1628). Petitions to Parliament now usually deal with questions of general policy rather than particular matters demanding redress. The Standing Orders prescribe form for such petitions.

Election petitions may be filed under Corrupt Practices Act.

Petitio Principii, begging the question; in logic, the fallacy of assuming in some covert way the proposition to be proved.

Petra, ruined city in N. Arabia (30° 19′ N., 35° 31′ E.), lying in valley near Mount Hor and surrounded by cliffs and ravines; once important caravan centre and cap. of Nabatæans; many ruined buildings to be found; most remarkable remains are treasury, temples, tombs, and dwellings hewn out of cliffs and rocks enclosing city; arch. of Gr., Roman, and Oriental types. Petra remained independent till *c.* 106 A.D., when taken by Romans; declined with rise of Palmyra.

Petrarch (or PETRARCA), FRANCESCO (1304–74), Ital. poet and humanist; one of the greatest lyric poets of all time. His life was a somewhat stormy one, due to the varied vicissitudes of Ital. political life. Destined for the law, he studied at Montpellier and Bologna, but devoted himself to class. and especially Roman letters, and in 1326 entered the priesthood. He travelled extensively and made valuable discoveries of manuscripts. In 1341 he was crowned poet laureate at Rome. Between 1343 and 1348 he lived in Avignon and various cities of Upper Italy, searching for class. manuscripts. After 1353 he was for a time at Milan with the Visconti, who sent him on various missions to Venice, Prague, and Paris. His next permanent abode was Venice, his last years being spent in the country at Arquà.

Petrarch's chief works are the epic poem *Africa*, centring round the character of Scipio, the prose historical biographies known as *De Viris Illustribus*, the prose dialogues *De Contemptu Mundi* or *Secretum*, a theological treatise breathing a certain note of pessimism, and the famous collection of letters in groups called *Variæ*, *Seniles*, *Familiares*, *Ad Veteres Illustres*, and *Sine Titulo*. But his fame as a lyric poet rests on the *Canzoniere*, sonnets to the mysterious Laura (whom he met at Avignon, and whose death he laments in his *In Morte di Madonna Laura*), the lyrical story of one of the great loves of the world's literature. Petrarch's influence on subsequent sonneteers was considerable, and may be seen in the verse of Surrey and Wyatt. See SONNET.

Jerrold, *Francesco Petrarca, Poet and Humanist* (1909); Symonds, *Renaissance in Italy* (vols. ii. and iv.).

Petrel Family (Procellariidæ), a family of marine swimming birds found in all the great oceans. They are strong swimmers, and include the storm petrel (Mother Carey's chicken), common in the North Atlantic.

Petrie, WILLIAM MATTHEW FLINDERS (1853–), English Egyptologist; during excavations in Egypt (1880–1914) discovered Gr. settlements at Naukratis and Daphnæ, inscription of Israelite war at Thebes, treasure of Lahun, etc.; founded Brit. school of archæology in Egypt (1905); prof. of Egyptology, University Coll., London, since 1892; pub. *History of Egypt* (1894–1905), *Egypt and Israel* (1910), *The*

Hawara Portfolio (1913), *Amulets* (1914), *Scarabs* (1917), *Eastern Exploration* (1919), etc.

Petrograd (formerly St. Petersburg), government, N.W. Russia (59° N., 30° E.), at head of Gulf of Finland. Surface is flat; forests cover 45 per cent. of area, and there are extensive marshes. Agriculture is backward. Area, 17,226 sq. m.; pop. 3,197,000.

Petrograd (formerly St. Petersburg), cap. of Russia (59° 57′ N., 30° 20′ E.), at mouth of river Neva where it enters the Gulf of Finland, 400 m. N.W. of Moscow. Neva and canals are frozen from the end of Nov. to about the end of April. Chief permanent bridges Nicholas Alexander and Trinity, both over Neva. Central and wealthier portions are those of a city of magnificent distances; wide, straight, very long streets, and large open spaces. Central point of street system the old Admiralty Buildings, where the Nevsky (3 m.) and Voznesensky Prospekts and Gorokhovaya Ulitsa meet. Winter Palace, an immense quadrilateral (1732–62), burnt (1837), rebuilt (1837–8), contains magnificent rooms of state. Other palaces: Old and New Mikhailovsky residences, Taurida (seat of Duma), Anitchkov, Marble or Orlov, and palaces of Dukes Vladimir and Michael. Most valuable art collections in Winter Palace and Hermitage (1765; rebuilt and greatly enlarged, 1840–52). Imperial or National Library ranks after those of Paris and London; contains Codex Sinaiticus and other priceless MSS. Library of Academy of Sciences has 500,000 vols.; univ. (founded 1819) has also large library. Many learned societies and technical schools. Observatory at Pulkowa, 9 m. S., completed 1839. Besides buildings already mentioned, architectural features include house of the Senate and Holy Synod, monument to Peter the Great (1775–82), and numerous other statues; thirteen cathedral churches, chief being St. Isaac, Kazan, St. Alexander Nevsky, St. Peter and St. Paul, the Resurrection, and the Emperor Alexander II. St. Isaac is most sumptuous; its gilded dome is central point of all city views. The Peter-Paul cathedral contains tombs of the Russian emperors. Other churches are too numerous to mention. The Gostinnyi Dvor, or Grand Bazaar, lies between the Nevsky Prospekt and the Sadovaya, forming a quarter of its own. There are also People's Theatres (first established in 1784), important hospitals, the Foundling Institute (1778), and the fortress-prison of St. Peter and St. Paul (1703).

The industrial establishments include metal works, iron foundries, sugar refineries, distilleries, breweries, shipbuilding yards, printing works; tobacco, soap, crystal and glass, cotton and cloth, leather, cordage, pottery, porcelain, and machinery are also made. Kronstadt-Petrograd Canal (1877–85) enables seagoing ships to come up to the Nicholas Bridge. Up to the revolution (1917) there were busy state dockyards. City is also connected by river, canal, and lake with the Volga and the Dnieper, and so with the Cas-

pian and the Black Sea. Six railways enter the city.

Founded (1703) by Peter the Great on drained marshes; was created imperial cap. (1712); destructive fires (1736–8), after which city reconstructed with Winter Palace as centre; relics of St. Alexander Nevsky brought to the city in 1724: and was centre of Russian political crisis in 1905, after which much civic improvement. Shortly after the outbreak of the Great War the Germanized name St. Petersburg was changed to Petrograd. See RUSSIA (*History*). Pop. said to have fallen from 1,900,000 to c. 700,000.

Petrol, one of the light oils; a mixture of hydrocarbons; distilled from petroleum at *c.* 60° C.; sp. gr. *c.* ·7; highly inflammable, and used as source of power for internal-combustion engines as fitted to motor cars, motor cycles, aeroplanes, etc.

Petrol Engines. See under MOTOR CARS (Vol. vii., p. 270).

Petrol Substitutes. (1) Coal gas under pressure slightly above that of the atmosphere contained in flexible bags. Experiments with light fabric containers on the lines of the pneumatic tyre are in progress for gas under high pressure. (2) *Paraffin*, where special heating arrangements are fitted to the carburettor or inlet pipe. Start usually made on petrol, and paraffin turned on when engine heated. Several distillates intermediate between paraffin and petrol have been used under fancy names. (3) *Benzole*, a by-product of gas making and of coking ovens, is a very good substitute. (4) ALCOHOL from vegetable waste, with or without mixture of benzole, seems the most promising substitute. The practical obstacle at present is the provision of a suitable denaturant.

Petroleum (Lat. *petra*, 'a rock,' and *oleum*, 'oil') includes all the naturally occurring hydrocarbons. It is obtained by drilling. The oil may flow spontaneously, or may require to be pumped. It is sometimes possible to induce a flow of oil by stopping the escape of the gas which issues along with the oil, so that the latter is raised by the pressure of the gas. At Baku, on the Caspian Sea, compressed air is used for raising the oil.

When a well falls off in its yield, it is usual to shock it by the explosion of a special kind of torpedo in order to increase the flow. In some cases quite dry wells can be made to resume their productiveness by the use of the torpedo. The transport of petroleum in large quantities is generally carried out by means of the pipe-line system, the oil being forced through the pipes by pumps. As the chief source of oil fuel, petroleum has assumed a place of paramount importance. Among its distillation products, the lighter portion contains cymogene (a gas at ordinary temperature, b.p. 0° C.), rhigolene (b.p. 16° C.), petroleum ether (b.p. 70–90° C.). By distilling at higher temperatures, benzoline, kerosene, paraffin oil, etc., are obtained. Over 200 different products are derived from its refining.

The Petroleum Acts of 1871 and 1879, and the Petroleum Hawkers Act of 1881, regulate

the storage, carriage, and hawking of petroleum and other similar oils. These Acts apply only to oils whose flash-point is below 73° F. See OIL.

Petrology, or PETROGRAPHY, the science of rocks, their composition, structure, history, and classification; sometimes called Lithology, it may be looked upon as a special branch of GEOLOGY. Rocks consist of mineral ingredients. The number of important rock-forming minerals is relatively small, and does not exceed a hundred. The commonest is quartz; others are felspar, mica, chlorite, kaolin, calcite, olivine, augite, hornblende, magnetite, and hæmatite. Calcite composes limestones, while quartz is found in the sandstones, and with a percentage of silica in igneous rocks. Disintegration produces constant changes in rocks, as does weathering. Some minerals are not affected by these causes, however—*e.g.*, white mica and quartz. Felspar may be changed into kaolin, and muscovite to quartz, while biotite yields chlorite and epidote. Disintegration may so affect rocks that, the essential compositions being taken away or changed, the remainder may form sand or gravel and give rise to beds.

Igneous Rocks (Lat. *ignis*, 'fire') owe their origin to volcanic action. While some of the *crystalline rocks* are composed of the same ingredients as occur in many igneous rocks, they differ so materially from lavas that they could not have been consolidated at or near the earth's surface. These include diorites, dolerites, quartz-porphyries, granites, and gabbros. The microscope reveals them to be of igneous origin. They have cooled deep down in the earth, and denudation has caused them to appear near the surface. Thus the igneous rocks are divided into two classes: the *volcanic*, or superficial, and the *plutonic*, or deep-seated. Some of the igneous rocks are crystalline or massive, others fragmentary. The former include granite, obsidian, pumice, and basalt; the latter are composed of volcanic ashes more or less closely compacted together, and are known as *tuffs*.

Sedimentary Rocks are generally the debris of pre-existing rocks which, having accumulated in seas, lakes, or upon land, have been subsequently subjected to pressure and pressed into solid form. Among these may be mentioned the sandstones, conglomerates, clays, and shales.

Organically derived Rocks.—Some rocks owe their origin to living organisms—*e.g.*, corals, limestones, lyenite beds, and chalk; others, again, may be due to remains of vegetable life, as peat and coal.

Metamorphic Rocks are rocks which have been changed by chemical action, percolation of water, or pressure. Sedimentary rocks are changed at their point of contact with igneous rocks as limestones, which become crystalline marbles, sandstones are changed to quartzites, coal to graphite, and clay to porcellanite. Nearly all such rocks are distinguished by their foliated structure. Rocks which are subjected to intense pressure become schistose and crystalline in structure,

and this applies equally to sedimentary and igneous rocks.

Some authorities form another class of rocks called the *Derivative Rocks*, because derived from other pre-existing rocks.

Harker, *Petrology for Students*.

Petropavlovsk. (1) Tn., Akmolinsk, Siberia (55° N., 69° E.), on Siberian Ry., 175 m. w. of Omsk, on riv. Ishim; cattle trade. Pop. 20,000. (2) Seapt., E. Siberia (55° N., 159° E.), on spacious harbour (Avacha Bay). Before 1856 chief station of Russian fleet in Pacific; now commercial depot of Kamchatka; exports furs. Pop. 400.

Petropolis, tn., health resort, Rio de Janeiro, Brazil (22° 40′ S., 43° 5′ W.), 28 m. N. of Rio de Janeiro; cap. of state from 1893 to 1903; cotton goods, beer, cheese, cigars. Pop. 20,000.

Petrovsk, tn., Saratov, E. Russia (52° 17′ N., 45° 16′ E.), 60 m. N.N.W. of Saratov city; tanneries, distilleries, breweries, oil works. Pop. 14,000.

Petrozavodsk, tn. and lake port, Olonets, N.W. Russia (61° 45′ N., 34° 28′ E., 190 m. N.E. of Petrograd, on w. shore of Lake Onega; cannon foundry; gunpowder factory; tanneries, brick works; iron and copper ware; seat of a bishop; school of mines. Pop. 14,000.

Pettie, JOHN (1839–93), Scot. painter, fine colourist; R.A. (1873); *The Drumhead Court-Martial, Two Strings to her Bow, The Chieftain's Candlesticks*, etc.

Petty Officers, NAVAL, members of a ship's company ranking below and next to warrant officers, and above rest of ratings. Two classes—viz., chief petty officers and petty officers. For first step promotions are made (for seamen class) from leading seamen; various crafts — *e.g.*, blacksmith, shipwright, armourer —are also represented in petty officer class. Chief petty officers, who are nominated by the commander-in-chief, include engine-room artificer, master-at-arms, and naval schoolmaster.

Petunia, genus of plants, order Solanaceæ; native to S. America; flowers funnel-shaped and blue or white; garden flower in Britain.

Petworth, par. and mrkt. tn., Sussex, England (50° 59′ N., 0° 37′ W.); tombs of the Percys in the church; Petworth House, seat of Lord Leconfield. Pop. (par.) 2,500.

Pevensey, vil. and par., Sussex, England (50° 49′ N., 0° 22′ E.), 6 m. N.E. of Eastbourne; one of the Cinque ports; remains of castle founded by Robert of Normandy; landing-place of William I. Pop. 460.

Pewter is an alloy, generally of tin and lead, long known and valued. Mugs, plates, dishes, etc., were cast or hammered from this alloy. Common pewter consists of four parts of tin to one of lead; a finer pewter contains no lead, but antimony, and a little copper and bismuth.

Pfleiderer, OTTO (1839–1908), Ger. theologian; prof. at Jena (1870), Berlin (1875); his philosophical views may be regarded as a blend of those of Hegel and Schleiermacher, while in criticism he leans towards the school of Baur; he wrote *Evolution and Theology*, and other works.

Pforzheim, tn., Baden, Germany (48° 52′ N., 8° 41′ E.),

at junction of Nagold and Enz, 16 m. S.E. of Karlsruhe; gold and silver ornaments, chemicals, paper, leather, and machinery. Pop. 69,000.

Phæton. See TROPIC BIRDS.

Phagocytosis, a term applied to the engulfing and destruction of micro-organisms and other minute bodies by certain cells of the body termed *phagocytes.* This power is possessed by minute unicellular organisms, such as the amœba, as their sole method of obtaining nutrition; in higher organisms we find phagocytic cells on the external surface and lining the alimentary tract; and in the most highly organized animals, such as man, there are many cells, fixed or wandering, which retain their power of phagocytosis, the purpose of which is to remove débris resulting from injury, inflammatory processes, etc., or foreign particles or micro-organisms.

The most important fixed phagocytic cells of the body are the large cells of the pulp of the spleen and of the lymph glands, certain endothelial cells—*e.g.*, in certain lining membranes of the body, and neuroglia cells. Of greater importance are the wandering cells, which include the white corpuscles of the blood, all of which are not, however, phagocytes, the phagocytic power being possessed by the *polymorphonuclear, eosinophil,* and *large hyaline* leucocytes, but not by the *lymphocytes.* When a foreign particle or micro-organism is taken within a cell, if it is digestible a digestive fluid is secreted by the cell, which forms a vacuole around the foreign body, digests it, and the resulting products are absorbed. But if the foreign body is not digestible, it may be retained for a time within the cell and at length discharged, or it may be killed and eventually digested, or, if it is very resistant, it may multiply and destroy the cell. See under BACTERIOLOGY; BLOOD.

Phalangers. See under MARSUPIALS.

Phalanstère. See FOURIER, FRANÇOIS M. C.

Phaltan, tn., cap. of feudatory state of same name, Bombay, India (18° N., 74° 29′ E.), 60 m. S.E. of Poona. Pop. 10,000. Area of state, 397 sq. m.; pop. 45,000.

Phanerogams. See BOTANY.

Pharisees, a Jewish religious party whose general aim was to separate the Jews from all neighbouring nations; they insisted on the eternal validity of the Law and on its traditional interpretation, but they became legalists, and in their effort to apply an unchangeable code to an ever-changing life they became casuists. Yet they preserved the Jewish religion at a critical time, and were supporters of the Messianic ideal among the people. *Chasidim,* or *Assideans,* were a party of Jews who protested against Gr. culture in the post-exilic community, and may be regarded as the progenitors of the Pharisaic party.

Pharmacology is the science dealing with the action of drugs upon the human organism, as distinct from *therapeutics,* which has reference to the application of remedies to disease. The action of drugs was for long studied

only empirically, and the ancient 'doctrine of signatures' required that the therapeutic effect of a drug be determined by its external configuration. Later it was realized that drugs possessing certain characteristics were applicable to certain classes of ailment (*e.g.*, astringents for diarrhœa), and the search for active principles began. During the present century pharmacology has made great strides, the action of drugs being much more thoroughly understood in the light of various discoveries in chemistry and physiology.

Action of Drugs.—Drugs act on the organism in various ways. The action of some is purely physical—*e.g.*, the insoluble salts of bismuth relieve gastric irritation by forming a protective lining to the stomach. Hypnotics act physically in another way: as a rule these are insoluble in water, but soluble in fats and oils; as the brain cells contain fatty (lipoid) substance, these drugs have a tendency to accumulate in the brain. Saline aperients act physically by *osmosis*—that is, by attracting water into the intestine. Other drugs act *chemically*—*e.g.*, tannin acts as an astringent by combining with the albumin of the tissues.

Most drugs, however, act directly on the protoplasm of the body-cells. Cocaine, strychnine, etc., have what is known as a *specific* action on certain nerve cells, producing the results associated with these drugs. Other drugs act injuriously on the protoplasm of disease-producing bacteria, while harmless to the body cells: a good example of this is 'salvarsan' or '606,' a compound of arsenic used against syphilis. All antiseptics have a destructive action on bacteria, but as a rule they are also destructive to the body cells, and cannot be given internally, while externally they have to be used with caution.

The action of a drug may be either *direct* or *indirect*—*i.e.*, it may exercise a direct action on a certain organ of the body, as digitalis acts on the heart; or it may cause certain alterations in the bodily functions, and thus bring about an indirect action on other organs; for example, digitalis, by stimulating the heart, improves the circulation in the kidneys, and causes indirectly a larger secretion of urine.

Drugs are classified, according to their action, in various ways. The following arrangement, given by H. C. Wood (*Pharmacology and Therapeutics:* Lippincott, 1912), is a good one, as it is based on more recent knowledge:

(1) *Drugs used to affect Secretion.*—These include: *diuretics*, which promote the flow of urine; *diaphoretics*, which produce sweating; *expectorants*, which increase the secretion of the bronchial mucous membranes; *astringents*, which diminish secretion by contracting tissue. Drugs which directly reduce secretion, such as atropine, which diminishes most of the glandular secretions, also come under this class.

(2) *Drugs affecting the Nervous System.*—Among these are *somnifacients* or *hypnotics*, which produce sleep; *anæsthetics*, which abolish sensation; *analgesics*, which relieve pain; *spinal depressants*, as bromides; *motor-*

nerve paralysants and *sensory nerve paralysants*, which act on the respective nerves.

(3) *Drugs affecting the Circulation.*—Of these we have *cardiac stimulants*, as digitalis, strophanthus, alcohol, etc.; *vaso-motor stimulants*, as nux vomica, ergot, etc.; and *blood-pressure reducing drugs*, as aconite and nitrites.

(4) *Drugs affecting the Alimentary Tract.*—These include *stomachics*, which increase the functional activity of the gastric mucous membrane (*e.g.*, gentian; aromatics); *emetics*, which produce vomiting, causing ejection of the contents of the stomach; *cathartics*, or purgatives, which act on the intestine.

(5) *Drugs affecting Metabolic Processes.*—Under this heading are grouped a number of drugs whose action is in some cases understood, but whose employment in many cases is justified only by clinical experience. Iron, arsenic, and mercury act in a manner definitely understood; the administration of glandular substances, such as thyroid, directly stimulates the gland concerned; colchicum, which is given for gout, has an action not fully understood.

(6) *Drugs acting on the Cause of Disease.*—In this class are grouped *anthelmintics*, which kill or cause the expulsion of intestinal worms; *antimalarials*, as cinchona and quinine; *disinfectants*, which kill or prevent the growth of disease-producing bacteria.

(7) *Extraneous Remedies.*—Under this head are put the special *digestants*, as mineral acids and pepsin, which have a specific action on the digestive process; *alkalis*, which are used to neutralize excessive acidity (when used for their effects on the digestive system they are termed *antacids*); *demulcents*, used for their soothing effect on inflamed surfaces, such as gum arabic, Irish moss, liquorice, and starch; *emollients*, or fatty substances which soften the skin, as lard or vaseline; *counter-irritants*, such as mustard or cantharides; *escharotics*, or caustics, which are employed for the purpose of destroying tissue.

(8) *Drugs of Minor Importance.*—In addition to these groups there are a number of drugs of minor importance, including *calmatives*, such as valerian, musk, etc., employed in the treatment of hysteria; *alteratives*—an old-fashioned group of drugs whose pharmacological action is at best doubtful, such as taraxacum and sarsaparilla; and a few drugs having specific action, such as stavesacre (to destroy lice), arnica (applied to bruises), pyrethrum or pellitory (used in toothache), and myrrh (a stimulant in affections of the mouth).

Recent research in pharmacology shows that many factors must be taken into account in determining the action of drugs. *Chemical constitution* is an important factor, but this depends as much on the arrangement or 'orientation' of the molecule as on the actual composition of the drug. For example, salicylic acid has certain effects on rheumatism; but the introduction of an acetyl group, forming acetyl-salicylic acid, gives us 'aspirin,' a drug whose properties in this respect are not only greatly in-

tensified, but have a character of their own. *Rate of absorption* is another factor. Drugs administered in a form which ensures slow absorption have a different action from the same drug when rapidly absorbed. *Colloidal condition* often affects the action of a drug (see CHEMISTRY). The employment of active principles in place of the crude drug (*e.g.*, morphine for opium, strychnine for nux vomica) has been found wanting in many respects, the crude drug often possessing other constituents which are in themselves of value. A good example of this principle is seen in tea and coffee, which could never be replaced by caffeine.

Pharmacopœia, term applied to a book pub. by an authorized body, containing a list of drugs, with their sources, physical and chemical properties, and tests for their purity; also preparations made from these drugs. The earliest Pharmacopœia pub. in this country was that of London, issued by the College of Physicians in 1618; the *Edinburgh Pharmacopœia* was first pub. in 1699; the *Dublin Pharmacopœia* in 1807. These three works were combined and unified in the first edition of the *British Pharmacopœia,* pub. in London in 1864. A second *Pharmacopœia* was pub. in 1867, and an Addendum in 1874. The third *British Pharmacopœia* appeared in 1885, with an Addendum in 1890; the fourth was issued in 1898, and an Indian and Colonial Addendum in 1900. The present edition of the *British Pharmacopœia* is the fifth—pub. in 1914 and amended in 1918. It is issued by authority of the General Medical Council, and the standards set therein are regarded as legal under the Food and Drugs Act. Most countries have now national pharmacopœias pub. by the respective governments, the *Pharmacopœia* of the U.S., however, being issued under authority of a commission of medical and pharmaceutical societies. There are many semi-official and unofficial pharmacopœias—*e.g.*, the *British Pharmaceutical Codex,* pub. by the Pharmaceutical Soc. in 1911, with an Addendum in 1915; the *Extra-Pharmacopœia,* by Martindale and Westcott, the 17th ed. of which was pub. in 1920; and Squire's *Companion to the British Pharmacopœia,* the latest edition of which appeared in 1916. Most large hospitals publish their own pharmacopœias.

Pharmacy, the art of preparing drugs and of compounding and dispensing physicians' prescriptions. The word is also applied to the premises in which such work is done, and the person qualified to practise pharmacy is entitled by law to call himself a *pharmacist.* Early in the 17th cent. the *apothecaries,* who were the compounders of medicines, as contrasted with the *druggists* who merely sold drugs, obtained a charter, and by the end of that century had begun to prescribe and to take upon themselves the duties of physicians. They several times attempted to obtain legal control over the chemists and druggists, who eventually met this attitude by forming the Pharmaceutical Soc. of Great Britain, which re-

ceived a Royal Charter of incorporation in 1843 to protect their interests and to organize an adequate system of education in pharmacy.

In 1852 a Pharmacy Act was passed, establishing a register of persons practising pharmacy, while the Act of 1868 made it illegal for unregistered persons to call themselves 'chemist' or 'druggist,' or to keep open shop for the sale of poisons mentioned in the Act. A decision by the House of Lords to the effect that corporate bodies, not being 'persons,' did not come under the scope of the Act in so far as the use of the name 'chemist' was concerned, led to the Poisons and Pharmacy Act of 1908, wherein it is enacted that a corporate body may use the title 'chemist' or 'druggist' provided the person actually effecting the sale of poison is duly qualified. In this Act individual qualified persons only are entitled to use the title of 'pharmacist,' and the schedule of poisons has been revised and amplified.

The Pharmaceutical Soc. controls the education and examination of persons desirous of qualifying under the Act. Persons qualified by examination are entitled to call themselves 'chemist and druggist' or 'pharmacist' and may join the Pharmaceutical Soc. as members (M.P.S.).

Pharomacrus. See TROGONS.

Pharyngitis, inflammation, frequently chronic, of the mucous membrane of the PHARYNX, or upper part of the throat, and of the soft palate, usually due to unhygienic surroundings, exposure to cold and damp, a debilitated condition, anæmia, or digestive disorders, or associated with a tendency to gout or rheumatism. It may often be due to speaking too much (especially in school teachers or clergymen), or to excessive smoking. ADENOIDS are a form of chronic pharyngitis with adenoid vegetations and granulations. The treatment of acute pharyngitis is to apply a cold compress externally, with warm gargles of sodium bicarbonate or weak alum to relieve congestion. In chronic forms the practice is to remove cause of irritation, gargle regularly with a pinch of common salt or alum in water, or spray locally with menthol, astringent paints (*e.g.*, silver nitrate, 20 grs. to the oz.) later. Tonics, cod-liver oil or iron, and a change of air are recommended.

Pharynx, the funnel-shaped pouch lying above the gullet or œsophagus, is of similar anatomical structure to the gullet, but has seven openings into it. These are the two posterior nostrils, the two Eustachian tubes, the large opening into the mouth, the laryngeal slit, and inferiorly the opening into the œsophagus, which is continuous with it below. Between the pharynx and the oral or buccal cavity are the uvula, above; at each side the pillars of the fauces, with the tonsils between them; and below, the epiglottis, at the back of the tongue. Posteriorly the pharynx is loosely attached to the spinal column, and the larynx lies in front of its lower portion.

Phascolomyidæ, wombats. See MARSUPIALS.

Phasianidæ. See PHEASANT FAMILY.

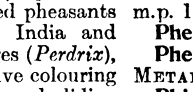
Pheasant Family (Phasianidæ), large and important family of game birds, widely distributed throughout the Old World, the majority being of Oriental origin. They are birds of splendid colouring, especially the males, and are characterized by long and wedge-shaped tail, spurred legs, and absence of feathers on sides of head; they often bear combs or wattles. Amongst them are the true pheasants (*Phasianus*), a familiar (introduced) sporting bird in Britain, while other handsome genera are the golden pheasant (*Chrysolophus pictus*), the Argus pheasant (*Argusianus argus*), and the horned pheasants or tragopans of N. India and China. The partridges (*Perdrix*), with mottled protective colouring and alternate beating and gliding flight, range over a wide area in Europe and Asia, while one species is a Brit. resident. The quail (*Coturnix*), though less in size, resembles the common partridge, but has a peculiarly distinctive note. It is a visitor to Britain, but ranges throughout Europe, N. Asia, and India, and winters in Africa. Most wonderful of all are the showy peacocks (*Pavo*), of which three species are known, all of which hail originally from the Far East.

Pheidias (*c.* 490–432 B.C.), the greatest sculptor of ancient Greece; *b.* Athens. He executed a number of splendid statues for Athens, including an ivory and gold figure of the goddess Athena. A colossal figure of Zeus at Olympia was considered his masterpiece. Fragments of his work are among the Elgin Marbles in the Brit. Museum.

Waldstein, *Essays on the Art of Pheidias* (1885); Collignon, *Phidias* (1886).

Phenacetin, $C_6H_4(OC_2H_5)NHCOCH_3$, an acetic acid derivative of phenol. It forms sparingly soluble scaly crystals, and is employed in med. as an antipyretic and for the relief of pain.

Phenacodus. See under Horse Family.

Phenazines, yellow solids, forming blue or red solutions in sulphuric acid, and yielding derivatives which are dyestuffs; phenazine itself is  ; m.p. 171° C.

Phenol. See Carbolic Acid.

Phenomenalism. See under Metaphysics.

Phidias. See Pheidias.

Philadelphia, cap. of Pennsylvania, U.S. (39° 57′ N., 75° 9′ W.), on Delaware R., at mouth of the Schuylkill (here spanned by some twenty-five bridges), 85 m. S.W. of New York; level site; streets laid out on gridiron plan; chief park, Fairmount (3,341 ac.), with fine Washington monument; fine zoological garden adjoining; large buildings include new city hall, Masonic temple, U.S. mint, and post office; stations of the Pennsylvania and the Baltimore and Ohio Railways are handsome structures; municipal library; univ. of Pennsylvania; numerous medical and other schools and colleges; 10 m. W.N.W. is the famous women's coll. of Bryn Mawr. Important commercial and manufacturing city; foundry and machine-shop products, shipbuilding (Cramp); refining of sugar, molasses, and petroleum;

locomotives (Baldwin works); carpets, rugs, and clothing. Chief exports: petroleum, Indian corn, coal, meat, cattle, wheat, and flour. Principal facilities for foreign and coastwise commerce of port extend along 20 m. of Delaware front. City founded by W. Penn in 1682; Declaration of Independence adopted here (1776); cap. of Union (1790–1800); great international exhibition (1876); damaged by storm (1878); labour riots (1910). Pop. 1,549,000.

Philæ, island in the Nile, Egypt (24° 1′ N., 32° 47′ E.), near Assuan Dam; covered with interesting temples and other buildings, of which most notable are the great columned hall known as 'Pharaoh's bed,' and the temple of Isis; these are sometimes submerged by waters of the Dam.

Philately, or TIMBROLOGY, a name suggested by Herpin of Paris (1865) for the systematic collection of postage stamps. The craze started shortly after the appearance in 1840 of the '1d. black' and 'Mulready envelope' of Sir Rowland Hill. From a mere hobby, it has now developed into a scientific pursuit, cultivated by numerous societies, the Royal Philatelic Soc., London, being the chief Brit. one, and possessing a large body of literature. Many famous collections have been made, notably those of King George v., M. La Rénotière, and Mr. T. K. Tapling, who bequeathed his collection to the Brit. Museum, where it is now housed.

Creeke, *Stamp-Collecting* (1914); Hardy and Bacon, *The Stamp-Collector* (1898); Bacon, *Reprints of Postal Adhesive Stamps* (1899).

Philemon, EPISTLE TO, a personal letter written by Paul to his friend Philemon, with whom he had worked probably during his stay in Ephesus, in which he refers to the loyalty and love of Philemon to Jesus Christ and all the saints, and requests him to take back the runaway slave Onesimus, who had sought Paul's help and had been brought by him to a knowledge of Christianity. The epistle was written in Rome, during Paul's imprisonment, and may be thus divided: (1) greeting; (2) thanksgiving for Philemon's loyalty and love; (3) the request on behalf of the slave Onesimus; (4) hopes of freedom, when he will visit Colossæ; (5) salutation and farewell.

Martin, *Century Bible;* Vincent, *International Crit. Commentary.*

Philemon and Baucis. See under BAUCIS.

Philip, the Apostle, is often confused with Philip the Evangelist (Acts 6 : 5); mentioned several times in St. John's Gospel, in which an account is given of his call (1 : 43–46); his estimate of the needs of the famished multitude (6 : 5–7); his conveyance of the request of the Greeks to Jesus (12 : 20–22), and his request for an actual appearance of God (14 : 8*f.*).

Philip II. (382–336 B.C.), King of Macedon; father of Alexander the Great; studied military science under Epaminondas and Pelopidas; deposed his brother's infant son (359) and seized the throne; conquered several Gr. cities on Macedonian border, and founded Philippi (358); capture of Olynthus inspired Olynthiac

orations of Demosthenes, who saw that Philip meant to make himself master of Greece; conquered Phocis (346) and Thrace (342–1); was chosen by Amphictyonic Council to punish Locrians of Amphissa for sacrilege, and routed Athens and Thebes at Chæronea (338), thus becoming supreme in Greece.

Philip I. (1052–1108), King of France; succeeded (1060); his vassal, William, Duke of Normandy, made himself stronger than crown by conquering England; but Philip, though reputed lazy and debauched, always held his own against Normandy; excommunicated for evil living (1094), but refused to repudiate wife; annexed Vermandois, Vexin, Valois, and bought Bourges.

Philip II., or PHILIPPE AUGUSTE (1165–1223), King of France; succeeded (1180); married Isabella of Hainault, descendant of Carolingians, and thus strengthened Capetian dynasty; wrested Vermandois from Count of Flanders; subdued Duke of Burgundy (1186), and established strong rule; ambitious of conquering Normandy; aided sons of Henry II. in revolt; went on Third Crusade (1189), but returned prematurely in order to prosecute his designs against Richard's Fr. possessions, planning to divide them with John; later aided Arthur against John, and finally (1204) united Normandy, Anjou, Touraine, and Poitou to France; defeated Emperor Otho at Bouvines (1214), thus consolidating his power. Philip was the greatest of the Capetians; gave France unity. See FRANCE (*History*).

Life, by Hutton.

Philip IV., LE BEL (1268–1314), King of France, succeeded (1285); was defeated by Flemings at Courtrai (1302), the 'Day of Spurs'; reign is chiefly remarkable for struggle with Papacy arising from Philip's taxation of clergy. Ultimately Philip seized Boniface VIII., and after his death secured election of Fr. pope, Clement V., the papacy migrating to Avignon four years later (1309). His reign is of greatest constitutional importance.

Philip VI. (1293–1350), King of France, son of Charles of Valois, younger brother of Philip IV.; succeeded in 1328; won great victory over Flemings at Cassel (1328), but was unfortunate against English during early stages of Hundred Years' War, which began in 1337; important acquisition of Dauphiné (1349). See FRANCE (*History*).

Philip II. (1527–98), King of Spain; married Mary of Portugal (1543), Mary I. of England (1554); his father, Charles V., abdicated (1556), and Philip became chief monarch of Christendom; defeated French at St. Quentin and Gravelines, and after peace of Cateau-Cambrésis (1559) devoted himself to counter-Reformation movement; he lost northern Netherlands through persecution of Protestants; his failure to conquer England in 1588 marked the beginning of decline of Spain, and his attempt to secure subservience of France through the Guises and Catholic League was foiled by Henry of Navarre. Though he acquired the throne of Portugal (1580), his narrow-minded bigotry proved disastrous to his country.

Philip III. (1578–1621), King of Spain, son of Philip II.; succeeded in 1598. Decline of Spain continued in his reign; expulsion of Moors (1609); alliance with Austrian Habsburgs, later involving Spain in Thirty Years' War. Government left to Lerma, who made alliance with France and negotiated with James I. of England for marriage treaty. Truce with United Provinces (1609), practically acknowledging their independence.

Philip IV. (1605–65), King of Spain; was much under influence of Olivarez, and later of less worthy favourites; intervened in the Thirty Years' War with disastrous effect; lost Portugal (1641); was defeated by French at Rocroi (1643), and by peace of Pyrenees (1659) had to cede Roussillon, Cerdagne, and Artois to France; was largely responsible for fall of Spain.

Philip V. (1683–1746), King of Spain, grandson of Louis XIV.; founded Spanish Bourbon dynasty; became king (1700), and thus brought about Span. Succession War. See SPAIN (*History*).

Philip the Bold (1342–1404), Duke of Burgundy (1363); was younger son of John of France; won title *le hardi* by gallantry at Poitiers (1356); led French against English (1372); crushed large Flem. army at Rosbeck (1382); inherited Artois, Burgundy, Flanders, etc. (1384), and developed their resources; ruled France for Charles the Mad.

Philip the Good (1396–1467), Duke of Burgundy; was driven by the assassination of his father, John the Fearless, to support Henry V., and did much to assist English; drove bargain with France (1435), and aided in expulsion of English; crushed Ghent rising with terrible slaughter (1454); was the most powerful ruler of his time in Europe.

Philip, SIR ROBERT WILLIAM (1857–), Scot. physician, authority on tuberculosis; founded the first tuberculosis dispensary (1887); took lead in establishing the Royal Victoria Hospital for Consumption and Farm Colony, Edinburgh; his co-ordinated scheme now adopted nationally in campaign against tuberculosis; pub. various works bearing on this subject.

Philippeville, seapt., N. coast, Algeria (36° 52′ N., 6° 53′ E.), 40 m. N.N.E. of Constantine; it exports wine, sheep, cattle, cereals, esparto grass, minerals, and cork. Pop. 27,000.

Philippi, city, anc. Macedonia (41° 2′ N., 24° 17′ E.); scene of victory of Octavianus and Antony over Brutus and Cassius (42 B.C.); visited by Apostle Paul, who addressed an epistle to its inhabitants.

Philippians, EPISTLE TO THE, one of the epistles of Paul, written during his imprisonment at Rome to the church at Philippi, which he had founded on his second missionary journey (Acts 16 : 12–40), and probably the last letter which he wrote to a church. Its immediate occasion was the fact that Epaphroditus had brought some money which had been collected in Philippi for the assistance of the apostle. The letter, with its touches of self-revelation and cordial intimacy, combined with a strain of deep spiritual feeling,

may be said to touch the high-water mark of epistolary literature. The divisions of the epistle are as follows: (1) Paul's thankfulness and prayer to God for the Philippians; (2) his readiness to glorify Christ; (3) how his friends may help him; (4) prospects of visits from Timothy, later from himself, and the immediate return of Epaphroditus; (5) his warnings and exhortations; (6) his acknowledgment of the help sent him from the Church at Philippi, and salutations.

Moule, *Cambridge Bible;* Martin, *Century Bible;* Strahan, *Westminster New Testament.*

Philippine Islands, large group of over 3,000 islands and islets in Pacific Ocean, belonging to U.S. (4° 40′–21° 10′ N., 116° 40′–126° 34′ E.); bounded N. and W. by China Sea, E. by Pacific, S. by Celebes Sea; largest islands are Luzon in N., Mindañao in S., Mindoro, Samar, Leyte, Cebú, Negros, Panay, Masbate, Bohol in centre, and Palawan and Balabac in W. Coast-line (over 11,000 m.) is broken, with numerous gulfs and bays; coral reefs, especially on the E. Chief rivers are Cagayan, Pampanga, on Luzon; Agusán, Mindañao, on Mindañao; Mindañao has lakes Lingausan, Buluan, and Lanao (an extinct crater). The group is connected by submarine ridge with Borneo and Celebes; traversed by high mountain ranges (mostly volcanic); highest peaks are Mount Apo (10,312 ft.) on Mindañao, Halcón (8,850 ft.) on Mindoro, Mayón (8,280 ft.) on Luzon; there are twelve active volcanoes and several extinct ones. The islands are subject to frequent earthquakes, heavy rains, and violent hurricanes (typhoons); climate fairly healthy. Vegetation is luxuriant; immense forests of valuable timber. Fauna includes buffalo, boar, deer, antelope, water-buffalo (caraboa), etc.; mammals scarce; numerous birds, bats, reptiles, sea and land turtles; fish abound; beautiful and varied land, fresh-water, and marine molluscs. Chief products and exports are sugar, coffee, hemp, rice, tobacco, copra, cigars, indigo, timber, edible birds' nests; gold, iron, lignite, copper, sulphur, petroleum, rock-salt, gypsum are found; but mineral resources have as yet hardly been developed; extensive pearl fisheries. Railways (757 m.) on Luzon, Panay, and Cebú have been completed, and some are under construction. Education is advancing under Amer. rule; St. Thomas Univ. at Manila; also industrial and trade schools, etc. Natives are mostly of Malayan origin, Negritos and Indonesians; chief tribes are Visayan, Tagálog, Bicol, Mows, Ingorrotes, etc. Principal towns are Manila (cap.), Cebú, and Iloilo.

Islands were discovered by Magellan (1521), and named San Lazarus Islands; first Spanish settlement established, 1565 (San Miguel on Cebú); Manila founded (1571); the present name dates from 1543, in honour of Philip II.; Manila taken by British (1762), and held until 1764; revolts against Span. rule (1872, 1896); scene of hostilities during Span.-Amer. War; ceded to U.S. (1898); Filipino rising under Aguinaldo (1899), which ended


PHILIPPINE ISLANDS
English Miles
0 50 100 200
PACIFIC OCEAN
SOUTH CHINA SEA
SULU SEA
CELEBES SEA
LUZON
MINDANAO
PHILIPPINE ISLANDS (United States)
PALAWAN (PARAGUA)
SULU ARCHIPELAGO
NTH BORNEO
Batanes or Bashi Is
Batan I
Balingtang Channel
Babuyan Is
Luzon
Vigan
Lingayen
Manila
Corregidor I
Catanduanes
Mindoro
Samar
Leyte
Cebu
Negros
Panay
Guimaras
Masbate
Ticao I
Sibuyan
Romblon
Tablas
Busuanga
Calamianes
Cuyo Is
Cagayancillo
Cagayan Is
Balabac
Balabac Str
Puerto Princesa
Victoria Peak
Tawi Tawi Is
Sibutu or St Maria B
Basilan
Zamboanga
Cotta Bato
Davao
Sarangani Is
Butuan
Surigao
Siargao
Dinagat
Bongao
Jolo
Sulu
Tawitawi
Nanusa Is
Talaur Is
Cape Sangi
Batchelor Edin.

with latter's capture (1901); military government abolished (1901). Islands were then administered by civil governor, assisted by mixed commission of Americans and natives and Philippines Assembly. U.S. Act of 1916 provided for autonomous form of government. Gov.-gen., vice-governor, auditor, and deputy-auditor are appointed by president of U.S.; senate and house of representatives are elective. The Filipinos are now demanding a scheme of self-determination (Oct. 1920). Area, 121,935 sq. m.; pop. *c.* 11,000 Europeans and Americans, 35,000 Chinese, and *c.* 9,000,000 natives.

Crow, *America and the Philippines* (1914); Worcester, *The Philippines, Past and Present* (1914).

Philippopolis, or FELIBI, city, E. Rumelia, Bulgaria (42° 3′ N., 24° 53′ E.), 97 m. W.N.W. of Adrianople, on Maritza; mosques, museum, national library; seat of Bulgarian, Greek, and R.C. bishops; on fruitful plain producing rice, wine, mulberries; silk, cloth, woollens, leather, and tobacco. Cap. of Thracia in Roman times; almost destroyed by earthquake (1818); occupied by Russians (1878). Pop. 48,000.

Phillips, F. C. (1849–), Eng. novelist and dramatist; novels: *As in a Looking-Glass, Jack and Three Jills,* etc.; plays: *The Dean's Daughter, John Chetwynd's Wife,* etc.

Philistines, people of Canaan inhabiting strip along Mediterranean from Ekron to Egypt; supposed originally Indo-Germanic stock migrated from Crete before settlement of Israelites; in language and institutions they seem to have become assimilated with the Semites; relatively well civilized and of high military capacity. Five centres of government: Ashdod, Gaza, Ashkelon, Gath, and Ekron—each with own satrap. Worshipped Dagon and Beelzebub. Not subjugated by Joshua; harassed Israel in time of the Judges and of the Kings. Never very strong after time of David, they disappeared ultimately as a nationality in the invasions of Assyria and Egypt. Gave name (Palestine) to whole country.

Sir G. A. Smith, *Historical Geography of the Holy Land.*

Phillip, JOHN (1817–67), Scot. painter, famed for his Span. pictures; in breadth and virility approaches Velazquez; his best known works are *Collecting the Offering at a Scottish Kirk, La Gloria* (National Gallery, Edinburgh), and *The Promenade* (National Gallery, London).

Phillips, STEPHEN (1868–1915), Eng. poet and dramatist; his *Poems* (1897) won *Academy* first prize; other poetical works include *Marpessa* (1890), *Christ in Hades* (1896), *The New Inferno* (1910); and plays: *Paolo and Francesca* (for Sir George Alexander), *Herod, Ulysses, The Sin of David, Nero, The Lost Heir.*

Phillipsburg, tn., New Jersey, U.S. (40° 38′ N., 75° W.), on Delaware R., 53 m. N. of Philadelphia; fine water power; has foundry and machine shop products, mining machinery and tools; railway workshops; silk and pulp mills. Pop. 14,000.

Phillpotts, EDEN (1862–), Eng. novelist; was a clerk in an insurance office from 1880,

to 1890. Most of his novels deal with Devonshire, typical examples being *Children of the Mist* (1898), *The River* (1902), *The American Prisoner* (1904), *The Secret Woman* (1905), *The Portreeve* (1906), *The Mother* (1908), *The Thief of Virtue* (1910), *The Forest on the Hill* (1912), *Widecombe Fair* (1913), *The Judge's Chair* (1914), *Old Delabole* (1915), *The Spinners* (1918), *Storm in a Teacup*, and *Evander* (1919); has also written plays and some excellent stories of boyhood, including *The Human Boy* (1899), *The Human Boy Again* (1908), and *The Human Boy and the War* (1916).

Philo (*b. c.* 20 B.C.), Jewish philosopher. lived at Alexandria, and was forerunner of Alexandrian school. His philosophy blends Platonism and Judaism.

Drummond, *Philo Judæus*.

Philolaus. See PYTHAGORAS.

Philology, the study of languages, especially as regards their historical development and their mutual points of contact, their internal structure and external groupings. Though it has of late acquired a new form, it is an old science, pursued with good results in anc. Greece, in Alexandria, and in Rome. It lay dormant till the Renaissance, when it acquired a great impetus, especially in Italy, France, and Germany. The great names in this period were Budé in France, Lambin and Muret in Italy, Scaliger and Casaubon, who eventually settled in England, Justus Lipsius of Louvain, and Erasmus.

The beginnings of *comparative philology* were an attempt, often repeated but without much success at the time, to establish a common origin of Greek and Latin, possibly in Hebrew. In 1786 an Eng. scholar, Jones, published conclusions ascribing a common origin to Greek, Latin, Gothic, Sanskrit, and Celtic, and his work, taken up by Franz Bopp, and later by Jakob Grimm, became the foundation of the modern science of philology. Grimm in particular crystallized much of the loose knowledge of his day, and gave his name to that law of philology which, so far as Teutonic languages are concerned, absolutely revolutionized the scientific study of languages. See GRIMM'S LAW. This discovery led to a much stricter investigation into the phenomena of philology and the placing of this as of other sciences under definite general laws.

One of the results of this was a much more accurate classification of the languages of the world than had been possible before, though philologists differ as to the principle on which classification should be made. Some would distinguish between isolating, agglutinative, and inflectional languages, but it is perhaps best to rest satisfied with the actual grouping of history, and arrange languages according to their genealogical connections. Among the best-determined linguistic families are: (1) Indo-European, including Sanskrit, Persian, Greek, Latin, French, German, English, Norse, Welsh, Gaelic, etc.; (2) Semitic, including Arabic, Hebrew, Assyrian, Aramaic, Ethiopic, etc.; (3) Indo - Chinese, including

Chinese, Tibetan, Siamese, etc.; (4) Ural-Altaic, including Turkish, Hungarian, Finnish, etc.; (5) Dravidian, in S. India, including Tamil, Telugu, etc.; (6) Malay-Polynesian; (7) Bantu, in S. Africa, including about 150 languages.

Friedrich Müller, *Einleitung in die Sprachwissenschaft* (4 vols. 1876–88); Sayce, *Introduction to the Science of Language* (1883); Whitney, *Language and the Study of Language* (1884); Paul, *Principles of the History of Language* (1891); F. Max-Müller, *Science of Language* (1891); Skeat, *Philology* (1905).

Philosopher's Stone. See ALCHEMY.

Philosophy, in the widest sense, is the reference of any set of phenomena to its determining principles, *e.g.*, the philosophy of invention, of digestion, natural philosophy; in its technical sense, practically equivalent to metaphysics, an account of the fundamentally real, of the laws applying to all phenomena. The meaning and scope of the term have varied in different ages and among different writers. It was first used by Pythagoras as the disinterested pursuit of knowledge. All branches of knowledge were at first parts of philosophy; thus Aristotle included mathematics and physics in its scope. Later, as knowledge increased, the special sciences became independent, and the task of philosophy was to co-ordinate the principles of each science, to harmonize the claims of their postulates, so far as conflicting. Further, since Gr. thought sought the real substance underlying the phenomena of sense, philosophy approximated to ontology—the science of being as being. If, however, as by modern empiricists, it is held that sensible objects and their laws may be known, but not any ultimate ground beyond phenomena, that things *are* only as they are *known*, philosophy then becomes epistemology—an examination of the forms and categories of human thought. And great stress is laid on epistemology, even by those who oppose this scepticism and seek the ultimate end of the universe. Besides these inquiries, philosophy is taken to include logic, ethics, æsthetics, psychology, sociology, philosophy of law, of religion, of history. Certain of these have two aspects, and only as far as they deal with the fundamental nature of existence are they strictly parts of philosophy; in other respects, they are separate sciences. Thus, psychology is experimental science and philosophical investigation of the knowing mind; ethics is natural history of moral ideas, metaphysical theory of obligation; æsthetics is branch of physiological psychology and a philosophy of the beautiful.

Croom Robertson, *Elements of General Philosophy* (1896); Sidgwick, *Philosophy: its Scope and Relations* (1902); W. R. Sorley, *A History of English Philosophy* (1920).

Philostratus, FLAVIUS (C. A.D. 170–250), Gr. rhetorician; taught at Athens and Rome; author of *Life of Apollonius of Tyana, Lives of the Sophists,* etc.

Philtre, a supposedly love-compelling magic potion or charm,

common in decadent Greece and Rome, in mediæval Europe, and still in use in the East; probably a powerful aphrodisiac.

Phiz. See BROWNE, H. K.

Phlebitis, or inflammation of a vein, has a double connection with thrombosis, since a thrombus leads to inflammation of the adjacent vein wall, and, on the other hand, an inflammatory condition of the lining membrane of the vein induces thrombosis. The condition is painful, and is very dangerous if the thrombus be septic, or if it be loosely attached to the vein. In the latter case the clot may be carried to the heart by the blood stream, and give rise to embolism. Varicosity and weakness of the vessel walls predispose to the affection, and puerperal patients are liable to a form of phlebitis known as 'white leg.' The most essential part of the treatment is continued rest until the thrombus is organized and firmly adherent to the vein wall. Soothing applications may also be applied locally.

Phlox, a genus of hardy plants belonging to order Polemoniaceæ; have salver-shaped corollas with five equal petals; some of species are large-growing border plants, others being of a dwarf creeping habit suited for rockeries.

Phocæna. See under DOLPHIN FAMILY.

Phocidæ. See SEALS.

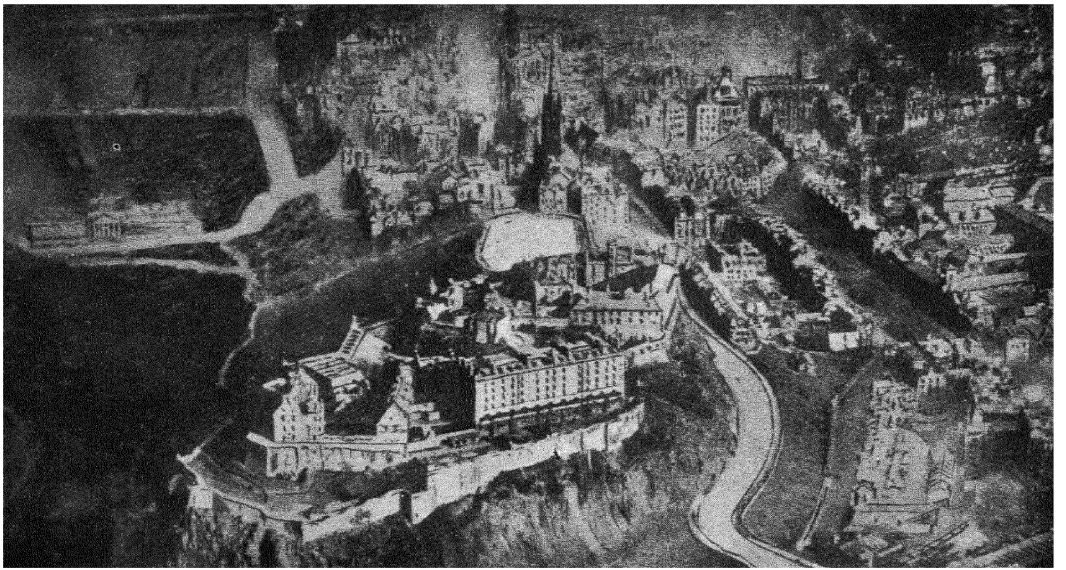
Phœbus. See APOLLO.

Phœnicia, coast region, Syria (*c.* 32°–36° N., 34° 45′–36° 30′ E.). Like the rest of Syria, Phœnicia was under the overlordship of Egypt from about the beginning of the 16th cent. B.C., and suffered from the invasions of Hittites from Asia Minor in the two following centuries. Egyptian rule began to decline soon after death of Amenhotep III. (*c.* 1392), owing partly to religious innovations of his successor, and partly to continued aggression of northern invaders. Soon afterwards Phœnicia ceased to be a dependency of Egypt, and became a flourishing and independent country. Tyre and Sidon became most important cities, but colonies were also established on the Mediterranean islands and the coasts of N. Africa, as at Carthage, Hippo, Utica, Tripoli. The Phœnicians were a trading and colonizing race; they are said to have had dealings with Solomon, and to have visited Britain in search of tin.

The country was invaded by Assyrians under Assur-nazir-pal in 9th cent. B.C., and from this time till late in the 7th cent. was a dependency of Assyria; Assyrian period was at first marked by peaceful prosperity, but in 8th and 7th centuries numerous revolts took place, and about 630 Phœnicia again became virtually independent. Subdued by Nebuchadrezzar (*c.* 605 B.C.), Phœnicia became part of Babylonian Empire, in the conquest of which by Cyrus of Persia it was included (537 B.C.). As part of the Persian Empire, the various states were ruled by their own princes, and the country enjoyed considerable prosperity; it was still dependent on Persia at the coming of Alexander the Great in 333 B.C., after whose victory at Issus several of the states at once surrendered; Tyre, how-



PHŒNICIANS TRADING WITH THE EARLY BRITONS.
(From the painting by Lord Leighton, P.R.A. In the Royal Exchange, London. By permission of the Gresham Committee.)



AERIAL PHOTOGRAPHY—EDINBURGH CASTLE LOOKING EAST.
(Aerial Photos, Ltd., Edinburgh.)

ever, opposed Alexander, and was besieged, and after a magnificent resistance compelled to submit to the conqueror. The decline of Phœnician trade begins about this time, when Gr. colonies were planted everywhere on Mediterranean coasts.

After Alexander's death part of Phœnicia passed to Egypt, and afterwards belonged, for a short time in the 3rd cent. B.C., to the Seleucids; most of it subsequently came into the possession of the Ptolemies, and in 1st cent. B.C. the whole was among the dominions of Tigranes of Armenia. It was conquered by Pompey in 64 B.C., and became part of the Roman province of SYRIA, with which its subsequent history is coincident.

Phœnicians were of Semitic race; they acted as the carriers of the world, and had large distributing trade between E. and W.; among their most important industries was dyeing with Tyrian purple, which was obtained from the murex; linen weaving, glass making, and metal working were also carried on. Most of their arts and crafts were taken from other nations; and the fact that they spread abroad so much useful knowledge is their chief claim to the gratitude of the world. Ægean civilization is supposed to have been derived from contact with the Phœnicians, who in passing on the knowledge derived from Egypt and Babylonia, and possibly also in passing on the alphabet, form an important link in the chain of civilization.

Rawlinson, *Phœnicia* (1889), and *History of Phœnicia* (1889).

Phœnix, a southern constellation, located between Grus and Eridanus by Bayer in 1603; principal stars form a curved line.

Phœnix. See DATE-PALM.

Phœnix, city, Arizona, U.S. (33° 20′ N., 112° W.), 100 m. N.E. of Tucson; winter resort; fine public buildings; trade in fruit, live stock, and mining products. Pop. 11,100.

Phœnix Group, eight small Brit. islands in W. Pacific (3° 11′ S., 170° 40′ W.), about 1,200 m. N.E. of Fiji. Area, 16 sq. m.; pop. 60.

Phœnix Park. See DUBLIN.

Phœnixville, town, Pennsylvania, U.S. (40° 7′ N., 75° 30′ W.), at mouth of French Creek, 23 m. N.W. of Philadelphia; large iron mills, blast furnaces, bridge and boiler works; graphite and plumbago in vicinity. Pop. 10,700.

Pholas. See under LAMELLIBRANCHIATA.

Phonetics is the science of speech sounds, or of voice—*i.e.*, embracing articulate and inarticulate sounds—but the former signification is the more general. The science has many immediate applications. By phonetics a correct pronunciation of foreign languages is best acquired, defects of speech are remedied, and the deaf and dumb are taught articulate speech. In this last department marvellous progress has been made in recent years. Moreover, the phonetician can by phonetic symbols register speech in languages that have no written form. In phonetics there are two methods of procedure. The external method

describes the effect of sounds on the ear of the listener. (The descriptions of sounds by this so-called acoustical method are often vague, but for testing and comparing the method is very useful.) The internal method describes the position occupied by the vocal organs in the production of sound. This latter method is usually adopted. A detailed knowledge of anat. of the vocal organs is necessary.

Speech sounds fall into two main classes: (1) sounds which are produced by the passage of the breath through the mouth; (2) sounds which are produced by the passage of the breath through the nose. These may be combined, as in the Fr. nasalized vowels. Numerous subdivisions of sounds produced by these two methods are determined by the extent and nature of the check to which the breath passage is subjected—*e.g.*, in vowel sounds the breath has a more or less free passage through the throat and mouth, in the sound *f* there is an observable friction, and in the sound *p* the passage is blocked.

The following are the principal groups of articulate sounds: (1) *Stop Consonants*, where the passage of the breath is blocked and then released (*p, t, k, b, d, g*); (2) *Spirant Consonants*, where the stream of breath is checked by the lips and point or back of the tongue (*f, wh, th, kh, v, w, dh, gh*); (3) *Sibilants*, where the blade of the tongue acts on the passage (*s, z, sh*, and *zh*); (4) *Nasals*, where the mouth passage is closed by the lips or tongue, and the breath escapes by the nasal passage (*m, n, ng*); (5) *Vowel* sounds, which depend on the point of articulation of the tongue (tip, blade, or back) and its vertical position (high, middle, and low). The part played by the lips and nasal passage is also taken into account. The beginner in phonetics should first learn to isolate sounds and then to analyze them patiently. Various mechanical appliances are used in determining the position of the vocal organs—*e.g.*, the laryngoscope (a mirror inserted in the mouth and throat), the X-rays, the palatogram (a thin plate inserted in the mouth which takes a chalk impression of the point of contact). The sounds are then registered by adequate phonetic symbols.

Phonograph. See TALKING MACHINES.

Phonography. See under SHORTHAND.

Phonolite, or CLINKSTONE, an igneous rock, consisting essentially of sanidine and nepheline; usually also contains some form of augite, hornblende, or biotite; splits easily into slabs which, when struck with hammer, give metallic ring or clink, hence other name; is found in Germany, Bohemia, France, and Italy.

Phormium, a genus, included in the Liliaceæ, which possesses isobilateral leaves. These are very resistant in character, the fibre termed New Zealand flax being derived from those of *Phormium tenax.*

Phoronidea, class of animals containing only the genus *Phoronis* with about six species. They are small marine animals which build leathery tubes encrusted with particles from the sea-

floor, diatoms, sponge spicules, sand grains, and such like. Several tubes are associated in a colony, though there is no organic connection between individuals. The animal itself is 'worm'-like, with an elongated body, crowned by a horseshoe-shaped group of tentacles within which lies the mouth. The individuals are hermaphrodite, and the development from the larva (Actinotrocha) to the adult is one of abrupt change. *Phoronis hippocrepia* occurs on Brit. coasts.

Phosgene, carbonyl chloride, $COCl_2$, the product obtained by the union of carbon monoxide and chlorine when passed over animal charcoal (catalytic agent), or by treating sulphuric acid with carbon tetrachloride. It is a colourless, fuming gas, that produces violent coughing when inhaled, and is decomposed by water into hydrochloric acid and carbon dioxide. It was used extensively as a poison gas, being first employed by Germans in Dec. 1915.

Phosphates, the most important of all fertilizers, consisting essentially of various forms of calcium phosphate ($Ca_3(Po_4)_2$). Bones were supplemented by mineral phosphates in 1840, the production of rock phosphate reaching 7 million tons in 1913, the chief producers being U.S. and North Africa. Rock phosphates are nearly all converted into superphosphate by action of sulphuric acid, before being used as a manure. Basic slag, a by-product in steel manufacture, is also a calcium phosphate, and if finely ground is the greatest rival of superphosphate, 4 million tons being produced in 1913. The ash of wheat contains as much as 50 per cent., while that of oats contains about 45 per cent., and that of peas about 33 per cent.; hence the value of such applications as bone, Peruvian guano, and superphosphate of lime.

Phosphorescence is the emission of a pale light—which may be white, orange, green, or violet—without apparent combustion. It is sometimes due to slow oxidation (chemi-luminescence) or to electric excitation (electro-luminescence), but otherwise it is probably the accompaniment of molecular readjustment after the strain produced by absorbed light energy. Diamond, when moderately heated, 'Bononian phosphorus' (barium sulphide), and Balmain's luminous paint (calcium sulphide) are phosphorescent in the latter sense. The phosphorescence of phosphorus and of organisms is due to oxidation. Fungi cause phosphorescence of decaying wood, minute organisms that of the sea, oxidation of fat probably that of glowworms, fireflies, centipedes, and deep-sea fishes.

Phosphorus, P=31·04, non-metallic element; occurs combined, chiefly as calcium phosphate, $Ca_3(PO_4)_2$, in phosphorite, apatite, coprolites, bone ash; widely diffused; essential to plants and animals; isolated from urine by Brand in 1669.

Phosphorus is obtained by treating in an electric furnace a mixture of finely divided calcium phosphate, sand, and coke. Crude phosphorus distils over, is collected under water, and subsequently purified.

Properties.—Phosphorus exists in several allotropic forms.

(1) White phosphorus is almost colourless, translucent, and wax-like; crystallizes in octahedra, sp. gr. 1·83, m.p. 44·3° c., b.p. 290° c. Molecule of vapour below 1,500° c. = P_4; above, dissociation into P_2 molecules occurs. Molecule in solvents is P_4. Phosphorus is nearly insoluble in water, easily soluble in carbon disulphide; ignites at 45° and burns to P_4O_{10}; kept under water. Luminous in dark (phosphorescence) owing to slow oxidation. When vaporized with steam shows greenish phosphorescence; peculiar smell; very poisonous, 1 decigram has caused death; vapour attacks jaw (*necrosis*, 'phossy jaw'). Use for matches now prohibited. Used as vermin killer, for chemical experiments, and as a nerve tonic.

(2) Red phosphorus ('amorphous') is formed by action of light and heat on white phosphorus; change is promoted by a trace of iodine, and is rapid at 240–250° c., but reversed at higher temperature; dark reddish brown, partially crystalline, tasteless, odourless, insoluble in carbon disulphide, not poisonous, oxidized slowly in moist, hot climates. Used for safety matches.

(3) Scarlet phosphorus (Schenck's) made by heating white phosphorus with the tribromide. Used for matches that strike anywhere (P_4S_3 also employed).

Hydrides: PH_3 (gas), P_2H_4 (liquid), $P_{12}H_6$, P_9H_2 (solid). *Chlorides:* PCl_3, PCl_5, $POCl_3$. *Oxides:* P_4O_6, P_2O_4, P_4O_{10}. *Oxy-acids:* H_3PO_2, H_3PO_3, $H_4P_2O_6$, H_3PO_4(HPO_3, $H_4P_2O_7$).

Photography, name given to process by which rays of light reflected, or emitted by objects, are used to produce, by chemical means, a permanent picture of the object. It is the outcome of many attempts to fix the vivid pictures produced in the 'Camera Obscura,' which has been known since the 16th cent. The camera is a light-tight box, in one side of which is fitted a lens which projects images of external objects on to the opposite side where a plate is fixed. The first permanent pictures were made by Daguerre, in France, in 1839. His process gave one picture, a positive on a plate of silvered copper, for each exposure. Daguerre was also the first to discover the *latent image*. He had attempted to secure a visible image on the plate by exposure in the camera, with little success; but he found by accident that if a plate which had been exposed in the camera for a very short time, and showed no trace of an image, was then exposed to the vapour of mercury a complete image *developed*, and became visible. Henry Fox-Talbot, in England (1841), discovered a process of making negative images on paper which were developed by gallic acid. These *negatives* represent the light parts of the subject as black or opaque, and the dark parts as white or transparent, and by placing this negative, after treatment to make it translucent, on a fresh piece of sensitive paper, and exposing to light, a positive print is obtained which represents the lights and shadows of the picture in their proper relation. It is from this

process, rather than from the process of Daguerre, that modern photography has developed. The next advance was the use of glass plates in place of paper, which was rendered possible by the adoption of an organic substance to carry the sensitive salts. Albumin was first used, but was soon displaced, for negatives at least, by collodion, which was introduced by Scott-Archer in 1851. These collodion plates were exposed and developed while still moist with the solution of silver nitrate used to sensitize them, and from this they were known as '*wet plates*,' or '*wet collodion plates*,' to distinguish them from the gelatine '*dry plates*,' which came into use about 1880. The wet collodion process is still largely used for special purposes such as the various reproduction processes.

The gelatine *dry plate* is the only plate known to the majority of photographers. It consists of a glass plate coated on one side with a film of gelatine containing the sensitive bromide of silver in the form of an emulsion. The film contains no free silver, and is used dry. The image formed by exposure in the camera is invisible or *latent*, but, when treated with a suitable *developer*, the parts of the film which have been altered by light become dark and opaque owing to the reduction of the silver bromide into metallic silver in proportion to the amount of light action. The unaltered bromide is next dissolved by the *fixing solution*, which is sodium thiosulphate ('*hypo*'), leaving the opaque silver in the film. After washing and drying, the negative is ready for the process of making prints.

If the negative is too dense it may be 'reduced' by treatment with solutions having a solvent action on the silver image, whilst if it is too thin and flat it can be 'intensified' by treatment which increases the density of the silver image, or changes its colour, increasing the contrast at the same time.

All the processes mentioned have the disadvantage that they are much more sensitive to blue and violet light than to green, yellow, and red, the result being that the latter colours appear much darker, and the former much lighter on the print than they ought. In 1873 Dr. Vogel discovered that certain dyes had the property of altering the colour-sensitiveness of plates treated with them, moving the region of maximum sensitiveness towards the red end of the spectrum. Plates so prepared are known as *orthochromatic* or *isochromatic*, and are much more sensitive to yellow and green than ordinary plates, but the sensitiveness to blue remains so strong that it is necessary to interpose a 'light-filter' or 'screen' of a yellow colour to subdue the blue and violet. *Panchromatic* plates are a further development, and are sensitive even to deep red. They require a strong yellow or orange filter during exposure, and must be handled and developed in almost total darkness.

Films consist of thin transparent celluloid, coated on one side with gelatino-bromide emulsion. They are either cut to the

standard sizes and used like plates, or the celluloid is in the form of a long band on which successive exposures are made. The first are known as 'flat,' and the second as 'roll' films. The advantage of the latter is that, being wound on a spool together with a longer band of opaque black paper, fresh spools can be inserted in the camera, and exposed ones removed, in ordinary daylight. Films are prepared of the same speed as plates, and are made orthochromatic in the same way.

The Camera.—The simplest form of photographic camera has already been described.

Another type of camera has extensible sides so that the distance between lens and plate can be adjusted to focus objects at any distance. The lens may also be made to be raised or lowered in relation to the plate, to 'swing back,' to enable the plate to be kept vertical when the camera has to be tilted, and so on. A form of camera largely used in press photography is the *reflex*, inside of which is a mirror inclined at an angle of 45°, which reflects the image on to a ground-glass screen in the top of the camera. The picture may be observed on this screen, exactly as it will appear on the negative, up to the moment of exposure, when the mirror flies up and allows the light to fall on the plate.

The photographic lens is made in many types: for portraiture, a lens of long focus and large aperture; for interiors and other confined situations, a lens of short focus and great covering power (wide-angle), and so on. The *telephoto* lens enables large-scale photographs to be made of subjects impossible to approach closely, such as mountain peaks, architectural details, and wild animals.

Printing.—The print is usually made on sensitized paper, which may be prepared with a number of salts other than the bromide and iodide of silver used in making negatives.

The first class are called *bromide* or *development* papers, and consist of stout paper coated with a bromide of silver gelatine emulsion similar to that used for dry plates, but not so sensitive. It is developed and fixed in the same way as plates, and is, indeed, coated on glass and used in making lantern slides.

Contact prints are made by placing the paper in contact with the negative in a printing frame, exposing to weak white light for a short time, and developing. This paper is also suitable for making *enlargements*. The negative is placed in an enlarging camera which projects the image, of any desired size, on to the paper. A variety of this paper made with specially slow emulsion is known as *gaslight* paper, as all the operations may be conducted by artificial light.

The normal colour of a bromide print is neutral black and white, but the colour may be altered by modifying the developer, or by *toning* after development. Bromide paper is prepared with a great variety of surfaces, from a high gloss to that of very rough drawing paper. A second class of papers are known as *print-out*

papers, or 'P.O.P.,' as the image becomes visible as exposure proceeds. The sensitive salt employed is silver chloride. It is suitable only for contact prints. When the picture appears slightly stronger than is required it is fixed with 'hypo,' but, as the colour of the image is unpleasant, it is usual to tone the print with a solution containing gold chloride before fixing. This produces tones ranging from reddish brown to purple black. A variety of this paper, known as *self-toning*, contains a toning salt in the emulsion, which tones the image when the print is placed in the fixing solution. 'Platinotype' paper is used for contact prints, but while the image becomes visible during exposure it must be developed. The sensitive salt is platinum, and it is developed in potassium oxalate, and fixed with weak hydrochloric acid. The prints are very permanent, beautifully soft and delicate, the colour ranging from black to warm sepia, with a matt surface.

A very large number of printing processes are based on the action of light on bichromated gelatine, gum, albumin, and similar substances. If the substance is readily soluble in water, the effect of light is to make it insoluble. This is the principle of the *carbon* or *autotype* process, also the *gum-bichromate* process. An insoluble pigment is mixed with the bichromated gelatine or gum, coated on paper, and exposed in contact with the negative. The print is developed in warm water, which dissolves the soluble portions, leaving a graduated thickness of insoluble pigment-bearing film representing the various shades of the picture. If the print is dabbed over with a greasy ink, the ink does not adhere to the soft, moist parts, but only to the more or less hardened portions in proportion to the amount of light action. This is the principle of the *oil* process, and of the *collotype* reproduction process, in which the ink image is transferred to paper in a special printing press.

By a modification of the above method a print may be produced in high relief, and this is the principle of various processes for producing photographs in relief, also the *Woodburytype* reproduction process.

Another modification is to mix a hygroscopic substance, such as glycerine, sugar, or honey, with the bichromated colloid. After exposure the print is exposed to moist air, when the parts unaffected by light absorb the moisture and become sticky, while the affected parts remain dry. If a very fine powder is brushed over the print it will adhere in inverse proportion to the amount of light action, thus producing a negative from a negative. It is chiefly used in *photoceramic* processes—*i.e.*, making photographic prints on china and porcelain.

An interesting print-out paper for the reproduction of colours has been produced by Dr. Smith. It is prepared by coating paper with a black film containing three dyes which combined appear black. These dyes bleach out in white light, but as each dye is bleached only by the colour rays which it *absorbs*, the black

film bleaches to red under red glass, green under green glass, and so on, and if exposed under a coloured transparency it will give a fair reproduction of the colours. The printing is slow, and there is some difficulty in fixing the colours satisfactorily, but these faults will probably be remedied.

Colour Photography.—The production of photographs in natural colours has been attempted by experimenters from Daguerre and Fox-Talbot onwards, but no advance was made till 1861, when Clerk Maxwell suggested a method based on the Young-Helmholtz theory of colour vision, that our eyes perceive colour by the stimulation of one or more of three *colour sensations*. Each sensation is stimulated by a different range of vibrations, approximating to red, green, and blue-violet. White is perceived by the equal stimulation of all three sensations, and colours by stimulation in varying degree of one or more sensations. Clerk Maxwell showed that if negatives were made recording respectively the amount of red, green, and violet contained in the camera image, and if the positives were projected by lanterns so that the images coincided, using for the projection of each the same coloured light as had been recorded in the negative, then the picture would appear in its natural colours.

Clerk Maxwell's results were imperfect, but the principles he demonstrated are the basis of almost all modern processes of colour photography.

In addition to projection by three lanterns, the images may be combined by projecting them in rapid succession, as in the cinematograph, the stimulation of each sensation recurring so rapidly as to blend. Another method is employed in Ives's 'Kromskop,' in which the three images are superimposed and combined by an arrangement of transparent reflectors, but the most convenient way is to make the three-colour sensation records in very minute portions side by side on one plate. The divisions of colour are too small to be distinguishable by the eye, and only the colour produced by the combination is seen. The two disadvantages of this method are that (1) the picture must be in the form of a transparency, and (2) the great loss of light, which even in the whites amounts to two-thirds. Of several processes making use of this method the autochrome plate of Messrs. Lumière is the most widely used. In this plate the compound filter consists of starch granules, dyed in three batches and mixed in the proportions which approximate to white when spread on glass in a film the thickness of a single grain. The panchromatic gelatine emulsion is spread on this film, and the plate is placed in the camera with the glass side next the lens so that the light passes through the coloured grains before reaching the plate. A yellow filter is required in the lens to correct the excessive blue sensitiveness of the plate (see above). The negative is developed, converted into a positive, and the image appears in its natural colours.

All the above methods are known as '*additive*,' as one light is added to another; but the three-colour principle may also be employed by subtracting colours from white, which has the advantage of enabling prints to be made on paper, as well as in the form of transparencies. The negatives are made in exactly the same way, through red, green, and violet filters, but the colours used for the print are the complementaries to those. The basis, which may be paper, porcelain, or glass, reflects or transmits red, green, and violet light (*i.e.*, white), and it is required to subtract from it successively these colours in the proportions recorded in their respective negatives. This is done by making a print from each negative, by the carbon process generally, and transferring the tissues on to the paper or glass, one over the other, making them coincide. The colours of the tissues must be such that each absorbs the rays passed by the filter used for that negative, and reflects the rays passed by the other two filters. These colours are found to be for the red filter print, a greenish blue; for the green filter print, a magenta pink; for the violet filter print, yellow. The widest use made of this method is in reproduction of coloured pictures by means of half-tone process and the printing press. Half-tone blocks are made from the three-colour negatives, and are printed in yellow, red, and blue inks, so that the three impressions coincide.

The Lippmann process, making use of the colours produced by *interference*, and Prof. R. W. Wood's process, based on *diffraction* (see LIGHT), are only of scientific interest so far.

One of the most remarkable developments in modern photography is the *cinematograph* (see MOVING PICTURES). The production of living pictures in natural colours by the *kinemacolor* process is also described in the article.

Amongst the numerous scientific applications of photography may be mentioned star-mapping and spectroscopic work in astronomy, X-rays in surgery, and the wide use of microphotographs in pathology and in the iron and steel industries. Several systems have been devised for the transmission of photographs by telegraph, the Korn system employing selenium, the electrical resistance of which varies with the intensity of the light falling on it, and the Thorne Baker system transferring directly without the necessity for development as in the Korn apparatus.

Military Photography.—In all wars since the introduction of photography, pictures associated with the campaigns have been numerous. But only a few authorized photographers accompanied the fighting forces, the bulk of the work being in the hands of civilians. In the Great War this branch of work attained great importance, particularly in connection with the various Air Services. *Aerial photography* became one of the most important means of obtaining information regarding enemy forces and dispositions. As a result, one of the chief duties of the Air Services was the carrying of mili-

tary photographers. Observations thus obtained enabled officers to study changes made from day to day in enemy dispositions. In this work the cameras were operated by hand until near the close of hostilities, when an automatic camera was devised.

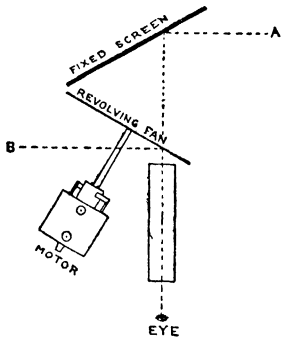
In addition, *ground photography* was employed to a much greater extent than formerly. Its primary object was to produce historical records, including pictures for propaganda and educational purposes, in the form of still and motion pictures. To accomplish this work special photographic sections were formed in the various forces.

Photogravure. See AUTOGRAVURE; PROCESS WORK.

Photometry deals with the measurement of the relative illuminating powers of different sources of light. The apparatus used is a *photometer*. The illuminating power of any source is the amount of light received by unit surface at unit distance from it. This varies inversely as the square of the distance, so that if the distance is doubled the light received by the same surface is one-fourth. A standard source must be fixed. The Brit. standard is a *sperm candle* burning 120 grains per hour and weighing six to the pound. For practical purposes, the *Harcourt lamp*, burning pentane and air, equal to 10 candles, is more manageable. The Fr. *Carcel lamp* burns 42 grammes of colza oil per hour; the Ger. and U.S. standard *Hefner-Alteneck* burns amyl-acetate and gives a reddish but very accurate light. The relation between these sources has been defined as Harcourt = 1·02 Carcel = 10·95 Hefner (Zürich Congress, 1907). As a final standard Violle proposed the light given out by a square centimetre surface of platinum at melting-point.

Since equal illuminations cannot be gauged directly by the eye, various devices are resorted to in photometers. Rumford's consists of a rod a short distance from a ground-glass screen. Two lights, one of known candle-power (c.p.), are moved till the shadows thrown by the rod are of equal darkness; then the powers of the two sources vary as the squares of their distances from the corresponding shadows, and the unknown light is determined. Bunsen's is a simple and common form, consisting of a grease-spot on a screen of paper. When viewed from the same side as a light, the spot appears dark; from the opposite side it appears bright. The lights to be compared are moved on opposite sides of the screen till the spot becomes invisible from both sides, when the powers of the lights are proportional to the squares of their distances from the screen. In Lumner and Brodhun's photometer, by an optical arrangement two patches appear, showing a spot from one source inside a ring from the other. Equal illuminations are judged accurately either (1) when the two patches are uniformly bright, (2) the two spots are of equal darkness. Photometers in general give varying results with different observers, when the lights compared are not of the same tint. This difficulty is removed with

the 'flicker' instrument, where the reflections from two lights are rapidly presented alternately, and equal illumination is achieved



'Flicker' Photometer.
A, B. Two sources of light.

while the reflection becomes steady. The Harvard and other stellar photometers are described under STAR.

Photosphere, name given to the sun's radiant surface, probably composed of incandescent clouds floating in a less luminous medium. See SUN.

Phrenology, a pseudo-science which infers from the shape of the head and skull of any given person what are his characteristics. It comes under the domain of physiological psychology, but as a worked-out system it is due firstly to Gall, who began to publish writings on it in 1796.

Gall worked out in full detail the idea of what are vulgarly called *bumps.* Other systems were worked out on similar lines by a number of other thinkers, particularly Spurzheim, who postulated 35 'bumps' (as against Gall's 26). Though these schemes have not generally won acceptance, they certainly resulted in a deeper study of the brain.

The physiological side of the question is a difficult one, for while anatomically the brain is fairly well understood now, physiologically much is still open to doubt. Though it seems probable that there is 'division of labour' in the brain, yet, if a portion be removed, its duties seem to be taken over by other parts of it.

Phrenology psychologically is also open to question. It is difficult to assume the existence of a number of different faculties which are as separate from each other as are the organs of the body, or else to assume a sort of common substance on which they all work. An attempt has been made to work out the principles of phrenology with recent research in psychology and physiology, but its validity is not always accepted by the best authorities. The reading of character by phrenology is really of little avail.

Dr. Bernard Holländer's *The Mental Functions of the Brain* (1901), which may be called an attempt to advance a phrenological science that ignores the 'bumps' doctrine, shows the association of certain types of insanity with definite lesions of particular parts of the brain; it is not a revival of Gall's doctrines, but rather gives a new significance to the word phrenology.

Phrygia, large country in Asia Minor which varied greatly in regard to boundaries at differ-

ent periods of history, but generally speaking formed western part of central plateau region of peninsula (37°–40° N., 28° 50′–31° 50′ E.), most fertile district being valley of Sangarius, and most thickly populated part in the S.W.; celebrated for marble, vines, and wool. Little is known about nationality and origin of inhabitants, but they are generally supposed to have been one of oldest nations in Asia Minor. The exact date of beginning of Phrygian monarchy is unknown; downfall of kingdom believed to have been in 7th cent. B.C., at time of Cimmerian invasion; in 6th cent. B.C. Crœsus conquered country, but was defeated by Cyrus (*c.* 546 B.C.), and Phrygia passed into hands of Persians; invaded in 3rd cent. by Gauls, who took possession of E. part of country and called it Galatia; country given by Alexander the Great to Antigones, and kept by him till his death; later succumbed to Pergamum kings; under Roman Empire Phrygia comprised part of prov. of Asia, and in W. in particular Græco-Roman civilization spread; at reorganization of Roman Empire by Diocletian all that remained of Phrygia was divided into Phrygia Pacatiana in E. and Phrygia Salutaris in W. The name disappeared at division of Eastern Empire, and now Byzantine Phrygia is comprised in vilayets of Broussa, Konia, and Aidin. Phrygia had important influence on Gr. art and culture.

Phthalic Acid, the ortho-variety of the three isomeric acids, having the formula $C_6H_4(COOH)_2$. It is obtained by the oxidation of naphthalene by means of fuming sulphuric acid and mercury, and forms colourless crystals (sp. gr. 1·6; m.p. 213° C.) that are soluble in water. It yields an anhydride when heated, and is the parent substance of phthalein dye-stuffs.

Phthisis, condition due to tuberculosis of the lungs. See TUBERCULOSIS.

Phyllite, a clay rock, resembling a slate, but containing a large percentage of fine, silky, pale-coloured mica. It splits readily, and has a shimmering lustre on the surface.

Phyllopoda. See under ENTOMOSTRACA.

Phyllostomatidæ. See under VAMPIRE BATS.

Phylloxera, or VINE INSECT, a genus of minute insects (family Aphidæ, order Hemiptera) which do enormous damage to vines. The life-history is very complicated, the females living on the vine roots and laying each 30 to 40 unfertilized eggs from which in a week the fresh brood hatches. So many generations succeed each other in a season that, barring accidents, the progeny of a single individual would in a year number more than 20 millions. In spring the leaves are attacked by newly hatched insects and great harm is done. In vineries the stems of roots are scraped in winter to destroy any *Phylloxera* eggs that may lurk in the crevices of the bark.

Physalia. See HYDROMEDUSÆ.

Physics, dep. of science concerned with the fundamental laws of the material universe. Broad distinction between chem. and **physics** is that chem. con-

siders more particularly the molecular changes of matter; but the two branches overlap, and a clear line of demarcation is not possible. See under ELECTRICITY; HEAT; LIGHT; SOUND.

Physiognomy, the theory and art of discerning mental character from bodily appearance. The earliest monograph on the subject is that attributed to Aristotle, which discusses (1) the signs of character in general, (2) the physiognomy of the sexes, and (3) the comparison of human and animal appearance. In the Middle Ages the study became implicated with cheiromancy and magic. Many treatises on it appeared in the 16th cent., that of della Porta being the chief. In the 17th cent. John Evelyn and John Bulwer treated of it in this country. By far the best-known 18th cent. writer on it is Lavater, the later editions of whose works are admirably illustrated. Lavater tried to bring the subject into relation to the fine arts. More recent writers (*e.g.*, Sir Charles Bell and Darwin) have discussed the subject from a more scientific standpoint.

Physiography, name given by Huxley to the systematic description and scientific discussion of the general properties of our earth and atmosphere. Practically synonymous with physical geography. See GEOGRAPHY.

Physiology, the science which deals with the functions of living organisms, as distinguished from anatomy, which deals with their structure. Human physiology may be considered under the headings of *nutrition*, including the processes concerned with the digestion of food and its assimilation and absorption into the blood and thence to the tissues, the absorption of oxygen from the air by the blood through the agency of the lungs and its conveyance to the tissues, the circulation of the blood and of the lymph, with the excretion of waste matters by the bowel, kidneys, lungs, and skin; *growth* of the body, brought about by the continued division of the cells composing the tissues; and *reproduction*, which is a specialized form of growth in which there is increase of living substance formed by cell division in such a way that a new individual is set free; *nervous activity*, comprising the functions of the brain, which is the seat of consciousness, the spinal cord, sympathetic system, sense-organs, and nerves; *movement*, which is carried out by the muscles in relation with their supporting structure, the skeleton.

History.—Until the 15th cent. speculation and discussion held sway, the outstanding names being HIPPOCRATES and GALEN, the dogmatic teaching of the latter dominating the science. With the fall of Constantinople (A.D. 1453) and the diffusion of the Gr. scholars through W. Europe, the writings of Hippocrates and Galen became known in the originals, and to their influence was due the revival of interest in anatomy and physiology. PARACELSUS, in the 15th cent., promulgated theories of life independent of Galen, but his influence was fleeting.

The study of anatomy was revived in Italy in the 16th cent.

by Vesalius, who dissected the human body and opposed the physiological theories of Galen; he was followed by FABRICIUS, and, at the beginning of the 17th cent., WILLIAM HARVEY, who had studied under the Ital. anatomists, made the epoch-making discovery of the circulation of the blood (1628). About this period arose the Iatro-mechanical school, of which Borelli and Pitcairne were the most notable members, and the Iatro-chemical school, founded by the Dutchman Sylvius, one of his most eminent followers being Willis, who made valuable researches in regard to the secretions. Both of these schools attempted, on opposing lines, to explain the phenomena of life in accordance with scientific facts. The invention and improvement of the microscope in the 17th cent. stimulated research, Leeuwenhoek and MALPIGHI especially making valuable discoveries with its aid, the science of Histology being founded by them (see CYTOLOGY).

Von HALLER, in addition to making various discoveries of greater or less importance, particularly in regard to muscular irritability, co-ordinated the different parts of the science, and gave it a definite form. Johannes Müller, in the first half of the 19th cent., laboured in the same direction, and showed, among other things, that different forms of stimuli produce the same effect upon a particular organ. Von BAER made valuable researches regarding the development of animal life, and may be regarded as the founder of the science of embryology; CUVIER linked palæontology with comparative anatomy, and was the first to realize the inter-dependence of the organs and parts of an organism; LAMARCK foreshadowed the theory of natural selection, and promulgated an important, but still debated, theory of evolution; Schleiden and Schwann showed that all organisms are built up of cells, while von Mohl and du Jardin discovered that protoplasm is the essential constituent of the cells.

Among noteworthy stages in the progress of the science are the discovery of the law of the conservation of energy by Mayer and HELMHOLTZ and its application to the living organism, the researches regarding the nervous system by Marshall Hall, who discovered the laws of reflex action, and of Weber, who discovered the laws of inhibitory nerve action, and the widespread investigations of CLAUDE BERNARD, among whose discoveries may be noted the saccharine function of the liver and its connection with the nervous system. CHARLES DARWIN added to the primary ideas of evolution of Erasmus Darwin and Lamarck the theory of natural selection, and made possible an explanation of the structure and evolution of living things, and harmonized all the branches of science.

Physiology has made extraordinary advances in recent years. Among these is an increased knowledge of the localization of brain functions largely due to the work of Horsley, Jackson, and Ferrier, and the nerve control of the body studied

by Sherrington. New methods of studying the circulation have been introduced. Notable advances have been the introduction of the sphygmomanometer, by which the blood pressure of a man can be conveniently and easily ascertained, and the electrocardiograph, by which the electrical currents set up by the action of the heart can be really recorded. But perhaps the outstanding discoveries of recent times have been in the field of chemical physiology. It has been found that the respiration and many of the other body functions are controlled by the amount of carbon dioxide in the circulating blood. A new page has been opened by the discovery of the internal secretions which are passed directly into the blood stream by certain 'ductless glands' and profoundly affect the nutrition of the body. Still more recent is the discovery of 'accessory food factors' or VITAMINES, substances present in articles of diet which the body cannot do without. Scurvy and beri beri are now known to be deficiency diseases due to the absence of certain 'vitamines' from the food. The part played by the body fluids in protecting the body against micro-organismal disease is now a huge field of study, embracing both physiology and pathology. See BRAIN; CELL; DIGESTION; HEART; NERVOUS SYSTEM; RESPIRATORY SYSTEM; REPRODUCTIVE SYSTEM, and similar articles.

Physophora. See under HYDROMEDUSÆ.

Physostigmine. See CALABAR BEAN.

Piacenza, tn., cap. of prov. of same name, Italy (45° 3′ N., 9° 40′ E.), on r. bk. of Po, 92 m. N.W. of Bologna; seat of a bishop; 12th cent. cathedral; 4th cent. church of Sant' Antonio; San Sisto (1499) formerly possessed Raphael's Sistine Madonna; public library; Palazzo Farnese and other palaces; Museo Civico and handsome theatre; leading town of Lombard League in Middle Ages; united to Parma (1545–1860); iron and brass manufactures, silk printing works. Pop. 38,500.

Pia Mater. See BRAIN.

Pianoforte, a familiar keyboard musical instrument, evolved from its immediate predecessors the *clavichord* and the *harpsichord*, of which latter the *spinet* was a variety. The fundamental difference between the pianoforte and the instruments named lies in the mechanism of the tone production. In the clavichord, the earliest mention of which occurs in a work of 1404, the tone was produced by brass blades impinging against the strings; in the harpsichord, by quills or strips of leather (technically called 'jacks') plucking the strings. In the pianoforte the tone is produced by hammers striking the strings and rebounding immediately afterwards. The latter (technically the 'check' action) is an essential condition; for if the hammer were to remain in contact with the string for the minutest fraction of a second, the contact would deaden the vibration and practically stop the sound. The tone of the clavichord was weak and metallic; that of the harpsichord was

louder, but hard and inflexible. Both instruments had the crowning defect implied in the fact that the tone could not be varied, as to loud or soft, by the player's impact of the key. It was precisely because this was at last attained in the pianoforte that the new instrument was so named: that is to say, it could play *piano* (soft) or *forte* (loud), with ranges of power between these extremes. At first it was called indifferently 'pianoforte' or 'fortepiano.'

The inventor was a Florentine named Bartolommeo Christofori (1651–1731), his hammer action, essentially that of to-day, being announced and described in 1711. Other claims to independent discovery have been made. Harpsichords continued to be made till the beginning of the 19th cent.; and it is significant that up to 1799 the title-pages of Beethoven's sonatas bore the words, 'for the pianoforte or harpsichord.' Curiously enough, it was not until 1767 that the first recorded performance on a pianoforte took place in England. In the last quarter of 18th cent. the new instrument was more and more gaining supremacy over its predecessors. Once fairly established, its development towards perfection was rapid. In this process, such makers as Erard, Collard, Brinsmead, Pleyel, Broadwood, Steinway, Bechstein, Blüthner, and Chickering have played a prominent part.

The most natural form of the pianoforte is that known as the *Grand*, in which the strings are placed in a horizontal position parallel with the keyboard. This form, the same as that of the harpsichord, was probably suggested by the varying length of the strings. Grand pianos are of three kinds—the concert grand, the semi-grand or drawing-room grand, and the boudoir grand, these names denoting the length. In the more familiar *cottage* or upright piano, patented in 1811 by R. Wornum, the strings are stretched vertically over the sound-board from top to bottom of the instrument. The different forms involve certain differences in the mechanism, but the essentials are in all cases the same. The hammer action has already been mentioned. What is known as the *damper* action is necessary for checking the continuance of the sound when the finger has left the key. It consists of a piece of leather or felt, elevated upon a vertical wire connected with the back of the key. When the key is struck, this mechanism, which otherwise rests upon or presses against the strings, is immediately removed therefrom, so that the tone may be clear and unimpeded; when the key is quitted, the 'damper' instantly springs back and stops the vibration of the wires. Intimately connected with this action is the so-called *loud pedal*, which, on being pressed down by the foot, virtually deprives the instrument of its dampers, so that the sound runs on without check so long as the vibrations last. The *soft pedal* is a contrivance which shifts the hammers slightly to the side so that one string fewer is struck, or which interposes a strip of cloth or felt and shortens the length

of stroke of the hammers, thus producing less tone. The number of strings to each key varies in different instruments. In the grand pianoforte there is usually one string to the lowest octave, two strings to the succeeding lower notes, and three to the middle and upper notes. The first pianofortes had a compass of about five octaves, thus corresponding to the harpsichord. Gradually this has been extended, until the instrument has now a range of seven octaves.

Practically all the really great composers, Wagner excepted, have made important contributions to music for the pianoforte. Beethoven, especially in his sonatas, was the first great classic of the piano. Schubert, Schumann, Mendelssohn, Brahms, and Liszt made each his peculiarly characteristic addition to the growing literature. In Chopin the pianoforte found its most poetic exponent.

History of the Pianoforte, by Brinsmead (1899), Bie (1899); Krehbiel, *The Pianoforte and its Music* (1911).

Pianoforte-players, MECHANICAL. The familiar street or handle piano has a mechanism of very simple construction. Inside the instrument is a metal barrel, on the surface of which are little projecting pins. When the handle is turned this barrel revolves, and each pin depresses a crank, which makes the connected hammer strike a blow on the strings; a spring causes the hammer to resume its original position as soon as the pin leaves the cranks.

The first method of playing an ordinary piano by mechanical means seems to have been invented by Debain of Paris about fifty years ago. According to his method, pinned boards termed 'planchettes' were used instead of the pinned barrels of street instruments, and, as a handle was turned, these called into action an extra set of hammers inside the piano. The apparatus formed a part of the instrument in which it was used, and could be introduced into organs and harmoniums as well as into pianos. In recent years this method has been almost entirely superseded by a system of mechanism controlled by pneumatic action. The mechanism was formally enclosed in a portable cabinet case, which was placed in front of the keyboard of the piano when in use, but is now usually enclosed within the piano case itself. A row of levers, termed fingers, projects from the instrument; these terminate in the form of little hammers, have their striking surfaces covered with soft leather, and rest upon the keys of the piano when not in action. In the upper part of the instrument there is a tracker-board containing longitudinal slots, and underneath each slot is a pneumatic tube, which leads to and controls the action of the finger thus connected with the slot. The musical notation of the composition which the instrument performs is represented by perforations made in a scroll of tough, strong paper wound upon a spool. When the instrument is brought into use, a scroll is placed in a spool-holder situated behind the

tracker-board; the free end of the scroll is then brought over the board and affixed to a roller in front of it. This roller being lower in position than the tracker-board, the paper is brought into close contact with its slotted upper surface. As the beginning of the scroll is unperforated, no air at this stage can pass through the slots. The instrument is furnished with several little bellows worked by pedals, as in playing the harmonium; these by suction action exhaust all air from the slots and tubes leading to the fingers; they also set in motion a motor, which causes the roller in front of the tracker-board to revolve. As the scroll is unwound each perforation in crossing a slot admits a rush of air which causes the finger in connection with it to strike its note on the keyboard of the piano. The scroll indicates the correct degree of *tempo* to be used, and contains signs which indicate the degrees of *nuances* to be observed. The desired effects are obtained by pressing a knob, which regulates the quantity of air admitted to the slots. Another knob, when depressed, acts upon the loud pedal of the piano, so that a *fortissimo* can be produced at will. The instrument, besides playing solos, can also be used to accompany songs, violin solos, etc. Some piano-players have a finger for each note on the keyboard of a piano of full compass, but the majority contain only sixty-five fingers, the first of which plays the second lowest A and the last the highest C sharp on the piano.

Piastre, coin of various values. Turk. = 2·11d.; Egyptian = 2·46d.; Span. = 1 dollar (about 4s.); the original Italian = about 3s. 7d.

Piatra, tn., Moldavia, Rumania (44° 22′ N., 24° 19′ E.), near E. foot of Carpathians; large timber trade. Pop. 18,000.

Piatti, ALFREDO (1822–1901), Ital. violoncellist; *b.* Bergamo; made his début in 1837; first appeared in London in 1844, and regularly for fifty years thereafter, being 'cellist at the London Monday popular concerts from 1859 onwards; as an interpreter of class. music had few equals.

Piauhy, mar. state, Brazil (3°–10° 30′ S., 40°–46° W.); riv. Paranhyba forms its W. boundary; cattle grazing; cotton, sugar, tobacco, rubber, wax, and dyewoods; silver, iron, lead, nitrates, and rock salt; cap. Therezina. Area, 116,523 sq. m.; pop. 335,000.

Piave, riv. rising in dist. of Cadore, Treviso, N. Italy (45° 50′ N., 12° E.). Below Belluno it runs S.W. through the last foothills of the Alps, and becomes a considerable stream, dwindling much in volume during the dry season. After passing Nervesa it makes a wide bend eastward, and thence flows to Porto di Cortellazo on the Adriatic through plain country. Between St. Dona and the sea it runs through marshy meadows intersected by canals which merge into the meres and lagoons of the coast. Length, 125 m.; area of basin, 1,583 sq. m. Navigable from entrance into prov. of Venice; above that used for floating timber. After the disaster at CAPORETTO (Oct. 24, 1917) the

3rd Ital. Army and the remnants of the 2nd retreated to the line of the Tagliamento; but on Nov. 7, when the Austrians crossed the Livenza, the whole line fell back on the Piave, where it maintained itself, despite all the efforts of the enemy to turn the position, until the Austrians began their retreat on June 22, 1918. The Allied advance, which began on Oct. 27, was followed by the request for an armistice (Nov. 1). See WAR, THE GREAT.

Piazza Armerina, tn. and bishop's see, prov. Caltanissetta, Sicily (37° 22′ N., 14° 22′ E.); trades in oil, wine, and nuts, and manufactures woollens; has Renaissance cathedral and old castle, now used as prison. Pop. 25,000.

Pica. See under CROW FAMILY.

Picardy, old prov. in N. of France, now comprising departments of Somme and portions of Pas-de-Calais, Aisne, and Oise; contained many important towns, including Amiens, Boulogne, St. Quentin, Abbeville, Laon, Soissons, and Noyon. Within it are the mediæval battlefields of Agincourt and Crécy, and the Great War added those of the Aisne, Oise, Somme, Amiens, and St. Quentin. See WAR, The GREAT.

Picarian Birds. See under ORNITHOLOGY.

Picas, MOUSE HARES, or TAILLESS HARES (*Ochotona*), genus of guinea-pig-like rodents abundant in Himalayas; one E. European species and one American.

Piccinni, NICCOLA (1728–1800), Ital. opera composer, a protégé of Marie Antoinette; prof. Royal School of Music, Paris (1784); lost ground in famous contest with Gluck for the composition of an opera on *Iphigénie en Tauride;* wrote also *La Cecchina, Roland,* etc.

Piccolo. See FLUTE.

Pichegru, CHARLES (1761–1804), Fr. general; commanded Army of the Rhine (1793), and captured imperial fortresses; overran Holland (1795), and set up Batavian Republic; plotted with Bourbons and frequently fell under suspicion; concerned in Cadoudal's conspiracy for assassination of Napoleon (1804); arrested, and committed suicide.

Pichon, STÉPHAN JEAN MARIE (1857–), Fr. statesman; *b.* Armaq-le-Duc, and educated at Paris; became associated with M. Clemenceau on the journal *La Justice* (1880); member of the municipal council of Paris (1882), and elected to the Chamber of Deputies (1885): secretary of the chamber (1889–90); in 1893 was defeated, and abandoned active politics; then served his country as minister in Haiti, Brazil (1895), and Peking (1897), where his period of office coincided with the Boxer rebellion, in which he showed great coolness and courage, and at its settlement obtained important railway concessions for France; was resident-general at Tunis (1901), minister for foreign affairs in the Clemenceau cabinet (1906-9), and in the cabinets of Briand (1910-11), Barthou (1913), and Clemenceau (1917); one of the Fr. representatives at the Peace Conference of Paris (1919).

Pickering, mrkt. tn., N. Riding, Yorkshire, England (54° 15′ N., 0° 46′ W.); 15th cent. church, partly Norman, with mural paintings; ruins of castle in

which Richard II. was imprisoned before being taken to Pontefract (1399). Pop. 3,600.

Picketing. See under LABOUR DISPUTES.

Pickle the Spy—ALASTAIR RUADH MACDONNELL or MACDONALD (? 1725–61)—chief of Glengarry; joined Lord Drummond's Royal Scots Guards in France (1743); captured in Scotland while on Jacobite business, and imprisoned in the Tower (1745–7); appropriated Jacobite treasure hidden at Loch Arkaig (1749); identified by Andrew Lang as the revealer of Jacobite secrets (1749–60).

A. Lang, *Pickle the Spy* (1897) and *Companions of Pickle* (1898).

Pickthall, MARMADUKE WILLIAM (1875–), Eng. novelist; made a close study of Egyptian life; his works include *Said the Fisherman* (1903), *Enid* (1904), *Brendle* (1905), *The House of Islâm* (1906), *The Myopes* (1907), *Children of the Nile* (1908), *Valley of the Kings* (1909), *Pot-au-feu* (1911), *Veiled Women* (1913), *With the Turk in War Time* (1914), *Tales from Five Chimneys* (1915), *House of War* (1916), *Knights of Araby* (1917), *Oriental Encounters* (1918).

Pico, isl., Azores (38° 20′ N., 28° 30′ W.), covered with lava; has volcanic peak 7,600 ft. high. Area, 250 sq. m.; pop. 24,000. Chief tn. Lagens.

Picquart, GEORGES (1854–1913), Fr. soldier; *b.* Strasbourg; joined the War Office staff (1883); became chief of the intelligence department (1895), but was forced to resign in the following year, on stating his conviction that the 'bordereau' in the notorious Dreyfus case was the work of Esterhazy, not of Dreyfus; for his evidence in the Esterhazy trial (1898) he was imprisoned, and afterwards dismissed from the army for the evidence he gave in the Zola trial; reinstated with the rank of general, and decorated with the Legion of Honour on the declaration of Dreyfus's innocence (1906); subsequently held portfolio of minister of war; was author of *Projets de Loi relatif à la Constitution des Cadres et des Effectifs des Armées active et territoriale* (1908).

Picric Acid, trinitro-phenol, $C_6H_2(OH)(NO_2)_3$, prepared by acting on phenol with concentrated sulphuric acid, subsequently nitrating the phenol-sulphonic acid with nitric acid. Forms yellow crystals (sp. gr. 1·74; m.p. 122·5° C.) soluble in water; intensely bitter taste; yields explosive salts, and when consolidated by fusion forms LYDDITE. Also used as a dye.

Picrite, a crystalline igneous rock which consists essentially of olivine and augite, but usually also contains iron oxides, a little felspar, biotite, hornblende, and apatite. Picrites form a subdivision of the peridotites.

Picrotoxin, neutral principle, consisting of colourless glistening prisms of a bitter taste, obtained from the fruit of an Ind. plant called the Ind. berry (*Anaminta paniculata*); a powerful poison, used medicinally—internally to check night-sweats of phthisis, and externally as a parasiticide.

Picton, SIR THOMAS (1758–1815), Brit. general; served in W. Indies (1794–7), and governor of Trinidad; accused by

enemies of cruelty to negroes, and resigned (1803); found guilty (1806), but later was acquitted; served in Walcheren expedition, and governor of Flushing (1810); commanded under Wellington in Peninsular War—Torres Vedras, Badajos, Ciudad Rodrigo, Vittoria, Toulouse; wounded at Quatre Bras, and fell at Waterloo.

Pictou, seapt., Nova Scotia, Canada (45° 42′ N., 62° 45′ W.), on N. side of Pictou Bay, 80 m. N.N.E. of Halifax; exports coal. Pop. 3,000.

Picts, early race inhabiting British Isles; pre-Celtic and probably akin to IBERIANS; so styled ('a painted man') by Romans. Their national life in Scotland received death-blow (844) when Kenneth MacAlpin established Celtic supremacy.

Piedmont, compartimento, N. Italy (45° N., 8° E.), partly surrounded by Alps and Apennines, consisting of provinces of Novara, Cuneo, Alessandria, Turin; long under house of Savoy; occupied by French (1796); passed to Sardinia (1814), and to Italy (1859). Area, 11,336 sq. m.; pop. 3,402,300.

Pierce, FRANKLIN (1804–69), fourteenth president of U.S.; distinguished in Mexican War (1846–7); president (1853–7); supported slavery and the Fugitive Slave Law; settled Mexican boundary dispute; arranged ten years' reciprocity with Canada; supported Ostend manifesto; reorganized consular and diplomatic service; established U.S. court of claims; completed surveys for Pacific Railway; sided with the Union (1861).

Piers Plowman. See under LANGLAND.

Pietermaritzburg, or MARITZBURG, tn., cap. of Natal (29° 46′ S., 30° 13′ E.), 46 m. N.W. of Durban; founded by Boers (1839); government buildings, town hall, univ. coll.; see of Anglican bishop. Alt. 2,220 ft. Pop. 30,500 (Europeans, 15,000).

Pigeon Family (Columbidæ). The true pigeons, found in most parts of the globe, are most abundant in Australia, New Guinea, and the Malay Archipelago. There are three Brit. varieties—the wood pigeon or cushat (*Columba palumbus*), the rock pigeon (*C. livia*), the wild form of the domestic pigeon, inhabiting the cliffs and foreshores of Scotland and Ireland, and the smaller stock-dove (*C. œnas*). The carrier pigeon is one of the most useful of the many domestic varieties, serving as message-bearer in times of war and peace. In all pigeons body is compact, power of flight is usually great, and habits are generally similar to those of domesticated form.

Pigeon-flying, sport popular in Belgium, England, and France. Homing pigeons are specially trained. Annual races take place in Belgium; birds sent from Toulouse to Brussels (*c.* 500 m.). Speed for distances up to 150 m. averages about 40 m. per hour.

Pigeon-post, the employment of trained pigeons to carry news; in use amongst the Greeks; still in use for military purposes; employed with remarkable success at siege of Paris (1870–1); during Great War was of particular value to mine-sweepers for sending information regarding newly-laid mines; pigeon service was first organized by Brit. War Office in

1915, and first Eng. pigeons sent to France early the following year, where their value proved so great that similar services were established in Salonica, Egypt, and Mesopotamia. This service was recruited from men who had been expert pigeon fanciers in civil life, and proved invaluable to naval, military, and air force services for transmission of information.

Pig Family (Suidæ), a family of even-toed ungulate mammals, including forty species found only in the Old World; forms with peccaries and hippopotami a group Suina, a division of Artiodactyla. They possess in common a long, cylindrical, mobile snout, with the nostrils on its flat disk-like extremity; narrow, four-toed feet, only the two central ones touching the ground; canines of upper jaw curving upwards and outwards to form tusks. The true pigs (*Sus*) are found in Europe, Asia, and Africa, inhabiting bush country and devouring vegetable or animal food almost indifferently, though they show preference for roots. They are, as a rule, exceedingly fierce in the wild state, and form adversaries by no means to be despised.

The common wild boar (*S. scrofa*), which persisted in England till the Middle Ages, is the probable originator of Brit. domestic pigs, of which there are many varieties derived from the old races of tall, bristly 'old English hogs,' or small, brownish Scot. Highland hogs, by crossing chiefly with Chin. stocks to give 'white breeds,' and Neapolitan to give 'black breeds.' Domestic pigs are known also as hogs, or swine; the male is a boar, the female a sow. The bush pigs, or river hogs (*Potamochœrus*), frequent the banks of rivers and lakes in Africa and Madagascar, while the babirusa and wart hogs (*Phacochœrus*) are confined to the Malay Archipelago and Africa respectively.

Pigments are powdered colouring matters applied through a medium in which they are insoluble. When natural, they may be of mineral, vegetable (*e.g.*, gamboge, indigo), or animal (*e.g.*, cochineal) origin. Substantive pigments have an original colour; adjective pigments (*e.g.*, crimson lake) are precipitated on a colourless base (*e.g.*, alumina).

Pigments must be finely ground in a drying oil (*e.g.*, linseed) for oil paints, or in gum water for water colours. They must have stability and body, and must not interact when mixed.

Important mineral pigments: lamp black and Ind. ink (carbon), zinc white or Chin. white (ZnO), Venetian red and burnt sienna (Fe_2O_3), red lead (Pb_3O_4), white lead ($2PbCO_3$, $Pb(OH)_2$), viridian green (hydrated Cr_2O_3), vermilion (HgS), chrome yellow ($PbCrO_4$), cadmium yellow (CdS). Prussian blue is ferric ferrocyanide; carmine and crimson lake are cochineal combined with alumina; rose madder is alizarin (from *Rubia tinctorum*) with alumina. Indigo and alizarin are now prepared artificially. See PERKIN.

Pigmy. See PYGMY.

Pigou, ARTHUR CECIL (1877–), Eng. economist; educated at Cambridge Univ.; prof. of political economy, Cambridge

(1908); has served as a member of the Committee on Currency and Foreign Exchange (1918), and of the Royal Commission on Income Tax (1919); his writings on economic subjects include *Riddle of the Tariff*, *Protective and Preferential Import Duties*, *Policy of Land Taxation*, and *Economy and Finance of the War* (1916).

Pike Perch. See PERCHES.

Pikes (Esocidæ), long-bodied, slender, large-mouthed, bony fishes, which are exceedingly voracious, feeding on their own kind and other fishes, and even on frogs, voles, and waterfowl; reach a length of *c.* 45 in., and a weight of *c.* 35 lb.; found only in the rivers of the N. hemisphere; *Esox lucius* is the only European species, but genus is represented in America by six other species.

Pike's Peak, summit (14,107 ft.) of Rocky Mts., 12 m. W. of Colorado Springs, Colorado, U.S. (38° 50′ N., 105° 14′ W.); cog-wheel railway (8¾ m.); meteorological station; searchlight on summit.

Pilate, PONTIUS, the Roman governor who authorized the crucifixion of Jesus Christ, was procurator of Judæa, probably from A.D. 26 to 36. He was deposed from his office because of his severity, and returned to Rome to stand his trial just after the death of Tiberius. According to the historian Eusebius, he committed suicide soon afterwards.

Pilatus. See LUCERNE, LAKE.

Pilchard. See under HERRING FAMILY.

Piles. See HÆMORRHOIDS.

Pilgrim Fathers, name applied to the 102 Eng. separatists (74 males and 28 females), members of John Robinson's church at Leyden, who, on board *Speedwell* (60 tons), set sail from Delft Haven (July 22, 1620) under the leadership of William Brewster. Arrived at Southampton, they found *Mayflower* (180 tons; port of registry Yarmouth) awaiting them with their fellow-passengers. The two ships set sail about Aug. 5 (15, N.S.), but *Speedwell* proving unseaworthy, both put in at Dartmouth, where repairs were undertaken, and again essayed the voyage. Off Land's End *Speedwell* was falsely declared by her master to be in a sinking condition, and again the vessels put about and reached Plymouth, where *Speedwell* was abandoned. On Sept. 6 *Mayflower left* Plymouth; arrived off Cape Cod, Nov. 9, and the pilgrims landed on 'Plymouth' rock on Dec. 11 (21, N.S.), where they founded the Plymouth Colony. Forefathers' Day is celebrated on Dec. 22. The Pilgrims are to be distinguished from the 'Puritans' who in 1629–30 founded the Massachusetts Bay Colony. The tercentenary of the departure of *Speedwell* and *Mayflower* from Southampton was celebrated by an appropriate pageant on July 23, 1920. Plymouth held a similar festival in September, and elaborate commemorations took place in U.S. during the year.

Pilibhit, munic. tn., cap. of Pilibhit dist., United Provinces, India (28° 48′ N., 79° 51′ E.), 31 m. N.E. of Bareilly; metal vessels: exports rice, borax, pepper, and sugar. Area of dist. 1,350

sq. m.; pop. 470,000. Pop. of tn., 34,000.

Pilitza, or PILICA, riv., Poland (51° 30′ N., 21° 10′ E.), chief l. bk. trib. of the Vistula, which it joins 30 m. S. of Warsaw from the region of Kielce; length, 200 m. During the Great War the Germans and Austrians were repulsed by the Russian forces N. and S. of the Pilitza in their first attempt to take Warsaw (Oct. 1914); the Germans forced the river defences in March 1915.

Pilkem, vil., W. Flanders, Belgium (50° 54′ N., 2° 54′ E.). Pilkem ridge was a position of strategic importance during the three battles of Ypres, and was scene of much fighting. During the first battle Germans won a temporary success by succeeding in penetrating line at Pilkem; ridge was captured by Welsh troops during third battle (July 1917), though garrisoned by the Guard Fusilier Regiment (the famous Cockchafers).

'Pill Box,' type of concrete defence constructed by the Germans and largely employed in Flanders, where the watery ground made deep underground shelters impracticable. They were generally covered on top with earth, and had loopholes in their sides for machine guns. They constituted formidable points in the Ger. defence during the third battle of Ypres (Aug.–Nov. 1917), and were impervious to anything except a direct hit by a large shell. They inflicted heavy losses on the attacking infantry, but latterly a method was found of dealing with them, bombers usually creeping up until they got within shelter of the walls, when they burst open the door and threw hand grenades inside, compelling the inmates to surrender or perish.

Piloña, comm., Spain (43° 16′ N., 5° 35′ W.), prov. Oviedo; in mining and agricultural district. Pop. 20,000.

Pilot, a special navigator who takes vessels into or from a port or through a particular channel. In U.K. pilots licensed since 1825 by Trinity House. In Brit. waters and in foreign ports, except those of France, Brit. warships are not required to employ a pilot.

Pilotage in Brit. waters may be either compulsory or free. If the former, a pilot has supreme control of the ship, temporarily superseding the master; but if the latter, he is considered as only advising the master, not superseding him. According to the majority of foreign mercantile codes, the pilot is regarded as an adviser only, and the master is not freed from liability.

By the Merchant Shipping Act (1894) a pilot is liable to a fine of £100 if he keeps, or is interested in, a public-house, defrauds the customs, lends his licence, acts when intoxicated, or refuses to act when called on. He is guilty of a misdemeanour if by wilful neglect he endangers a ship or refuses to save it from destruction. By the Aliens Restriction Amendment Act, 1919, no alien may hold pilotage certificate, with sole exception in favour of Fr. captains engaged in cross-Channel traffic.

Pilot-fish (*Naucrates ductor*), a small, bony fish, about which a large element of myth has gathered; derives its name from

habit of swimming in company with large fish, such as sharks, or of accompanying ships in mid-ocean; held sacred by ancients on account of supposed habit of vanishing in vicinity of land; closely related to mackerel.

Pilot Whale, or CA'ING WHALE. See CA'ING WHALE.

Pilsen, tn., Bohemia, Czecho-Slovakia (49° 45′ N., 13° 23′ E.); was stormed by Mansfeld (1618); sugar, clothing, pottery, machinery, alum, furniture, hardware, spirits, leather, and paper; famous for its beer (*Pilsener*). Pop. 81,200.

Pilsudski, JOSEPH (1867–), Polish soldier and statesman; for Nationalist views suffered imprisonment in Russia and in Germany; at outbreak of Great War, on his own authority invaded Russia at head of Polish Legion (Aug. 6, 1914); became head of provisional government formed when the state of Poland was restored by the Treaty of Versailles (1919); succeeded Paderewski as president (Dec. 1919), and exercised the powers of a dictator; as marshal of the army led the Poles in the invasion of the Ukraine (July 1920), which resulted in the Bolshevist attack on Poland. See POLAND.

Pimento, a genus of tropical American trees belonging to the order Myrtaceæ. They bear cymes of small flowers and coriaceous leaves. The chief species are *P. officinalis,* the pimento bush, from which allspice (Jamaica pepper) is obtained, and *P. acris,* the wild clove or black cinnamon tree. Both have economic importance. Oil of pimento is a popular remedy for toothache.

Pimlico, a quarter of London, England, between Westminster and Chelsea; contains Buckingham Palace and Victoria Station, and is connected with Battersea by Chelsea Suspension Bridge, and with Vauxhall by Vauxhall Bridge.

Pimpernel, name given to certain plants of the genus *Anagallis,* a subdivision of the order Primulaceæ; scarlet pimpernel (*A. arvensis*). 'poor man's weather-glass,' closes its petals in dull weather; bog pimpernel (*A. tenella*) has large pink flowers.

Pinar del Rio. (1) Most westerly prov. of Cuba; tobacco, rice, corn, coffee, cotton, and fine woods. Area, 5,000 sq. m.; pop. 252,400. (2) Tn., cap. of above (22° 26′ N., 83° 32′ W.); tobacco. Pop. 11,000 (comm. 52,500).

Pinches, THEOPHILUS GOLDRIDGE (1856–), Eng. Assyriologist; began study of Assyrian in 1875; appointed assistant in the Dep. of Oriental Antiquities of the British Museum (1878), retiring from his connection with that institution in 1900; holds the appointments of lecturer in Assyrian at University Coll., London, and at the Liverpool Institute of Archæology; his writings include *Archæology* (Assyro-Babylonian), *Cuneiform Inscriptions of Western Asia, The Old Testament in the Light of the Records of Assyria and Babylonia* (1908), *An Outline of Assyrian Grammar* (1910), etc.

Pindar (*c.* 522–443 B.C.), Gr. lyric poet; *b.* at Cynoscephalæ, Bœotia; studied music and poetry at Athens; after long study began to write choral odes, and attained great fame, not only

in Greece, but in Sicily, Cyrene, and Magna Græcia; died, probably at Argos, at age of eighty. His poems consisted of songs in praise of gods and men, processional songs, festal songs, dirges, and pæans of victory, besides poems on other themes. A great part of his work has been lost, but his songs of victory (*Epinikia*) have come down to us in four books, describing and praising the victors in the Gr. national games. The discoveries at Oxyrhynchus (1905–7) provided several hitherto unknown poems of Pindar.

E. Myers' *Translation* (2nd ed. 1883); O. Schroder, *Texts and Notes* (1908).

Pind Dadan Khan, tn., Jhelum dist., Punjab, India (32° 36′ N., 73° 4′ E.); weaving, boat-building, manufacture of pottery, metal wares, salt. Pop. 17,000.

Pindus, mountain chain in Central Greece (39° 15′ N., 21° 46′ E.), dividing Thessaly from Epirus; greatest height, 7,665 ft.

Pine (*Pinus*), genus of evergreen coniferous trees of varied habit and habitat; are of symmetrical appearance, this being due to the production of annual pseudo-whorls of branches. These produce scale leaves in the axils of which dwarf shoots, or 'foliar spurs,' arise, each bearing from two (*Pinus sylvestris*) to five (*P. strobus*) needle-shaped leaves. The male cones are borne in clusters, each one consisting of numerous stamens containing abundant, powdery pollen. The pollen grains have a pair of wing-like extensions which facilitate their transport by the wind. The female cones take three years to ripen, being pollinated about June, fertilized the following June, and matured during the third season. Each scale bears two winged seeds, containing an embryo with a whorl of cotyledons, embedded in a rich nutritive tissue. On this account the seeds of some species (*P. pinea*) are utilized as food. The pines are of immense value as timber trees, *P. sylvestris* (the Scots fir) yielding deal, *P. palustris* pitch-pine, and *P. echinata* yellow pine. When well seasoned, pine wood is not subject to attacks of boring insects, and its strength, lightness, durability, resinous character, and cheapness fit it for ships' timbers, planking, sleepers, fuel, boxes, etc. In addition turpentine is obtained by tapping the trunks of various species, and also by distillation of the resin exuded from the wounds. Tar and pitch are yielded on destructive distillation in closed chambers.

Veitch, *Manual of the Coniferæ.*

Pineal Body. See BRAIN.

Pine Apple (*Ananas sativa*), plant of order Bromeliaceæ, native of tropical America; sharp leaves spring from root, and in centre flowers grow on a spike; largely cultivated in W. Indies, Florida, and the Azores.

Pine Bluff, city, Arkansas, U.S. (34° 13′ N., 91° 54′ W.); cotton, planing, and vehicle mills. Pop. 15,100.

Pinene. See TERPENES.

Pinero, SIR ARTHUR WING (1855–), Eng. dramatist; on the stage (1874–81); first noted play *The Money-Spinner* (1881); at Court Theatre were produced (1885–98) series of comedies—

The Magistrate, The Cabinet Minister, Trelawney of the Wells, etc.; wrote also *Sweet Lavender, The Hobby Horse, The Second Mrs. Tanqueray, The Princess and the Butterfly, The Gay Lord Quex, His House in Order, Playgoers* (1913), *The Big Drum* (1915), *Mr. Livermore's Dream* (1917), etc.; was knighted in 1909.

Pinerolo, city, Turin, Italy (44° 53′ N., 7° 19′ E.); 11th cent. cathedral; place of imprisonment of the Man in the Iron Mask (1679–81); silk, cotton, woollens, etc. Pop. 18,500.

Pink (*Dianthus caryophyllus*), a member of the Caryophyllaceæ, garden varieties of which are largely grown on account of their scent and attractive appearance. Often propagated by layering, but easily raised from seed.

Pink Eye, a disease of horses; symptoms are—high temperature, loss of appetite, redness of eye, stiffness and swelling of joints, constipation; treatment—stimulation of heart to prevent clotting of blood, laxatives, absolute rest; disease is contagious, and may be transmitted by men.

Pinkie, estate with mansion, Inveresk par., Musselburgh, Scotland (55° 57′ N., 3° 3′ W.); Scots here defeated by English (1547).

Pinnipedia. See CARNIVORA.

Pins are generally manufactured in Wright machine; brass wire is drawn to the requisite length; head shaped by die; dropped into slot and pointed by rotating cutter; coated with tin; formerly made with separate heads. They were once very expensive, and with ladies 'pin-money' was a consideration. Pins and safety pins of various metals are found on prehistoric dwelling sites and in class. remains. Birmingham is Brit. centre of industry. See illustration on next page.

Pinsk, tn., Minsk, Ukraine (51° 45′ N., 26° 7′ E.), 140 m. S.S.W. of Minsk; potteries, tanneries, breweries, oil and soap works. During Great War was taken by the Germans at the close of the Russian retreat (Sept. 1915). There are extensive marshes in the neighbourhood, and here the Ger. advance stopped; seized by the Poles and recovered by the Bolshevist Red armies (1920). Pop. 28,000.

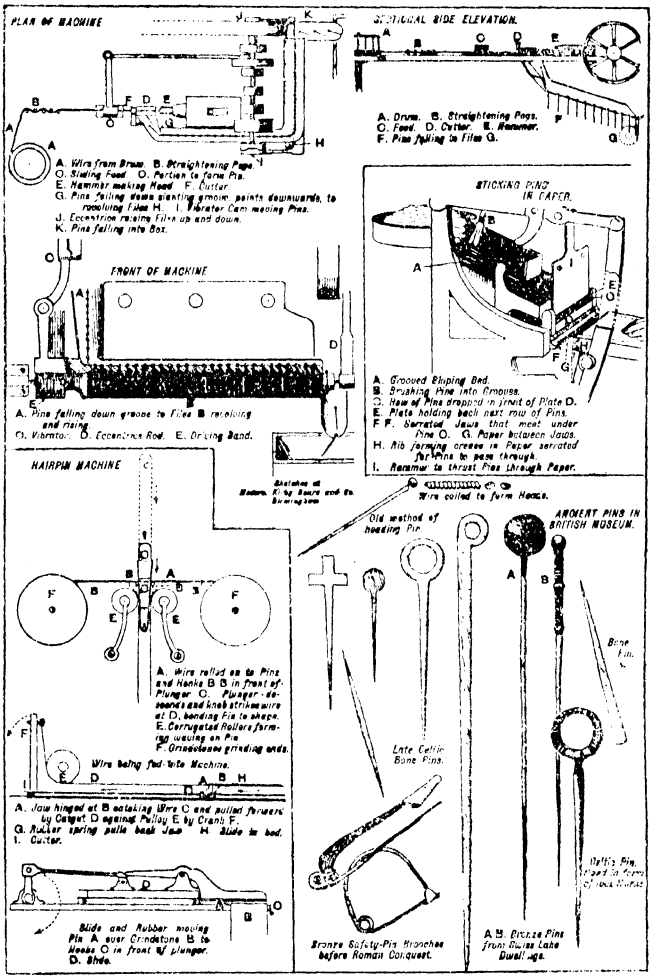
Pinsuti, CIRO (1829–88), Ital. composer, *b.* Italy; came to England (1848) as a teacher of singing; was at the Royal Academy of Music (1858–85); wrote two successful operas, *Il Mercante di Venezia* (1873) and *Mattia Corvino* (1877), a *Te Deum* (1859), and nearly 300 songs in English and Italian, and numerous pianoforte pieces.

Pint. See under WEIGHTS AND MEASURES.

Pinto, SERPA. See SERPA PINTO.

Pinxton, par. and vil., Derbyshire, England (53° 6′ N, 1° 23′ W.); coal mines in vicinity. Pop. (par.) 5,100.

Pinzon, family of Span. navigators, who claim to share with Columbus honour of discovering America. MARTIN ALONZO (*d.* 1493) and his brothers, VICENTE YAÑEZ and FRANCISCO, supplied Columbus with funds and sailed in his expedition (1492–3). Vicente Yañez was first European to cross equinoctial line, discovering Brazil and riv. Amazon.



The Manufacture of Pins.

Piombo. See SEBASTIAN DEL PIOMBO.

Piotrkow. (1) Government, Poland; surface mostly flat, though not very fertile; coal (formerly one-fourth of Russia's total output), iron, and zinc are mined; cotton, wool, and silk working; bricks, glass, candles, and metal objects. Area, 4,729 sq. m.; pop. c. 2,000,000. (2) Tn., cap. of above (51° 35′ N., 19° 44′ E.); scene of Russian victory over Poles (1769). Pop. 39,000.

Pip. See POULTRY FARMING.

Pipal, or PEEPUL. See under BO TREE.

Pipe. (1) Musical instrument consisting of pierced cylinder; mediæval pipe had three holes; was chromatic; Highland bagpipe has eight holes, one in back; achromatic. (2) Device for smoking tobacco, probably N. American in origin, though some authorities hold that the pipe was used by the ancients for smoking aromatic herbs; first made of stone, now of wood, clay, or meerschaum; briar pipe most popular. (3) Brit. and U.S. liquid measure, generally containing two hogsheads or 105 imperial or 126 wine gallons. Two pipes form a tun.

Pipe-fishes and Sea-horses (Syngnathidæ), some 175 species of very long, slender fishes, with bodies covered by bony rings; found in almost all seas. Many of the males possess a brood pouch in which the eggs are retained until hatched. Five kinds of pipe-fishes, distinguished by their long, hard snout, occur on the Brit. coast, as also does the peculiar sea-horse (*Hippocampus*), which clings to seaweeds by its prehensile tail, but prefers the warmer S. seas.

Piperidine, $C_5H_{11}N$, a secondary amine, occurring in combination with piperic acid in pepper. It may be prepared synthetically, from which it appears to be a hexa-hydro-pyridine, and is a colourless liquid (b.p. 106° C.), with pungent peppery odour and basic properties.

Piperine, $C_5H_{10}NC_{12}H_9O_3$, an alkaloid occurring in pepper; from its synthetical preparation from piperyl chloride and piperidine, it is a piperyl-piperidine. It is a feeble base that crystallizes in prisms (sp. gr. 1·19; m.p. 128° C.) and colours sulphuric acid red.

Pipe Rolls. See RECORD OFFICE.

Pipits (*Anthus*), genus of perching birds closely related to the wagtails, having long legs, a slender bill slightly notched at the tip, and dull-coloured plumage. They occur in almost all parts of the world.

Pippin. See PEPIN.

Pipridæ. See MANAKINS.

Piqua, city, Ohio, U.S. (40° 7′ N., 84° 13′ W.); iron and furniture works; woollen goods, linseed oil, flour, etc. Pop. 13,400.

Piracy consists in committing on the high seas such acts of robbery and depredation as, if committed on land, would amount to a felony. The following actions are statutory piracies in Brit. law: (1) acts of hostility by a subject under colour of a foreign commission; (2) running away with a ship, or mutiny; (3) trading with pirates; (4) assisting an enemy in time of war; (5) slave dealing. The punishment is penal servitude for life or less, but

piracy accompanied by attempted murder or unlawful wounding is still punishable by death. Notable pirates of the past were the corsairs of N. Africa, and the successors of the buccaneers on the Span. Main. Except perhaps in Chin. waters, piracy is practically unknown in modern times.

Piræus, tn., anc. Attica, Greece (37° 56′ N., 23° 40′ E.), 5 m. S.W. of Athens; port of anc. and modern Athens; fortifications destroyed 404 B.C.; restored 393 B.C.; captured and destroyed by Sulla in 86 B.C., and town declined until 1835; now chief port of Greece; arsenal; exports wines, brandy, currants, marble, vinegar; flour and cotton mills, machinery factories, soap works. Pop. 82,000.

Pirano, seapt., Istria, Italy (45° 32′ N., 13° 34′ E.); salt works; wines and olives; birthplace of Tartini the musician (1692). Pop. 15,300.

Pirates, freebooters or corsairs, who formerly sailed the seas for robbery and plunder of merchant vessels. See PIRACY.

Pirmasens, tn., Palatinate, Germany (49° 12′ N., 7° 37′ E.); boots, shoes, leather goods, and musical instruments. Pop. 38,500.

Pirna, tn., Saxony, Germany (50° 57′ N., 13° 56′ E.); glass blowing, tanning, brewing; manufacture of porcelain and enamelled ware; scene of surrender of Saxon army to Prussians (1756). Pop. 19,500.

Pirot, tn., dep. Pirot, Serbia, Jugo-Slavia (43° 12′ N., 22° 35′ E.); cloth and carpets; scene of defeat of Serbs by Bulgarians (1885). During Great War was the scene of heavy fighting; was taken by Bulgarians (Oct. 1915), and recaptured by French (Oct. 1918). Pop. 11,000; dep. 105,000.

Pirrie (WILLIAM JAMES PIRRIE), 1ST BARON (1847–), Brit. shipowner; *b.* at Quebec; joined Harland and Wolff's shipbuilding and engineering establishment (1862); became head draughtsman in 1869; showed such enterprise in the development of new types of naval architecture, etc., that the business of the firm rapidly increased, and he was made a partner in 1874, and is now chairman; was lord mayor of Belfast (1896–7), and became its first honorary freeman (1898); controller-general of merchant shipbuilding (1918–19); created baron (1906).

Pisa. (1) Prov., Tuscany, Italy; produces wheat, oil, and wine; manufactures silk, cotton, linen goods, pottery, glass, soap, and candles; marble quarries; copper and coal mines. Area, 1,179 sq. m.; pop. 342,000. (2) Tn., cap. of above, on riv. Arno (43° 43′ N., 10° 23′ E.); is seat of an archbishop; has broad streets and plenty of open spaces. Its outstanding features include celebrated 11th cent. Gothic cathedral of white marble with magnificent façade and valuable paintings by Andrea del Sarto, etc.; baptistery with conical dome completed in 1278; campanile, known as the Leaning Tower (1174–1350), built entirely of marble, 178½ ft. high and over 16 ft. out of the perpendicular; Campo Santo, or burying ground, formed in 14th cent.; univ. founded in 14th cent.; numerous palaces, churches, etc. Pisa was

mentioned by Livy as Julia Pisana; became subject to Rome; was independent under Carolingians, and rivalled Genoa as a naval power in 11th, 12th, and 13th centuries, until defeat of fleet off Meloria (1284); later fell under dominion of Milan and of Florence; became an independent republic under Fr. protection (1494), but was retaken by Florentines (1509); was finally incorporated with Italy (1860). Manufactures silk, cotton, linen, coral, and alabaster work, and was the birthplace of Galileo. Pop. 65,200.

Pisces. See FISHES.

Pisciculture, the artificial breeding and rearing of fishes from the egg for the purpose of stocking suitable localities with young fishes. The aim of pisciculture is to guard and shield the embryonic fishes during the early stages, when they are so liable to wholesale destruction, until they are able to fend for themselves—that is to say, until at least the yolk sac is wholly absorbed. Methods of hatching and rearing have long been carried out in specially adapted hatcheries, where especially trout and salmon were dealt with; but great advances have been made as regards edible marine creatures and many plaice and other marketable fishes, and even lobsters are hatched and released on suitable grounds every year. Artificially propagated fry have been 'planted' in waters where their species was previously unknown, with excellent results—*e.g.*, the shad on the Pacific coast of N. America.

Pisek, tn., Bohemia, Czecho-Slovakia (49° 18′ N., 14° 10′ E.); breweries and iron and brass foundries. Pop. 16,500.

Pisistratus. See under PEISISTRATUS.

Pissarro, CAMILLE (1830–1903), Fr. impressionist painter; took refuge in London (1871–2); rejected by Salon, but, along with other impressionists, held own exhibitions (1874–86); equally successful in rural and street scenes, as in *Pont Neuf—Effet de Pluie, Mi-carême sur les Boulevards, Bazincour in Flood.*

Pistacia, genus of small trees, order Anacardiaceæ, mostly natives of Mediterranean countries; flowers are dioecious and have no petals; fruit is a single-seeded dry drupe; *P. vera* yields the pistachio nut used in cooking; *P. lentiscus* gives mastic, a gum-resin; and from *P. terebinthus* Cyprus turpentine is obtained.

Pistoia, or PISTOJA, tn., Tuscany, Italy (43° 57′ N., 10° 55′ E.); contains 12th cent. cathedral and many buildings of architectural interest; is noted for gun barrels and for pistols, which are said to have derived their name from town; iron and steel ware, glass, silk, paper, macaroni, etc. Pop. 65,000.

Pistol. See REVOLVER.

Pitcairn, isl., Pacific (25° 5′ S., 130° 5′ W.); produces sweet potatoes, bananas, oranges, cocoanuts, coffee, and arrowroot. Discovered 1767; colonized by the mutineers of the *Bounty* (1790); annexed by Great Britain (1839). Area, 2 sq. m.; pop. (1920) 175.

Pitch, the complex mixture of hydrocarbons and their derivatives that is either left when tar, oils, or fatty acids are distilled;

is found naturally in Trinidad and other places. Coal-tar pitch, which is typical of the others, forms about two-thirds of the tar, and is a black substance that is either 'soft' or 'hard' according to the temperature to which the distillation is carried. It breaks with a conchoidal fracture if struck, but bends and flows under the influence of long-continued stresses, such as its own weight. It forms a viscous liquid when heated, and is used for cementing paving sets, binding coal dust into 'patent fuel,' as a protective both alone and as black varnish, and for admixture with natural asphalt.

Pitchblende, essentially a uranate of uranyl, lead, thorium, etc.; the source of uranium and radium, found in Cornwall, the Erzgebirge, and Colorado; composed largely of oxide of uranium and classed as a variety of uraninite; colour is brown or black, often tinged with green. See RADIUM.

Pitcher-plants, forms in which the whole leaf (*Sarracenia darlingtonia*) or the apical portion (*Nepenthes*) is modified to form a lidded pitcher-like structure for the capture and digestion of insects. The pitcher is often brightly coloured, and has an incurved lip round which are numerous honey glands. Beyond this is a slippery zone down which insect visitors glide helplessly, to fall into the liquid below and be prevented from returning by downward-pointing hairs. Here they drown and decay, and are digested by special secretions, thus forming an additional source of nitrogenous food.

Pitchstone, a glassy igneous rock, dark green, brown, grey, or almost black in colour, and characterized by rather greasy or resinous lustre; found in Hebrides, Saxony, and S. America.

Pitesci, or PITESTI, tn., Rumania (44° 52′ N., 24° 52′ E.), on riv. Argas, 65 m. W.N.W. of Bukharest; captured by the Germans in their invasion of Rumania (Nov. 30, 1916). Pop. 15,000.

Pithecanthropus Erectus, a genus of anthropoid ape, represented by a few fossil bones from Java, and believed to link the highest apes to man; was discovered by Dr. Dubois (1892).

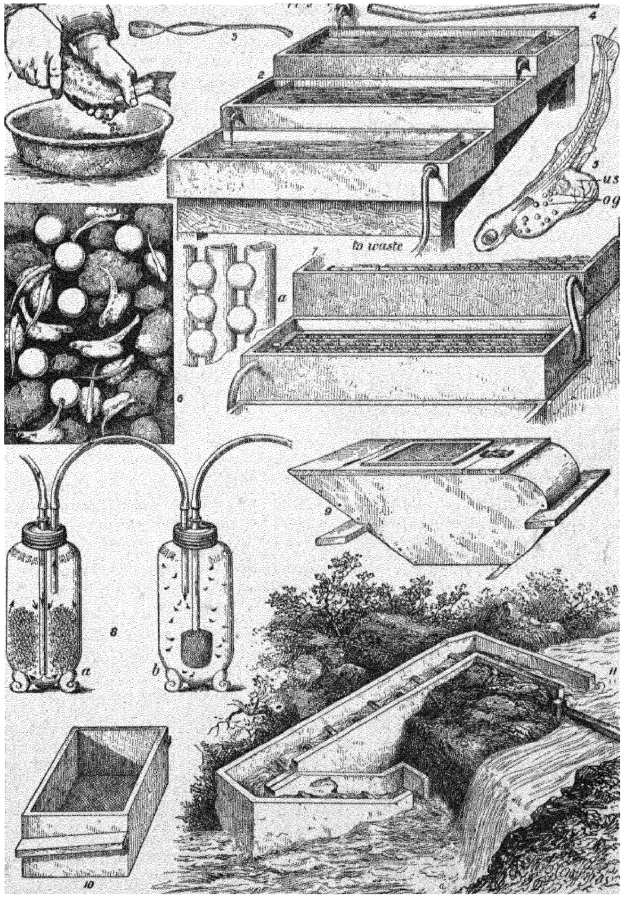
Pitlochry, vil., Perthshire, Scotland (56° 42′ N., 3° 44′ W.); near Pass of Killiecrankie and Loch Tummel; health resort. Pop. 1,700.

Pitman, SIR ISAAC (1813–97), inventor of a system of shorthand; *b.* at Trowbridge, Wiltshire; became a schoolmaster, and while at Wotton-under-Edge pub. his *Stenographic Sound Hand* (1837); devoted himself thereafter to the development of shorthand and to spelling reform; his system of SHORTHAND became very popular, and is extensively used. The *Phonetic Journal* was begun in 1842, and he continued it till his death; was knighted (1894).

Life by T. A. Reed (1890) and by A. Baker (1908).

Pitt, the Elder. See CHATHAM, 1ST EARL OF.

Pitt, PERCY (1870–), Eng. composer; musical director at Royal Opera, Covent Garden, London; his works comprise a *Symphonic Prelude, Le Sang des Crépuscules* (1900), *Suite* from the incidental music to Stephen Phillips's *Paolo and Francesca*



Modern Pisciculture.

1. 'Stripping' a trout. 2. Hatching troughs: any number may be added as desired. 3. Tweezers for removing dead eggs, etc. 4. Siphon for transferring young fish, etc. 5. Young Trout: *us*, **umbilical sac**; *og*, **oil globules. 6. Young trout and unhatched eggs as they appear on floor of hatching trough (Fig. 2)** nat. size. **7. Shuck's hatching grille: *a*, details of tubes with eggs on them (nat. size). 8. M'Donald jar: *a*, vessel with unhatched eggs; *b*, vessel into which the young are drawn by the current when hatched. 9. Wave hatching-box. 10. Wave hatching-box, open topped. 11. Salmon ladder constructed on pool system at a weir.**



WILLIAM PITT ADDRESSING THE HOUSE OF COMMONS IN ST. STEPHEN'S CHAPEL, WESTMINSTER, IN 1793.

(From the painting by K. A. Hickel in the National Portrait Gallery.)

(1902), *Ballade for Violin and Orchestra* (1900), *Dance Rhythms* (1901), *Five Poems for Baritone and Orchestra* (1902), and *Symphony* (1906).

Pitt, WILLIAM (1759–1806), Brit. statesman; second son of 1st Earl of Chatham; called to bar (1780); member for Appleby, Cumberland (1781); took important part in Opposition side, especially denouncing the war with the Amer. colonies. On the death of Rockingham (July 1782), Shelburne became prime minister and the youthful Pitt chancellor of the Exchequer. The Shelburne government came to grief in 1783 over the preliminaries of peace with the Americans. The Portland coalition ministry (including Fox) was formed in April 1783, but was dissolved by the king in Dec. 1783, and Pitt formed new cabinet. His cabinet was without ability and opposed by House of Commons, led by Fox, but he was supported by king and lords, and, as son of Chatham, by the country, and the result of a general election (1784) was a triumph for the government. Pitt sat for the univ. of Cambridge thenceforward. He proceeded to restore Britain to the position in Europe she had lost by the Amer. War, restored national credit by his genius for finance, initiated a scheme of offering public loan for private tender, lowered the tea duties, and suppressed smuggling, etc. He had already brought in bills for parliamentary reform, and made a last vain effort to extinguish rotten boroughs (1785), and now attempted to establish free trade with Ireland, but failed, owing to the outcry of Eng. manufacturing interests; carried a commercial treaty with France (1786), strongly opposed by landed interest; alienated powerful interests by his attempted partial abolition of the slave trade (1799); passed India Bill re-forming the E. India Co. on a new basis (1788).

When the Fr. Revolution broke out Pitt did not perceive its international importance until his ally, Holland, was attacked (1792), and until he was forced to repress seditious writings and call out the militia in London. War with France was declared (1793). Pitt's war policy was designed to break the power of France on land and to maintain England's supremacy at sea. He succeeded in the latter, but failed in the former, because, owing to the weakness of the Eng. army, he had to carry on the war on land by subsidizing half-hearted allies. To carry out this, heavy taxation was necessary, and to suppress sympathy with the Revolution drastic coercion laws were passed, the Habeas Corpus Act being suspended (1794). Pitt, induced by the Irish rebellion of 1798, passed the Act of Union (1800), but quarrelled with the king on Catholic Emancipation, and resigned.

Again called to office (1804), he formed a new coalition (1805) against Napoleon. Petty parliamentary attacks completed the ruin of his health, and he never recovered his spirits after news of Austerlitz. His last words are said to have been, 'Oh, my country! How I leave my country!' Self-contained and apparently cold of nature, Pitt was passionately patriotic and a great orator.

Life, by Gifford (1809), Rosebery (1891), Whibley (1905), Holland Rose (1911).

Pittas, or OLD WORLD ANT-THRUSHES (Pittidæ), a family of about fifty songless perching birds, having brilliant crimson, green, and blue plumage, found in the tropics of Africa, S.E. Asia, E. Indies, and Australia.

Pittenweem, seapt. and royal burgh, Fifeshire, Scotland (56° 13′ N., 2° 43′ W.); fishing and fish curing. Pop. 1,900.

Pittsburg, city, Kansas, U.S. (37° 26′ N., 94° 40′ W.); situated in lead and zinc region; railway works; bricks, tiles, sewer pipes, glass, and meat-packing products. Pop. 14,800.

Pittsburg, or PITTSBURGH, city, Pennsylvania, U.S. (40° 30′ N., 80° 1′ W.), situated on Allegheny, Monongahela, and Ohio rivers; among principal buildings are the Carnegie Institute, which includes a large art gallery, a music hall, and a museum, the Carnegie Library and Museum, and the new buildings of univ. of Pittsburg. Originally a stockade, built by the French, it was known as Fort Duquesne; was afterwards called Fort Pitt at the suggestion of Washington, in honour of William Pitt.

Pittsburg is a city of enormous industrial importance, and is the headquarters of the U.S. Steel Corporation; built in centre of the richest coalfields in America, with vast deposits of iron close at hand, it is the largest distributing point for coal in U.S.; region also produces natural gas and petroleum; centre of extensive railway system; great river traffic, locks and dams being constructed on rivers to secure slack-water navigation; factories extend for miles along river banks. The leading manufactures are iron and steel products of all kinds; also glass, rolled brass and copper, foundry and machine-shop products, silver and nickel-plated ware, earthenware, tinplate, electrical machinery, bricks, carriages, and furniture; slaughtering and meat packing are important industries. Pop. 533,900.

Pittsfield, city, Massachusetts, U.S. (42° 30′ N., 73° 18′ W.); electrical goods, motor cars, cotton and woollen goods, boots and paper; is a favourite summer resort and automobile centre. Pop. 32,100.

Pittston, city, Pennsylvania, U.S. (41° 18′ N., 77° 53′ W.); coal-mining centre; machinery, vulcanized iron, terra cotta, paper, silk, etc. Pop. 16,300.

Pituitary Body (hypophysis cerebri), a small reddish-grey mass at base of brain, proportionately larger in fœtus than in adult; is probably associated with development of the brain; secretes an active chemical substance (hormone), which has a powerful action on renal secretion. Disease of this body is sometimes responsible for particular type of giantism (acromegaly).

Piura. (1) Coast dep., Peru; is partly desert and almost rainless; petroleum, salt, sulphur, and soda. Area, 16,800 sq. m.; pop. *c.* 220,000. (2) Tn., cap. of above (5° 10′ S., 80° 38′ W.); was first Span. colony in country; petroleum and cotton. Pop. 12,000.

Pius, the name of several popes. P. IV. (1559–65); his pon-

tificate was marked by the Council of Trent. P. v. (1566–72) excommunicated Queen Elizabeth and drove the Jews from Rome. P. VII. (1800–23) crowned Napoleon in Paris. P. IX. (1846–78); infallibility of Pope declared. P. X. (1903–1914), a pope from the ranks of the people; opposed modernism.

Pizarro, FRANCISCO (1478–1541), Span. conqueror of Peru; was with Balboa when he discovered the Pacific; landing with Almagro in Peru, he then marched inland, captured the Inca Atahualpa by treachery, and strangled him. Pizarro and Almagro then set up Manco as nominal Inca; founded Lima as the new capital (1535); but the two adventurers quarrelling about their respective shares of land, a civil war ensued, and Almagro was slain. Three years later Pizarro was assassinated by Almagrists.

Prescott, *History of the Conquest of Peru.*

Place Names. See NAMES.

Placenta, the structure by which a fœtus is nourished in the uterus, or womb, of its mother, and which is expelled after the young is born, constituting, with the membranes, the 'after-birth.' To it the fœtus is attached by the allantoic stalk, which later becomes elongated and is known as the umbilical cord. The fully developed human placenta is a circular disk-like structure, 7 or 8 in. in diameter, about 1¼ in. thick at the centre, and becoming thinner at the edges, and weighing about 1 lb.

Placuna. See under LAMELLIBRANCHIATA.

Plagioclase, important group of rock-forming minerals; occurs as primary constituent of igneous rocks; is a triclinic felspar.

Plagiostomi. See under FISHES.

Plague, term formerly applied to any epidemic disease of considerable mortality, but now restricted to a particular malignant contagious disease caused by a specific bacillus, the *Bacillus pestis,* and characterized by buboes, or swellings of the lymphatic glands, and carbuncles. The Black Death of the 14th cent. is supposed to have been true bubonic plague. Its last appearance in this country, with the exception of occasional cases in seaport towns—notably in Glasgow in 1900—was the Plague of London (1665), when about 10,000 people died. During 19th cent. plague in Europe has been confined almost exclusively to Turkey and S. Russia. In 1898, 1904, and 1905 plague raged with fatal violence in India, and it has also appeared of recent years in other parts of Asia and Africa, and in San Francisco and several Australian ports.

The symptoms of plague usually include a preliminary stage of depression and pains, but the onset of the disease is sudden, with shivering, and the temp. rising to 103°, or even three or four degrees higher; there may be delirium, and there is marked prostration, headache, dizziness, and lethargy. In one or two days swellings usually appear, due to the inflamed glands, singly, or in groups, which may be very painful and may suppurate, while there may be small hæmorrhages under the skin.

There are three main varieties

of plague—*bubonic*, with the characteristic glandular swellings; *septicæmic*, a very fatal type, in which the symptoms are more severe than in bubonic, without the glandular swellings; *pneumonic*, in which there is an inflammatory condition of the lungs, resembling pneumonia, with intense prostration, no glandular swellings, and usually death about the second or third day.

The only treatment is to treat symptoms as they arise—*e.g.*, headache or delirium—while alcohol and other stimulants may be given to keep up strength of the heart. An antitoxin, termed the Yersin-Roux serum, is of great benefit when employed within twenty-four hours of the commencement of the disease, very large doses being injected. As a preventive measure inoculation with Haffkine's fluid, which is prepared from the sterilized virus of plague, has been proved to be of the greatest value, and is systematically carried out by the Indian Government. It has been shown that infection is carried by the fleas which have their habitat on the bodies of rats, and fleas also convey infection from one human being to another. This, in conjunction with the well-known fact that an unhealthy and filthy environment favours the disease, shows that the best preventive of plague is a clean and hygienic mode of living.

Plaice. See FLAT-FISHES.

Plainfield, city, New Jersey, U.S. (40° 36′ N., 74° 26′ W.); manufactures clothing, tools, printing presses, and iron-working machinery. Pop. 20,600.

Planchette, a piece of board shaped like a heart, mounted on supports, two of which are castors, fixed at the broader end, with a pencil at the other, so that it moves easily over a sheet of paper when hands are placed lightly on it. This instrument was at one time believed to write independently of the volition of the person touching it; but its action is now explained by the 'dominant idea,' which influences the hands of the operator.

Plane (*Platanus*), genus of trees, order Platanaceæ; *P. orientalis*, a native of the East, and buttonwood, or N. Amer. plane (*P. occidentalis*), are common; in Scotland the sycamore (*Acer pseudo-platanus*) is called a plane; planes are unaffected by smoke—hence their abundance in cities.

Planet (Gr. *planetes*, 'a wanderer'), name given to eight celestial bodies revolving in same direction around sun by gravity, and known collectively as the SOLAR SYSTEM, and called planets because of their apparent wanderings among the fixed stars.

A planet may be distinguished by (*a*) this movement, or (*b*) its steady 'glare,' for unlike the stars planets very seldom twinkle, except when low in sky and thus near horizon vapours; and (*c*) telescopically by the fact that they show an appreciable disk, whilst even in the largest telescopes the stars are seen only as points of light, owing to their extreme distances.

The planets are divided into two groups, *major* and *minor*, and sometimes the four major planets nearest to the sun are called the Inner planets, and the other four the Outer planets.

The major planets are (in order of distance from sun, commencing with nearest) Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune. See articles under these heads.

All planets shine by reflected light, but probably both Jupiter and Saturn have some inherent luminosity.

Planetoids, or MINOR PLANETS. See ASTEROIDS.

Planimeters. See CALCULATING MACHINES.

Plankton, the medley of marine animals and plants which, incapable of active movement, drift with the surrounding water.

The plankton consists of three types of ingredients. (1) Most important in point of numbers and significance are the microscopically minute *vegetable organisms*—bacteria, diatoms, and blue-green algæ (Cyanophyceæ). These form the true pastures of the ocean, for they alone (with a few of the simplest animals—Peridinians, some Flagellates and Halosphæra), aided by sunlight, have the power of manufacturing from the inorganic substances in the sea the organic fats, proteids, and carbohydrates upon which alone animals can subsist. (2) A *Permanent Zoo-Plankton,* formed of *animal organisms* which spend their whole life floating in the waters. Such are the microscopic Protozoa which, besides those mentioned above, include the Foraminifera—Radiolarians and some Ciliata; many Cœlenterates—jelly-fishes, sea-blebs (Ctenophores), etc.; the arrow-worms (*Sagitta, Spadella*), and a few Chætopods (*Tomopteris, Chætopterus*); countless hosts of minute crustaceans, chiefly copepods; and, amongst vertebrates, the sea-squirts (Salpæ). (3) A *Temporary Zoo-Plankton,* constituted by the early stages of animals which when adult live on the bottom or swim freely—for example, the larvæ of zoophytes and corals, of star-fishes and sea-urchins, of molluscs, worms, and crustacea, and the eggs and larvæ of fishes.

Lohmann's examination of a cubic metre of Mediterranean water, which yielded 2,425,665 minute organisms, gives but a faint idea of the numbers generally present. Polar seas are more fertile than temperate or tropical waters, and shallow seas than oceanic deeps.

Plankton is all-important economically as the ultimate food-supply upon which all fisheries depend. Man eats the haddock, which feeds on young cod and launces, which feed on copepods, molluscs, or worms, and these feed on diatoms. So it is in every case: in every marine food-chain diatoms form the final basis.

Planorbis. See GASTEROPODA.

Plantain (*Plantago*), a plant of the order Plantaginaceæ; greater plantain (*P. major*), a common wayside plant, has long spikes whose seeds are given to cage-birds; ribwort plantain (*P. lanceolata*) is the 'cocks and hens' of meadows; term is also applied to the BANANA of the tropics (*Musa*).

Plantain-eaters. See TURACOS.

Plant-lice. See APHIS.

Plants. All living things are divided by common consent into two kingdoms, the *animal* and the *vegetable.* These are separated

from each other by two main distinctions: the plant is not capable of free locomotion, and possesses green colouring matter. Neither of these distinctions is anything like universally true. Many plants and parts of plants can move freely, and whole classes of plants possess no green pigment. But it is true that in the vegetable kingdom there is a *tendency* towards these two properties; and those plants which depart from this tendency may be recognized as plants because of their near resemblance in other points to forms undoubtedly vegetable.

As a living thing a plant possesses a certain *form*, a certain *structure*, and performs certain *functions*. The study of form is termed *morphology;* of structure, *anatomy;* and of functions, *physiology*. These three branches of study have in the course of time given off subsidiary branches, such as *cytology*, which deals with the structure of the cell, and *palæontology*, which treats of the form, structure, and classification of fossil plants, and others which will be mentioned in their proper connection.

Morphology.—If we examine any common weed we observe that it may be divided into a *root system* and a *shoot system*. The root system occurs characteristically underground, and is usually much branched. There may be present one large tap-root, which gives off side-roots—*e.g.*, plantain; or there may be a bunch of more or less equal roots also giving off side-roots—*e.g.*, grasses. The roots traverse a large volume of soil and fix the plant firmly in position; but they also serve to absorb moisture, and this is accomplished by fine hairs which are found near the tips of the finest root branches, and which attach themselves firmly to the soil particles. The tip of the root is protected by a little cap. Roots do not, however, always remain of the typical fibrous form. Very frequently they become swollen up and serve as stores of food—the most important examples of this being the carrot and turnip.

The *shoot system* is readily divided into two classes of organs—the stem and branches, and the leaves. The leaves are the part of the plant in which food is built up, and to carry out their functions properly it is necessary that they should spread a large area out to the light. This the form of the typical leaf aims at: it has a thin blade with a large area, and is frequently held out from the stem on a special stalk. The leaves also are frequently modified to suit other ends. Thus the bulbs of hyacinth and onion are nothing but collections of leaves which have become much thickened, lost their green colour, and have taken to storing food instead of manufacturing it. Many leaves are thin and brown—*e.g.*, the scales which protect delicate buds. Most important modification of all is that which is seen in the *flower*. The outer circle of the leaves which compose the flower is protective in function, and is named the *calyx* (separate parts are the *sepals*); the second circle is generally brightly coloured, and may have associated with it scent or honey glands; it

is named the *corolla* (composed of *petals*), and serves to attract insects; inside the corolla are two sets of organs, the *stamens* and the *carpels*, also modified leaves, but bearing, the one *pollen-sacs*, the other *ovules*. The pollen-sac and the ovule are not modified leaves; they are special organs known as *sporangia*, whose special duty it is to produce *spores*, with which we shall deal later.

The *stem* has as its function the holding of the leaves and flowers in an advantageous position; to this end it is typically rigid, or else suited to twisting itself round or otherwise fastening itself to an external support. It may, however, under certain conditions, take on the functions of a leaf; this takes place when for some reason the leaves are much reduced in size: thus in the common broom leaves are almost absent, and the stem becomes green and winged, and so increases the surface which it exposes to the light. The stem, too, may become thickened and form a food store; especially is this the case in underground stems (distinguished from roots by the fact that they bear buds which give rise to shoot systems), as in the potato.

The surface of stem and leaves is frequently set with hairs, prickles, and spines, which are mere surface excrescences, or may be modified branches or leaves.

Anatomy or Phytotomy.—When we examine with the microscope a thin slice of a very young part of a plant, we find that it is built up of a mass of little boxes closely united together and known as ***cells.*** The study of the structure of these cells is called *cytology*. It is found that they consist of a wall (made of *cellulose*, a substance seen almost pure in cotton wool), lining which is a layer of viscous, half-fluid substance, called the *cytoplasm*; this, together with a more solid, round object, the *nucleus*, which is embedded in it, is the actual living substance of the plant (*protoplasm*). Various other bodies are found embedded in the cytoplasm, of which in the plant the most important are the *chloroplasts*, which contain the green colouring matter, *chlorophyll*. Inside the cytoplasm is a watery fluid containing various salts and other substances dissolved in it—the *cell-sap*.

All cells of the plant do not, however, remain in this state; if we examine older parts, we find that many of the cells have taken on quite different shapes and properties in order to perform different functions. One important requirement of many parts is mechanical strength, and this is attained generally by the thickening of the walls of the cells, which thickening may or may not be accompanied by a deposition in the wall of substances which change it into *wood*. At the same time these strengthening cells generally lose their contents and thus die, and elongate greatly, taking on the character of fibres. Another important function which must be carried out by the cells is the carriage of water and food substances. This is most easy if the cells are very long, and consequently we find that the water-conducting cells are greatly elon-

gated, and very frequently that the end walls separating them disappear, so that the water can traverse tubes consisting of rows of cells joined end to end. Such cells are also dead, and have thickened walls which serve to strengthen the plant. The cells which are used for conducting food are also long and wide, and the end walls between are pierced by small pores, to allow of the more ready passage of the contents.

These different types of cells are not scattered at random through the plant, but are arranged in definite groups called *tissues.* Thus the water-conducting cells and vessels are grouped together as *wood,* the food conductors form the *bast,* strengthening cells form the *stereome.* These tissues are also arranged definitely in the different organs of the plant. As an example we may take the young stem of a plant such as the sunflower. To the outside we have a tissue consisting of a single layer of cells extending over the whole surface and known as the *epiderm;* inside this we have a broad layer of ground tissue, the *cortex.* Then comes a ring of bundles—the so-called *fibro-vascular bundles*—each of which has a group of wood cells inside and of bast cells outside; inside the ring of bundles is a central core of ground tissue, the *pith.* If we examined an older stem we would find that certain changes had occurred: there would be a complete ring of wood surrounded by a complete ring of bast—or at least the rings would be broken only by slender spokes, the *medullary rays,* connecting the pith with the cortex. This change has occurred because a single circle of cells running between the wood and bast has remained in an actively growing condition, and has given rise to new wood and bast; this growing layer is called the *cambium,* and is responsible for the increase in thickness shown by many stems—of trees, for example.

The arrangement of the tissues varies greatly in different organs—roots, stems, leaves—and in different plants. In the simpler forms of vegetation not all the kinds of tissue described are found. Thus in the mosses it is impossible to distinguish true water-conducting vessels; and at the same time the mosses possess no true root. In plants like the seaweeds and their relatives the structure is still simpler—leaves, stem, root are all absent; we are left with a simple, or branched, more or less strap-like body, which is named a *thallus*, it consists of cells which may take on different shapes, but which are far less distinct in form and function than are those of the higher plants. In still simpler forms we find that the plant consists of a simple row of cells joined end to end, or may even be reduced to one single cell—*e.g.*, the bacteria.

This tracing of similarities and dissimilarities between different members of the vegetable kingdom is known as *comparative morphology* or *anatomy,* and on the basis of such comparative studies is built up the system in which plants are classified.

The system is, however, largely

based on the difference in the methods of reproduction—one of the plant's *functions*—so that its study comes under the head of physiology.

Physiology studies the way in which a plant lives—*i.e.*, the different functions of the plant: (1) growth and reproduction, (2) nutrition, (3) movement.

The actual operation of growth consists of two distinct processes: one is the enlargement of the individual cells, due either to an increase of living substance or of cell-sap; the other is the division of the cell into two halves, a process which is carried out with great nicety. The rate of growth and the form which a plant assumes are influenced greatly by external conditions. Thus heat increases rate of growth, as does also moisture. A prime necessity is the presence of oxygen. Particularly light and water are efficacious in altering the form of a plant: many water plants produce one type of leaf in the water and another in the air; leaves grown in the shade are larger and of a finer texture than those from sunny positions. Growth ultimately brings the plant to a stage at which it sets about reproducing its kind.

Reproduction may be very simple: in the bacteria it consists simply in one cell dividing into two new ones. In the seaweeds and their relatives we have, however, a more complicated state of affairs; here we have special cells set aside for reproduction; they are termed *spores*, and may be of the most diverse design. For our purpose we may divide them into two classes: (*a*) *asexual spores* (usually spoken of simply as *spores*), which can germinate directly and produce a new plant; (*b*) *sexual spores* or *gametes*, which can germinate only after two have fused together and formed a completely homogeneous starting-point for the new organism. In many cases the spores and the gametes are produced by the same plant in response to different external conditions; but in some it is found that one plant will only give rise to spores, and that these spores give origin to a plant which produces only gametes, which give rise to a spore-bearing plant, and so on. The two plants may be morphologically exactly alike, or they may differ the one from the other.

In such a case it will be seen that the complete cycle of development of a plant must include the plant which produces gametes and that which produces spores; the former is termed the *gametophyte*, the latter the *sporophyte*, and this phenomenon of the occurrence of two distinct types of plant in one life cycle is spoken of as the *alternation of generations*.

Considering the reproduction of the higher classes of plants we find that this alternation of generations is universal, but that the higher we go the less prominent becomes the gametophyte. The leafy moss plant produces in special organs, as its tip, gametes; from the fusion of these arises the moss capsule, in which are produced spores, which in turn give rise to new moss plants. The moss plant is

thus the gametophyte, the capsule the sporophyte. In the ferns the gametophyte is a tiny green thallus, which grows in wet places, and is not generally connected with the fern; from the fused gametes arises the fern plant or sporophyte, on the backs of the leaves of which are to be found sporangia containing spores. In the flowering plants the whole plant, as we know it, is the sporophyte—the sporangia are of two kinds: the pollen-sacs of the stamens, and the ovules; the spores are the pollen grains, and the *embryo-sac* a large cell in the ovule. The gametophyte is scarcely recognizable: it is reduced to one or two cells or even nuclei formed by the division of the pollen grain and embryo-sac; the fused gametes give rise to a new sporophyte which develops to a certain extent in dependence on the old plant—it forms the embryo inside the seed; when the seed is set free it continues its development and becomes a new spore-producing plant.

Mention must be made of the fact that while in some of the seaweed-like plants the gametes are equal, yet in many and in all the higher plants there is a differentiation into a large female *egg* and a small, and often motile, male *sperm;* and that, as in the flowering plants, these two may be produced on different gametophytes, which have developed from different spores. The significance of the fusion of two gametes is probably to be found in the theory that the union of two different organisms produces a more robust offspring. It should be observed that it is this fusion of cells from two different plants that gives opportunity for *hybridizing—i.e.*, the production of plants combining the properties of two different parents. This is of much importance in *plant-breeding*, as it allows of the production of new forms which may combine advantageous properties of two parents. The other means of securing new varieties consist chiefly in selecting carefully any forms which appear showing characters differing from those of the strain to which they belong.

Bearing in mind the different types of reproduction, we may turn to the *classification* of plants. The arranging of plants in a system of groups, each of which contains forms more nearly related to each other than to those of other groups, has a practical interest only when it is recognized that one type of plant has *evolved* from another ancestral type—*i.e.*, that an actual 'blood' relationship between different forms exists. Plants are divided into four main groups. The first contains the seaweed-like forms, or *algæ*, and the *fungi*—toadstools, etc., which differ from the algæ by their lack of chlorophyll. These are distinguished by their simplicity of structure: there is no differentiation into leaves, stem, and root. An alternation of generations is frequently not to be observed. The *mosses* and *liverworts* are more complex, and many have distinct stems and leaves. All have typical alternation of generations, the gametophyte predominating. The *ferns*, and their allies the *club*

mosses and *horse-tails*, have distinct roots and vascular systems, and are distinguished from the highest plants—*cone-bearers* (Gymnosperms) and *flowering plants* (Angiosperms)—by the fact that the latter produce seeds. In flowering plants and ferns the sporophyte is best developed. The study of fossil plants—*palæontology*—has shown that many plants formerly existed which bridged the gaps now existing between the four great groups.

To return to physiology. We come now to the physiology of *nutrition*. The plant, like the animal, consists largely of three types of organic compounds: fats, carbohydrates (*e.g.*, sugar and starch), and proteids; the latter form the main part of the protoplasm. To these must be added a large quantity of water and certain mineral salts. Unlike the animal, however, the plant is able to build up these substances from carbon dioxide obtained from the air, and water and mineral salts obtained from the soil; the animal obtains its organic compounds from the plant or from other animals. The water supply is taken over by the root, which pumps a sufficient amount, containing the necessary mineral salts in solution, into the conducting vessels of the stem. The leaves perform a twofold function. In the first place they give off a large amount of water vapour; this is necessary in order that a large amount of water may pass through them, leaving behind the mineral salts necessary to the plant's nutrition. This water vapour passes out through openings in the leaf surface — the *stomata* — through which enter, from the air, small quantities of carbon dioxide. In the leaf these meet— the mineral salts, the carbon dioxide, and the water necessary for the building up of organic food substances. In order to form these a supply of energy is necessary, and the second function of the leaf is to absorb by means of its green chlorophyll energy from the sunlight. In the leaf and with this supply of energy are formed sugar and starch from carbon dioxide and water, and with liberation of oxygen; from these carbohydrates in turn are formed fats, and, along with nitrogen from the mineral salts, proteids. The food substances are used partly to build up the plant's structure, and are partly combined with oxygen and turned back into carbon dioxide, water, and energy, the latter being used for carrying on the vital activities of the plant.

Movement in plants is chiefly carried on under the direction of external stimuli, with the object of obtaining suitable conditions of growth. Thus, under the influence of gravity roots move down into the earth; under the influence of light leaves turn so as to obtain a suitable light supply.

Ecology is a recent development of botany which aims at studying the way in which plants are related to their environment. In this way associations of plants are recognized from their similar habitat—*e.g.*, aquatic plants (Hydrophytes), moisture-loving plants (Hygrophytes), drought-loving plants (Xerophytes), and an intermediate class known as Meso-

phytes, to which the majority of the plants in this country may be referred. Other plant associations may be formed in which opposite requirements are complementary, as in the case of shade-bearing plants in the shelter of light-seeking plants. *Plant pathology* is economically important in that it studies the cause and cure of plant diseases.

C. Darwin, *The Movements and Habits of Climbing Plants* (1875), *Insectivorous Plants* (1888); F. Darwin, *Practical Physiology of Plants* (1894); Bevis and Jeffrey, *British Plants* (1911); Keeble, *Plant-Animals: a Study in Symbiosis* (1911); Scott, *The Evolution of Plants* (1911).

Plasma, variety of chalcedony, which has a dark green or leek-green colour, due to admixture of minerals belonging usually to chlorite group; is principally found in India in cavities of igneous rocks; takes a good polish, and was a favourite stone for rings, etc., among the Romans. When red spots are scattered through dark-green ground it is known as bloodstone.

Plasmodiophora. See under MYCETOZOA.

Plasmodium. See under MYCETOZOA; SPOROZOA.

Plassey, vil., Bengal (23° 47′ N., 88° 16′ E.), famous as scene of Clive's victory over Suraja Dowla, Nawab of Bengal (1757).

Plaster of Paris. See GYPSUM.

Plata, RIO DE LA, or RIVER PLATE, name given to inlet of S. America, between Argentina and Uruguay (*c.* 35° S., 57° W.), forming estuary of Parana and Uruguay rivers; width of estuary is *c.* 130 m., and estimated area 5,000 sq. m.; is of great commercial importance, but navigation is hampered by extreme shallowness. Estuary was discovered by de Solis (1516), and explored by Magellan (1520).

Platæa, ruined city of Bœotia, ancient Greece, at N. base of Mt. Cithæron; was allied with Athens against Theban supremacy in Bœotia, and inhabitants took part with Athenians in battle of Marathon (490 B.C.); near here Greeks defeated Persians (479 B.C.); suffered during Peloponnesian War, being destroyed in 427 B.C.; was rebuilt in 387 B.C., and again destroyed by Thebes in 373 B.C.; was finally restored in 330 B.C., after conquest of Thebes by Philip and Alexander.

Platinum (Pt, 194·8), a noble metal, occurring in the Urals, native, but impure.

Metallurgy.—In rough outline the crude metal is extracted with *aqua regia*, ammonium chloride added, and the platinichloride $(NH_4)_2PtCl_6$, crystallized; ignition yields a spongy platinum which is melted in a lime crucible by the oxyhydrogen blowpipe.

Properties and Uses.—Tin white, soft, and malleable; it can be welded at white heat; sp. gr. 21·42, m.p. above 1,700° C.; unattacked by nitric or hydrochloric acid, corroded by hot caustic alkali; forms fusible alloys with tin, lead, etc., whose compounds must not be heated with platinum.

Used for making wire for chemical purposes and for electrical leads fused into glass, for standard weights and measures, also for foil, crucibles, dishes, etc., for analysis,

and for photographic prints. Finely divided platinum catalytically causes combination between hydrogen and oxygen, and sulphur dioxide and oxygen. Used as the catalyst in the commercial manufacture of sulphuric acid, and of nitric acid from ammonia. Demand for platinum now exceeds supply, and so the metal is very costly.

Plato (*c.* 427 B.C.–347 B.C.), Gr. philosopher; at the age of twenty he made the acquaintance of Socrates, and thenceforward devoted himself to philosophy. After death of Socrates he travelled widely, and probably visited Italy and Sicily. When about forty years old he began to teach and write in Athens, where he remained till his death, except for two journeys to Syracuse, the first of which took place in 368 B.C., on the death of Dionysius, and the second visit a few years later.

All Plato's philosophical writings have been preserved. They are cast in the form of dialogues, in most of which Socrates is represented as the chief speaker. In order of composition the slighter, so-called *Socratic*, dialogues undoubtedly come first, such as the *Laches* and the *Crito*; they were followed probably by the *Protagoras*, *Gorgias*, and *Meno*, and then by the first set of great constructive dialogues: the *Symposium*, *Phædo*, *Republic*, and *Phædrus*. Then come four dialogues in which logical outweighs ethical interest: the *Theætetus*, *Parmenides*, *Sophist*, and *Politicus* or *Statesman*; then the *Timæus* and *Philebus*, and, last of all, the *Laws*.

Plato's Philosophy.—In his ethical and political teaching Plato, like Socrates, is at war with sceptical theories that deny the possibility of a common good. Human welfare consists in the harmonious activity of all functions of the soul under the guidance of the highest. The highest welfare evidently requires the highest possible activity of reason, or knowledge; but Plato allows that ordinary men may attain such welfare as they are capable of by following the precepts of those who know. This is of importance in Plato's political theory, since man is necessarily a social being, and can make the best of himself only in a well-ordered state. It is above all things necessary that those who know should rule, and that each citizen should perform that function in the state which he is best fitted to perform. Now the mass of men is not capable of wisdom, but can recognize and follow wise rulers, and exercise the virtue of Temperance; they should be the productive workers and traders in the state. A smaller number is representative of Spirit, and should be the state's courageous warriors; a very few, selected early for mental, moral, and physical promise, and carefully trained, not only in general culture, but through many years' arduous study in science and philosophy, are to be the rulers of the state. They must devote themselves wholly to the public good, and therefore Plato denies them any private property and private family life.

The goal of the 'philosopher-king's' knowledge Plato calls the

Idea (or Form) of the good. Most men have opinions which they hold without justification or steadfastness, but true knowledge is reasonable and abiding, and has for its object what really and eternally is. Generally speaking, he who knows, knows not particular material things, or the flux of events in time, but immaterial, universal, eternal objects. Such an object Plato calls an Idea or Form; and by this word he means real objects which the mind apprehends in knowing. What in common parlance we often nowadays call 'actual' things—the particular objects of sense-perception—are not for Plato real objects. They 'partake in' or 'copy' real Ideas or Forms more or less fully, but they always include an incalculable, material, evil element, whereas real being is free from imperfection or any unintelligibility. The Ideas constitute a rational organic system, the object of non-sensuous thought, and every member of the system derives its being and intelligibility from an ultimate principle which Plato calls 'the Good' or 'the idea of the Good.' Plato's meaning is doubtless most easily grasped if we personify the Idea or the Good as God; but it is not clear that he made this identification himself.

Plato agrees with Socrates that to impart knowledge is impossible, and in two dialogues he represents the process of learning as 'reminiscence' (or 'recollection') of knowledge gained in a state of existence before bodily birth. He consistently maintains that the life of the soul neither begins nor ends with the body. In several dialogues we find the notion of transmigration, the soul passing at its next birth into the body of man, or some other animal whose character is like its own.

Certain statements of Aristotle's are usually taken to imply that, in his later oral teaching, Plato represented his Ideal Theory in a more mathematical form, and this is certainly true of the earliest successors to the leadership of his school, known as the *Academy*. For a time its interests were chiefly mathematical and scientific; later, it developed a critical and even sceptical tendency.

Neo-Platonism.—Far more important, however, than the Academy is the *Neo-Platonic* movement of 3rd to 5th centuries A.D., the final effort of philosophy. Its greatest name is Plotinus (*c.* 204–*c.* 264). Central in his doctrine is his conception of God, the absolute and perfect One, superior to all positive statements that we can attempt. Of the later members of the school the most famous are Porphyry, Iamblichus, Hypatia, and Proclus.

All Plato's dialogues have been eloquently trans. by B. Jowett. Davis and Vaughan's trans. of the *Republic*, and Church's trans. of the *Euthyphro*, *Apology*, *Crito*, and *Phædo*, under the title of *The Trial and Death of Socrates*, are handy and useful. In general, Adam, *The Religious Teachers of Greece*; Benn, *The Greek Philosophers*, vol. i.; Bosanquet, *Companion to Plato's Republic*; Caird, *The Evolution of Theology in the Greek Philosophers*; Gomperz,

The Greek Thinkers, vols. ii., iii.; Grote, *Plato and the Other Companions of Socrates;* Nettleship, *Lectures on Plato's Republic;* Pater, *Plato and Platonism;* D. G. Ritchie, *Plato;* A. E. Taylor, *Plato;* Zeller, *Plato and the Older Academy;* Bigg, *Neo-Platonism;* Whittaker, *The Neo-Platonists.*

Plattsburg, city, New York, U.S. (44° 42′ N., 73° 27′ W.), 140 m. N.N.E. of Albany; pulp, flour, typewriters, sewing machines and automobiles. Pop. 11,100.

Platyhelminthes, or FLATWORMS, worms, generally with a flattened body, the majority of which occur as parasites within other animals, although some are found living independently in water or on land. They possess no blood system, and the food canal is either absent or without posterior opening. The flat-worms form a phylum which includes the Turbellarians, the Trematodes (with liver flukes), and the Tapeworms.

Platypus. See under ORNITHORHYNCHUS.

Platyrrhini, or PLATYRRHINE APES. See under PRIMATES.

Plauen, tn., Saxony, Germany (50° 30′ N., 12° 8′ E.), important centre of lace making and embroidery. Pop. 121,000.

Plautus, TITUS MACCIUS (*c.* 254–184 B.C.), comic poet and dramatist of anc. Rome, pioneer of Roman literature; twenty plays extant; imitated Gr. form, but, unlike Terence, characterization is distinctly Roman; Latin pure and vigorous; Shakespeare's *Comedy of Errors* is based on the *Menœchmi* of Plautus, and Molière's *L'Avare* on the *Aulularia;* imitated also by Dryden, Addison, and Lessing.

Playfair, LYON, 1ST BARON PLAYFAIR OF ST. ANDREWS (1818–98), British chemist and Liberal politician; prepared Eng. ed. of Liebig's *Organic Chemistry* (1841); chemist Geological Survey (1845); prof. of chem., Edinburgh (1858–69); M.P. universities of Edinburgh and St. Andrews (1868–85); postmaster-general (1873–74); chairman Ways and Means, and deputy-speaker of House of Commons (1880–3); M.P. for S. Leeds (1885–92); peerage (1892); took part in royal commissions on health of towns, potato disease, and cattle plague; discovered nitroprussides; and investigated blast-furnace gases, and the specific gravity and atomic volume of hydrated salts.

Plays. See DRAMA.

Plea. At one time a plea was the general name for a suit or action; common pleas were actions between one subject and another, and pleas of the crown were criminal prosecutions. More strictly, a plea was the answer of the defendant to the declaration of the plaintiff. In modern pleadings, since the Judicature Acts, a statement of claim takes the place of the old declaration, and a statement of defence takes the place of the plea.

Pleadings, in Eng. law, the name given to certain documents which must be prepared for trials at law, and which consist of (1) Statement of Claim, (2) Defence. A defence is often coupled with a counter-claim, which may be followed by a reply and a defence to the counter-claim, rejoinder, surrejoinder, rebutter, and sur-

rebutter. Pleadings have been simplified by the Judicature Acts, and may now be amended in case of error. Certain cases are tried without pleadings. The purpose of pleadings is to enable the parties to know exactly what are the matters in dispute, and what facts must be proved at the trial. They are also useful in determining whether the dispute is a pure point of law to be decided by a judge without the aid of a jury, or whether it is a question of fact to be decided by a jury. The record of matters in dispute is settled by the pleadings, and it is of the utmost importance that there should be certainty as to these matters, for decisions upon them made by a final court cannot be upset or even reopened by any subsequent proceedings.

Plebeians. See under ROME (*History*).

Plebiscitum, a plebiscite, was originally a term used in anc. Rome to denote a resolution of the *plebs* or commons formally passed at their regular assembly, the *Concilium Plebis.* At first such resolutions were only binding on the plebeians themselves; but after 287 B.C., by a law of Hortensius, such resolutions, though not laws, were equally binding on all Roman citizens, and, in fact, most important measures were thus carried. See also REFERENDUM.

Plectrophenax. See under EMBERIZIDÆ.

Pledge. See PAWNBROKING.

Pléiade. See FRANCE (*French Literature*); RONSARD.

Pleiades, in anc. Gr. legend the seven sisters of Hyades who, when pursued by Orion, prayed for deliverance to the gods, who changed them into doves and placed them amidst the stars. The conspicuous star cluster known as Pleiades is situated in the constellation of Taurus, and known popularly as the Seven Stars, though only six are commonly visible: hence the tradition of a 'lost Pleiad.' In reality the cluster contains more than six stars.

Pleistocene. See under GLACIAL PERIOD.

Plender, SIR WILLIAM (1861–), British financial expert, whose services have been frequently utilized on government and public inquiries both at home and abroad. During Great War was Treasury controller of Ger., Austrian, and Turk. banks (1914–18), member of Foreign Trade Debts Committee (1914), of Liquor Trade Finance Committee (1915), government representative on Metropolitan Munitions Committee (1915–18), member of Enemy Debts Committee (1916), of the Surplus Government Property Disposal Board (1918); was nominated director army trustee (1918), and in the same year became honorary financial adviser to the Board of Trade; became chairman of Panel Ministry of Labour Grants Committee and member of Committee Public Trustee Organization Inquiry (1919); cr. G.B.E. (1918).

Pleura. See under RESPIRATORY SYSTEM.

Pleurisy, inflammation of the *pleura,* or lining membrane of the lung cavity, caused by certain specific organisms. The chief varieties of pleurisy are *dry pleurisy,* in which there is in-

flammation of the pleura with a fibrinous exudation of lymph, tending to form adhesions, and *pleurisy with effusion*, when an effusion of fluid varying in amount up to a gallon takes place after the inflammation. The onset is usually quite sudden, with a stitch-like pain in the side, increased on taking a deep breath; the patient has a dry cough, and the temperature may rise to 100° or a little over. In pleurisy with effusion the pain gradually becomes less, the patient feels uncomfortable and has difficulty, because of the weight of the fluid, in lying on the unaffected side. Treatment in dry pleurisy is to strap affected side with adhesive plaster so as to limit the movements of breathing, apply locally a linseed poultice or an ice-bag to relieve pain, and administer a purgative. If effusion takes place, iodine is painted on locally as a counter-irritant, and saline purgatives (*e.g.*, Epsom salts) given to get rid of the fluid, while tonics are useful. If good progress is not being made by these methods, the fluid is drawn off by puncturing the chest with an aspirator (an instrument which is a combination of a hollow needle and a syringe), which usually at once relieves distressing symptoms.

When a patient has sweatings, shiverings, and irregular rises of temperature, and the pleurisy does not clear up, the disease is probably EMPYEMA, the fluid having become purulent, which is a serious condition requiring surgical treatment.

Pleuro-pneumonia, in veterinary med., a specific, highly-contagious disease prevalent amongst cattle in W. Europe, U.S., S. Africa, and Australia. It affects the pleura and lungs, the latter finally becoming consolidated, and causes enormous loss of life.

Plevna, tn., Bulgaria (43° 27′ N., 24° 35′ E.); here defence and final surrender of Osman Pasha took place during Russo-Turkish War (1877); woollens, silks, wines, live stock. Pop. 23,000.

Plexus. See under NERVOUS SYSTEM.

Plimsoll, SAMUEL (1824–98), British politician—the 'sailors' friend'; M.P. (1868); publication of *Our Seamen* (1872) led to passing of Merchant Shipping Act (1876), which empowers Board of Trade to detain unseaworthy vessels; the 'Plimsoll mark,' painted on every ship, indicates maximum load-line.

Plinlimmon, or PLYNLIMMON, mountain on borders of Cardiganshire and Montgomeryshire (52° 28′ N., 3° 47′ W.); centre of great mountain group containing source of riv. Severn. Alt. 2,468 ft.

Pliny. (1) CAIUS PLINIUS SECUNDUS, called 'the Elder' (*c.* A.D. 23–79), Roman writer; served in the Ger. campaign; became pleader, but retired to estate at Novum Comum (modern Como) and devoted himself to literature; most prolific writer. His one surviving work, *Historia Naturalis*, shows encyclopædic knowledge, and though inexact scientifically, is of great use regarding nomenclature and popular contemporary ideas; procurator in Spain (71); guardian of younger Pliny; killed by eruption of Vesuvius. (2) CAIUS PLINIUS CÆCILIUS SECUNDUS (A.D. 61–*c.* 115), called 'the Younger'

in contradistinction to his uncle and father by adoption; practised as pleader; military tribune in Syria (83); consul (100); friend of Trajan and Tacitus. His *Letters*, in ten books, are written in best Ciceronian style; chiefly valuable for glimpses of life of the upper classes in Rome. Also wrote panegyric on Trajan.

Pliocene. See GEOLOGY.

Ploceidæ. See WEAVER BIRDS.

Plock, or PLOTSK. (1) Government, Poland, in Vistula basin; is mostly flat and marshy with numerous lakes; sugar refineries, distilleries, breweries, flour mills, sawmills, tanneries; matches and agricultural implements. Area, 4,200 sq. m.; pop. 650,000. (2) Tn., cap. of above (52° 45′ N., 19° 40′ E.); 12th cent. cathedral and old Piarist college. During Great War was captured by the Germans (Nov. 1914); here Poles drove back Russian Bolshevist troops (Aug. 1920). Pop. 31,000.

Ploegsteert, comm., W. Flanders, Belgium (50° 42′ N., 2° 52′ E.), 8 m. S. of Ypres and 3 m. N. of Armentières; called by Brit. soldiers in the Great War 'Plug Street'; the village and neighbouring wood lay on the Brit. front during the long trench warfare and were the scene of numerous raids; formed the southern point in Plumer's brilliant assault of the Messines ridge (June 7, 1917); captured by the Germans in the battle of the Lys (April 12, 1918); finally recovered by the British on Sept. 4, 1918.

Ploesci, or PLOESTI, tn., Prahova, Rumania (44° 56′ N., 26° 2′ E.): situated on Rumanian oilfield: woollen industry and petroleum refineries. During the Great War, after fall of Bukharest oil wells around Ploesci were destroyed (Dec. 1916) to prevent them from falling into enemy hands. Pop. 57,400.

Plotidæ. See SNAKE BIRDS.

Plotinus. See under PLATO (*Neo-Platonism*).

Plotsk. See under PLOCK.

Plough. See IMPLEMENTS AND MACHINERY, AGRICULTURAL.

Plover Family (Charadriidæ). The plovers are in general small, graceful birds, with long legs, usually partially webbed feet, and often long bills. In habit they are mostly waders, seeking their food amongst the aquatic insects and larvæ, worms, and molluscs which frequent the shallows of sea or river. They have long, pointed wings, are excellent fliers, and are so given to migration that at one part of the year or another every land knows them. Most lay four spotted eggs in a single nest or mere excavation on the ground. Of the 200 species known, 8 are resident in, while 25 are regular and 19 irregular visitors to, Britain. The true plovers, with short bills and three or four toes, include the golden plover (*Charadrius*), the American kill-deer plover (*Ægialitis*), a rare straggler to Brit. shores, the dotterels (*Endromias*), the crested green plovers (*Hoplopterus*), all with three toes, as well as the four-toed and crested common lapwing or pee-wit (*Vanellus*).

The members of another group possess long bills and four toes, of which at least two are united by a web: such are the long-

legged plovers or stilts (*Himantopus*) and the avocet (*Recurvirostra*), both with exceedingly long legs, the latter with an upcurved 18-in. long bill, formerly a common Brit. visitor; the curlews and whimbrels (*Numenius*), with long down-curved bill; the thick-set short-legged oystercatchers or sea-pies (*Hæmatopus*); the sandpipers, with short, straight, hard-tipped beak, including the common sandpiper (*Totanus*), and the ruff (*T. pugnax*), noted for its courtship dances, and so called on account of the collar of feathers assumed by the male in breeding season.

In another section of the family all the toes are quite free to the base, no trace of webbing being present. Here are classed the short-billed turnstones (*Strepsilas*), so called from their habit of overturning stones on the seashore for the sake of the sand-hoppers lurking beneath; the long, slender-billed woodcock (*Scolopax*) and snipe (*Gallinago*), both of which may be reckoned as residents in the Brit. Isles as well as winter visitors from Scandinavia, the former particularly interesting on account of its peculiar grave aspect, the eyes being set far back in the head, its extraordinarily sensitive bill, and its habit of carrying the young; the latter on account of the 'drumming' sound caused by the vibration of the tail feathers of the male as it drops to earth. Both form a simple nest, that of the woodcock being lined with dead leaves.

Plum (*Prunus domestica*), a Rosaceous tree cultivated for its fruit, and growing best on a somewhat calcareous and well-drained soil. The fruit is known technically as a drupe, and consists of a seed (kernel) enclosed by a stony endocarp, a juicy mesocarp, and a membranous epicarp.

Plumbago. See under CARBON; GRAPHITE.

Plumbism. See under LEAD POISONING.

Plumer OF MESSINES (HERBERT CHARLES ONSLOW PLUMER), 1ST BARON (1857–), Brit. soldier; entered the army in 1876; served in Sudan (1884), being present at El Teb and Tamai; took part in operations in S. Africa (1896), commanding a corps of mounted rifles under Sir Frederick Carrington; commanded Rhodesian column in S. African War (1899–1902); was mentioned in dispatches in each campaign; promoted major-general (1902), and lieutenant-general (1908); has held various important commands, including the Northern (1911–14). The Great War greatly increased his reputation; he commanded 5th Army Corps in France (1915) and 2nd Army (1915–17), being promoted general (1916). From Nov. 1917 to March 1918 he commanded the Ital. Expeditionary Force, returning to France to resume command of 2nd Army, which he held till close of war. After commanding the Army of the Rhine for a time, he was appointed governor of Malta (1919), and later in the same year was promoted field-marshal. For his distinguished services during the war he was awarded the G.C.M.G. and G.C.B., was raised to the peerage, and received a grant of £30,000.

Plumularia. See under HYDROMEDUSÆ.

Plunkett, SIR HORACE CURZON (1854–), Irish politician; M.P. (1892–1900); founded Irish Agricultural Organization Soc. (1894); vice-president, Department of Agriculture and Technical Instruction for Ireland (1899–1907); commissioner, Congested Districts Board; chairman, Irish Convention (1917–18). He has pub. *Ireland in the New Century* (1904), *Noblesse Oblige: an Irish Rendering* (1908), *The Rural Life Problem of the United States* (1910), *Some Tendencies of Modern Medicine* (1913), *A Better Way: an Appeal to Ulster not to Desert Ireland* (1914).

Plunkett, JOSEPH (1892–1916), Irish rebel, the son of Count Plunkett; was a journalist by profession and for a time ed. *The Irish Review;* took an active part in the Sinn Fein rebellion of April 1916; was one of the seven signatories to the declaration of an Irish republic; executed after DUBLIN rebellion.

Plutarch (*c.* A.D. 46–120), Gr. biographer, native of Chæronea, Bœotia; visited Italy and lectured on philosophy at Rome; later, a magistrate in his native town; renowned for his *Parallel Lives* of forty-six famous Greeks and Romans, arranged in pairs for comparison—*e.g.*, Alexander the Great and Cæsar; of great value to posterity.

Pluto (Gr. myth.), god of the underworld, called Hades by Homer; son of Cronos and Rhea, and brother of Zeus and Poseidon; carried off Persephone, daughter of Demeter; judge of the dead; worshipped especially at Elis; Lat. name Dis is a trans. of Pluto, meaning 'wealthy.'

Plymouth, seapt., munic., parl., and co. bor., Devonshire, England (50° 22′ N., 4° 9′ W.); at head of Plymouth Sound, between estuaries of Plym and Tamar; connected with Stonehouse and Devonport, and constitutes with them the 'Three Towns.' Few traces of antiquity are left except citadel; town is well built, and has many fine structures, including guildhall, municipal buildings, museum, Charles Church, St. Andrew's, R.C. cathedral, and many educational establishments; on Hoe is statue of Drake, monument in memory of Armada, and tower of Smeaton's lighthouse. At Stonehouse are marine barracks, naval victualling yard, and naval hospital; Devonport contains important dockyards; the 'Three Towns' are protected by line of fortifications. Plymouth is one of chief naval stations; there are shipbuilding yards, foundries, starch works, flour and flax mills, etc., and manufactures include sailcloth, rope, brushes, etc. Fishing is important.

Plymouth took prominent part in history; Pilgrim Fathers left here for America (1620), tercentenary celebrated by a pageant (1920); among many famous men connected with town are Drake, Raleigh, Hawkins, and Grenville. During the Great War Plymouth was an important centre for light craft operating against submarines in the Channel, and also for the examination of merchant vessels. Pop. 112,000.

Plymouth. (1) Tn., Massachusetts, U.S. (41° 54′ N., 70° 53′

w.); landing-place of the Pilgrim Fathers (1620); cordage, hardware, cotton and woollen goods, and machinery. Pop. 12,100. (2) Tn., Pennsylvania, U.S. (41° 14′ N., 76° w.), on Susquehanna; coal mines; silk, hosiery, and mining drills. Pop. 17,000.

Plymouth Brethren, Christian sect founded by Rev. J. N. Darby (1800–82) in 1830. The new sect spread all over Britain, into France and Germany, U.S., Canada, and Australia; but several schisms took place, and now the sect is in six divisions. Plymouth Brethren object to an official ministry and regard infant baptism as non-essential. They are Calvinistic in doctrine; practically any brother may preach or pray, but those 'not gifted with utterance' are quietly discouraged from officiating.

Plympton, tn., Devonshire, England (50° 23′ N., 4° 2′ w.), consisting of Plympton St. Mary and Plympton Earle; ruined castle; birthplace of Sir Joshua Reynolds. Pop. 5,000.

Plynlimmon. See PLINLIMMON.

Pneumatic Dispatch, transport of written documents through tubes by compressed air or vacuum. Chiefly used in post offices and for transmitting telegrams from central to suburban offices, or from one department to another in same building. The conveying pipe is of lead, about 1½ in. to 3 in. in diameter, and the dispatches are contained in a case of rubber. Behind this, compressed air is admitted, and a velocity of 25 m. per hour has been attained. Pneumatic Dispatch was introduced in 1858 by Clark, who laid tube between International Telegraph Co.'s offices and London Stock Exchange.

Pneumatic Tyre. See TYRE.

Pneumonia, inflammation of the lung tissue proper, due to specific micro-organisms, occurs in two forms, termed, according to the distribution of inflammation, lobar or croupous pneumonia and lobular or bronchopneumonia. In *acute lobar* or *croupous pneumonia* the air-cells are filled with a fibrinous exudate with blood corpuscles and epithelial cells, which coagulates, consolidating the lung.

The onset of an attack is sudden, there is headache and rigor, the temp. rising to 103° or 104°. About the seventh or eighth day the fever terminates by crisis, falling to normal in a few hours, accompanied by perspiration, and there is general improvement, the pulse and respiration becoming normal. The treatment of acute lobar pneumonia is absolute rest, plenty of fresh air, ice poultices over the chest to relieve pain, and to support the patient's strength by milk, soups, and similar light nourishment. Stimulants, of which strychnine and digitalis are the best, may be given if required. A vaccine treatment has been employed with some success.

Acute lobular or *bronchopneumonia* comes on more gradually than the lobar form and runs a different course, while it is due to catarrhal inflammation of the small bronchi spreading to the neighbouring air-cells. The fever is remittent, there is cough, difficulty in breathing, and a frothy sputum. The pulse is rapid. An attack is very frequently sec-

ondary to an acute infection (*e.g.*, measles, typhoid fever), or chronic debilitating conditions (*e.g.*, chronic heart disease or Bright's disease). Treatment practically the same as in lobar pneumonia, but stimulants are given from the beginning, while a steam tent for children, or opium, in the form of Dover's powder, is valuable for relieving the pain.

Chronic interstitial pneumonia is a rare condition, consisting in a localized or diffuse increase of the fibrous tissue of the lung, occurring in connection with occupations in which dust is habitually inhaled (*e.g.*, coal-miners, stone-masons, millers, jute workers), or after syphilis or repeated attacks of pleurisy. The symptoms resemble those of chronic phthisis, with progressive weakness and deficient expansion of the affected side, and the diagnosis is difficult. It is treated by respiratory exercises for the better expansion of the lung, painting iodine on the chest as a counter-irritant, and administration of potassium iodide.

Pnom-Penh, or PANOMPENG, tn., cap. of Cambodia, Fr. Indo-China (11° 35′ N., 104° 48′ E.); rice, cotton, pepper, fish, tobacco. Pop. 62,000.

Po, riv., Italy; rises in Monte Viso (44° 42′ N., 7° 5′ E.); flows N.E. and E., through Piedmont and Lombardy, and enters Adriatic by numerous mouths; length over 400 m.; navigable from Casale Monferrato; chief tributaries, Dora Riparia, Ticino, Adda, Oglio, Sesia, Tanaro; is enclosed by embankments on each side from Piacenza to the sea.

Poaching. See GAME LAWS.

Pobiedonostzev, CONSTANTINE PETROVICH (1827–1907), Russian jurist and procurator of the Holy Synod of Russia; *b.* Moscow; studied at the Petrograd school of law, and became prof. of civil law at Moscow Univ. (1859–65), and had among his pupils Alexander III.; senator at Petrograd (1868), a member of the imperial council (1872), and procurator (1880), but resigned (1905); showed strong opposition to all liberal reforms, especially to religious nonconformity; as a result his life was attempted (1905). Among his works are *Cours de Droit Civil*, *Manuel de la Procédure Civile* (1868), a volume of essays trans. into English as *Reflections of a Russian Statesman* (1898), and a trans. of the *Imitation of Christ*.

Pocahontas (*c.* 1597–1617), daughter of Powhatan, an Ind. chief in Virginia; when twelve years old saved life of Captain John Smith, one of Jamestown colony leaders, who had been captured by Indians. Pocahontas was captured by English and held as a hostage; married Captain Rolfe (1614), and went with him to England (1616); died at Gravesend; tomb in St. George's Church.

Pochard, or POCKARD, a bird related to the canvasback duck; it has a copper-coloured head, with a broad bill, bluish-coloured at the base; the Amer. species is somewhat larger, but both are smaller than the canvasback duck.

Pocket Gophers, or POUCHED RATS (*Geomys* and *Thomomys*), small rodents with cheek-pouches, lined with hair, opening on the cheek outside the mouth. In this respect they resemble the

pocket mice (*Perognathus*) and kangaroo rat (*Dipodomys*), and all are American; but the gophers always live underground.

Pocklington, par. and mrkt. tn., E. Riding, Yorkshire, England (53° 56′ N., 0° 47′ W.); corn mills, manufacture of agricultural implements, brewing; important fairs. Pop. 2,600.

Pocock, ROGER (1865–), English traveller and author; raised the Legion of Frontiersmen (1904); his writings include *A Frontiersman*, autobiographical (1903); *Curley* (1904), *Sword and Dragon* (1909), *The Chariot of the Sun* (1910), *Jesse of Cariboo* (1912), *Captains of Adventure* (1913), *The Splendid Blackguard* (1915), *Horses* (1917).

Podgora Ridge, near vil. of Podgora, Gorizia, N. Italy (45° 56′ N., 13° 37′ E.), a strongly-fortified position of great natural strength, commanding Gorizia; was the scene of heavy fighting during campaign of 1915, and was captured by Italians during advance of Aug. 1916.

Podgoritza, or PODGORICA, tn., Montenegro (42° 27′ N., 19° 23′ E.); Roman ruins of Diocleia, birthplace of Diocletian, are in vicinity. Pop. 10,000.

Podicipedidæ. See GREBES.

Podolia, government, Ukraine (48° 40′ N., 28° E.); soil belongs to black earth zone, and is exceedingly fertile, producing wheat, hemp, flax, beet, tobacco, etc.; cattle rearing; distilleries, breweries, flour mills, sugar refineries, manufactures of cloth, candles, soap, etc.; was subdued by Mongols (13th cent.) and by Lithuanians (14th cent.); became subject to Russia by third partition of Poland (1795), and is now part of new republic of Ukraine (1918). Area, 16,224 sq. m.; pop. *c.* 4,000,000.

Podophyllin, drug, consisting of a resin in yellowish-brown powder obtained from the root, or the powdered root itself, of the Amer. may-apple (*Podophyllum peltatum*), of natural order Berberidaceæ, with a bitter taste and disagreeable smell; used medicinally as a biliary stimulant and purgative, particularly in disorders of the liver.

Podostomata. See under PYCNOGONIDA.

Poe, EDGAR ALLAN (1809–49), Amer. poet and prose writer; adopted by John Allan of Richmond, Virginia, but eventually left to own resources; died from wounds in election riot; best-known poems: 'The Raven,' 'The Bells,' 'Annabel Lee'; prose tales include *The Black Cat, The Gold Bug, The Murders in the Rue Morgue, The Masque of the Red Death, William Wilson*—a double personality, prefiguring R. L. Stevenson's *Jekyll and Hyde*.

Poel, WILLIAM (1852–), Eng. actor and stage director; founded Elizabethan Stage Soc. (1895), and in various ways has revived many old plays and done much to spread a knowledge of the Eng. drama in its greatest days; amongst his revivals were *Everyman*, Marlowe's *Dr. Faustus* and *Edward II.*, Milton's *Samson Agonistes*, Webster's *The Duchess of Malfi*, and Ben Jonson's *Poctaster*; his writings include *Shakespeare in the Theatre, Lilies that Fester*, and comediettas, *The Wayside Cottage, Absence of Mind*, and *The Man of Forty*.

Poelcappelle, vil., W. Flanders, Belgium (50° 56′ N., 2° 58′ E.); was the scene during Great War of some of the heaviest fighting around Ypres, changing hands on more than one occasion; was held by Germans during first battle of Ypres (Oct. 1914); during second battle Canadians made famous stand between Poelcappelle and Zonnebeke roads (April 1915); was captured by British (Oct. 1917) during third battle, and finally by Belgians during Allied offensive (Sept. 1918).

Poetry. Perhaps no definition has occasioned so much controversy and given so little satisfaction as the definition of poetry. The Greek tendency was to regard the matter or content as of prior importance, and this view is upheld by Aristotle in his *Poetics*, a magnificent treatise on the art of poetry. The Romans, on the other hand, tended to regard poetry as a mechanic art, and the *Ars Poetica* of Horace is mainly devoted to points affecting metre and diction. The Fr. school was for long trammelled by formalism, as is well illustrated by Boileau's treatise on Poetics. But no true understanding of poetry can be reached until form and content are regarded as complementary and not independent.

There are certain qualities that are characteristic of the highest poetry when regarded from the point of view of subject-matter, and among these the qualities of elevation and expansion stand conspicuous. Elevation is exhibited in divers ways, in sublime thoughts, sublime actions, and sublime forms. Expansion is manifest in wider sympathies, ecstatic emotions, and subliminal feeling. These characteristics explain why it is that imagination and symbolism are such potent factors in poetry; they are gates to elevation and expansion. Thus, too, are the religious, philosophic, and metaphysical tendencies of poetry explained. From the standpoint of form there are many adventitious accompaniments of poetry, but only one essential, and that is recurrent *rhythm*. There are, indeed, prosodists who insist that metre is essential to poetry, but such a view would exclude the whole of Hebrew poetry, the whole of Teutonic poetry (Old German, Old English, and Icelandic), and much modern poetry classified as *vers libre*. The rhythm in poetry is marked in various ways. It may be restricted and systematized to form metre, or it may be given a loose rein and only marked by such devices as alliteration, parallelism, repetition, and rhyme.

Poetry was considered by the Greeks, and is still considered by most moderns, as an imitation of life, but it is probably better to say that it is an expression of life. But poetry cannot express life in all its aspects; it can only deal with life in its highest moods. In the case of humorous poetry, it is the incongruity between the subject and the manner of treatment that adds piquancy to the verse. If it be granted, then, that poetry can only properly deal with certain themes, we arrive at a truth enunciated by Coleridge, that poetry must employ a somewhat different vocab-

ulary from prose. Wordsworth attempted to show that such a thing as a poetic diction was wholly unessential to poetry. But an examination of the works of any great poet will always show a difference in vocabulary between his works and those of any great prose writer of the period. The tendency of the poet is generally towards a somewhat more archaic form of expression, and in proportion to the greatness of his theme his language will rise above that of common life, and he will express himself in the 'grand style' which Matthew Arnold marked out as the supreme characteristic of the highest poetry.

Poetry in its embryonic state arises from religious worship, veneration of heroes, and instruction in conduct. This stage precedes the *ballad* stage, at which the veneration of heroes has reached a high degree of development. Succeeding the ballad stage is the age of the *epic*, where the various heroic ballads are woven into a unity round one central idea. *Didactic* poetry rises out of the old instruction verses. So far poetry has been purely objective in character; subjectivity and analysis of emotion belong to an advanced state of culture. Thus, *lyric*, a highly subjective form of verse, is posterior to the epic, and its complexity of thought has its counterpart in the complexity of the metrical scheme. Last of all is evolved the *drama*, with its balance of subjectivity and objectivity of psychology and action.

For various kinds of poetry, see BALLAD; DRAMA; EPIC; LYRIC; ODE, etc. See also Aristotle's *Poetics;* Horace's *De Arte Poetica;* Boileau's *Art Poétique;* Scaliger's *Poetics;* Sidney's *Defense of Poesie;* Dryden's *Essay on Dramatic Poesy;* Courthope's *History of English Poetry* (1895–1910); Bradley's *Oxford Lectures on Poetry* (1909); and Watts-Dunton in *Encyclopædia Britannica* (11th ed.).

Poiana. See CIVET FAMILY.

Poincaré, JULES HENRI (1854–1912), Fr. mathematician and physicist; *b.* Nancy; prof. at Paris Univ. from 1886; made original contributions in pure maths., in celestial mechanics, and in the maths. of physics; awarded the Sylvester medal by the Royal Soc. of London (1901); publications include *Leçons sur la Théorie Mathématique de la Lumière* (1888), *Cours de Physique Mathématique* (13 vols. 1890 *sqq.*), *Les Méthodes Nouvelles de la Mécanique Céleste* (1892–9), *La Théorie de Maxwell et les Oscillations Herziennes* (1899), *Théorie du Potentiel Newtonien* (1899), *La Science et l'Hypothèse* (1903).

Poincaré, RAYMOND (1860–), Fr. statesman and member of Fr. Academy; *b.* Bar-le-Duc; educated at the College of Nancy; called to the bar (1880), and practised for a time as a lawyer in Paris; turned to politics, and wrote political articles for the *Voltaire* and the *République Française;* was elected to the Chamber of Deputies (1887), and was minister of public instruction (1893), and minister of finance (1894 and 1906); was vice-president of the Chamber of Deputies (1895–8); became a member of the senate (1903), and premier of France (1912), his term of office

being marked by important Fr. initiatives in connection with the Near Eastern crisis; in 1913 was elected president of the republic, and held office till 1920; by his constancy and calm dignity did much to inspire confidence in the Fr. nation during the Great War; on the termination of his presidency joined the staff of the *Revue des Deux Mondes* as contributor of the political chronicle; for a time was president of the Reparations Commission, but resigned owing to disagreement with the Allied policy on that question. His eloquent *Messages, Discours, Allocutions, Lettres et Télégrammes*, models of style, from the Armistice to the signing of the Peace Treaty, were pub. in 1920 (2 vols.).

Point de Galle. See GALLE.

Poiré, EMMANUEL (1858–1909), or CARAN D'ACHE, Fr. caricaturist, *b.* Moscow; under his pseudonym, which is Russian for 'lead pencil,' achieved celebrity; contributed political cartoons to *Figaro*, and won great fame by *L'Epopée*, a series of over 2,000 portraits of the celebrated men who helped to win Napoleon's victories; during the Panama scandal issued his *Cheque Book*, which made a great sensation.

Poison, a substance which by internal or external use injures or destroys life; it may be local or general, acute or chronic; its effect may be modified by idiosyncrasy and by habit (*e.g.*, opium, arsenic, etc.).

Symptoms include derangement of circulatory, nervous, muscular, and digestive systems; the latter often accompanied by stomachic pains, vomiting, and diarrhœa.

Treatment embraces evacuation and cleansing of stomach, use of emetics (mustard, zinc sulphate, ipecacuanha), and antidotes.

COMMON POISONS (*treatment in brackets*).

(1) *Corrosives*—
- Corrosive sublimate (white of egg).
- Mineral acids and oxalic acid (chalk, lime-water).
- Caustic alkalis (dilute vinegar, olive oil).
- Carbolic acid (emetic—weak alkali, white of egg—keep warm).

(2) *Irritants*—
- Arsenic (emetic—freshly precipitated ferric hydroxide—white of egg).
- Phosphorus (emetic—Fr. turpentine).
- Lead salts (emetic—Epsom salts).
- Copper salts (white of egg).

(3) *Neurotics*—
- Prussic acid, and the cyanides (emetic — artificial respiration).
- Opium and morphine (emetic—atropine subcutaneously—artificial respiration).
- Strychnine (emetic—chloroform or chloral).

(4) *Gaseous poisons*—
- Chlorine, the poison gas introduced by the Germans during the Great War, sulphur dioxide, oxides of nitrogen, ammonia, carbon monoxide, carbon dioxide, coal gas, hydrogen sulphide, chloroform vapour (plentiful respiration of air or oxygen).

(5) *Micro-organic Poisons*—
- Ptomaines, toxines.

The evidence of poisoning in a dead body depends upon the characteristic post-mortem appearances which certain poisons (*e.g.*, corrosives) cause in the alimentary canal and elsewhere; upon the results of the chemical analysis of the contents of the stomach and bowels and of other tissues; and upon the results of experiments upon animals with the substances obtained from the stomach, bowels, and other tissues, or with the suspected food.

There are certain circumstances which point to a case of poisoning, and upon which the evidence of poisoning in a living person largely depends: the suddenness of the onset of symptoms (although violent symptoms may come on very suddenly in certain diseases—*e.g.*, apoplexy), the fact that the symptoms usually follow the taking of food or drink, the finding of poison in the remains of food or drink, or in vomited matter from the affected person, suspicious conduct of individuals with easy access to the affected person—*e.g.*, nurse or relatives.

It is a felony to administer a poison or other destructive thing with intent to murder, or in order to overcome or stupefy a person for the purpose of committing an indictable offence, and a misdemeanour to administer a poison or other noxious thing with the purpose of injuring or annoying a person. Registered chemists and druggists, pharmaceutical chemists, or legally qualified apothecaries, veterinary surgeons, or dealers in patent medicines are alone permitted by law to sell or dispense poisons. By the Pharmacy Acts of 1868 and 1908, two groups of poisons are scheduled; those in Part I. are only allowed to be sold to persons known to, or introduced by persons known to, the seller, and the quantity of the poison sold, the purpose for which it is to be used, with the date and the name and address of the purchaser, must be entered in a register kept for the purpose; the name of the article, the word 'Poison,' and the name and address of the seller must be affixed to the box containing the poison. For those poisons included in Part II. no entry in the register is required, but on the box containing any of them must be affixed name of article, word 'Poison,' and name and address of the seller.

Poison Gas Warfare. Two methods of gas warfare were employed in the Great War: (1) the gas, supplied from cylinders, was discharged as a cloud; and (2) shells containing gas were used as projectiles. All the gases mentioned under POISONS (*Gaseous*) might be described as asphyxiating gases in that they produce suspended animation or suffocation by excluding the necessary supply of oxygen. Some of them are in addition irritating even in small quantities. This is true of chlorine, which was the gas chosen for the first cloud attack made against the French in the N. of Ypres on April 22, 1915. In Dec. 1915 chlorine was replaced by phosgene, a compound of chlorine and carbon monoxide. Five cloud attacks were made in 1916, the last Ger. effort taking place on Aug. 8, 1916. We employed chlorine for our first reprisal at Loos on Sept. 25, 1915.

The employment of gas projectiles eventually became general, since the atmospheric conditions could not be relied upon to be favourable for the use of cloud gas, and also a wider range of substances could be made use of. Among the lachrymators without toxic value were brominated xylene and brominated aliphatic ketones. There appeared later the toxic trichlorethyl chloroformate, often with 50 per cent. of chloropicrin, then phosgene, dichlorethyl arsine (used in 1918), and many others, of which the most effective was MUSTARD GAS.

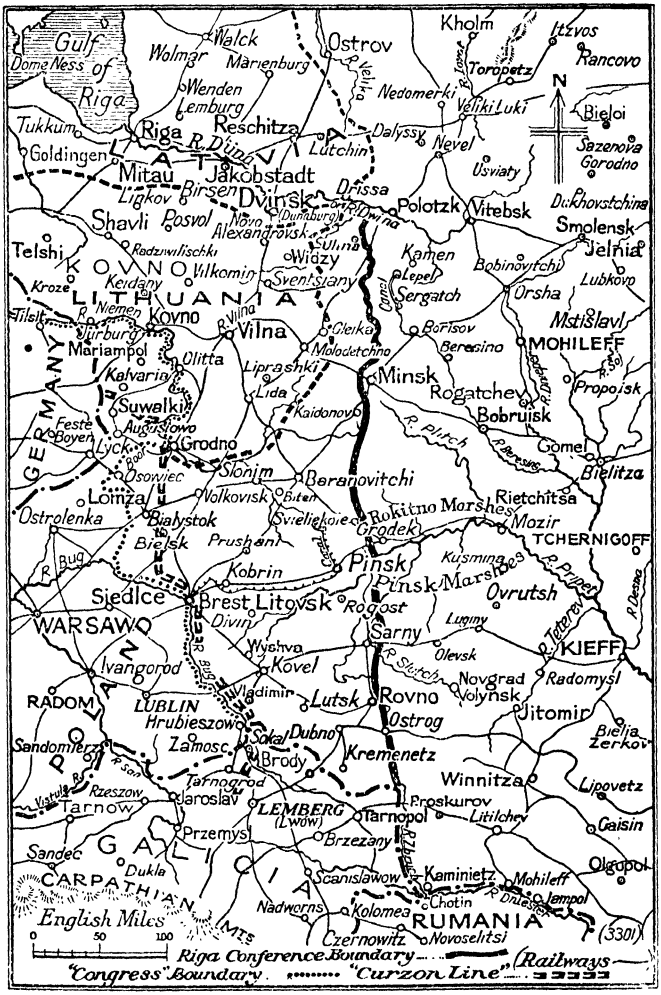
Of great importance in gas warfare is the equipment of respirators. The first contained cotton wool dipped in a solution of sodium thiosulphate and sodium carbonate, and gave protection for a few minutes against chlorine concentrations of 1 part in 10,000 parts of air. The box respirator, adopted in 1917, protected its wearer against 1 part of phosgene in 100 parts of air for over half an hour.

Poitiers, chief tn., Vienne, France (46° 34′ N., 0° 22′ E.), 60 m. S. by W. of Tours; bishopric; cathedral founded 1161 by Eleanor, queen of Henry II. of England; churches of St. Hilaire le Grand and St. Radegonde; the Palais de Justice and the Hôtel de Ville are fine buildings. Industries include brewing and the manufacture of hosiery and cloth. Here the Black Prince defeated the French (1356); later a Huguenot stronghold. Pop. 41,200.

Poitou, old prov. of W. France (*c.* 46° 30′ N., 0° 30′ W.), comprising roughly the modern departments of Vienne, Deux-Sèvres, and La Vendée; was an appanage of Eng. crown at different periods from 12th to 14th cent.; chief town, Poitiers.

Pola, tn., Istria, Italy (44° 52′ N., 13° 50′ E.); was prior to Great War principal naval station of Austria, with strongly fortified natural harbour; has Roman and mediæval remains and 15th cent. cathedral; was taken by Venice (1157), and repeatedly destroyed during contests of Venetians and Genoese. During Great War major portion of Austrian fleet was shut up in Pola, and harbour was raided by Ital. torpedo boats (Nov. 1916); was scene of daring raid (May 1918) by four Ital. sailors, known as the 'Four of Pola,' who torpedoed and blew up a battleship of Dreadnought class. In Oct. 1918 sailors, headed by Croatian officers acting under instructions from Jugo-Slav National Council, revolted and seized the ships. A few days before cessation of hostilities Italians, unaware of change, again raided harbour and blew up *Viribus Unitis*, flagship of the Austrian navy, thus inadvertently increasing friction between Jugo-Slavia and Italy. Town was occupied by Italians (Nov. 1918). Pop. 59,300.

Poland, republic, E. Europe (49°–55° N., 15° 55′–*c.* 27° E.); bounded N. by Baltic Sea, Danzig Free City, E. Prussia and Lithuania, E. by Russia (White Russia and the Ukraine), S. by Czecho-Slovakia, W. by Germany; E. from the Russo-Latvian frontier on the Dvina to Zbrucz R. The surface is plain, the only highland being the Tatra Mts. and Beskids in S.—


Gulf of Riga
Dome Ness
Walck
Wolmar
Marienburg
Ostrov
Kholm
Itzvos
Toropetz
Rancovo
Wenden
Lemburg
Nedomerki
Veliki Luki
Bieloi
Tukkum
Riga
R. Düna
Reschitza
Dalyssy
Nevel
Sazenova Gorodno
Goldingen
LATVIA
Lutchin
Usviaty
Mitau
Jakobstadt
Drissa
Ligkov
Birsen
Dvinsk
Polotzk
Vitebsk
Dukhovstchina
Shavli
Posvol
Novo Alexandrovsk
Smolensk
Telshi
Radziwilischki
Widzy
Kamen
Jelnia
KOVNO
Vilkomir
Bobinovitchi
Kroze
Keidany
Sventsiany
Lepel
Lubkovo
LITHUANIA
Sergatch
Orsha
Tilsit
Niemen R.
Kovno
Vilna
Cleika
Borisov
Mstislavl
Jurburg
Mariampol
Olitta
Molodetchno
Beresino
MOHILEFF
Kalvaria
Lipraishki
Minsk
Rogatchev
Propoisk
GERMANY
Suwalki
Lida
Kaidanovo
Bobruisk
Augustowo
Grodno
Gomel
Lyck
Sosnowiec
Slonim
Baranovitchi
Bielitza
Lomza
Volkovisk
Rietchitsa
Ostrolenka
Bialystok
Sviedlikoie
Bokitno Marshes
Mozir
Grodek
TCHERNIGOFF
Bielsk
Prushani
Kusmina
Kobrin
Pinsk
Pinsk Marsh
Ovrutsh
Siedlce
Brest Litovsk
Rogost
WARSAWO
Divin
Sarny
Luginy
KIEFF
Wyshva
Olevsk
Ivangorod
Kovel
Novgrad Volynsk
Radomysl
RADOM
Vladimir
Lutsk
Rovno
Jitomir
LUBLIN
Hrubieszowo
Ostrog
Sandomierz
Zamosc
Sokal
Dubno
Brody
Kremenetz
Bielia Zerkov
Tarnogrod
Winnitza
Lipovetz
Rzeszow
Jaroslav
Proskurov
Tarnow
LEMBERG (Lwow)
Tarnopol
Litilchev
Gaisin
Przemys
Brzezany
Sandec
GALICIA
Dukla
Olgopol
CARPATHIAN MTS
Scanislawow
Kaminietz
Mohileff
Nadworna
Kolomea
Chotin
Lampol
RUMANIA
English Miles
0 50 100
Czernowitz
Novoselitsi
(3301)
Riga Conference Boundary
Railways
"Congress" Boundary
"Curzon Line"

Poland.

parts of Carpathian system. The riv. Vistula flows through the republic. The climate is extreme. Over 20 per cent. of the surface is forested; 15 per cent. unproductive. The remainder is arable land (more than one half) or grazing country. Rye, oats, wheat, and barley are the chief cereals raised; potatoes and beetroot yield the largest crops. Cattle, sheep, swine, and horses are largely reared. Among minerals are coal, iron ore, zinc, lead, salt, petroleum, potassium salts. Industries include textiles and minerals. Occupations, manufactures, and commerce have suffered severely from political troubles, and development must wait until peace is secured. At present (Nov. 1920) the country is suffering from an epidemic of typhus, the scourge of famine. Railway mileage is 7,295; lines are state-owned. Navigable waterways, 1,875 m.; mercantile fleet programme, providing for 220,000 gross tons, is being carried out. Roman Catholicism is the national religion, all forms of religion enjoy freedom; there are many Protestants and Jews. R.C. archbishoprics exist at Warsaw and Gnesen; there are twelve bishoprics. Elementary education is compulsory and free, but a national system of education is not yet established. There are universities at Warsaw and Cracow, polytechnics at Warsaw, and many academies. WARSAW is the cap.

Constitution has not yet (Nov. 1920) been settled. Universal suffrage for men and women over 21 years of age is proposed, and on this basis the present Diet was elected in January 1919. Local government and judiciary arrangements are not yet organized. All able-bodied men are liable for service in the army, which is still (Nov. 1920) in the field; present strength, *c.* 714,000; peace strength will depend on frontiers finally secured. A small navy for defence of Baltic coast is proposed. Within the frontiers laid down by Supreme Council on Dec. 8, 1919, area about 80,000 sq. m.; pop. about 20,000,000.

History.—In early times Poland was inhabited by several Slavonic tribes, among which the Poliani attained pre-eminence. Poland first appears as an important state about the 10th cent., records previous to this date being so interspersed with legend as to have little historical value. In the reign of Mieczyslas, or Mieszko I., Christianity was introduced, and the suzerainty of the Emperor Otho was acknowledged; Mieczyslas was succeeded in 992 by his son, Boleslas I., under whom the country became a united state; Boleslas greatly increased his dominions by various conquests, and was recognized as king by Emperor Otho III. After his death in 1025 a time of disorder ensued, ending with the accession of his grandson Casimir in 1040; in Casimir's reign a great number of foreign ecclesiastics settled in the country; he died in 1058, when his son, Boleslas II., became king. Boleslas succeeded, in the course of a brilliant military career, in regaining Silesia and other provinces which had been lost in the years following the death of Boleslas I.; in

1079 he quarrelled with and killed Stanislas, Bishop of Cracow, in consequence of which Gregory VII. laid him under papal interdict and absolved his subjects from their homage and fealty; his subsequent flight to Hungary was followed by his death in 1081, when his brother Ladislas assumed control, though he had to content himself with only a ducal title, the country continuing as a duchy for over two centuries from this time.

Under Boleslas III. (1102–38) the Prussians were defeated, and Pomerania incorporated in Polish dominions; he encouraged Christianity, in which he was supported by Otho, Bishop of Bamberg. After his death Silesia was practically severed from Poland in the division of his dominions among his sons; under Casimir II. (1177–94) all the various parts except Silesia were reunited, and a constitution was framed; he died in 1194, when the succession was disputed and the country again subdivided, while Pomerania established its independence. About this time there occurred war against the Prussians, and afterwards against the TEUTONIC KNIGHTS, who seized various territories in Lithuania and Podlachia and settled there. In 1241 occurred an invasion of Mongols, who inflicted severe defeat on Poles at Liegnitz, but soon afterwards left the country. Various regions were transferred to Brandenburg during this period, and in reign of Boleslas V. (1247–79) numbers of Jews and Germans established themselves in Poland.

Under Ladislas I., *Lokietek* (1306–33), Poland was again united, and various reforms were carried out; kingly title was revived in 1320, when Ladislas was crowned with consent of the Pope; and successful war was waged against the Teutonic Knights. Ladislas was succeeded in 1333 by his son, Casimir III., under whom further reforms were inaugurated, while the country became once more a prosperous and powerful state; wars were waged against Tatars, Lithuanians, and Wallachians, and Galicia was annexed to Poland; on the other hand, all claims to Silesia were finally renounced in 1335. With death of Casimir in 1370 the *Piast* dynasty came to an end, after having ruled for over five centuries. He was succeeded by his nephew, Louis the Great of Hungary, who died without male issue in 1382; his daughter, Jadwiga, became queen in 1383, and in 1386 married Jagiello, Grand-duke of Lithuania, thus uniting Lithuania and Poland (which, however, were again separated in following reign), and founding the *Jagiellon* dynasty. Jagiello reigned as Ladislas II.; he encouraged Christianity, and defeated Teutonic Knights at Grünewald (1410); he was succeeded in 1434 by his son, Ladislas III., who was elected to Hungarian throne, and was killed at Varna in 1444. Casimir IV. then became king, again uniting Lithuania and Poland; he obtained W. Prussia and suzerainty over Prussia proper from Teutonic Knights by Treaty of Thorn (1466). After his death in 1492 three of his sons reigned in succession. Under John Albert and Alex-

ander, the Polish Diet became increasingly powerful, and Lithuania was more firmly united to Poland.

Under Sigismund I. (1506–48) and his son, Sigismund II. (1548–72), Poland may be said to have reached its apogee; former defeated Wallachians, and acquired suzerainty over Moldavia, but lost Smolensk to Basil of Russia; he opposed Reformation, which, however, spread greatly in country under Sigismund II.; the latter captured Livonia from Knights Sword-Bearers; under him Lithuania and Poland were inseparably united, and the state of which Warsaw now became cap. was one of the most powerful in Europe. With his death the Jagiellon dynasty ended, and monarchy was made elective. Henry of Valois was first king elected, but he presently gave up his claim on becoming king, as Henry III., of France, and was succeeded in Poland by Stephen Bathori (1575–86), who waged war against, and defeated, Ivan IV. of Russia, and subdued the Ukraine Cossacks; in his reign numbers of Jesuits settled in country, and gradual decline of Reformed religion began. His successor, Sigismund III. (1587–1635), was son of John of Sweden; he persecuted the Protestants, and formed alliance with Sweden, but failed to establish his claim to Swed. crown. His sons, Ladislas IV. (1632–48) and John Casimir (1648–68), warred against Sweden, Russia, and Turkey; in 1655 Poland was invaded by Charles X. of Sweden, who took Cracow and Warsaw and compelled John Casimir to fly to Silesia; in 1657 Brandenburg succeeded in throwing off the Polish yoke, and in 1668 the king abdicated.

His successor, Michael Wisniowiecki (1669–73), warred against the Turks, who were eventually defeated by John Sobieski. At Michael's death John Sobieski was elected king; he gained brilliant victory over Turks at Vienna (1683), but his reign was disturbed by quarrels among nobles. After his death in 1697, Elector Frederick Augustus of Saxony became king as Augustus II.; he regained Ukraine from Turks; made treaty with Russia, and warred against Charles XII. of Sweden, who secured his deposition and election of Stanislas Leszczynski to Polish throne; but after Charles's defeat at Poltava in 1709, Augustus was reinstated; his reign is also marked by persecution of Protestants and by beginnings of Polish dependence on Russia; he died in 1733, when the election of his son, Augustus III., was secured by Russian influence, which further increased during this reign. Augustus III. was succeeded by Stanislas Augustus Poniatowski in 1764; in his reign various reforms which had been effected by the Czartoryski party were repealed through Russian influence, against which the patriotic insurrection known as the Confederation of Bar was unsuccessfully directed in 1768; in 1772 occurred the First Partition of Poland, at whose expense Russia, Austria, and Prussia then extended their dominions. The 1788–91 Diet made

great effort to reform constitution and to make monarchy hereditary; Russia, however, interfered, and was joined by Prussia in invading Poland, and by a Second Partition in 1793 both these powers obtained further territories.

The Poles, led by Kosciuszko, rose in rebellion in 1794, and the invaders were at first defeated, but were presently joined by Austria; patriots were finally defeated by the capture of Warsaw by the allies; and by the Third Partition (1795) the rest of the country was divided among the three great powers, and Poland as a separate political unit ceased to exist.

In these three partitions Russia did not annex any ethnically Polish territory, this being all divided between Austria and Prussia, the latter taking Warsaw. Russia's acquisitions were exclusively in Lithuanian, White Russian, and Little Russian territories. In 1807 and 1809, after wars against Prussia and Austria, Napoleon reunited most of ethnic Poland in the Grand-duchy of Warsaw. In 1815, at the Congress of Vienna, Prussia recovered Posnania and Thorn, but most of the grand-duchy was formed into the so-called congress-kingdom of Poland, to be ruled by the tsar as an independent state. It was then only that ethnic Polish territory came to be united with Russia. National risings occurred in Austrian Poland in 1846, in Prussian Poland in 1848, in Russian Poland in 1830 and 1863. After the revolution of 1863, the congress-kingdom was deprived of its separate government.

In 1914, for the first time, the partitioning powers were ranged in war against each other; this was Poland's chance. Russia, in Aug. 1914, put forward a programme of reunion of all ethnically Polish territories in an autonomous state under Russia. Austria-Hungary aimed at uniting Russian Poland with Galicia as a third partner in the dual monarchy. As this scheme would have left Prussian Poland the only unredeemed Polish territory, and thus concentrated the Poles on an anti-German front, it met with Germany's opposition. By Aug. 1915, all Russian Poland fell under military occupation of Central Powers. On Nov. 5, 1916, proclamation was issued by them forming it into kingdom under their auspices. But again disagreement between Germany and Austria, as well as Ger. ill-will towards and distrust of the Poles, prevented all genuine development. On March 30, 1917, the first revolutionary Russian government acknowledged Poland's independence within her ethnic frontiers. This programme was endorsed by Allied and Associated Powers. In July 1917, Polish National revolutionaries under PILSUDSKI, who at the beginning of the war had taken the field against Russia, turned against Central Powers; Pilsudski, from 1914–16 brigadier in Austro-Polish legions, was imprisoned in Germany. On outbreak of Ger. revolution (Nov. 1918), he returned to Poland and became the chief of the new Polish state.

President Wilson's fourteen points stipulated for independent

Poland, including 'territories inhabited by indisputably Polish populations,' with free access to the sea. This programme was realized by Paris conference, at which Poland was conceded position of ally, and where her cause was brilliantly pleaded by PADEREWSKI, he famous pianist, at that time Polish premier. By Treaty of Versailles Germany renounced Posnania and most of W. Prussia, whereby E. Prussia was separated from rest of Germany. Danzig and its surroundings were formed into a Free City under the League of Nations, full use of its harbour, and control of its foreign relations being conceded to Poland. Plebiscite was ordered in other parts of E. and W. Prussia claimed by Poland, but this having gone decisively against her, territories reverted to Germany in summer of 1920. Another plebiscite was ordered in Upper Silesia, but had not yet taken place at time this was written (Nov. 1920). Of the territories of the late Russian Empire the so-called congress-kingdom was assigned to Poland, without northern Lithuanian part of Suvalki, which was ceded to Lithuania, but with addition of district of Bielostok, ceded by Prussia to Russia in 1807. Of late Austrian territories Poland received W. Galicia (Dec. 1919) and part of TESCHEN (June 1920). A treaty concluded between Poland and principal Allied and Associated Powers (June 1919) secures rights of national and religious minorities in Poland, placing them under protection of the League of Nations.

But Polish claims in the E. exceeded by far ethnic border of Poland. Between this border and Poland's frontiers of 1772 lie Lithuania, White Russia, E. Galicia, and the Western Ukraine, territories more than twice the size of all ethnic Poland. In most parts of them Poles form less than 5 per cent. of pop.—only in E. Galicia as much as 20 per cent. But most of the nobility, owning nearly half of the land, is Polish, and so is part of the intelligentsia; the vast majority of the population, the Lithuanian and Russian peasantries, are intensely anti-Polish. From the very outset, Poland, disregarding friendly warnings from Brit. Government, engaged in wars for conquest of these territories. By July 1919, Poland succeeded in crushing resistance of Little Russians in E. Galicia. In Nov. 1919, Allied and Associated Powers proposed compromise—wide self-government for E. Galicia under Polish mandate for twenty-five years. Offer rejected by Poles, who preferred to hold E. Galicia by military force, though without legal title. Problem still unsolved at the beginning of November 1920. Similarly aggressive policy was pursued by Poland towards Lithuania. Her cap., Vilna, occupied by Poles (April 1919); two successive lines of demarcation laid down by Paris conference violated by Poles. Once more, against earnest warnings from Great Britain, in spring of 1920 Poland continued war against Russia, pushing further and further into purely Russian territory, and demanding renunciation by her of territory up to

frontiers of 1772, inhabited by well over 20,000,000 Russians. Polish expedition against Kiev (April–May 1920) resulted in defeat, and only when Bolsheviks invaded ethnic Poland were the Poles able—thanks to help of Fr. generals—to defeat them in turn. Great Britain and America again warned the Poles to rest satisfied with ethnic frontier, within which Allied and Associated Powers guarantee their independence. By Art. 87 of Versailles Treaty Poland had agreed to accept frontier in E. drawn for them by the Allies. See RUSSIA.

Wars of conquest in the E. had disastrous effect on Poland's economic and financial position, frustrating attempts at reconstruction. The first Diet of reunited Poland, elected by universal suffrage in Jan. 1919, passed an Act of Land Reform limiting amount of land to be held by a single person, and assigning the surplus for division among peasants, compensation to be paid to previous owners. This act was still a dead letter in Sept. 1920. Hardly any revival of Polish industries; unemployment and misery in towns worse than during the war. Misgovernment of first year best illustrated by fall in Polish exchange Jan. 1919, 30 Polish marks were paid for the pound sterling; July 1919, 90; by autumn, 200. During the victorious Polish advance on Kiev, about May 1, 1920, 750 marks were paid for the pound. In eighteen months the Polish mark had fallen from a value of 8d. to less than ¼d.

Language and Literature.—The Polish language belongs to Slavonic group, and is flexible and highly synthetic. Early literature includes a few ballads and proverbs in the vernacular, dating from pre-Christian times, and a number of Lat. chronicles of later date. To the 15th cent. belongs the *Historia Poloniæ* of Dluglosz, while Laski, who compiled the old Polish laws, and the astronomer Copernicus, are among the great names of the early 16th cent.

The first great age of Polish literature begins about 1548; chief poetic forms were then the idyll and satire, and the period is perhaps best represented by Jan Kochanovski (1530–84), who wrote a wonderful series of elegies called the *Treny*, and Szarzynski, who first composed sonnets in Polish tongue; while Skarga (*d.* 1612) is a well-known rhetorical writer, the product of the Jesuit counter-Reformation, which dominated the intellectual life of Poland from the beginning of the 17th cent. till about 1760. The *Jesuit* or *Macaronic period* produced few literary monuments of importance; artificiality was a leading characteristic of the writers of this time, many of whom mixed the Polish and Lat. languages in extraordinary fashion in their works, and the only literary exercise which flourished was eloquence. From about 1760 onwards Polish literature shows influence of Fr. writers; the drama now became an important literary form, Boguslawski being the best-known dramatist of the time; poetry showed a tendency to lapse into

the mere making of rhymes, though Krasicki's plays, satires, and other works, and Wegierski's satirical poems gained their authors some reputation.

Greatest literary epoch, known as the *Romantic Period*, dates from 1820–50; to this era belong Mickiewicz, the greatest national poet, the author of *Wallenrod*, *Dziady*, and *Pan Tadeusz*, the great national epic; Krasinski, a sentimental R.C. aristocrat; and Slowacki, whose chief quality is brilliance of diction, and whose style has left a mark on all modern Polish poetry. The playwright Fredro also flourished at this time, and produced a number of excellent comedies. The *Ukraine* school includes Zaleski, who wrote lyrical poems, Malczewski, author of *Marya*, a romantic poem, and other writers. Among modern novelists is Sienkiewicz, whose *Quo Vadis* and other novels have been translated into most European languages; further, Przybyszewski and Żeromski; lastly, Wyspianski, a great poet, dramatist, and painter.

Szujski, *History of Poland* (1865–66); Morfill, *Poland* (1893) and *Early Slavonic Literature* (1883); Lord Eversley, *The Partitions of Poland* (1915); R. H. Lord, *The Second Partition of Poland* (1915); Miss E. C. Benecke, *Tales by Polish Authors* (1915), *More Tales* (1916); Professor W. Alison Phillips, *Poland* (1916); Miss J. S. Orvis, *A Brief History of Poland* (1919); Miss M. Gardiner, *Krasinski* (1919).

Polarization (1) of an electric cell refers to the falling off of the current as a result of the chemical action within the cell. The chief differences in cells consist in the various devices for obviating polarization. In the simple voltaic cell polarization is caused by the accumulation of hydrogen on the copper plate.

(2) *Polarization of Light.* See LIGHT.

Polarization of a ray may also be produced by its reflection from a polished surface at a particular angle of incidence. It is found that when polarized light is passed through a tube containing a solution of cane sugar, the plane of polarization is rotated through an angle which depends on the strength of the solution, and this has been developed into a method (*saccharimetry*) for determining the proportion of cane sugar in any given sample.

Polar Regions. From the chronicle of Alfred the Great we learn that Othere and Wulfstan made voyages in the Arctic Ocean, probably round the N. coast of Lapland, but their exact route cannot be determined. In the 10th and 11th centuries Norsemen made various voyages of discovery in the Far North. In 1001 Eric 'the Red,' an Icelander, made a settlement on the W. coast of Greenland. Cabot, in 1497, discovered Newfoundland and Labrador; subsequently Gaspar Cortereal attained a lat. of 60° N. But Arctic expeditions were comparatively sporadic until the 16th cent., when the minds of the adventurous were fired by the idea of a N.E. or a N.W. Passage to the rich countries of the East, for, according to current beliefs, America and Asia were a geographical unit. The original mo-

tive of Polar exploration was therefore commercial and not scientific, and the direction was not due N., but either N.E. or N.W. In 1553 Sir Hugh Willoughby, in search of the N.E. Passage, discovered Novaya Zemlya, but he and his party ultimately perished. In 1556 Stephen Burrough discovered the Kara Strait, and in 1580 the Yugor Strait was discovered by Pet and Jackman. In 1585 Davis discovered Davis Strait and attained a lat. of 72° 41′ N. Barents discovered Bear I. and Spitzbergen in 1596, and was the first European explorer to winter in the Arctic regions. In 1607 Henry Hudson touched Cape Hold and discovered Hakluyt I. In 1610 he tried the N.W. Passage and discovered Hudson Strait. Hudson Bay he believed to be a part of the Pacific Ocean (this was refuted by Button in 1613). In 1615 Baffin found the outlet in Baffin Bay and recorded some invaluable observations. On his return journey he discovered Jones Sound and Lancaster Sound. In 1631 Fox and James explored the coast of N. America and reached Peregrine Point in the Fox Channel. The quest was then abandoned for over a century.

Peter the Great gave an incentive to Russian exploration, and in 1725 gave Bering the conduct of an exploring expedition. On reaching Kamchatka, Bering discovered that America and Asia were not continuous. In 1741 he crossed the Sea of Okhotsk and reached the northern coast of America, but died on Bering I. Phipps sailed in 1773 to Spitzbergen and attained a lat. of 80° 48′ N. Subsequently Scoresby registered important geographical observations in Jan Mayen I. and the E. coast of Greenland (1822).

In 1818 Sir John Ross, with the *Isabella* and *Alexander*, set out to explore the regions discovered by Baffin and abandoned for over a century. In 1819 Parry, in command of *Hecla* and *Griper*, located N. Devon, Cornwall and Bathurst Islands, and Cape Walker and Banks Land. In 1821, in command of *Fury* and *Hecla*, he sailed up Fox Channel and named the Fury and Hecla Straits. In 1829 Ross sailed up Regent Inlet to the Gulf of Boothia, which he named after Felix Booth, a distiller who financed the expedition. Sir J. C. Ross, his nephew, explored King William Land and discovered the North Magnetic Pole (1831).

In 1845 Franklin started on his ill-fated voyage. He sailed in command of *Erebus* and *Terror*, in search of a N.W. Passage, via Lancaster Sound and Bering Strait. The ships were last seen in Baffin's Bay. In 1848 the first of the many search expeditions was dispatched. In 1859 M'Clintock found traces of the expedition and a MS. recording the route of the vessels and the death of Franklin in June 1847, on King William Land. The crews of *Erebus* and *Terror*, under Captain Crozier, had started for the Great Fish R., and their remains were found near Adelaide Peninsula by Dr. Rae. Dr. Hayes in 1831 reached a lat. of 81° 35′ at Cape Lieber. Captain Hall, with *Polaris*, reached 82° 16′ lat. and named Polaris Bay.

In 1875 the great Nares expedition started with *Alert* and *Discovery*. *Alert* wintered off Grinnell Land in lat. 82° 24′ N. The sledge party, under Markham, reached 83° 20′. Lockwood of the Greely expedition in 1881 reached Lockwood I. (83° 24′ N.), the Farthest North till the voyage of Nansen. There were 25 explorers in this expedition, of whom 18 perished.

Lieut. Peary in 1892 crossed the N. of Greenland to Independence Bay. In 1893 Nansen began his voyage in *Fram*, which reached a lat. of 85° 57′, and he himself on foot reached 86° 14′ N. In 1897 a balloon expedition, under André, Strindberg, and Fraenkel, perished in search of the North Pole. Captain Cagni in 1900 reached 86° 33′. In 1903 Amundsen, in command of *Gjöa*, started on an expedition to survey the region of the North Magnetic Pole, and accomplished the N.W. Passage entirely by water, which M'Clure had failed to do in 1850.

The year 1909 witnessed the culminating event of North Polar exploration. Lieut. Peary, in *Roosevelt*, with six colleagues and a large party of Eskimos trained during his long sojourns in the Far North, taking 133 dogs and 19 sledges, started in 1908 for the Pole. His method of advance was original, and aimed at saving the strength of the leaders for the final stages. A pioneer party, lightly equipped, marched a day ahead and cleared the route for the main party. Companies at various stages returned with the empty sledges and exhausted followers. Prof. Marvin was drowned while crossing a big *lead* —the only fatality of the expedition. Peary hoisted the Amer. flag at the Pole on April 6, 1909. Dr. Cook alleged that he had gained the Pole a year before, and at first received due honour for it, but his proofs were discredited.

Amundsen in the summer of 1918 set out on a long polar voyage across the North Polar basin, but owing to unfavourable currents off the Siberian coast had not been able to begin the drift in the ice by Aug. 1920. He, however, discovered new land near Nicholas II. Land, which was thoroughly explored, and has completed the N.E. Passage. His expedition is due to return in 1924.

Antarctic Exploration. — The Antarctic region was not explored for centuries after the Arctic had been an object of research and adventure. The idea of a rich and wealthy southern continent was in the minds of the early southern explorers—an idea that was doomed to have a rude disillusioning. The pioneer of Antarctic exploration was Captain Cook, who reached a lat. of 71° 10′ S. in 1774. Cook discovered and named S. Georgia and the Sandwich group. In 1819 William Smith discovered the S. Shetlands. The next great expedition was sent out by Russia under Fabian von Bellingshausen. He reached lat. 69° 53′ S. and named Peter I. I. In 1823 Weddell reached lat. 74° 15′ S. In 1830 Biscoe discovered Biscoe I. and sighted Graham Land. In 1839 John Balleny named and discovered Balleny Islands. Dumont d'Urville's expedition (1838–40) discovered Zionville Land, Louis Philippe Land, Adélie Land,

and Côte Clairie. Wilkes, of the U.S. navy, discovered Wilkes Land to the w. of Balleny Islands.

In 1840 J. C. Ross's great expedition sailed to the s. with *Erebus* and *Terror*. To mark the British occupation Ross named the Possession Islands and Victoria Land, which he skirted from Cape North to Cape Crozier. He discovered the marvellous ice barrier which rises precipitously out of the sea to the height of 200 ft., subsequently the base of the Brit. and Norweg. expeditions. He named Mt. Erebus (12,922 ft.), and Mt. Terror (10,900 ft.), located the South Magnetic Pole (75° 5′ S., 154° 8′ E.), and reached a lat. of 78° 9′ 30″. In 1898 Captain de Gerlache spent the winter within the Antarctic Circle, his ship, *Belgica*, being icebound. This was the first winter sustained by man within the Circle. In 1898 C. E. Borchgrevink made an expedition to Victoria Land in *Southern Cross*, wintering at Cape Adare.

In 1901–4 the Brit. National Antarctic expedition, led by Captain R. F. Scott in *Discovery*, followed the Ross Barrier eastward and named Edward VII. Land. Captain Scott, Dr. Wilson, and Sir Ernest Shackleton (third officer of *Discovery*) attained with sledges a 'Farthest South' of 82° 17′. In 1901 the Ger. Antarctic expedition, in *Gauss*, sailed southward. New land was discovered and named Wilhelm II. Land. An extinct volcano (1,200 ft.) in the new terr. was named Gaussberg. In 1901 the Swed. expedition sailed in the vessel *Antarctic* and made valuable geographical discoveries, proving the continuity of Oscar II. Land, Louis Philippe Land, and Graham Land. *Antarctic* was lost in 1903, but the crew was rescued. In 1902 the Scot. National Antarctic expedition in *Scotia* explored Weddell Sea and discovered new land (Coats Land) in lat. 72°–74° S. The expedition returned in 1904, after establishing an observatory on the S. Orkneys, since maintained by the Argentine Government.

A great advance S. was made in 1907 by Sir Ernest Shackleton in command of *Nimrod*. His route was via the Beardmore Glacier to King Edward VII. Plateau. He attained a 'Farthest South' of 88° 73′ (within 97 m. of the Pole). In 1910 two vessels were equipped for expeditions—*Terra Nova*, a Brit. vessel commanded by Captain R. F. Scott, and *Fram*, a Norwegian ship commanded by Captain Roald Amundsen. Amundsen started a few months later than Scott. His vessel was originally equipped for northern exploration, and the announcement in Oct. 1910 that it was destined for the Antarctic occasioned much surprise. Peary's successful expedition to the North Pole had caused him to abandon his projected Arctic expedition and seek the Southern Unknown.

Framheim, Amundsen's headquarters and base, was situated on the shores of the Bay of Whales, on the Ross Barrier. The Polar party, consisting of 5 men, 52 dogs, and 4 sledges, started on October 20, 1911. Amundsen's route was entirely new. The journey during the first month was comparatively easy. On Nov. 19 a camp was

established at a height of 4,500 ft., and on Nov. 20 a dangerous glacier was descended. On Nov. 25 mountain ranges were sighted to the E. with peaks of 15,000 ft. and upward. The ranges were named Queen Maud's Ranges. On Nov. 30 the ascent of the Devil's Glacier was commenced. On Dec. 6 the last depot was made at a lat. of 87° 40′ S., when the greatest height (10,750 ft.) was reached. This was the most arduous stage in the march. The ice was hollow, and resounded to the tread, hence the region was named the Devil's Dancing Room. The Pole was reached on Dec. 14, 1911. The Polar camp was named Polheim, and the vast plateau in which the Pole is situated was called King Haakon VII. Plateau. On Dec. 16 observations were taken to determine as closely as possible the position of the Pole. On Jan. 25, 1912, party reached Framheim without casualty, with 2 sledges and 11 surviving dogs.

The chief geographical results of the expedition were: (1) the discovery of the South Pole; (2) the discovery that the great Ross Barrier terminates in a bight (lat. 86° S., long. 163° W.), between the range running S.E. from South Victoria Land and a range running S.W. from King Edward VII. Land (the barrier is thus a vast glacial mass, floating in a great bay between South Victoria Land and King Edward VII. Land); (3) the discovery of the probable connection between South Victoria Land and King Edward VII. Land; (4) the discovery of the great range of Queen Maud Mountains, which appears to be a continuation of Queen Alexandra Ranges, and whose peaks reach an altitude of 15,000 ft. An expedition also left *Fram*, under Lieut. Prestrud, and surveyed the Bay of Whales and the Ross Barrier.

Captain R. F. Scott set out to discover the South Pole and to make a scientific and geographical survey of the South Polar regions. His company therefore included several scientific experts. His vessel, *Terra Nova*, sailed into Robertson Bay, landed a geological party at Cape Adare, and then landed the Polar party in M'Murdo Sound. Scott's first task was to station a depot E.S.E. of Hut Point, the winter quarters of the previous expedition. On Feb. 8, 1911, Captain Scott proceeded S., but owing to the severity of the weather and the loss of several ponies, the party was forced to return to the main base, after depositing a ton of stores at 'One-Ton Camp.' On visiting Hut Point, Scott learned of the arrival of *Fram*. In November, accompanied by Dr. Wilson, Captain Oates, Lieut. Bowers, and petty officer Evans, he pushed southwards and reached the South Pole on Jan. 18, 1912. On the return journey he and his four companions perished. Seaman Evans died from concussion on Feb. 17, 1912; Captain Oates, who had been failing for some time, rather than be a drag upon his comrades, on March 17 walked from the tent and perished; Captain Scott, Dr. Wilson, and Lieut. Bowers died from exposure on March 29.

In May 1911 a Ger. Antarctic

expedition under Lieut. Filchner set out for Weddell Sea, and in Jan. 1912 reached its southern shores in lat. 78° S. An attempt to establish winter quarters failed, and throughout the winter of 1912 *Deutschland* drifted N., frozen up in the ice. A Japanese expedition, under Lieut. Shirase, left Tokio in Nov. 1910 and did some exploring in the Ross Sea area, but did not attempt to winter. During the years 1911 to 1914 an Australian expedition, under Dr. (now Sir Douglas) Mawson, investigated the coasts W. of Cape Adare as far as the Gaussberg. Base stations were established on Adélie Land and on Queen Mary Land, from which sledge journeys were made over the inland ice sheet. In 1914 Shackleton organized an expedition for the crossing of Antarctica from Weddell Sea to Ross Sea via the South Pole. The attempt failed, as, owing to a very cold summer, *Endurance* was beset in Weddell Sea about 80 m. from the desired haven, in lat. 78° S. and drifted N. until Oct. 27, 1915, when she was overwhelmed by ice pressure in lat. 69° S., long. 51° W., and sank three weeks later, after 306 days' drift. The party lived in tents on floating pack ice for five and a half months, drifting slowly N., and on April 15, 1916, reached Elephant I., one of the S. Shetlands. A week later Shackleton left with five men in a 20-ft. boat for S. Georgia, 800 m. away, and landed there after a perilous voyage of fourteen days. The Elephant I. party were rescued on Aug. 30, after three previous attempts had failed. The Ross Sea branch of the expedition wintered in M'Murdo Sound, and in the summer of 1915–16 laid the depots for the Trans-Antarctic party. Operations were hampered by their ship, *Aurora*, being blown away from her moorings on May 6, 1915, with much essential gear on board. The Ross Sea relief was made in Jan. 1917, *Aurora* having reached New Zealand in April of the year previous.

A great field is yet open to scientists in order to bring those vast Polar regions into the realms of knowledge. Amundsen's project of using aeroplanes in the work of discovery in the Arctic and Antarctic Circles may be realized in the future with great success. Much has been done in recent years in connection with the economic development of Spitzbergen, where there are valuable mineral deposits, principally coal, and in the Dependencies of the Falkland Islands. There are prosperous whale fisheries at S. Georgia and the S. Shetlands. No fields have witnessed greater hardihood, endurance, and courage, nobler experience of defeat and worthier merit of victory, than the North and South Polar regions.

Polecat. See WEASEL FAMILY.

Poles, the two terminal points of the earth's axis. The position of the poles is not perfectly constant, and recent observations show that there are a yearly counter-clock elliptical movement of some 30 ft. and a counter-clock circular movement of some 26 ft. in diameter in a period of 428 days. The *pole of land hemisphere* is the end of the axis

of the hemisphere which contains the greatest proportion of land, and is situated near the mouth of the riv. Loire.

Pole Star, or POLARIS = α Ursæ Minoris, a solar star of 2·1 magnitude, situated 1° 14′ from the pole, loosely linked with a 9th-magnitude companion at 18″, and revolves in four days round a spectroscopically disclosed attendant. Irregularities in the motion suggest the presence of another invisible companion. Its intrinsic light-power appears, from its photographically determined parallax of 0″·05, to be forty-seven times that of our sun.

Polesworth, par. and vil., Warwickshire, England (52° 37′ N., 1° 37′ W.): collieries, quarries, and clay works. Pop. 5,600.

Police. The modern police force in this country owes its origin to the action of Sir Robert Peel in 1829 (hence the vulgar use of the words 'peeler' and 'bobby') in establishing a police force for the metropolis, to act under the direct authority of the home secretary. The City of London had its own police under the Lord Mayor and Corporation (1839). Previously there existed in England no organized body charged with the maintenance of order and the suppression of crime; most of the large towns had paid watchmen, and elsewhere there were parish constables; but the arrangements were grossly inadequate. Each county in England now has a paid constabulary under an Act of 1856, and in Scotland under an Act of 1857; bor. police in England are regulated by the Municipal Corporations Act, 1882, and the Local Government Act, 1888, and in Scotland by the Burgh Police Act, 1892, although the towns of Edinburgh, Glasgow, Aberdeen, Dundee, and Greenock, have all private Acts. In Ireland there are two bodies of police—the Dublin Metropolitan Force, originally created by an Act of the Irish Parliament in 1786, and the Royal Irish Constabulary, a semi-military organization, formed in 1836. In the Brit. dependencies, especially in the wilder districts, there are various police forces which are virtually military bodies, such as the N.W. Mounted Police of Canada, the Cape Mounted Police, and the S. African Constabulary.

Political Parties in Britain. Whig and Tory parties, modified successors of Roundheads and Cavaliers respectively, were creation of revolution of 1688. During 18th cent. Whigs (term first applied to Covenanters of S.W. Scotland) were quite as aristocratic as Tories (name derived from Irish word meaning to pursue for the sake of plunder). After Reform Act (1832) term Conservative came into use, and seemed to suggest wise moderation rather than blind opposition. Name then adopted by rival party was Liberal (see LIBERALISM). Old Tory party was shattered by Free Trade, and Conservative party did not take final shape till leadership of Disraeli. Liberal party was practically constituted under Palmerston, and embodied old Whig aristocracy, philosophical and unphilosophical Radicals, and remaining Peelites. Under Gladstone there was a growth of

Radical influence. Formation of Unionist party dates from split over great issue of Home Rule (1886), and included both Radical and Whig elements; two anti-Home Rule parties coalesced in 1892. For LABOUR PARTY, see article under that head. The rise and fall of the Nationalist Party can be followed under IRELAND, while SINN FEIN is treated separately. The COALITION at present (Dec. 1920) in power is an alliance of Unionists and Lloyd George Liberals rather than a party, the remaining Liberals being known as Independent Liberals. The group system has never taken root in British politics, but at the general election of 1918 the tendency towards sectionalism was more marked than heretofore, and members were returned —for the National Democratic Party (10), Independent Democratic Party (1), National Party (2), Socialist (1), Co-operator (1), and Federation of Discharged Sailors and Soldiers (1).

Politzer, ADAM (1835–1920), Austrian aurist; studied Vienna, Warzburg, Paris, and London; became prof. at Vienna (1873). Achieved world fame for his work on the ear, his method being known as the Politzer method He pub. *Lehrbuch der Ohrenheilkunde* (4th ed. 1901), *Die anatomische und histologische Zergliederung des menschlichen Gehörorgans* (1889), etc.

Polk, JAMES KNOX (1795–1849), eleventh president of U.S.; speaker of House of Representatives (1836); gov. of Tennessee (1839); president (1845). Chief events: settlement of Oregon boundary dispute with Great Britain; war with Mexico (1846–47), resulting in annexation of New Mexico and California; refused re-election (1848); was strongly democratic and an upholder of states' rights.

Pollack, or LYTHE (*Gadus pollachius*), handsome green member of cod family, without barbel and with projecting lower jaw; distributed from Norway to the Mediterranean, but in Brit. seas is most abundant on the S. coast, especially of Devon and Cornwall; usual length, 18–30 in.

Pollan. See SALMON FAMILY.

Pollard, ALBERT FREDERICK (1869–), Eng. historian; prof. of Eng. history, Univ. of London; assistant editor of *Dictionary of National Biography* (1893–1901); his numerous historical works include *England under Protector Somerset* (1900), *Henry VIII.* (1902; new ed. 1905, 1913), *Life of Thomas Cranmer* (1904), *Factors in Modern History* (1907), *The Reign of Henry VII. from Contemporary Sources* (3 vols. 1913–14), *The Commonwealth at War* (1917), *The League of Nations: an Historical Argument* (1918), and *A Short History of the Great War* (1919).

Pollard, ALFRED WILLIAM (1859–), Eng. critic and bibliographer; keeper of printed books in Brit. Museum (1919); secretary of the Bibliographical Society since 1893; his works include *Early Illustrated Books* (1893), *Italian Book Illustrations* (1894), *Old Picture Books* (1902), *An Essay on Colophons* (1905), *Shakespeare's Folios and Quartos* (1909), *Fine Books* (1912), *Italian Book-Illustration and Early Printing* (1914), *Two Brothers* (1916),

Shakespeare's Fight with the Pirates (1917); has also pub. editions of *English Miracle Plays*, Herrick, Chaucer, etc.

Pollen, ARTHUR JOSEPH HUNGERFORD (1866–), writer on naval affairs; recognized expert in the methods and appliances of naval gunnery and a pioneer of naval fire control; during the Great War gave lectures and contributed numerous expository articles to periodicals on the naval campaign; has written *The Navy in Battle* (1918).

Pollination, the transference of pollen grains to the ovules in Gymnosperms, or to the receptive part of the carpels in Angiosperms, is a necessary preliminary to fertilization. This may be accomplished by the wind (*anemophily*), by animals (*entomophily, ornithophily*), or by water (*hydrophily*). Among the best-known anemophilous types are Coniferæ (*Pinus*), catkinate forms (alder, birch, hazel), and grasses, all characterized by absence of bright coloration, odour, or honey, by production of vast quantities of light pollen, and by provision of a large stigmatic surface for its collection. Insect-pollinated (entomophilous) flowers are usually attractively coloured and possess nectar; many have an agreeable scent (*e.g.*, lavender). In more highly evolved types many adaptations to ensure cross pollination are noticeable (*e.g.*, primrose), as this is believed to result in the production of more robust offspring, although in some forms the plants are normally self-pollinated.

Pollock, HON. SIR CHARLES EDWARD (1823–97), Eng. judge; called to the bar (1847); was baron of the Exchequer (1873–75) and a judge of the high court from 1879; was author of *The Practice of the County Courts, Treatise on the Power of the Courts of Common Law to Compel the Production of Documents for Inspection*, and joint-author of *A Compendium of the Law of Merchant Shipping.*

Pollock, SIR ERNEST MURRAY (1861–), Eng. lawyer and politician; was called to the bar in 1885; entered Parliament as member for Warwick and Leamington (1910); appointed chairman of the Contraband Committee (1915), controller of the Foreign Trade Department (1917), and solicitor-general (1919).

Pollock, RT. HON. SIR FREDERICK (1845–), Eng. lawyer; called to the bar (1871); became prof. of jurisprudence at University Coll., London (1882), Corpus prof. of jurisprudence at Oxford (1883–1903), and was prof. of common law in the Inns of Court (1884–90); fellow of the Brit. Academy (1902); privy councillor (1911); judge of the Admiralty Court of Cinque Ports since 1914; editor of *Law Reports*, and author of *Principles of Contract* (8th ed. 1911), *Digest of the Law of Partnership* (10th ed. 1915), *The Land Laws* (3rd ed. 1895), *Spinoza* (reissue with addenda, 1911), *A First Book of Jurisprudence* (4th ed. 1918), *History of English Law* (2nd ed. 1898), *Law of Fraud* (1894), *Law of Torts* (10th ed. 1916).

Pollock, JOHN (1878–), Eng. barrister and author; called to the bar (1906); devoted himself for some years to the pro-

duction of plays, and during the Great War served as chief commissioner in Russia and Poland of the Great Britain to Poland and Galicia Fund under the Russian Red Cross (1915–18); taken prisoner by the Bolsheviks, he escaped in 1919, and later acted as special correspondent in Finland; has written *The Popish Plot* (1903), *The Policy of Charles II. and James II.* (*Cambridge Modern History*, vol. v. 1908), *War and Revolution in Russia* (1918), and *The Bolshevik Adventure* (1920).

Pollock, WALTER HERRIES (1850–), Eng. barrister and author; has written *Lectures on French Poets*, *Jane Austen and her Contemporaries*, *A Nine Men's Morrice*, *Animals that have Owned Us*, *The Paradox of Acting* (from Diderot), *Mémoires Inédits du Marquis de ——*, *King Zub*, *Impressions of Henry Irving*, *Fencing* (Badminton Library), and two books of verse, *Old and New*, and *Sealed Orders*.

Pollokshaws, town, Renfrewshire, Scotland (55° 50′ N., 4° 18′ W.), on White Cart R., and on S.W. side of Glasgow, with which incorporated (1912); cotton factories and iron foundries. Pop. 13,000.

Pollux. See under CASTOR AND POLLUX.

Polo, equestrian game, popular in almost all Eng.-speaking lands. The game was played for many centuries in Oriental countries—Persia, Tibet, Japan—under similar rules; first played by Europeans in Calcutta (1863); spread with extraordinary rapidity. Except that it is played on horseback, polo closely resembles hockey; club used is about 4 ft. long with 8-in. cross-head; dimensions of field, 300 by 200 yards; distance between goal-posts, 8 yards; four players on each side; height of ponies must not exceed 14·2 hands. These animals, when well trained, exhibit an almost human intelligence and command high prices; the best, so far, have come from Ireland. Hurlingham is the centre of polo in Britain.

Dale, *Polo* (1905).

Polo, MARCO (*c.* 1254–1324), Venetian traveller; when seventeen years old accompanied his father, Nicolo, and uncle, Maffeo (merchants), on a journey to the court of Kublai Khan of Cathay (China), won favour of the Khan, and remained with him till 1292, when he returned to Europe, reaching Venice in 1295; captured in a sea-fight between Venice and Genoa (1298), and dictated account of his travels, in French, to a fellow-prisoner, Rusticiano of Pisa; a keen and truthful observer.

Polotsk, tn., W. Russia (55° 29′ N., 28° 47′ E.), 63 m. W.N.W. of Vitebsk, at junction of Volota and Dvina; brick works, tobacco and candle factories; remains of palace and fortifications; Spaskii convent (famous for conflict of July–Oct. 1812); cathedral of St. Sophia. Pop. 31,000.

Poltava, tn., cap. of Poltava government, S.W. Russia (49° 33′ N., 34° 38′ E.), *c.* 88 m. W. of Kharkov; formerly seat of most important wool fair in Europe; trade in horses, cattle, and grain; flour mills, tobacco factories and tanneries. Zemstova building with museum. Column

of victory in Alexandrovskaya Square. Was captured by Denikin (1919). Pop. 85,000.

Polyanthus, flower possibly evolved from the primrose, from which it differs in having the umbels carried on a stalk.

Polybius (*c.* 204–122 B.C.), Gr. historian; a statesman of the Achæan League, and one of the 1,000 Achæan hostages taken to Rome; won friendship of younger Scipio, through whom he gained access to Roman archives; later, joined Scipio's African expedition, saw fall of Carthage (140), and accompanied him to Egypt and Spain; negotiated with Romans on behalf of revolted Achæan cities; wrote *Universal History,* of which only four books out of forty remain.

Polyborinæ, caracaras. See HAWK FAMILY.

Polycarp (*c.* A.D. 70–155), one of the apostolic fathers; Bishop of Smyrna for about fifty years; is said to have known and spoken with John and other disciples; had a position of great authority among the Asiatic Churches. See *Apostolic Fathers* in Ante-Nicene Christian Library; Lightfoot, *Apostolic Fathers,* ii.

Polydactylism. See under TERATOLOGY.

Polygonaceæ, herbaceous dicotyledons, with mainly trimerous, though occasionally (*Polygonum*) partly pentamerous floral symmetry; leaves characterized by possession of a membranous, sheathing stipule termed the ochrea; includes rhubarb, dock, and sorrel.

Polygon Wood, W. Flanders, Belgium (50° 51′ N., 2° 57′ E.), 4 m. E. of Ypres; scene of terrific fighting in first battle of Ypres and of fierce Brit. counter-attack on 4th Brigade Prussian Guards (Oct. 11, 1914); abandoned when line shortened (May 3, 1915); cleared in third battle of Ypres (Oct. 17, 1917); lost in Ger. offensive of April 1918; recovered by the Belgian-Brit. advance of Oct.

Polyhedron, a finite portion of space bounded by many faces or planes. Polyhedra are classified according to number of *faces.* If faces are similar and equal regular polygons, solid is a regular polyhedron. Only five regular polyhedra exist, as is easily proved by examining the number of ways in which a solid angle may be formed out of the plane angles of various regular polygons, remembering that the sum of the plane angles forming a solid angle is less than four right angles. The regular polyhedra are: (i.) *tetrahedron* (4 faces), (ii.) *octahedron* (8 faces), (iii.) *icosahedron* (20 faces)—all of which have equilateral triangles for faces; (iv.) cube (6 square faces), (v.) *dodecahedron* (12 faces, which are regular pentagons). Euler's theorem proves that if F is the number of faces, E of edges, and V of vertices in any polyhedron, then $E+2=F+V$.

Polymerism, the chemical change which occurs when two or more molecules of the same kind combine to form a more complex compound. Thus, when a few drops of concentrated sulphuric acid are added to aldehyde, CH_3CHO, it is converted with evolution of heat into paraldehyde, of which each molecule consists of three aldehyde molecules

linked together. Similarly, acetylene, C_2H_2, when passed through a red-hot tube, polymerizes and forms benzene, C_6H_6.

Polymethylenes, a series of synthetic hydrocarbons, chiefly liquid, to some of which the terpenes are related. They consist of from three to seven *methylene* (CH_2) groups joined together in a ring, and are isomeric with the olefines, from which they differ by being saturated. *Trimethylene* (or cyclopropane) is somewhat unstable, combining with bromine to form the open chain compound 1·3 dibromopropane; *tetramethylene* is more stable, *penta-* and *hexa-methylene* are very stable, forming no addition products with bromine. These facts are accounted for by Baeyer's 'strain theory,' which shows why a 5- or 6-membraned ring is more stable than a ring containing fewer carbon atoms.

Polymorpha, a sub-order of beetles distinguished by their clubbed antennæ, serrate along inner margin; include whirligig beetles (Gyrinidæ), carnivorous forms, with paddle-like hind limbs, which perform mazy dances on the surface of ponds; the carrion and burying beetles (*Necrophorus*), the latter known for their habit of digging a grave beneath small dead vertebrates, so that they may afterwards enjoy an undisturbed feast; the familiar lady-birds (Coccinellidæ), valuable on account of the plant-destroying insects they devour; the borers (*Anobium*), the larvæ of which bore into wood; they include the so-called 'weevil,' which is responsible for weevily ship biscuits; the larva of *A. paniceum*, also known as the book-worm; the cause of 'worm-eaten' furniture (*A. striatum*); 'death watches' (see BOOK-LICE); click beetles (Elateridæ), so called because when lying on their backs they can with a click jerk themselves in the air. The larvæ of some are known as 'wire-worms.' American fire-flies (*Pyrophorus*) belong to this family. Amongst Malacodermidæ the phosphorescent glow-worms and European fire-flies (*Luciola*) are placed. The family Buprestidæ, also grouped amongst Polymorpha, is of interest because the metallic green and bronze wing-covers of its members are used as ornaments and for embroidering dresses.

Polynesia, term now usually confined to the South Sea islands westward, roughly, of a line drawn from New Zealand through Samoa to Hawaii and extending from about 120° to 180° W. Besides NEW ZEALAND, the more important archipelagos are Tonga (Friendly Islands), Tubuai (Austral Islands), with Rapa or Oparo; Cook or Hervey; Tahiti (Society Islands); Paumotu or Tuamotu (Low Islands), with Gambier; Marquesas; Samoa (Navigator's Islands), with the outlying Ellice (Fanfute) group; Tokelau (Union Islands); Phœnix; Manahiki (Penrhyn); and Hawaii (Sandwich Islands). For details, see separate articles on the principal islands, which are inhabited by Kanakas.

Polyp, a name applied to those Cœlentera in which the body has the form of a tube, fixed at one end, and bearing a circle of tentacles round the other

or free end. This form is well exemplified in the common hydra, sometimes called the fresh-water polyp; but the name is equally applicable to the individual zooids of a sea-fir colony, to solitary sea-anemones, and to the members of a colonial 'coral.' In its original form of polypous or polypus, the term was, however, applied to cuttle-fish such as the octopus, or even to woodlice of the genus *Oniscus*.

Polyplacophora. See under GASTEROPODA.

Polyprotodontia. See under MARSUPIALS.

Polypterus, one of the two living genera of Crossopterygian fishes, found only in rivers of W. Tropical Africa. The body is covered with rhombic ganoid scales, there are numerous dorsal fins, and the air bladder, which is double, is used as a lung. Nine species are recognized, the best known being the bichir (*P. bichir*). They live on muddy bottoms, rising occasionally for air, and are esteemed as food.

Polypus. See CEPHALOPODA.

Polypus, pendulous, non-malignant overgrowth of mucous membrane, occurring most commonly in the nasal passages, but also found in the uterus, intestine, and other situations.

Polyzoa, or BRYOZOA, SEA MOSSES, etc., a phylum or subkingdom of the animal kingdom, including small seaweed-like colonies commonly cast on shore after a storm. The colonies may be flat and encrusting, spread over a surface of seaweed, like the sea-mat (*Flustra*), or growing like miniature bushes or trees. This appearance is due to an external skeleton (really the cuticle), usually whitish, on account of the lime it contains, and sometimes so massive and solid that it resembles coral (*Retepora, Porella*). The animals themselves are sheltered by small cups in the skeleton, within which they can altogether withdraw. When expanded they can be seen by the microscope to be small transparent sac-like creatures surmounted by a crown of ciliated tentacles which waft food to the mouth lying in their midst, and also act as respiratory organs. The disk on which mouth and tentacles are placed is known as the lophophore.

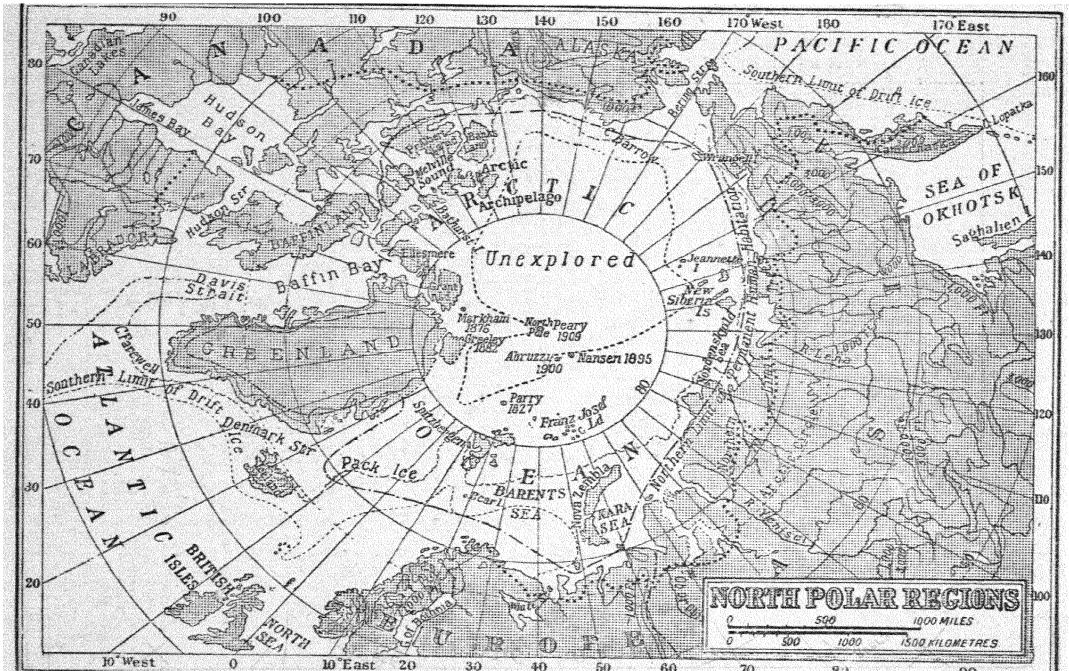
Polyzoa are exceedingly simple creatures, without head, heart, or vascular system, and with only a single ganglion to represent the nervous system. The food canal is U-shaped, the hinder end opening near the mouth. Polyzoa are mostly marine organisms, but a few forms are confined to fresh water. They live chiefly between tidemarks, fixed to or encrusting stones and seaweeds, and feeding on minute organisms, such as diatoms and Protozoa.

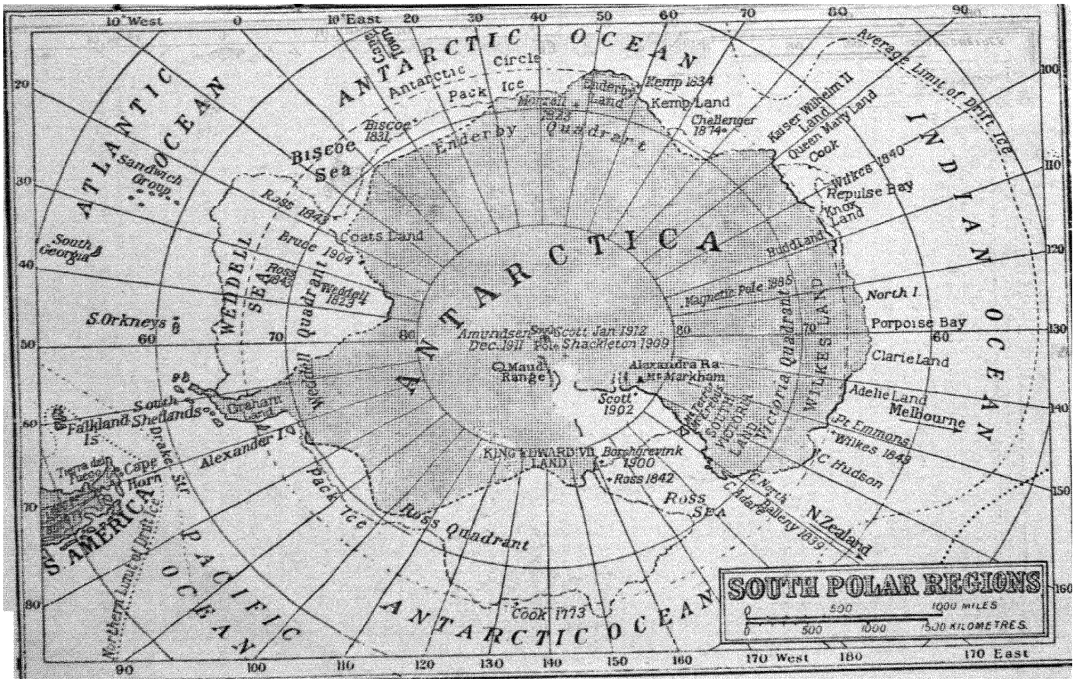
The Phylum Polyzoa is divided into two classes: (1) *Ectoprocta*, in which the vent opens outside the crown of tentacles; containing by far the greater number of Polyzoa; (2) *Entoprocta*, in which the vent opens within the crown of tentacles; containing a comparatively few small species.

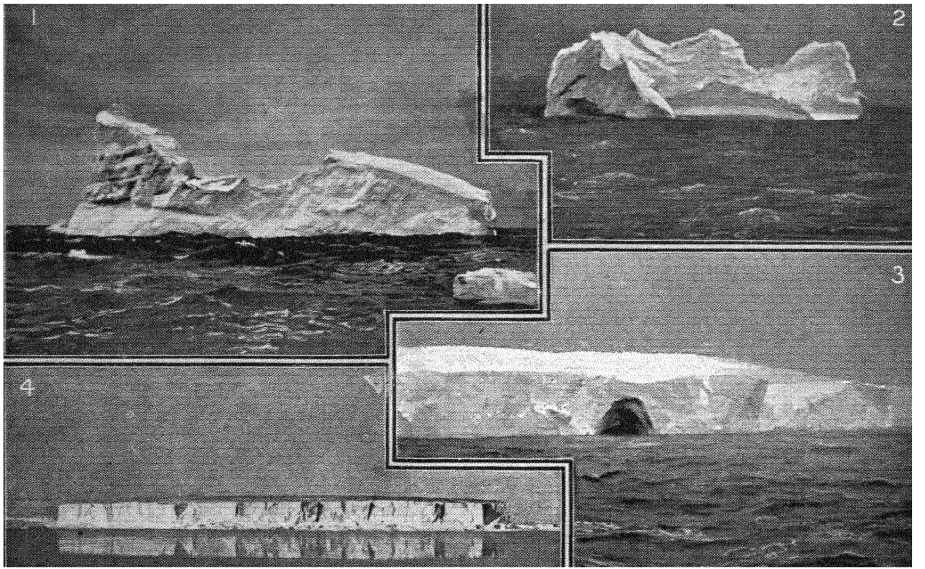
Pomegranate (*Punica granatum*), tropical tree which bears a fruit with an extremely tough, leathery pericarp. This is packed with a large number of red or purple seeds with succulent coats. The fruit, which is about the size



POLAR REGIONS: CAPTAIN SCOTT'S WINTER QUARTERS ON ROSS ISLAND, 1902.
(From 'The Voyage of the "Discovery."' By permission of Mr. John Murray.)


NORTH POLAR REGIONS
PACIFIC OCEAN
ATLANTIC OCEAN
Unexplored
Arctic Archipelago
Baffin Bay
Hudson Bay
Davis Strait
GREENLAND
Pack Ice
Southern Limit of Drift Ice
Denmark Str.
BARENTS SEA
KARA SEA
NORTH SEA
BRITISH ISLES
SEA OF OKHOTSK
Sakhalien
New Siberia
Franz Josef Ld
Spitzbergen
Nova Zembla
Parry 1827
Nansen 1895
Abruzzi 1900
Peary 1909
Markham 1876
Greely 1882
Jeannette
Barrow
Behring Sea
Behring Str.
Hudson Str.
Lancaster Sound
Melville Sound
Prince Regent Inlet
Boothia Land
Parry Islands
Ellesmere
Greenland
Iceland
Jan Mayen
Aleutian Is.
Commander Is.
Kurile Is.
Kamchatka
Lopatka
Behring Sea
Behring Str.
Northeast Passage
Northwest Passage
Franz Josef Land
Novaya Zemlya
Nova Zembla
Pearl I.
Barrow
Point
Cape Chelyuskin
Cape Wrangel
Cape Barrow
Cape Prince of Wales
Cape Farewell
Cape Lopatka


ANTARCTIC OCEAN
ATLANTIC OCEAN
INDIAN OCEAN
PACIFIC OCEAN
ANTARCTICA
Antarctic Circle
Pack Ice
Average Limit of Drift Ice
Biscoe 1831
Biscoe Sea
Enderby Quadrant
Enderby Land
Kemp 1834
Kemp Land
Mawson
Challenger 1874
Kaiser Wilhelm II Land
Queen Mary Land
Cook
Wilkes 1840
Repulse Bay
Knox Land
Ross 1843
Coats Land
Bruce 1904
Weddell 1823
Weddell Quadrant
WEDDELL SEA
Sandwich Group
South Georgia
S. Orkneys
Biddle Land
Magnetic Pole 1935
North I.
Porpoise Bay
Amundsen Dec. 1911
Scott Jan 1912
Shackleton 1909
Maud Range
Alexandra Ra.
Mt. Markham
Scott 1902
Victoria Quadrant
WILKES LAND
Clarie Land
Adelie Land
Melbourne
Pt. Emmons
Wilkes 1840
C. Hudson
South Shetland Is.
Graham Land
Weddell
Falkland Is.
Alexander I.
Drake Str.
Tierra del Fuego
Cape Horn
SOUTH AMERICA
Pack Ice
KING EDWARD VII LAND
Borchgrevink 1900
Ross 1842
Ross Sea
C. North
Edward Gallery 1841
N. Zealand
Ross Quadrant
Northern Limit of Drift Ice
Cook 1773
SOUTH POLAR REGIONS
0 500 1000 1500 MILES
0 500 1000 1500 KILOMETRES.
10° West
0
10° East
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170 West
180
170 East



ICEBERGS.

1, 2, 3, Atlantic types; 4, Antarctic type.

of an orange, has never become popular in Britain. The tannin found in the rind is used in the manufacture of morocco leather.

Pomerania, province, Prussia (53° 50′ N., 15° E.); stretches along Baltic E. and W. of mouth of Oder and Stettiner Haff; numerous small lakes; agriculture. Cap. Stettin. Slav down to 1637. Most of Hither Pomerania (W. of Oder) and part of Farther Pomerania (E. of Oder) in Swed. hands from *c.* 1630 to 1720. Area, 11,625 sq. m.; pop. 1,716,500.

Pomeranian Dogs. See under DOG FAMILY.

Pomfret. See PONTEFRACT.

Pommern, Ger. battleship, completed at Wilhelmshaven in 1907; displacement 13,200 tons; speed 18 knots; armament four 11-in., fourteen 6·7-in., twenty-two 3·4-in., eight smaller guns, and six torpedo tubes; sunk in battle of JUTLAND (May 1916).

Pomona, city, California (34° 5′ N., 117° 48′ W.), 32 m. E. of Los Angeles: beautiful surroundings; residential and health resort; fruit and vegetables; fruit canning. Pop. 10,200.

Pomona, or MAINLAND, largest isl. of Orkneys (59° N., 3° 10′ W.). Kirkwall Bay and SCAPA FLOW, 2 m. apart, divide it into two unequal portions, W. part being larger, mostly moorland with fertile tracts and good trout lochs. Stromness is good harbour N. of Hoy Sound, 14 m. from Kirkwall; Standing Stones at Stennis. Area, 150 sq. m.; pop. 14,700.

Pompeii, former town, Italy (40° 45′ N., 14° 30′ E.), at foot of Mt. Vesuvius, on Bay of Naples; said to have been founded by Oscans in late 7th or early 6th cent. B.C.; captured by Romans (80 B.C.), after belonging in turn to the Etruscans and Samnites. For about 160 years was a prosperous Roman town and a favourite seaside resort of the upper classes; but in A.D. 79 it was overwhelmed by volcanic ashes during the historic eruption of Mt. Vesuvius, which destroyed also the neighbouring town of Herculaneum. For centuries it was entirely lost sight of, but in 1592 some remains were discovered by Fontana when constructing an aqueduct; and a century and a half later these were realized to be part of Pompeii. Excavations were begun in 1748, and since 1860 have been carried on with great regularity, so that now a large part of the town is exposed to view. Forums, various temples and shrines, and a huge amphitheatre have been revealed. Private houses include the villas which belonged to Cicero and Diomedes. A great number of beautiful works of art have been discovered, including wall-paintings and statues. Perhaps the private houses are more interesting than the public buildings, from the light they throw on ancient domestic life. Several contain a complete arrangement for the bath, with warm and hot chambers, treated by hot air, and swimming tanks. In 1915 a magnificent house was unearthed, with all the frescoes and vaulting in a perfect state, and with several pictures of exquisite colouring. Marble and bronze tables, lamps, and other articles of furniture

have been found, of most artistic shape. A complete set of kitchen utensils was practically identical with those of the present day. The discovery of a set of auctioneers' receipts indicates clearly Ital. business methods. See Pisa and Mackenzie, *Pompeii* (1910).

Pompeius, or 'POMPEY,' distinguished Roman family; noted members were—(1) GNÆUS, consul (89 B.C.); conferred Lat. rights on all communities from the Alps to the Po. (2) GNÆUS, POMPEY THE GREAT (106–48), aided Sulla against Marius; repelled Lepidus (77); defeated Marians in Spain (76–71); suppressed Mediterranean piracy in forty days; consul (71); conquered Mithridates; annexed Syria and Palestine (66–63); formed 'first triumvirate' with Cæsar and Crassus; defeated by Cæsar at Pharsalus (48); murdered in Egypt by Achillas.

Ponape. See under CAROLINE ISLANDS.

Ponce, tn., Porto Rico (18° N., 66° 41′ W.), 50 m. S.W. of San Juan; its port is Playa de Ponce, 3 m. distant. Second largest city in island and first in commercial importance; coffee, sugar, rum, molasses, and tobacco; well built, with electric traction and light. Pop. 35,000.

Pondicherry, or PONDICHÉRY, chief Fr. settlement in India (11° 56′ N., 79° 53′ E.), on E. coast of Madras, 90 m. S.S.W. of Madras; no harbour; artesian wells for water supply; exports ground-nuts, oilcake, cotton cloth, and thread. First settled by French (1674); frequently taken by British, but finally restored to French (1815). Area, 115 sq. m.; pop.—tn. 50,000, terr. 260,000.

Poniatowski, JOZEF ANTON (1763–1813), Polish prince and patriot; was commander-in-chief against Russia (1792); took part in Kosciuszko's rising; assisted in Napoleonic campaigns; commander-in-chief of new duchy of Warsaw; distinguished in last Napoleonic invasion of Russia; marshal after battle of Leipzig, but drowned three days later.

Ponta Delgada, largest tn. of Azores (37° 40′ N., 25° 32′ W.), on São Miguel; exports grain and fruit. Pop. 18,000.

Pont-à-Mousson, tn., Meurthe-et-Moselle, France (48° 54′ N., 6° 2′ E.), on Moselle, 16 m. N.N.W. of Nancy; ironworks; velvet; heavily bombarded during battle of Nancy (Sept. 1914); within Amer. zone during St. Mihiel battle (Sept. 1918). Pop. 14,000.

Pontardawe, vil., Glamorganshire, Wales (51° 43′ N., 3° 51′ W.), on the Tawe, 8 m. N.N.E. of Swansea; has coal mines. Pop. 31,500.

Pontarlier, tn., Doubs, France (46° 54′ N., 6° 21′ E.), on riv. Doubs, 30 m. S.E. of Besançon, on main ry. route through Jura Mts. into Switzerland; watches and clocks. Pop. 9,400.

Pontecorvo, tn., Caserta, Italy (41° 28′ N., 13° 42′ E.), 70 m. S.E. of Rome; belonged to Papal States up to 1860. Pop. (comm.) 12,000.

Pontefract, or POMFRET, tn., W. Riding, Yorkshire, England (53° 42′ N., 1° 19′ W.), 13 m. S.E. of Leeds; ruined castle (*c.* 1080) where Richard II. was killed (1400); has two Norman churches; market gardens;

grain; makes 'Pomfret cakes' from liquorice. Pop. 15,900.

Pontevedra, city, cap. prov. Pontevedra, Spain (42° 28′ N., 8° 35′ W.), 30 m. S.W. of Santiago, at head of deep bay; handsome and progressive city in Spanish 'Switzerland'; fishing, food preserving. Pop. 22,300.

Pontiac, city, Michigan, U.S. (42° 38′ N., 83° 19′ W.), 26 m. N.N.W. of Detroit; in region dotted with 400 picturesque lakes; summer resort; Michigan military academy; exports wool and agricultural produce; iron foundries, etc. Pop. 14,500. Named after the famous Ind. chief (*c.* 1712–69) who assisted French against British and showed great ability in the siege of Detroit; submitted in 1766; his murder led to the Illinois War.

Pontoon. See under BRIDGES.

Pontremoli, tn., Tuscany, Italy (44° 23′ N., 9° 52′ E.), 20 m. N. by E. of Spezia; tanneries; silk, wine, and oil. Pop. (comm.) 14,000.

Pontus, anc. dist. of Asia Minor, on S.E. of Euxine or Black Sea (itself known as the *Pontus*). Eastern part became a Roman province (A.D. 63).

Pontypool, tn., Monmouthshire, England (51° 42′ N., 3° 3′ W.), 8 m. N.N.W. of Newport; great centre of coal and iron trade; numerous forges and iron mills, ore being chiefly imported from Spain. Pop. 6,400.

Pontypridd, tn., Glamorganshire, Wales (51° 36′ N., 3° 21′ W.), at confluence of Rhondda and Taff, 12 m. N.W. of Cardiff; iron and coal mines, foundries, chain and cable works. Pop. 43,200.

Poole, seapt., Dorsetshire, England (50° 43′ N., 1° 58′ W.), on Poole Harbour (7 m. long), 18 m. E. of Dorchester; yacht building; fishing. During Great War shipbuilding yards were established and large cordite works were erected. Proposals for development as first-class port at cost of £3,250,000 were submitted to Harbour Board in Oct. 1920. On Branksea I., at mouth of harbour, is Branksea Castle. Potter's clay is quarried. Pop. 38,900.

Poole, REGINALD LANE (1857–), Eng. historian; keeper of archives of Oxford Univ. since 1909, and lecturer in diplomatic, Oxford Univ., since 1896; fellow of the Brit. Academy (1904); associated with the editorship of the *English Historical Review* since 1885, and sole editor since 1901. His numerous publications include *A History of the Huguenots of the Dispersion* (1880), *Wycliffe and Movements for Reform* (1889), *The Exchequer in the 12th Century* (1912), *On the History of the University Archives* (1912), *Lectures on the Papal Chancery* (1915), *Historical Atlas of Modern Europe* (1897–1902); was joint-ed. of the *Political History of England* (12 vols. 1905–10).

Poona, tn. and cantonment, Deccan, Bombay, India (18° 31′ N., 73° 55′ E.), 80 m. S.E. of Bombay; headquarters of Bombay army; seat of government of Bombay during hot weather; gold, silver, and brass ware, ivory carving, modelling of small clay figures; two art colleges and college of science; centre of Brahmanical influence in W. India. Pop. 155,000.

Poor Law. Until 1601 almsgiving was regulated by charity only, usually administered through

medium of Church, which had received power by Act (1553) to distrain on neglect of this religious duty. The famous Elizabethan Act of 1601 was the beginning of the poor law in England, and remained in force till the Poor Law Amendment Act (1834); it provided that *overseers of poor*, with the consent of justices of the peace, might levy taxes on propertied people of the parish. Corruption of overseers and the increase of destitution through economic changes led to Gilbert's Act (1783) for building workhouses and appointing guardians; before this Act a workhouse had been built at Bristol (1697). The Act of 1834 provided for the appointment of three Poor Law Commissioners with supreme control over local relief, power to form unions (united parishes for poor relief purposes), etc.; Poor Law Board established (1847), replacing commissioners; superseded (1871) by Local Government Board, now Ministry of Health. The local authorities are the boards of guardians appointed for each of the 649 unions in England and Wales. In urban districts they are elected by the parochial electors for three years, and generally retire by thirds annually; in rural districts the district council acts as the board of guardians. Their duties include the administration of the Poor Relief Acts, the Union Assessment Committee Acts, Registration of Births, Deaths, and Marriages Acts, Vaccination Acts, and Children Act, 1908 (Part I.). Relief is provided by indoor, outdoor, and medical relief. Indoor relief is maintenance in accordance with the Poor Law Institutions Order, 1913, in general workhouses, workhouse infirmaries, sick asylums, homes for aged poor, casual wards, cottage homes, or by boarding out. Outdoor relief is domiciliary aliment in accordance with the Relief Regulation Order, 1911. Medical relief is medical and surgical attendance as recommended by the medical officer. The Poor Law Commission, appointed in 1905, issued in 1909 two reports, majority and minority, agreeing as to the deficiencies of the system, but differing in policy and principle. Some of the recommendations have been adopted —*e.g.*, old age pensions, state insurance against unemployment, and creation of a Ministry of Labour (1917). A Local Government Committee appointed by the Ministry of Reconstruction (1918) again recommended the abolition of Boards of Guardians and Poor Law Unions, and the transference of their functions to county councils and urban district councils. In Scotland poor law relief was provided for as early as 1579, and the Eng. Act of 1601 copied many of the ideas of the Scots law. There was a remarkable decline in pauperism throughout the country during the period of the Great War; by July 1918 it was two-thirds what it was in July 1914.

Popayan, chief tn., dep. Popayan, Colombia, S. America (2° 23′ N., 76° 35′ W.), on Cauca R., at foot of volcano Purace, 245 m. S.W. of Bogota; cathedral; episc. and provincial palaces; univ. Pop. 18,000.

Pope. See PAPACY.

Pope, ALEXANDER (1688–1744), Eng. poet; *b.* London; educated privately; showed poetic bent from an early age—'I lisped in numbers, for the numbers came'; his first publication was *Pastorals* (written 1704), which appeared in 1709; his *Essay on Criticism* (1711), in spite of a want of clearness in some of its theories, is a marvel of epigrammatic brilliance, and remains the best Eng. statement of the doctrines of classicism; the *Rape of the Lock* (1712), a mock-heroic poem, won him instant fame; in 1717 he brought out an ed. of his works, including, in addition to those mentioned, *The Temple of Fame, Epistle of Eloisa to Abelard, Elegy to the Memory of an Unfortunate Lady, Imitations of Chaucer,* and several translations. For the next ten years he was occupied chiefly in translating, and his *Iliad* (1715–20) and *Odyssey* (1725–6) were the fruits of his labours. The latter justified Bentley's remark: 'A pretty poem, but you must not call it Homer,' but the *Iliad* was far superior, and had great influence on 18th cent. poetry. Having brought out an ed. of Shakespeare (1725) which was adversely criticized, Pope retaliated on his critics with the *Dunciad* (1728). His great didactic poem, the *Essay on Man* (1732–4), and the *Moral Essays* (1731–5), undertaken at the suggestion of Bolingbroke, are only fragments of his great scheme. His philosophy was borrowed from Bolingbroke, and the *Essay on Man* remains merely an 'exquisite mosaic.' His latest works comprise *Imitations of Horace* (1733–7), *Epistle to Dr. Arbuthnot* (1735), and *Epilogue to the Satires* (1738). He also pub. his *Correspondence* (1737). He represents the culmination of the school which began with Waller and Denham, and is unexcelled for precision, terseness, epigrammatic brilliance, and perfection of form.

Leslie Stephen, *Pope* (1878); G. Poston, *Pope: his Life and Times* (1909).

Poperinghe, tn., W. Flanders, Belgium (50° 52′ N., 2° 43′ E.), 6 m. W. of Ypres; woollen and linen goods; hops. During Great War important military centre; one of the objectives in the great Ger. thrust of April 1918. Pop. 12,600.

Poplar (*Populus*), a genus of trees allied to willows (*Salix*), and included with them in Salicaceæ; several species—*P. tremula* (aspen), *P. fastigiata* (Lombardy poplar), *P. alba* (white poplar, or abele), and *P. nigra* (black poplar) being the best known. The inflorescences take the form of catkins, the carpellary flowers being wind-pollinated. The timber, though used for scaffolding, is not of great value.

Poplar, bor., London, England (51° 31′ N., 0° 2′ W.), 3 m. E. of St. Paul's; connected with E. Greenwich by Blackwall tunnel, running under Thames; has shipbuilding, chain cable works, tank works, and wire-rope factories. Pop. 165,000.

Poplin, mixed material of silk and worsted, introduced by Fr. refugees (1685), and ever since a distinct Irish industry. Many poplins have now no silk in their composition, being woven of

worsted and flax or of worsted and cotton.

Popocatepetl ('smoking mountain'), active volcano between valleys of Mexico and Puebla (19° N., 98° 38′ W.); sulphur is obtained from its crater. Height, 17,780 ft.

Poppy (*Papaver*), a genus of hardy annual and perennial plants; *P. rhœas*, the common cornfield poppy; *P. somniferum*, the opium poppy. See OPIUM.

Population. See CENSUS.

Poquelin. See MOLIÈRE.

Porbandar, chief tn. and seapt., Porbandar state (21° 37′ N., 69° 48′ E.), on Kathiawar peninsula, 215 m. s.w. of Ahmedabad; docks and stone quarries. Pop. 25,000.

Porbeagle. See under SHARKS AND DOG-FISHES.

Porcelain. See POTTERY.

Porcupine Fishes and **Rabbit Fishes** (Diodontidæ), globular or oblong fishes, armed with long projecting spines, movable or immovable; found in all, but chiefly in tropical, seas.

Porcupines, moderately large rodents, protected by long, strong spines. The common porcupine (*Hystrix cristata*) occurs in the countries round the Mediterranean Sea; the tree porcupine (*Synetheres*) is American.

Porfirio Diaz. See CIUDAD PORFIRIO DIAZ.

Porifera. See SPONGES.

Pork, the flesh of swine; frequently preserved by being salted or pickled, and then dried, generally in smoke; when this is done to the sides or the back it is known as bacon; the leg, similarly treated, is known as a ham.

Porosity, term indicating presence of minute holes or pores throughout an otherwise solid body; vary greatly in size, from large holes in sponge and pumice to much smaller pores of charcoal and unglazed earthenware; still tinier in platinum, in which pores can occlude gases, or in hot iron, which allows of their transmission. Porosity gives quality of absorption, as in blotting-paper or charcoal; also used for filtration of liquids and for separating gases by diffusion.

Porphyry (Gr., 'purple'). (1) (Petrology) hard stone, resembling granite, and known also as *porfido rosso antiquo*; red, with green, black, or white variations; polished and used for ornamental purposes; composition: felspar, hornblende, and oxidized iron; found in Egypt (where, near Siout, there was a dyke some 80 ft. thick), in East, and in parts of England, Ireland, and Germany. (2) (Geol.) term used in reference to any unstratified igneous rock containing felspathic crystals or other minerals—*e.g.*, quartz-porphyry, augite-porphyry, porphyritic-granite, porphyritic-greenstone, etc.

Porpoise. See under DOLPHIN FAMILY.

Port. See under WINE.

Port Adelaide, port of Adelaide, S. Australia (34° 52′ S., 138° 35′ E.), on Gulf of St. Vincent; silver and copper smelting works. Pop. 21,000.

Portadown, mrkt. tn., Armagh, Ireland (54° 26′ N., 6° 27′ W.), 25 m. s.w. of Belfast, on Upper Bann; linen. Pop. 11,700.

Portalegre, tn., episc. see, Alemtejo, Portugal (39° 14′ N., 7° 26′ W.), 37 m. s.w. of Badajoz; cathedral; cloth. Pop. 12,000.

Portarlington, tn., Queen's co., Ireland (53° 9′ N., 7° 11′ W.), on riv. Barrow, 42 m. W.S.W. of Dublin. Pop. 2,000.

Port Arthur, port, Ontario, Canada (48° 30′ N., 89° W.), on Lake Superior (Thunder Bay); large docks and grain elevators; lumbering and mining interests. A large paper mill is being erected by the Great Lakes Paper Co., at cost of £1,000,000. Pop. 7,000.

Port Arthur, or LUSHUNKAU, harbour and fortified tn. on E. side of Kwang-tung peninsula, Manchuria (38° 48′ N., 121° 20′ E.); entrance to harbour 500 yds. broad. Taken by Japanese (1894); leased by China in 1898 to Russia, who fortified it and made it terminus of Siberian Ry.; capitulated to Japanese (Jan. 1905) after siege of eleven months. Pop. 50,000. See JAPAN.

Port Augusta, seapt., S. Australia (32° 35′ S., 137° 40′ E.), at head of Spencer Gulf, 175 m. N. by W. of Adelaide; exports flour, copper, tallow, and hides. Pop. 2,400.

Port-au-Prince, cap. of Haiti (18° 34′ N., 72° 20′ E.); on W. coast at head of Bay of Gonaïves; monopolizes most of the foreign trade; exports coffee, logwood, hides, and cacao. Partly in ruins as result of civil wars, fires, and earthquakes; good fortified harbour; state palace; arsenal, mint, etc.; cathedral; seat of archbishop. Pop. *c.* 70,000.

Port Blair, tn. and harbour, S. Andaman I., Bay of Bengal (11° 41′ N., 92° 43′ E.); Ind. convict settlement. Pop. 18,000.

Port Chester, vil., New York, U.S. (41° N., 73° 40′ W.), on Long Island Sound, 26 m. N.E. of New York; summer resort; cotton and woollen goods, carriages, and ironware. Pop. 12,800.

Port Elizabeth, seapt., Cape of Good Hope (33° 57′ S., 25° 37′ E.), on Algoa Bay, 436 m. by sea E. of Cape Town; well laid out with handsome buildings (town hall, public library); open harbour but safe roadstead. 'Liverpool of S. Africa.' Pop. 33,000.

Porter. See BREWING.

Porter, WILLIAM SYDNEY (1862–1910), Amer. author; wrote under pseudonym of 'O. Henry'; native of N. Carolina; was bank clerk, but took to reporting (1895); imprisoned (1898–1901) for alleged embezzlement while in bank. While in prison began writing his popular short stories. They include *The Gentle Grafter, Cabbages and Kings* (1905), *Four Million* (1906), *Trimmed Lamp* (1907), *Voice of the City* (1908), *Roads to Destiny* (1909).

Port Erin, sea-bathing resort, Isle of Man (54° 6′ N., 4° 12′ W.), 5 m. W. by N. of Castletown; marine biological laboratory and fish hatchery.

Port Florence, tn., terminus of Mombasa-Victoria Ry., Kenya Colony (formerly Brit. E. Africa) (0° 7′ S., 34° 46′ E.), cap. of Kisumu dist., stands at head of Kavirondo Bay, N.E. of Victoria Nyanza.

Port-Glasgow, seapt., Renfrewshire, Scotland (55° 56′ N., 4° 41′ W.), on l. bk. of Clyde, 3 m. E.S.E. of Greenock; graving dock, shipbuilding yards, timber ponds; sails, tents, ropes, brass and iron founding. Founded 1668 as a port for Glasgow. Pop. 17,700.

Portglenone, par. and small mrkt. tn., Antrim, Ireland (54°

52′ N., 6° 28′ W.), on riv. Bann, 8 m. W. of Ballymena; linen and salmon fishing. Pop. 4,000.

Porthcawl, coast vil., Glamorganshire, Wales (51° 28′ N., 3° 42′ W.), 6 m. W.S.W. of Bridgend; bathing resort; exports coal and iron. Pop. (urban dist.) 3,400.

Porthleven, seapt., Cornwall, England (50° 5′ N., 5° 19′ W.), on Mount's Bay, 10 m. E.S.E. of Penzance; good harbour; fishing. Pop. (eccles. par.) 2,000.

Port Huron, city, Michigan, U.S. (42° 59′ N., 82° 29′ W.), on Lake Huron at mouth of St. Clair R., 60 m. N.E. of Detroit; opposite Sarnia, Ontario; summer resort; mineral springs; important port of entry on Great Lakes; dry docks, shipyards, grain elevators, etc. Site of old Fort Joseph (1686). Pop. 18,800.

Portici, seapt., Campania, Italy (40° 50′ N., 14° 20′ E.), on Bay of Naples, 4 m. S.E. of the city; fishing, coasting trade, sericulture; built over part of site of Herculaneum. Pop. 14,500.

Port Jackson. See SYDNEY.

Portland. (1) Largest city of Oregon, U.S. (45° 31′ N., 122° 31′ W.), on Willamette R., 12 m. above its junction with the Columbia, at head of deep water navigation of this river; spacious fresh-water harbour; fifteen ocean and coastwise steamship lines and fourteen river lines run to port; fine new boulevard drives; extensive park system; many noteworthy buildings and educational institutes (departments of law and medicine of univ. of Oregon). Leading lumber exporting port of the world; timber manufactures, printing and publishing, meat packing. Pop. 260,600. (2) Largest city and chief seapt. of Maine, U.S. (43° 40′ N., 70° 20′ W.), on Casco Bay, 108 m. N.E. of Boston; winter port for several transatlantic lines; deep and spacious harbour with forts; has many important public buildings; Longfellow House (1785) in which poet was born; bronze statue; has extensive coastwise trade; fishing; shipbuilding; foundries, machine shops, etc. Pop. 63,000.

Portland, ISLE OF, peninsula S. of Dorsetshire, England (50° 32′ N., 2° 27′ W.), connected with mainland by CHESIL BANK and a causeway, 4½ m. S. of Weymouth; breakwater on N.E. forms large harbour of refuge; convict prison on isl.; Portland Castle is a military residence; extensive quarries of fine building stone, which is largely exported. Pop. 17,000.

Portland Cement. See CEMENT.

Port Louis, cap. and chief seapt., Mauritius, Indian Ocean (20° 10′ S., 57° 28′ E.), at head of bay on N.W. coast; seat of Anglican and R.C. bishoprics; two cathedrals, botanical gardens, observatory; exports sugar. Pop. 53,000.

Port Mahon, naval station, seapt., and cap. of Minorca, Balearic Islands, Spain (39° 54′ N., 4° 19′ E.), on bay on S.E. coast; exports live stock, cheese, boots and shoes, machinery, and cotton stuffs; taken by British in 1708, by French in 1756, and again held by British (1763–82); finally ceded to Spain in 1802; strongly fortified; safe port. Pop. 18,000.

Port Natal. See DURBAN.

Port Nolloth, seapt., N.W. of Cape of Good Hope (29° 15′ S.,

16° 52′ E.), 50 m. S.E. of mouth of Orange R.; terminus of railway running into Namaqualand exports copper. Pop. 1,000.

Porto Alegre, cap. Rio Grande do Sul, Brazil (30° 1′ S., 50° 4′ W.), 100 m. N.N.E. of Rio Grande do Sul; fine situation at convergence of five navigable rivers; extensive harbour; see of bishop; cathedral; woollens, hosiery, boots and shoes; jerked beef, hides, beans, and cereals are exported. Pop. 125,000.

Portobello, wat.-pl., Scotland (55° 57′ N., 3° 7′ W.), on Firth of Forth, within munic. boundary of city of Edinburgh; bottles, bricks, and pottery.

Port of Spain, chief tn. and port of Trinidad, W. Indies (10° 42′ N., 61° 36′ W.); beautifully situated on shallow but sheltered harbour; well laid out with wide thoroughfares and handsome buildings; fine botanical garden; place of call for numerous lines of ocean steamers. Pop. 60,000.

Porto Novo. (1) Seapt., Madras, India (11° 30′ N., 79° 48′ E.), on Coromandel coast; here Haidar Ali was defeated by Sir Eyre Coote (1781). Pop. 14,000. (2) Seat of government and chief commercial centre, Fr. colony of Dahomey, W. Africa (6° 20′ N., 2° 51′ E.), on a lagoon in Gulf of Guinea. Pop. 20,000.

Porto Rico, isl. (U.S.), West Indies, the most easterly and smallest of Greater Antilles (17° 54′–18° 31′ N., 65° 13′–67° 15′ W.), 75 m. E. of Haiti. Largest natural harbours: San Juan, Guayanilla, Guanica, and Jobos. Interior rugged and mountainous (El Yunque, 3,700 ft.); low coastal plain; no navigable rivers; climate equable and comparatively healthy; volcanoes and earthquakes and occasional monsoons; mineral resources unexploited; guano abundant; salt from lagoons; abundant forests; sugar cane, coffee, tobacco, and fruits are staple agricultural products; 220 m. of railway; government vested in governor and legislative assembly (executive council and house of delegates). Discovered by Columbus (1493); captured by U.S. in Span.-Amer. War, and ceded Dec. 10, 1898 (Treaty of Paris). Area, 3,606 sq. m.; pop. 1,118,000.

Portpatrick, fishing vil. and seaside resort, W. coast of Rhinns of Galloway, Wigtownshire, Scotland (54° 51′ N., 5° 6′ W.), 6 m. S.W. of Stranraer. Pop. 1,100.

Port Phillip, fine landlocked bay, Victoria, Australia (38° 10′ S., 144° 50′ E.), on S. coast; at N. end is MELBOURNE.

Port Pirie, seapt., S. Australia (33° 10′ S., 138° 1′ E.), on Germein Bay, 130 m. N.N.W. of Adelaide; smelting and refining works, foundry, ice and butter factories. Pop. (dist.) 11,000.

Portree, seapt., vil., and tourist resort on bay E. coast of Skye, Inverness-shire, Scotland (57° 25′ N., 6° 12′ W.), 120 m. N.N.W. of Oban. Pop. (par.) 2,400.

Port-Royal, or PORT-ROYAL DES CHAMPS, famous Cistercian nunnery near Versailles, founded in 1204; removed to Paris, and became prominent in 17th cent. as Jansenist and educational centre; produced a noble type of spirituality; abolished in 1710.

Sainte-Beuve, *Port-Royal* (4th ed. 1878); Mrs. Romanes, *The Story of Port-Royal* (1907).

Portrush, summer resort, N. coast Antrim, Ireland (55° 13′ N., 6° 40′ W.), connected by electric tramway with Giant's Causeway, 8 m. E. Has excellent golf links. Pop. 2,100.

Port Said, tn., entrance to SUEZ CANAL, Egypt (31° 15′ N., 32° 18′ E.); outer harbour covers 580 ac.; inner sheltered discharging basins; one of largest coaling stations in world; railway communication with Ismailia, Cairo, and Suez; calling place for liners to and from India; statue of Lesseps on breakwater. Pop. of town, which mainly caters for passing tourists, 50,000.

Portsmouth, tn., Hampshire, England (50° 48′ N., 1° 5′ W.), 18 m. S.E. of Southampton, on Portsea I., between Longstone and Portsmouth Harbour; includes Portsmouth proper, Portsea, Southsea, and (on opposite shore) Gosport; greatest arsenal, chief naval station, and most strongly fortified place in the kingdom; chief landing-place, Clarence Pier; naval and military barracks, hospitals, Royal Sailors' Home, Jewish Coll., Royal Naval Coll., royal dockyard (300 ac.) are at Portsea. Whale I. is famous school of gunnery. The younger Brunel, Dickens, Sir W. Besant, and John Pounds were natives. Pop. 231,100.

Portsmouth, city, New Hampshire, U.S. (43° 5′ N., 70° 45′ W.), on Piscataqua R., 3 m. from Atlantic, 58 m. N.E. of Boston; only seaport of state; fine harbour. On isl. in river is U.S. Navy Yard; port of entry; summer resort. Treaty of Portsmouth, which ended war between Japan and Russia, signed here (Sept. 5, 1905). Pop. 18,000.

Portsmouth (LOUISE DE KÉROUALLE), DUCHESS OF (1649–1734), mistress of Charles II.; born in Brittany; was mother of first Duke of Richmond. She retired to France (1688) after death of Charles.

Forneron, *Louise de Kéroualle* (Eng. trans. 1897).

Port Sudan, seapt., Red Sea, Sudan (19° 35′ N., 37° 12′ E.), 40 m. N. of Suakin: gum, ivory, cotton, sesame, and durra; harbour formally opened April 1, 1909; railway to Berber on Nile.

Port Sunlight, model industrial vil., Cheshire, England (53° 20′ N., 2° 58′ W.), 3 m. S.S.E. of Birkenhead; built in 1890 by Lever Brothers, Ltd., in connection with their soap works.

Port Talbot, port, Glamorganshire, Wales (51° 36′ N., 3° 47′ W.), on E. side of Swansea Bay, 7 m. E.S.E. of Swansea; Cwm Avon copper works.

Portugal, republic, forming W. part of Iberian Peninsula, Europe (37°–42° N., 6° 15′–9° 30′ W.), bounded on N. and E. by Spain, W. and S. by Atlantic Ocean. It consists of six provinces—Entre Minho-e-Douro, Beira, Tras-os-Montes, Alemtejo, Estremadura, Algarve; Azores and Madeira Islands are accounted integral parts of Portugal; length from N. to S., *c.* 360 m.; average breadth, 100 m.; coast-line is *c.* 460 m., with two large indentations—Bay of Setubal and estuary of Tagus. Surface is generally mountainous, especially N. of Douro, where Cantabrian Mts. terminate; between Douro and Tagus is the Serra da Estrella


ATLANTIC OCEAN
English Miles
100
50
25
0
PORTUGAL
Minho
Braga
Traz os Montes
Bragança
Alcaracaxe
Oporto
Villa Real
Miranda do Douro
Beira
Salamanca
Aveiro
Viseu
Almeida
Coimbra
Ciudad Rodrigo
Sabugal
Sa de Gata
Leiria
Pombal
Monsanto
Moraleja
Coria
Galisteo
Cedavin
Caceres
Alcantara
Arroyo
Cacerez
Malpartida
Albuquerque
ESTREMADURA
Estremadura
LISBON
Badajos
Olivenza
Alcantara
Setubal
Evora
Alemtejo
Jerez
Xeres
Fuente
Beja
Ayamonte
Sa de Aracena
Almaden
Mertola
Huelva
Valverde
Algezur
Tavira
Ayamonte
Cape St. Vincent
Lagos
Sagres
Faro
Gulf of Cadiz
42
40
38

Portugal.

(6,532 ft.), which reaches ocean at Cabo da Roca, the most westerly point of the country; the Serra de Monchique (2,963 ft.) runs into Atlantic at Cape St. Vincent. Immense plains stretch S. of Tagus; coastal districts generally flat (except near Lisbon and in S.) and marshy. Almost all geological formations are found; about two-thirds belong to Archæan (granite, schist, gneiss, etc.) and Palæozoic periods: Cambrian and Silurian in region of Tagus and Douro; Carboniferous deposits in Alemtejo, etc.; extensive Jurassic rocks are found in Estremadura, Tertiary deposits in flat coastal regions and Tagus dist. Principal rivers are Minho, Douro, Tagus, and Guadiana.

Climate is generally healthy and equable in elevated regions. Summers are tempered by seabreezes; winters, short and mild; marshy districts are unhealthy. Country is subject to heavy rainfalls (greatest in N. and Serra da Estrella); mean temp. of Lisbon, *c.* 61° F.; mean ann. temp. of N., *c.* 59° F.; of S., *c.* 63° F. Flora is rich and varied; extensive forests of cork, oak, pine, Port. cypress, etc., mainly in S.; large tracts of pasture-land; extensive moors of cistus; numerous fields of rhododendrons in Serra de Monchique. The fauna is akin to that of Spain.

Principal products are wheat, maize, rye, potatoes, tomatoes, oranges, lemons, figs, olives, grapes and other fruits, and timber. Wine-making is an important industry; famous port-wine dist. is Alto Douro; important cattle-rearing in the N.; sheep and goats in the mountainous regions, and swine in the S.; valuable fisheries (sardine, tunny, oyster, whiting, etc.); much mineral wealth—viz., copper, antimony, iron, lead, tin, wolfram, manganese, salt, etc.; also marble, gypsum, and petroleum; coal is scarce, which accounts for many valuable mines not being worked. Other chief industries are cotton spinning, weaving of woollens, cork-cutting, tanning, glass and earthenware, lace, paper, gold and silver filigree work, porcelain tiles, making of preserves, hats, etc. 43 per cent. of country is waste land. Chief exports are wine, cork, cottons, fish, fruits, copper, timber, olive oil. Railway mileage (1918), 2,047, of which 733 m. are state-owned.

There is no state religion, but Roman Catholicism is almost universal; there are 4,500 Protestants and *c.* 500 Jews. Portugal is divided into three eccles. provs. (including Azores and Madeira), with sees at Lisbon, Braga, and Evora. Republican government has separated Church from State. Monasteries were suppressed in 1834. Elementary education is compulsory and rigorously enforced since 1911. There are universities at Lisbon, Coimbra (founded 1290), and Oporto, military and naval schools and conservatoire of music at Lisbon, polytechnics at Lisbon and Oporto, besides schools of commerce, agriculture, and various other institutions.

Government.—Since 1910 Portugal has been a republic, with president elected for four years, and Congress, consisting of senate (71 members, elected for six

years), and national council (164 members, elected for three years). Country is divided into 21 districts, each administered by governor and local council (*Junta*). There are a court of first instance in each of 193 comarcas, courts of appeal at Lisbon and Oporto, and a supreme court at Lisbon.

Chief seaports are Lisbon (cap.), Oporto, Setubal, Funchal (Madeira), Ponta Delgada (Azores), Tavira, Faro; largest inland towns, Braga, Coimbra, Evora, Covilhã, Elvas.

Defence.—Military service is compulsory (Laws of 1887, 1911). From seventeen to twenty youths undergo drill and rifle practice; at twenty they pass into active army; volunteers, supplemented (if necessary) by conscripts chosen by lot, serve one year; others receive preliminary training (15 to 30 weeks); then follow yearly courses of two weeks till men pass into reserve (at thirty) and territorial army (at forty), when periods of training are reduced. Peace strength is fixed at 30,000 men. The navy is manned from the seafaring pop. by obligatory service. Ships are few, comprising (1920) three protected cruisers, some old small craft, etc. The personnel is *c.* 6,000.

Colonies.—Dependencies and colonies are: Cape Verde Islands, Port. Guinea, Angola, São Thomé and Principe (islands), and Mozambique, in Africa; Goa, Damão, Diu (India), Macao (China), and part of Timor in Eastern Archipelago. Total area, 936,264 sq. m.; pop. *c.* 9,000,000. Port. colonies are administered by gov.-generals and governors. Area, 34,254 sq. m.; including Azores and Madeira, 35,490 sq. m.; pop. *c.* 6,000,000.

History.—Like Spain, Portugal was in early times inhabited by Iberians and Celtiberians. Carthaginians made settlements on coast (3rd cent. B.C.); country came under Roman rule (138 B.C.) (*Lusitania*); then successively taken by Alans, Suevi, Visigoths, and Moors (711); partly recovered for Christendom by Ferdinand I. of Castile, and named *Portus Cale* (11th cent.). In 1095 Portugal became independent as hereditary fief of Count Henry of Burgundy; his son, Alfonso I., assumed title of king (1139), and conquered (with help of Eng. Crusaders) Lisbon (1147), which became the capital. The kingdom was gradually extended southward until Algarve was taken (1251). In 1383 the male line of house of Burgundy became extinct with Ferdinand I., and the crown passed to John I., his illegitimate son. From this time onward Portugal began to flourish; Port. mariners, aided and encouraged by Prince Henry the Navigator, laid the foundation of colonial empire and oversea trade; Ceuta taken (1415); Madeira (1420); slave trade begun (1434). In reign of John II. (1481–95) Cape of Good Hope rounded by Diaz (1486). During reign of Manoel I. (1495–1521) Vasco da Gama discovered sea route to India (1498), and Brazil was taken (1500); Ascension and Madagascar discovered (1501); Goa (1510); Malacca (1511); Ceylon, etc., and island of Ormuz (1515) in Persian Gulf. Portugal now controlled the Eastern trade, and was at the zenith of her power.

In 1580 the illegitimate Burgundian line became extinct. Conquered by Philip II. of Spain (1581), who claimed the crown, Portugal suffered severely through Spain's wars with Netherlands, etc. (see SPAIN). Revolution broke out (1640), and Duke of Braganza was proclaimed king as John IV.; the struggle for freedom continued until 1668, when Spain was forced to recognize the independence of Portugal. During succeeding reigns her power declined, and a heavy price had to be paid for England's support against Spain and other foes. The famous Methuen Treaty was made with England (1703), practically making Portugal commercially dependent on the former. Great government reforms were made by Pombal, the distinguished and powerful minister of Joseph I. (1750–77); Lisbon partially destroyed by earthquake (1755). When Maria I. (1777–1816) ascended the throne Pombal was dismissed In the PENINSULAR WAR, Portuguese were allied with Britain and Spain against Napoleon (1807–14). The royal family had fled to Brazil, and when John VI. became King of Portugal and Brazil (1816), he remained in Brazil and appointed Marshal Beresford governor of Portugal. This caused the revolution of 1820, and in 1821 a Liberal constitution was framed which John had to accept on his return (1821). Bitter strife now ensued between Liberals and Reactionaries (led by John's brother, Miguel). Brazil established its independence under John's son, Pedro (1825), who, as Pedro IV., resigned his claim to Port. crown in favour of his young daughter Maria II., *la Gloria*, who ascended the throne (1826), with her great-uncle, Miguel, as regent. In 1828 Miguel proclaimed himself king; a civil war followed until 1833, when Miguel renounced his claim.

In 1836 Maria II. married Ferdinand, Prince of Saxe-Coburg-Gotha (Ferdinand II., *d.* 1885). Pedro V. ruled (1853–61), followed by Luiz I. (1861–89), during whose reign the various boundary disputes in Africa began. Britain claimed part of Delagoa Bay, which was eventually awarded to Portugal by arbitration (1875); boundaries fixed in W. Africa by Germany, France, and Portugal (1886); Macao ceded by China (1887); Nyasaland dispute with Britain (1889); in 1891 Port. Government withdrew its claim, which caused great dissatisfaction. When Carlos I. ascended the throne (1889) the financial condition of the country was deplorable; national bankruptcy ensued (1892). Carlos attempted to improve matters, and made Franco dictator; whereupon the king and crown prince were assassinated (Feb. 1, 1908). MANOEL II. was proclaimed king; in 1910 a revolution broke out; the royal family fled to England; Lisbon was bombarded, and Portugal was proclaimed a republic. In 1911 a republican constitution was adopted, and was formally recognized by the Powers.

During the Great War, under her treaty obligations, Portugal, at the request of Great Britain, commandeered all Ger. and Austrian vessels in her waters. Germany and Austria declared war

in March 1916, and Port. troops joined the Allies. Altogether 65,116 officers and men were sent to France, where 1,862 were killed and 11,902 were taken prisoners or wounded; 35,000 Port. troops served in Africa, where the colonial natives were mobilized. During that period local revolutionary movements, centred in Lisbon, occurred; in 1918 Dr. Paez, who had carried out a *coup d'état* the previous year, was elected president, but was assassinated on Dec. 14. Admiral Canto y Castro, who succeeded, gave place to Dr. Antonio José de Almeida, the present president (Aug. 6, 1919). A royalist uprising was suppressed in Feb. 1919.

Language.—Portuguese (also spoken in Brazil) is a Romance tongue, akin to Span. Galician; influenced by Celtic, Frankish, and Arabic invaders; abounds in sibilants and nasal sounds.

Literature dates from 13th cent., when Port. language attained literary form, thanks especially to King Diniz (1261-1326), himself an accomplished poet. Provençal influence prevailed till Ital. models were introduced in 15th cent. through Spain. Gil Vicente (1490–1536), who created Port. drama, the poet Sá de Miranda (1495–1558), and Bernardim Ribeiro (*c.* 1500), writer of eclogues, ushered in class. age of Port. literature, of which the greatest figure is CAMOENS (1524–80), whose *Lusiads* ranks among world's greatest epics. Other poets and prose writers of this period are Antonio de Ferreiro, Côrte-Real, Pereira de Castro, Ferreira de Vasconcellos, João de Barros, Albuquerque, Francisco de Andrade. Coimbra Univ. became a great seat of the Humanists. Montemayor, Portuguese by birth, wrote his *Diana* in Castilian. Loss of Port. independence (1581) was fatal to Port. literature, which showed little sign of recovery until 19th cent. The Port. nun Alcoforado, Gonzaga, Bocage, and de Macedo may, however, be mentioned. D'Almeida Garrett (1799–1834), de Castilho (1800–75), and Herculano (1810–79) introduced the Romantic movement; Castello Branco, and Braga the literary historian, have kept Port. literature alive. The influence of King Luiz (*d.* 1889), who translated some plays of Shakespeare, was strongly in favour of literature. Portugal has produced of late poets of high rank, such as Palmerim and Soares de Passos; historians worthy to follow Herculano in Luz Suriano, Latino Coelho, and Oliveira Martins; while novelists of the newer school are represented by Eça de Queiros and other writers of merit.

Stephen, *Portugal* (Story of Nations; 2nd ed. 1903); Koebel, *Portugal: its Land and People* (1909); Bell, *Portugal, of the Portuguese* (1915).

Portuguese East Africa, dependency of Portugal, between Tanganyika terr. on N. and Brit. S. Africa on S., with Indian Ocean (1,400 m. of coast) on E. Lies between 10° 40′–27° S. and 31°–41° E. Area, 428,132 sq. m.; est. pop. 3,000,000 natives, 10,500 whites, and 1,100 Asiatics and half-castes. Divided into the prov. of Mozambique (295,000 sq. m.), Companhia de Moçambique (59,840 sq. m.), and

Companhia do Nyasa (73,292 sq. m.). N. of Zambezi colony traversed by Changwari and Luasi hills (8,000 to 9,000 ft.), chief range being Namuli Mts. S. of Zambezi occupied by scattered mountain groups (6,500 ft.), including Gorongoza plateau. Walled in on w. by Lebombo Mts. Gaza, in s., is broad steppe. Rivers s. of Zambezi include Pungwe, Sabi (Save), and Limpopo. Rainy season Nov. to March. Mean temp. at Tete is 84° F.; July (coldest month) 72° F. Marshy coasts unhealthy; highlands temperate and salubrious, Namuli highlands in particular. Sugar, tobacco, tea, coffee, rice, millet, and beans round Inhambane. Highlands yield timber. Zambezi delta and valley of Busi have sugar plantations. Deposits of coal, iron, gold, etc., in Companhia do Nyasa. Chief exports: sugar, rubber, ores, wax, and ivory. Delagoa Bay Ry. (57 m.) from Lorenzo Marques runs N.W. to join Transvaal system. Railway from Beira to Bulawayo (240 m. in colony), and from Quilimane to Port Herald (153 m.); also line under construction from Delagoa Bay to Swaziland (44 m. open). Administered by various Port. chartered companies. Gov.-gen. resides at Lorenzo Marques, the capital. Vasco da Gama visited mouth of Zambezi (1498); Mozambique captured from the Arabs in 1507; Port. S. African possessions received separate government in 1509; boundaries fixed by Anglo-Port. agreements (1890, 1891, and 1905). By Treaty of Versailles Portugal allotted the 'Kebuga triangle,' s. of Rovuma R. (formerly part of Ger. East Africa). Ger. troops during Great War were forced into Port. E. Africa during the last phase of the struggle. See EAST AFRICA, CONQUEST OF.

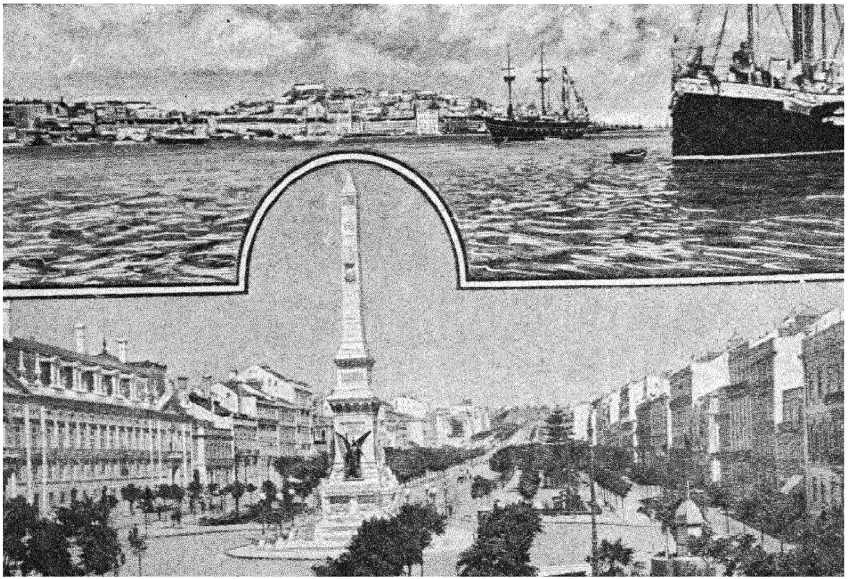
Portuguese Guinea, colony of Portugal, Senegambia, w. coast of Africa, along Atlantic between 12° 30′ N. and 15° W. Enclosed landward by Fr. terr. Consists of low coast and Bissagos Archipelago. Chief tn. Bolama; chief port, Bissao; rubber, palm nuts, ground nuts, hides, wax, etc. Area, 14,000 sq. m.; pop. 800,000.

Portuguese India. See INDIA, PORTUGUESE.

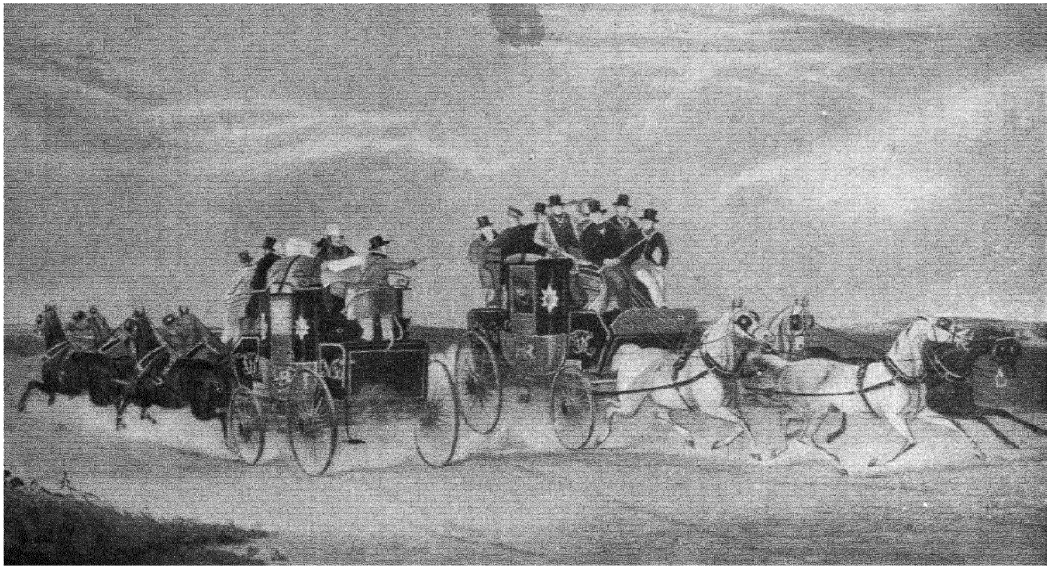
Poseidon, god of the sea in Greek myth., and identified with the Roman god Neptune. He was the son of Cronus, and when new order was established Zeus became lord of heaven, Poseidon of the sea, and Hades of the underworld. He is represented in art as driving a sea-chariot and bearing a trident.

Posen, tn., cap. of prov. of Posen, Poland (52° 24′ N., 16° 51′ E.), on Warthe, 90 m. N. of Breslau; 18th cent. cathedral and 15th cent. church, Kaiser Friedrich Museum, and Royal Hygienic Institute. Castle intended to placate Poles, begun 1905, opened by ex-Kaiser William II. in 1910; agricultural implements, machinery, liqueurs, beer, and cigars. One of oldest towns in Poland; residence of early Polish monarchs; a flourishing member of Hanseatic League. Important border fortress. Passed to Poland by Treaty of Versailles (1919). Pop. 156,700.

Positivism, any system confining philosophy to data and



PORTUGAL: VIEWS OF LISBON.



THE BRIGHTON MAILS PASSING ON HOOKWOOD COMMON.
(After the painting by J. Shayer.)

methods of natural sciences, and opposed to *a priori* assumptions; applied also more particularly to the philosophy of COMTE.

Possneck, tn., Saxe-Meiningen, Germany (50° 43′ N., 11° 38′ E.), 23 m. S.S.E. of Weimar; flannels, leather goods, and porcelain. Pop. 12,400.

Postal Services. In ancient Egypt, Assyria, Persia, Greece, and Rome, 'swift runners,' relays of men and horses, conducted primitive postal services. Some Gr. states possessed postmen (*hēmerodromes*, 'daily messengers'). Under the Roman Empire a *cursus publicus* (public postal system) was established, with offices (*stationes*) and postmen and postmasters (*stationarii*, *mancipes cursus publici* or *mancipes mutationum*). All over the Roman world were to be found couriers' horses (*veredi*), couriers (*veredarii*), and the *judices curiosi*, who exercised police control. This elaborate system was solely for state use, and might not be employed by individuals until Diocletian granted private posting facilities. Rome never conceived the idea of utilizing this important opportunity of revenue, but her system was of the greatest speed and excellence.

The Roman organization disappeared in the West on the barbarian conquest of the empire, but survived in the Byzantine Empire. Charlemagne vainly attempted to revive it in the West. An international postal service was carried out in the Middle Ages by religious orders, whose various cells kept up communication with each other, the scholars of universities, trade guilds, and merchants. The univ. of Paris had organized an excellent service by 1464, when Louis XI. promulgated an edict by which the Fr. royal post, for use of individuals as well as of state, was established. The two services, however, ran side by side till 1596, when the state took charge of all private letters. Besides the excellent Prussian service of the Teutonic Knights, emperors of the Holy Roman Empire restored the Roman *cursus publicus* in their Ital. and Ger. dominions. Germany had also from 13th to 17th cent. the 'drovers' post'; herdsmen and butchers were almost *ex officio* postmen.

The family of Taxis organized the posts of the empire. Francis, count of Thurn and Taxis, became captain and master of the posts in 1500, and undertook the service of Netherlands, Empire, and Spain (1505), Rome and Naples (1516). His nephew, Johann Baptista von Taxis, was appointed postmaster-general of all Charles v.'s realms (1520), and the position was made hereditary in the Taxis family (1615). Despite the agitation of minor states of Germany the Taxis retained the privilege, confirmed by treaties of 1815 after reconstitution of the empire; but sold their right to Prussia (1867) for three million thalers, having carried out their task in an exemplary manner for three and a half centuries. Brandenburg had established a state postal service (1646), which spread all over Germany in the first half of 19th cent., before the purchase of the Taxis rights.

British Postal History.—The

early history of the Brit. postal service is obscure. Expenses of *nuncii* (messengers), who carried government letters, are entered in Exchequer accounts from the earliest times. Edward IV. during the war with Scotland (1482) appointed a single horseman for every 20 m., who travelled with the utmost speed over his respective section, and by this means letters were carried from hand to hand 200 m. within two days. These horsemen were the original posts. They were controlled from the king's household; and an officer was appointed to direct them known as the Master of the Posts. The first Master of the Posts whose name is known was Brian Tuke, who was in office as early as 1516. This organization of relays of horsemen was the germ of the postal service. Tuke in 1533 informed Cromwell, who was dissatisfied with the posts, that there were no settled posts on any road except to Dover. Elsewhere posts were set up when required, and the constables were often obliged to take horses out of ploughs and carts.

The City of London, in the time of Queen Mary, kept horses from Hackney in readiness for the posts, and these horses, when not required, were specially licensed to ply for hire. Ordinances were issued about 1555 for the posts on the Dover Road, which were clearly permanent. The posts were to have a monopoly of letting out horses to 'Currors,' and they were to have a horn hanging at the door, or a painted sign to show that it was the post's house.

The state for long had no monopoly, and Scot. services were separate; James I. regulated public postal charges (1603) and the rate of speed at which letters were to be delivered, and in 1619 instituted the office of 'postmaster of England for foreign parts.' Charles I. in 1635 abolished private services. Attempts of the Common Council of London (1649) and of John Hill of York during the Commonwealth to run a private improved service were stamped out by Parliament and Cromwell respectively. Hill opposed government monopoly, as against the 'liberty and birthright of every Englishman.' Similar attempts of Dockwra, under Charles II., and Povey, under Anne, failed. An Act for Erecting and Establishing a Post Office (1660), known as the 'Post Office charter,' confirmed changes introduced during the Commonwealth. Under this Act the letter monopoly and the post-horse monopoly were both retained; an officer to be called 'the Postmaster-general of England and Comptroller of the Post Office' was to be appointed; and the office might be granted for a yearly rent. In this way the public revenue of the Post Office in the form of an annual rent was instituted.

In 1695 an Act of the Scottish Parliament set up a separate Post Office and postmaster-general for Scotland; but an Act of 1711 established a General Post Office for the three kingdoms and the colonies under one postmaster-general. In 1784, however, a separate Post Office and postmaster-general for Ireland

were set up by the Parliament of that country; and this arrangement outlasted the Union, for the Irish Post Office remained under an Irish postmaster-general until 1831.

By the last quarter of the 18th cent. stage coaches were running; and they travelled much faster than the carts which carried the mails. It was a common practice to make up urgent letters into parcels and send them by the coaches. An agitation for the establishment of coaches to carry the mails was therefore set on foot by John Palmer, a theatre proprietor of Bath. He described the postboy of the day as an 'idle boy without character, mounted on a worn-out hack; who, so far from being able to defend himself against a robber, was more likely to be in league with one.' Pitt supported Palmer, and the first mail coach ran on Aug. 2, 1784, under armed guard, from Bristol to London. The system was soon extended to other roads.

The rise of railways in the 19th cent. exercised a profound influence on postal affairs. A Post Office Management Act (1837) confirmed government monopoly, and decreed that although letters might be carried from friend to friend, if no fee were paid, no letters, even unpaid, except such as related to their goods, might be borne by common carriers, or masters, crews, or passengers of passenger vessels or barges.

In 1840 came the important reforms of ROWLAND HILL; two centuries earlier John Hill had shown that cheap rates of postage would increase profits, and in 1837 Rowland Hill pub. *Post Office Reform*, advocating prepayment of postage by means of stamps, and penny postage (a rate of 1d. for ½ oz., plus 1d. for each additional ½ oz.). A committee of the House of Commons made an enlightened report on these suggestions, predicting an improvement of revenue on their adoption, through increased use of the service, and emphasizing the beneficial influence of cheap correspondence on civilization. In spite of government's reluctance, an Act of 1840 introduced penny postage, and ultimately increased postal revenue. Letters more than doubled in number the first year, as Hill had prophesied, but it took some years to abolish the deficit in revenue. The Act of 1840 also suppressed the old system of *franking*, and introduced money orders, regularized by Money Order Act (1848). Book post was inaugurated (1848); halfpenny postcards issued (1870); postal orders introduced (Jan. 1, 1881); parcel post instituted (1883); express delivery service started and Express Messenger Co. licensed (1891). Imperial penny postage was introduced in 1897, much to the gratification of the late Sir J. Henniker Heaton, who had long advocated it both in the House of Commons and in the press. Penny postage was extended to U.S. (1908). The rate was raised to 1½d. on June 3, 1918, and to 2d. on June 1, 1920.

Provident arrangements connected with the Post Office started with Post Office Savings Banks, opened 1861. Monopoly

of the electric TELEGRAPHS was granted to Post Office by Act (1868), and lines of the various telegraph companies were purchased (1870); rate of 6d. for twelve words instituted in 1885, and maintained until Nov. 1, 1915, when rate was increased to 9d. On Sept. 1, 1920, the rate was further increased to 1s. The Wireless Telegraph Act (1904) placed Wireless Telegraphy (see TELEGRAPHY) likewise under state control. The principle of government monopoly was also applied to TELEPHONES; by Telegraph Act (1892), the Post Office worked and owned trunk lines, and was empowered to buy up lines of telephone companies, which had already (1881) been compelled to obtain licences from Post Office; National Telephone Co.'s lines purchased by government (Dec. 31, 1911).

Espionage of Letters. — The postmaster-general (P.M.G.) has the privilege of opening and detaining correspondence when so authorized by the secretary of state. This right was assumed in early days of state provision for letter carriage. In 17th and 18th centuries in France special officials were appointed to examine private correspondence. Napoleon revived *Cabinet noir*, which the restored Bourbons and Napoleon III. continued to utilize; prefect of police now has power to open correspondence. The Brit. system of espial was regulated by proclamation (1663), and by Post Office Act (1710). As in France, this governmental right has been subject of much attack, notably in Mazzini's case (1844). The system is much more employed in Russia, Austria, and Germany. For procedure during the war, see CENSORSHIP.

Postal Union. — The International Postal Union was constituted by a convention signed at Berne on Oct. 19, 1874, by representatives of the governments of Europe, of the U.S., and of Egypt. The convention came into force on July 1, 1875. The union, which has been aptly called 'The First Parliament of Mankind,' now includes nearly every civilized country in the world. It normally holds quinquennial congresses to settle international postal questions. The first congress held since the Great War interrupted international amity was held at Madrid, Oct. 1920.

United States.—Congress assumed direction in 1775; stamps were introduced (1847), made compulsory (1856); registration of letters (1855); compensation for loss (1897), effected in many districts at door of house (1899); uniform 3 cents rate (1863); reduced to 2 cents (1885); money orders (1864); express delivery in certain areas (10 cents extra) (1885); varying rates charged for four kinds of postal matter: (1) ordinary correspondence, (2) periodicals, (3) books and pamphlets, (4) other matter (parcels post matter), at rates (since 1913) varying with distance for from 5 to 12 cents per pound. Postal banks were authorized (1910), minimum deposit $1, maximum $100 per month, maximum balance $500; certificates issued for deposits and surrendered on withdrawal; interest 2 per cent. per annum.

Official Records; Bennett, *Post*

Office and its Story;' Bowie, *Romance of the Post Office.*

Post-impressionism, name given to the art development following IMPRESSIONISM, and representing not a continuation of but a reaction from the former movement. It combats the attitude that art is a matter of imitation, and holds rather that its chief concern is creation; that its aim, as has been said, is 'not at illusion, but at reality.' A work of art, according to this creed, is not an attempt to transfer to the canvas some phase of nature, but to give expression to the artist's emotional experience of life, to which all other facts are made subsidiary. Briefly, it subordinates representation to expression. Aside from this fundamental principle, the work of the post-impressionists is in general characterized by a bold decorative sense, frank use of colour, and the use of certain simple formulas for mass. Among the acknowledged leaders of the movement are Cézanne, formerly associated with the Impressionists; Gauguin, van Gogh, and Matisse.

Of the various manifestations of post-impressionism, the two which have attracted the greatest attention are *Cubism* and *Futurism.* Cubism is characterized primarily by the attempt to produce mass effects through the repeated use of a single geometric unit, preferably the cube, as well as by free use of decorative colour. Futurism is even more revolutionary, standing as it does for the translation of motion into the terms of plastic art.

Post-mortem Examination, or AUTOPSY, examination of a corpse by a medical man for purpose of discovering cause of death. In England is made by order of coroner, or at request of relatives; in Scotland, if there be reason to suspect the possibility of death by culpable violence or neglect, the procurator-fiscal petitions the sheriff, who authorizes the examination. When death is believed to be result of assault, two medical men are necessary, and independent examination may subsequently be claimed, and may be made after the Crown examination. Post-mortem examination cannot take place in an infirmary or hospital without consent of the deceased's next-of-kin.

Post Office. See POSTAL SERVICES.

Potash, the term loosely and generally applied to the salt of potassium. Reference to the use of potash as a fertilizer may mean the employment of one or more of potassium sulphate, potassium chloride, potassium carbonate, etc. Caustic potash is potassium hydrate (KOH).

In pre-war times Germany had a monopoly of potash. The better-known deposits were situate at Stassfurt, containing layers of sylvine, carnallite, kainite, etc. Richer fields were discovered in Alsace in 1904, of which the German Potash Syndicate secured control and limited the working. France now holds these deposits. During the Great War, the world was faced with a potash deficiency partially remedied by the recovery of potash from the gases and dust of blast furnaces, cement kilns, coke ovens, etc. At the high temperatures in these fur-

naces, potash is volatile, and is carried over and collected from the dust and gases; 15,000 tons per annum were obtained in the U.K. from these sources. In U.S., in addition, considerable amounts were obtained from the brines in Western Nebraska.

Potassium, K (kalium), 39·10; metallic element of alkali group; occurs combined in many silicates; by the weathering of felspar, etc. The Stassfurt deposits include sylvine, KCl; carnallite, $KClMgCl_2 6H_2O$; kainite, $K_2SO_4MgSO_4MgCl_2 6H_2O$, (see MANURES). Potassium compounds are an essential plant food, and wood ash contains potassium carbonate (potash=ash from pot). Metal was first obtained by Humphry Davy (1808) by electrolysis of fused caustic potash (previously thought an element), and is still prepared by the same method. It is not manufactured to any great extent. Sodium, more easily produced, serves all the purposes for which potassium is required.

Properties. — Lustrous silvery white, crystalline, sp. gr. 0·862, brittle at 0° C., soft at 15° C., melts at 62·5° C., b.p. 720° C.; vapour green, colours Bunsen flame lilac, spectrum contains a red and a violet line; quickly tarnishes in moist air, rapidly decomposes cold water; monovalent, and most electropositive of the well-known metals; hydroxide (KOH) a strong alkali. The salts are numerous and important; stable and soluble in water, the least soluble being $KClO_4$, $KHC_4H_4O_6$, K_2PtCl_6 (by which metal is estimated).

Potato (*Solanum tuberosum*), a perennial vegetable, order Solanaceæ; first brought from America by Sir Walter Raleigh, and introduced into Ireland about 1584. Potatoes require a 'crumby' soil and much farmyard manure, soot, and phosphates. In 1903–4 Findlay, a Fifeshire farmer, produced his El Dorado, and obtained huge prices for single tubers. *Potato disease* appeared in England (1845), caused the Irish famine of 1846–7, and has persisted since then; it is caused by a fungus, *Phytophthora infestans*, and results after prolonged rain or damp weather; symptoms are brown spots on the leaves; treatment consists in spraying with copper sulphate solution. Potatoes are used in starch, sugar, and brandy manufacture. A number of varieties immune from wart disease are now in use.

Potato Beetle. See COLORADO BEETLE.

Potchefstroom, oldest tn. in Transvaal prov., S. Africa (26° 30′ S., 27° 40′ E.), on Mooi R., 88 m. W.S.W. of Johannesburg; preceded (till 1863) Pretoria as cap. of S. African Republic. Pop. 9,400.

Potemkin, GREGORY ALEXANDROVICH, Prince (1736–91), Russian statesman and general; favourite of Catherine II.; retained power throughout life, skilfully guiding foreign policy of Russia; kept Prussia in check and won ports on Black Sea from Turkey; died shortly before Peace of Jassy.

Potential. See ENERGY.

Potentilla, genus of plants, order Rosaceæ; common wayside plants are creeping cinquefoil (*P. reptans*), goose-grass or silver

weed (*P. anserina*); flowers white or yellow.

Potenza, tn., cap. of Potenza prov., Italy (40° 39′ N., 15° 48′ E.), 70 m. W. by N. of Taranto; anc. *Potentia;* Doric cathedral; almost wholly destroyed by earthquake (1857). Pop. 16,000.

Potomac, riv., U.S. (38° 10′ N., 77° 10′ W.), forming boundary between Maryland on N. and E., and W. Virginia and Virginia on S. and W.; empties into Chesapeake Bay; passes Harper's Ferry and becomes tidal at Washington; scenery of upper river very picturesque; tribs. are Shenandoah, Casapon, Monocacy, and Bull Run. Length, *c.* 360 m. Has many associations with the Civil War.

Potosi, tn., Bolivia (19° 38′ S., 65° 25′ W.), 50 m. S.W. of Sucre, on flank of Cerro de Potosi (15,724 ft.); formerly celebrated for silver mines; univ. and Bolivian mint; cathedral (1810); alt. 13,600 ft. Pop. 21,000.

Potsdam, chief tn., Brandenburg, Prussia (52° 24′ N., 13° 3′ E.), on the Havel, 16 m. W.S.W. of Berlin; beautiful situation; numerous lakes; former royal palaces with luxurious gardens, etc.; several fine city gates (Brandenburg gate); Palace Sans-Souci (1660), New Palace, etc.; cottons, woollens, tobacco, and sugar; flower gardening. Pop. 62,200.

Potter, PAUL (1625–54), Dutch animal painter; his life-size *Young Bull* is the most celebrated of all his pictures; but renowned also for smaller paintings, such as *The Dairy Farm,* sold in London (1890) for £6,090.

Pottery. The art of fashioning rude clay urns, vases, and other earthen vessels evidently dates back to little after the first appearance of man, for traces of these vessels have been found in the tombs of the earliest prehistoric races.

Among the ancient Egyptians we find there that the ceramic art had reached a high state of development as far back as the 16th cent. B.C. Not only were the Egyptians then producing the fine red ware which is familiar to most visitors to museums, but they were making a kind of pottery from a substance consisting of a mixture of clay and sand, which was covered with a siliceous glaze, formed from oxide of copper, which produced beautiful colour effects. Likewise, with the Assyrians, the Babylonians, the Phœnicians, and the Romans, the potter's art reached a considerable state of development in the early stages of their civilization. Of the Greeks, however, it may be said that down to the 7th cent. B.C. they showed little advance in the art, but progress was steady during the next three hundred years, and by the 4th cent. B.C. it had reached its highest development. The most exquisite specimens of their work which have come down to us belong to this latter period, after which a marked decadence is to be observed. The ceramic art reached a high state of development in Italy, France, and Germany during the 16th and 17th centuries; but in England, down to the beginning of the 18th cent., the native pottery ware was of a very rude character.

Pottery may be roughly divided under three heads: (1) *Earthenware*, a material exposed only to a moderate heat in the process of baking, which can be scratched with a pointed instrument; (2) *Stoneware*, a harder substance, baked at a great heat; and (3) *Porcelain*, including all the more delicate forms of pottery, which is fired at the highest possible temperature. The commoner sorts of clays are so impregnated with metallic ores and other foreign substances as to be useless except for the manufacture of bricks, tiles, etc. The purest kind of workable clay is that known as KAOLIN, or china-clay, consisting of hydrated silicate of alumina, and smaller proportions of lime, soda, and potash, and derived from decomposed granitic rock. Another fine potter's medium is that known as *pipeclay*, or blue clay, which is chiefly found in the neighbourhood of Poole, Dorset. The ingredients used in the mixing of porcelain clay vary in proportion in different countries and in different districts, but the following may be named as the chief constituent elements: kaolin, sand, pipeclay, chalk, ground flints, Cornish stone, and the calcined bones of oxen and sheep.

Process of Manufacture.—Having prepared his clay, the next work of the potter is to mould it into the required shape by means of the 'potter's wheel' (an instrument mentioned in Homer), which is said to have been invented by the Egyptians. A portion of the prepared clay is placed upon the wheel, or 'throwing machine,' as it is also called, which is kept in rapid motion by hand, foot, or a machine-driven flywheel. Having roughly shaped his vessel, the thrower then passes it on to the turner, who smoothes down all roughnesses and inequalities, and then in turn gives it to the handler. Another method of manufacture is by pouring *slip* into moulds, which are often in several parts. Thus in making a china cream-jug there would probably be four moulds—one for the body, a second for the neck and lips, a third for the foot, and a fourth for the handle. Dishes, plates, saucers, and other flat ware are invariably made upon plaster moulds. The next process is by firing the moulded vessel in a kiln, or 'biscuit oven,' after which the baked article is allowed to cool, and the glaze, produced from red and white lead, felspar, salt, and other materials, is then applied. After glazing, the piece of pottery is placed in the glost oven, in which the temperature varies according to the composition of the glaze and the kind of ware to be produced. After being removed from the glost oven the article is in a finished state, or, if necessary, it may be enamelled in gold or some other colour.

Modern Porcelains.—A brief account must now be given of the rise and development of the porcelain industry.

Chinese.—It is to the Chinese that we owe invention of porcelain. It is certain that the craft flourished in China under the Ming dynasty, which lasted from 1368 to 1644 A.D. Indeed, there is evidence to show that porcelain

was being manufactured in China under the Tang dynasty (618–907), and that it was a flourishing industry during the rule of the Sung emperors (960–1279). The earlier examples of the art are now almost entirely lost to us, but there are in existence numerous examples of the 17th and 18th centuries at least, and at the present time excellent work is being manufactured, and the glorious traditions of the china we call Old Nanking are still preserved.

Japanese.—The Japanese certainly learned the craft of porcelain manufacture from the Chinese. The first Jap. porcelains are believed to have been made about 1510 A.D. Europeans have little opportunity of comparing the early work of the Japanese in this medium with that of other nations, as most of the finest examples are still in Japan. Such specimens as are known to us are chiefly 18th cent. work, and are called by the names of the districts in which they were made—Kaga, Kioto, Hizen, and Owari. The ware known as Satsuma does not, strictly speaking, belong to the porcelain class.

European.—Porcelain is believed to have been manufactured in Italy as early as the 15th cent., but the earliest examples which exist were manufactured about 1580, for Francis de' Medici, Grand-duke of Tuscany; after his death, seven years later, the industry appears to have languished. About a century later a small amount of porcelain was produced in Paris and Rouen, while in 1693 its manufacture was begun at St. Cloud, other Fr. towns shortly afterwards also engaging in the industry. A factory was established at Vincennes about 1745, in which Louis XV. eventually became a partner. Then in 1756, for want of space, the manufacture was transferred to Sèvres, and in 1759 the king became sole proprietor. The products of this noted factory have always been the fragile porcelains of the aristocracy, no attempt being made to cater for the requirements of the middle classes, and kings made presents to one another of Sèvres china, the nobility of Europe and the leaders of society competing with each other in collecting examples of the work produced by the royal factory. All the earlier porcelain made at Vincennes and Sèvres was what is known technically as *soft porcelain*, and it was not until 1764 that the *hard* variety was first produced there. Saxony must be regarded as the real home of 'hard,' or true Chinese, porcelain in Europe, and its invention was due to Johann Friedrich Böttger, who, in 1710, furnished Augustus II., King of Saxony, with the earliest example of what has since become known throughout the world as *Dresden china*. Every endeavour was made to keep the method of its manufacture a profound secret, but it was eventually betrayed, and factories for the making of Dresden ware came into existence in various places.

Among the most famous Eng. porcelain wares, each with its distinctive features, the following are the outstanding names: Bow, Chelsea, Staffordshire, Worcester,

Derby, Crown Derby, and Lambeth. Eng. manufacturers have largely devoted themselves to the production of soft porcelain, and it was not until about 1768 that the making of hard porcelain was begun at Plymouth by Cookworthy, the discoverer of Cornish china-clay. The famous Bow works were established about 1740; those at Chelsea and Derby about five years later; and the manufacture of Staffordshire porcelain was begun at Longton Hall in 1752, Josiah Wedgwood's famous works being established at Burslem in 1759.

Marryat, *History of Pottery and Porcelain* (1864); Shaw, *History of the Staffordshire Potteries* (1900); Benton, *History of English Earthenware and Stoneware* (1901); Walter, *History of Ancient Pottery* (1905); Franz, *French Pottery* (1906).

Pottos, or AFRICAN SLOW LEMURS (*Perodicticus*), genus of Lemuroidea (see PRIMATES) with short tail, short and nailless index finger; nocturnal and sluggish; found in W. Africa.

Pottstown, bor., Pennsylvania, U.S. (40° 13′ N., 75° 32′ W.), on Schuylkill R., 35 m. N.W. of Philadelphia; iron and steel; agricultural implements, silk, and hosiery. Pop. 15,600.

Pottsville, bor., Pennsylvania, U.S. (40° 41′ N., 76° 17′ W.), on Schuylkill R., 78 m. N.W. of Philadelphia; busy commercial city; steel, iron, lumber, etc.; repair shops of two railways; large coal shipments; anthracite in vicinity. Pop. 20,200.

Pouched Mouse, or DORMOUSE PHALANGER, small marsupial related to the flying phalangers; nocturnal and arboreal; found in W. Australia, Tasmania, and New Guinea.

Pouched Rats. See POCKET GOPHERS.

Poughkeepsie, city, New York, U.S. (41° 38′ N., 73° 58′ W.), on Hudson R., 70 m. N. of New York city; Vassar Coll. and other educational institutions; cantilever bridge (2,260 yds. long; 200 ft. above high water) over Hudson R.; agricultural implements, etc. Pop. 28,000.

Poultice, or CATAPLASM, for the application of moist heat to any part of the body, may be made of bread, oatmeal, linseed, or any substance which will absorb hot water. Of these mentioned crushed linseed is the best, because it forms a soft, oily poultice, which will retain heat and moisture longer than the others. A poultice, to be of use, should be applied as hot as it can be borne.

Poulton-le-Fylde, urban dist. and mrkt. tn., Lancashire, England (53° 50′ N., 2° 59′ W.), 3 m. N.E. of Blackpool; agricultural centre. Pop. 2,400.

Poultry Farming. The keeping of poultry (which includes ducks, geese, and turkeys) for profit is now generally recognized as an essential and valuable adjunct to all branches of agriculture. The methods generally adopted are what may be described as 'extensive'—that is, the birds have their liberty all the year round, and many of them are kept in colony houses on the stubbles and pasture fields. Poultry keeping on 'intensive' principles—that is, where the birds are confined to a roomy, well-

lighted, open-fronted house, with or without an outrun—has also made very material progress, principally on small holdings where intensive methods of cultivation are practised, as well as on allotments, and even in small gardens in suburban areas. Along with the development of commercial poultry keeping, artificial methods of hatching and of rearing chickens have correspondingly increased.

As with other kinds of stock, Britain has taken a leading position in the breeding of 'exhibition' poultry. For these there is always a very keen demand, and many highly-bred fowls of all varieties are exported all over the world. For the best specimens high prices are obtained. In addition to poultry farming connected with agriculture, and to the breeding of exhibition poultry, specialization has taken place in the establishment of large commercial farms run purely for egg production and the breeding of high-class pedigreed utility stock. To the latter, to the stimulus of egg-laying competitions, to the educational development of poultry keeping under county councils and agricultural colleges, and to the government schemes of egg distribution through local stations, can be traced the marked improvement in Brit. poultry keeping in recent years.

Breeds.—There are a large number of breeds of poultry eminently adapted for the Brit. soil and climate. These may be classified under four heads: (1) Breeds most suitable for table purposes, such as Indian game, Old English game, Dorkings, and Sussex. The best table fowls are, however, obtained from a cross between the Indian or Old English game with Dorkings, Sussex, Faverolles, and Orpingtons. The above breeds are all broody. (2) The non-sitting breeds most suitable for egg production, of which the principal are Leghorns, Minorcas, Campines, and Anconas. (3) The general purpose breeds, which are useful for both table purposes and for egg production. These include Orpingtons, Wyandottes, Plymouth Rocks, Rhode Island Reds, and Croad Langshans, all of which go broody. (4) Purely fancy breeds, such as Hamburghs and Bantams in their many varieties. New breeds are constantly being introduced or evolved (such as Orloffs and Mendels) to take the place of those which become effete.

Ducks and geese are similarly subdivided into classes according to their table or egg-producing qualities.

Marketing.—Britain imports very large quantities of eggs and of poultry produce from other countries. Co-operative methods of marketing poultry produce, such as are found in Denmark, have not yet become general, though latterly the practice has considerably increased.

Feeding.—Various methods of feeding are adopted in accordance with the quantity and nature of the food locally produced. The general method is to give one diet per day of hard grain—wheat, oats, or maize—and one diet of a mash consisting of a mixture of meals, scalded, to which is added clover, meal, or

vegetables, with either fish or meat, fresh or in meal form.

Housing.—The health of the stock being the first essential to successful poultry farming, all poultry houses must have abundance of *fresh air*, plenty of *light*, and *dryness*. Modern poultry houses are, therefore, designed with the fronts partly open, and should be so situated as to get shelter from the prevailing winds, with the full benefits of the sunlight.

Diseases.—Much research work has been devoted to the prevention and cure of poultry diseases. Under proper conditions diseases should rarely occur. Those most prevalent are: *gapes*, caused by the gape worm, *Syngamus trachialis*; *roup*, a highly infectious form of cold which causes swelling of the head with a watery discharge from the eyes and nostrils (this disease is very fatal when it assumes diphtheric form); *pip*, an excessive thick secretion of mucus in mouth and throat; *tuberculosis*, and various ovarian troubles. Insects and mites are common on poultry, but can be easily treated by the frequent use of insect powder.

Poussin, NICOLAS (1594–1665), Fr. class. artist; court painter to Louis XIII.; examples in the Louvre, Paris, and National Gallery and Wallace Collection, London; brother-in-law and pupil, GASPARD POUSSIN (1613–75), is also well represented in London galleries and Glasgow collection.

Pout, BIB, POUTING or WHITING POUT (*Gadus luscus*), a relative of the cod and haddock, with brown body marked with upright bands; abundant on most parts of the Brit. coast; also in Arctic Ocean.

Pouting. See POUT.

Powan. See SALMON FAMILY.

Powers, THE GREAT, term applied to nations whose military or naval strength is relatively of great importance in international affairs, and who, in combination, are rulers of the world. Since the Great War eclipsed Germany and Austria-Hungary, and the revolution destroyed the unity of Russia, the Great Powers are Great Britain, U.S., France, Italy, and Japan.

Power Transmission. See BELT AND ROPE GEARING; COMPRESSORS, AIR; TRANSMISSION OF POWER; WATER MOTORS.

Poynter, SIR EDWARD JOHN (1836–1919), Eng. class. painter, pupil of Leighton; R.A. (1876); director, National Gallery, London (1894); president, Royal Academy (1896); baronetcy (1902); works: *Atalanta's Race*, *Visit to Æsculapius* (Tate Gallery), etc.; also decorated church of St. Stephen's, Dulwich; pub. *Lectures on Art* (1879, 1897).

Pozarevac, or PASSAROWITZ, tn., Jugo-Slavia (45° 15′ N., 21° 10′ E.), 12 m. E.S.E. of Semendria. Peace between Turks and Emperor Charles VI. concluded here (July 21, 1718). Pop. 13,000.

Pozières, former vil., Somme, France (50° 3′ N., 2° 40′ E.), 4½ m. N.E. of Albert on Albert-Bapaume road; on the highest part of the ridges for which the British fought during the BATTLE OF THE SOMME (1916); Ger. observation post; its capture (July 23–6) was the finest achievement of the Great Push, and a great feather in the cap of the Australians,

who carried the sunken road to the E. Position lost in the great Ger. offensive of March 1918; recovered in the triumphal advance of Sept. 1918. Destined to be the site of many memorials. Brit. cemetery near by. The windmill formerly on the ridge has disappeared.

Pozoblanco, tn., Cordova, Spain (38° 22′ N., 4° 45′ W.), 37 m. N. of Cordova; cloth and woollen weaving; zinc and argentiferous lead mines in vicinity. Pop. 13,000.

Pozsony. See PRESSBURG.

Pozzuoli. See PUTEOLI.

P.R.A., President of the Royal Academy.

Praed, WINTHROP MACKWORTH (1802–39), Eng. poet and politician; M.P. successively for St. Germans, Great Yarmouth, and Aylesbury; secretary Board of Control (1834-5); best poems vivid, rhythmic, and imaginative; such are 'The Red Fisherman,' 'The Vicar,' 'A Letter of Advice,' etc.

Præmonstratensians. See PREMONSTRATENSIANS.

Pragmatism, or HUMANISM, in philosophy, a school of thought emphasizing practical utility as test for determining the truth of philosophical conceptions; a reaction against absolutism of recent metaphysics; theory put forward by C. S. Peirce (1878); developed by William James and F. C. S. Schiller. All thought is purposive and personal; no knowledge is determined exclusively by abstract intellectual considerations. The difference between two conceptions lies in the different consequences for life purposes involved in their belief. Pragmatism is connected with religion as justifying the will to believe. Humanism is the application of the pragmatic method to all the sciences.

W. James, *Pragmatism* (1907), *A Pluralistic Universe* (1909), *The Meaning of Truth* (1909); F. C. S. Schiller, *Humanism.*

Prague, cap. of Czecho-Slovakia (50° 5′ N., 14° 26′ E.), on riv. Moldau, 217 m. by rail N.W. of Vienna. City consists of seven quarters: four on r. bk., three on l. bk.; Smichow (l. bk.), Karolinenthal, Zizkow, and Weinberge (r. bk.) are suburbs; Charles's Bridge (1357–1503), scene of martyrdom of John of Nepomuk (?1383); opposite town hall is Teyn church (1360–1460), important in religious strife of Bohemia, with tomb of Tycho Brahé (1546–1601). Clementinum contains seminary, univ. library, observatory, and part of univ. (founded 1348), divided in 1882 into Ger. section and Czech section. Rudolphinum contains conservatory of music and art institutions; Academy of Fine Arts. In the new town are the Czech Polytechnic, criminal law courts, etc.; on N.E. stands the Bohemian Museum. The l. bk. of river dominated by fortress of Hradschin. On same hill are Gothic cathedral (begun 1344), various palaces, monasteries, and gardens. At foot of hill are Parliament House and palaces, including that of Wallenstein. Engineering and iron works; chemicals, vehicles, cement, etc. For history, see BOHEMIA. Pop. with suburbs (1920), *c.* 1,000,000.

Pratincoles (Glareolidæ), a family of ten species of wading

birds confined to the Old World. The common pratincole (*Glareola pratincola*), whose winter home is chiefly in Africa, is a rare spring and autumn visitor to Britain. This species occurs in summer in S. Europe, Central and S. Asia.

Prato, tn., Florence, Italy (43° 53′ N., 11° 5′ E.), 11 m. N.W. of Florence; 12th cent. cathedral, rebuilt in 14th cent. by Pisano, with paintings, frescoes, reliefs, and della Robbia *Madonna* (1489); Renaissance church of Madonna delle Carceri; straw, woollen and cotton goods; quarries of serpentine in vicinity. Pop. 50,000.

Prawn, small translucent crustacean distinguished by the long spike (rostrum) projecting in front of head; greyish, with red markings, and turns bright red when boiled; thus distinguished from shrimps, which are brownish red when boiled; esteemed as food. See MALACOSTRACA.

Praxiteles, Gr. sculptor of 4th cent. B.C.; may be ranked next to Pheidias for perfection of his work. His most famous works were his Cnidian *Aphrodite*, his *Satyr* and *Eros*, and his *Hermes and Dionysos*, the last of which, discovered during the excavations at Olympia, is the only sample of his work extant, though there are some supposed copies, notably the *Aphrodite* in the Vatican.

Prayer includes every form of address from man to God, and is the acknowledgment of the dependence of the human spirit upon the divine. In Christianity it is the human side of an actual communion, based upon a revelation which has been given. It includes adoration, confession of sin, praise, thanksgiving, and petition, and it is the revelation of God's will that man has the right to approach Him in prayer and to expect an answer which shall bring him some recompense. Apart from the question whether or not a direct answer to prayer is to be expected, prayer is of great value, inasmuch as, if it is engaged in truly, man's will is harmonized with the divine, and thus he is strengthened for the duties and trials of life.

Prayer, BOOK OF COMMON, name given to the liturgy of the Church of England in use since the Reformation. Before that, there were three principal 'uses' in England—those of Salisbury, York, and Hereford. The movement for reformation in the public service of the Church originated during the latter years of the reign of Henry VIII. Cranmer's Litany appeared in 1544; a committee of Convocation sat for seven years and produced the Prayer Book of 1549, known as the first Prayer Book of Edward VI. The book was not considered satisfactory either by Protestants or Romanists. Another revision was undertaken, and the second Prayer Book was pub. in 1552, with numerous alterations in a Prot. direction. This Prayer Book was of short duration, and after the Catholic reaction of Mary's reign the Elizabethan Prayer Book appeared in 1559. It is practically the same book as that now used throughout the Church of England. The Commonwealth formally suppressed the Book of Common Prayer in 1645, and it was out of use until the restoration

in 1660, when it was revised on lines as conciliatory as possible, without sacrifice of essentials, and was authorized in 1662. The Act of Uniformity of that year constituted it the only legal service book in England, and notwithstanding the secession of some two thousand ministers, the mass of the people welcomed the rule and adopted the Prayer Book. The Episcopal Church in Scotland, while adopting the Book of Common Prayer, has also an Office for the Holy Communion, which may be used under certain conditions (Scottish Communion Office). The Church of Ireland revised its Prayer Book, after disestablishment, in 1877. The Amer. Church also uses a version revised for its own use.

Pullan, *History of the Book of Common Prayer* (1900).

Praying Insects, or SOOTHSAYERS (Mantidæ), a family of insects with about six hundred species, belonging to the order Orthoptera; furnished with long bristly fore-legs, the resting pose of which gives rise to the popular name; with these it seizes insects for food; very voracious. Mantidæ occur in tropical and sub-tropical regions, but *Mantis religiosa* is sometimes found in central France.

Pre-Cambrian. See GEOLOGY.

Precedence in the United Kingdom. See Table, p. 304.

Precentor, occasionally called *Cantor,* generally the leader of the musical portion of the service in a church; specifically an officer in an English cathedral, in rank next the dean, who has the direction of the music.

Precession of the Equinoxes, a motion discovered by Hipparchus about 150 B.C., consisting of a slow advance of equinoxes, owing to revolution of earth's axis round pole of ecliptic, a similar effect to the 'wobbling' of a peg-top. Period of precession is about 26,000 years, or 50·35 seconds of arc per annum.

Predeal Pass, pass in Transylvanian Carpathians (45° 30′ N., 25° 37′ E.), carrying road and railway from Ploeshte to Kronstadt (Brasso). Captured by Falkenhayn after bitter fighting towards end of Oct. 1916.

Predestination, in theology, the decree of God by which all things are pre-ordained, and by which, in particular, some men are pre-determined to salvation and others to perdition. It is set forth in the Epistle to the Romans and also in Ephesians, and is a recognized element in many creeds. There are, however, difficulties in the way of the acceptance of such a doctrine, as it would seem to take away all moral significance from human action; on the other hand, if the free will of man is affirmed, the all-controlling sovereignty of God would seem to be infringed. The problem has repeatedly been before the Church. Two great controversies—the one between Augustine and Pelagius, and the other between Calvin and Arminius—have raged over predestination, Calvinism maintaining that election is absolute, and Arminianism that it is conditional. Whitefield and Wesley also differed on this subject.

Preece, SIR WILLIAM HENRY (1834–1913), Brit. electrician; engineer-in-chief and electrician to Brit. Post Office (1892–9);

Table of Precedence.

The Sovereign.
The Prince of Wales.
Younger sons of the sovereign
Grandsons of the sovereign.
Brothers of the sovereign.
Uncles of the sovereign.
Nephews of the sovereign.
Ambassadors.
Archbishop of Canterbury.
Lord High Chancellor.
Archbishop of York.
Prime Minister.
Lord High Treasurer.
Lord President of the Council.
Speaker of the House of Commons.
Lord Privy Seal.
Lord Great Chamberlain.
Earl Marshal.
Lord Steward.
Lord Chamberlain.
Master of the Horse.
Dukes—(1) of England; (2) of Scotland; (3) of Great Britain; (4) of Ireland; (5) those created since the Union.
Eldest sons of dukes of the blood royal.
Marquesses (in the order as for dukes).
Eldest sons of dukes.
Earls (in the same order as for dukes).
Eldest sons of marquesses.
Younger sons of dukes.
Viscounts (in the order as for dukes).
Eldest sons of earls.
Younger sons of marquesses.
Bishops of London, Durham, Winchester.
Other English bishops, according to seniority of creation.
Secretaries of state, if of baronial rank.
Barons (in the same order as for dukes)
Treasurer of the Household.
Comptroller of the Household.
Vice-chamberlain of the Household.
Secretaries of state, being under baronial rank.

Eldest sons of viscounts.
Younger sons of earls.
Eldest sons of barons.
Knights of the Garter, if not of baronial rank.
Privy councillors.
Chancellor of the Exchequer.
Chancellor of the Duchy of Lancaster.
Lord Chief Justice of England.
Master of the Rolls.
Lord Justices of Appeal, according to seniority of appointment.
Judges of the High Court, according to seniority of appointment.
Younger sons of viscounts.
Younger sons of barons.
Sons of life peers.
Baronets, according to date of patents.
Knights Grand Cross of the Bath.
Knights Grand Commanders of the Star of India.
Knights Grand Cross of St. Michael and St. George.
Knights Grand Commanders of the Indian Empire.
Knights Grand Cross of the Royal Victorian Order.
Knights Grand Cross of the British Empire.
Companions of Honour.
Knight Commanders of the above Orders.
Knights Bachelors.
Companions of the Bath.
Companions of the Star of India, St. Michael and St. George, and Indian Empire.
Commanders of the Royal Victorian Order.
Commanders of the British Empire.
Companions of the Distinguished Service Order.
Judges of the County Courts of England, Wales, and Ireland (including Judges of the City of London Court), according to seniority of appointment.

Serjeants-at-law.
Masters in Chancery.
Masters in Lunacy.
Members of the Royal Victorian Order (4th Class).
Officers of the British Empire.
Companions of the Imperial Service Order.
Gentlemen of the Privy Chamber.
Eldest sons of the younger sons of peers.
Eldest sons of baronets.
Eldest sons of Knights of the Garter.
Eldest sons of Knights Grand Cross in the precedence of their fathers.
Members of the Royal Victorian Order (5th Class).
Members of the British Empire.
Younger sons of baronets.
Esquires.
Younger sons of knights.

Knights of the Thistle and Knights of St. Patrick have no relative precedence accorded to them by statute in the Table of General Precedence.

Ladies.—Precedence of ladies is always derived from the father, or husband, except in the case of a peeress in her own right.

A dowager peeress, or baronetess, while a widow, takes precedence of the wife of the incumbent of the title.

The children of a living peer, or baronet, have precedence above the children of the previous possessor of the title. If the daughter of a peer marries a peer, she takes her husband's rank; but if she marries the eldest or younger son of a peer, she ranks either according to her own inherent precedence or according to that of her husband, whichever happens to be the higher, whatever the courtesy title may be.

wrote (with others) *Text-book on Telegraphy* (18th ed. 1905), *The Telephone* (1889), and a *Manual of Telephony* (1893).

Preference. See under TARIFF REFORM.

Prejevalski. See PRJEVALSKY.

Prejevalski's Horse. See under HORSE FAMILY.

Premier. See PRIME MINISTER.

Premonstratensians, PRÆMONSTRATENSIANS, or NORBERTINES, a religious order founded by St. Norbert in 1120 at Prémontré in France; in England known as 'the White Canons.' The rule was that of St. Augustine; although the primitive rule has been modified, it is still strongly ascetic. They are now almost extinct in England.

Prenzlau, or PRENZLOW, tn., Brandenburg, Prussia (53° 20′ N., 13° 50′ E.), on Ucker R., 68 m. N.N.E. of Berlin; sugar, beer, tobacco, cigars, margarine, woollen goods, machinery. Pop. 21,300.

Pre-Raphaelites. See under PAINTING.

Prerau, tn., Moravia, Czecho-Slovakia (49° 25′ N., 17° 25′ E.), 14 m. S.E. of Olmütz; old castle; Gothic town hall; textiles, hardware, machinery, sugar. Pop. 20,200.

Prerogative, the right pertaining to certain offices, now commonly used in reference to the crown. The royal prerogative is a power of the crown that does not depend upon the sanction of Parliament, and includes the dissolution and convocation of Parliament, the making of treaties with foreign sovereigns and states, the right of declaring war on foreign states, the creation of peers and regulation of order of precedence, the appointment of bishops of the Anglican Church, and the granting of pardon to persons convicted of crimes. As a matter of fact, treaties and declarations of war are the work of the king's ministers, peers are made and bishops appointed by the prime minister, and the prerogative of pardon is only exercised on the advice of the home secretary or secretary for Scotland.

Presbyter, office in the Christian Church, properly the same as *priest*, but the word really means 'elder,' and is generally used in a non-sacerdotal sense of the elders of Judaism and of Christian officials. See PRESBYTERIANISM.

Presbyterian Church of England, in its present form, dates from 1876, when congregations in connection with the Free Church of Scotland and those in connection with the United Presbyterian Church of Scotland united under the name of the Presbyterian Church of England.

There are 352 congregations, 85,551 members, 365 ministers; it supports 89 missionaries abroad, including 40 women; its theological coll. is Westminster Coll., Cambridge, transferred from London in 1899. Its supreme court was known as the Synod until 1920, being changed in that year to General Assembly.

Presbyterianism, a form of eccles. government which has been defined as 'democracy in Church polity.' It was moulded into a system by Calvin (1509–64), who, basing his deductions on the Scriptures, gave to the world in his *Institutes* the earliest example of Presb. Church polity,

which had already been established in Geneva. It included such provisions as these: a separate ministry, who alone may dispense ordinances; consent of the people to the appointment of pastors; the association of elders with the pastors for the exercise of discipline, the elders being elected either directly by the people or through their representatives. The congregation is governed by the kirk-session, composed of the representative elders of the congregation, presided over by the pastor; while the financial affairs of the congregation are in the hands of the deacons' court, a body elected for this purpose. These two bodies are under the authority of the next higher court, the presbytery, consisting of the representatives of all the congregations within a certain defined district. Over this is placed the synod, comprising the presbyteries within a larger defined district; while the supreme court is the General Assembly, to which all the presbyteries send representatives. Various divergences from Calvin's system have taken place, but in its main features the system is practically the same.

Prescot, tn., Lancashire, England (53° 26′ N., 2° 47′ W.), 7 m. E. of Liverpool; watches; electric cables; coal mines. Pop. 8,100.

Prescott, WILLIAM HICKLING (1796–1859), Amer. historian; specialized in field of Span. history; his *Ferdinand and Isabella* (1838) had immense success, and was followed by *Conquest of Mexico* (1843), and *Conquest of Peru* (1847); wrote also *Charles V. after his Abdication,* and an unfinished *History of Philip II.*

Prescription (law), the rule that long usage makes good possession, founded on the legal assumption that an uninterrupted possession of anything for a sufficiently long period implies that no one disputes the right of the possessor to its enjoyment. In Scots law prescription has a wider meaning than in England. Negative prescription, implying undisturbed possession for a given time, gives a valid and unassailable title, for it deprives all claimants of the right to contest. It corresponds to what in England is called the limitation of actions (see LIMITATION, STATUTES OF). Positive prescription depends upon usage from time immemorial. Rights of common, of use of water, and of building lights are prescriptive.

President. (1) Chief official of a body—*e.g.*, president of Board of Trade, president of a college. (2) Head of a republic. President of U.S. has salary of 75,000 dollars, with an allowance of 25,000 dollars, is commander-in-chief of army and navy, holds supreme executive power, chooses a cabinet, and retains office for four years. The Fr. president is elected for seven years by National Assembly, chooses his ministers, holds the right of pardon, appoints to military and civil posts; with senate's consent he may dissolve Chamber of Deputies; salary is 600,000 francs, with a similar sum for expenses.

Prespa (or PRESBA), LAKE, partly in Macedonia, Jugo-Slavia, and partly in Thrace

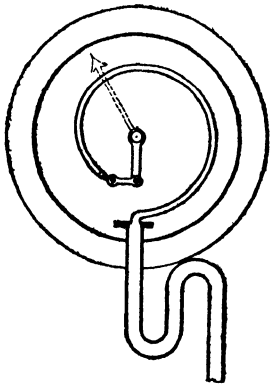
(Greece), crossed by boundary between these two countries (40° 55′ N., 21° 2′ E.), S.E. of Lake Ochrida; N. end 13 m. W. by S. of Monastir; alt. 2,770 ft.; about 15 m. long by 7 broad; no apparent outlet. Between Lakes Prespa and Ochrida the French unsuccessfully attacked (March 1917). The whole lake was behind the Allied lines by Sept. 15, 1918.

Press Association, chief Brit. news agency, founded by owners of provincial newspapers in 1868; began operations Feb. 5, 1870; co-operative principles; has agreement with Reuter's Agency for monopoly outside metropolis of that organization's foreign news; transmits news mainly by telegraph.

Press Bureau. The Brit. official Press Bureau for the censorship of all matter intended for publication was opened under the Defence of the Realm Act at the Royal United Services Institution on Aug. 10, 1914, just after the outbreak of the Great War. The necessity for depriving the enemy of any information which might be useful to him in the conduct of his operations against the arms of the Allies was ample justification for the revival of this mediæval institution, and the lessons of the S. African War had taught the authorities the advisability of some such immediate step. The Press loyally accepted the situation, contrary as it was to the whole genius of Brit. institutions and traditions. See under CENSORSHIP.

Pressburg, or POZSONY, tn., Czecho-Slovakia (48° 10′ N., 17° 6′ E.), on l. bk. of Danube, 35 m. E. of Vienna; one of finest cities of country; seat of Hungarian Parliament until 1848; cathedral (1060); old ruined castle; centre of wheat and wine growing dist.; furniture, musical instruments, gloves, silk, champagne, and spirits. Formerly made explosives. Pop. 78,000.

Pressure Gauge, an instrument for indicating the pressure of a fluid contained in a vessel. Low pressures may be recorded by the height of the column of mercury which they can support, but for high pressures the height of the mercury column (two inches



Pressure gauge—back view, showing form of flattened tube.

for every pound per sq. in. pressure) becomes inconvenient. In the ordinary pressure gauge used on boilers, the recording mechanism consists of a bent tube closed at one end, and at the other communicating with the vessel whose pressure it is desired to measure. The tube is

elliptical in section, and is bent into the arc of a circle, the open end being fixed to the frame of the instrument, and the other being left free. The effect of the pressure is to make the tube tend to straighten itself, and the motion of the free end causes a pointer to revolve on a dial, usually graduated to read pressures in pounds per sq. in. When used for steam, the gauge should be connected to the boiler or pipe by means of a tube of U-shape. The steam condenses in the bottom of the U, and prevents the hot steam from entering the gauge tube, which might be affected by the high temperature.

Prester John, semi-mythical potentate of Middle Ages; believed to reign over a Christian kingdom in the Far East, but it is certain that no Christian potentate ruled in Asia in the 12th cent., and John has been variously identified with a certain Mongol chief, and with the founder of the empire of the Khara-Khitai; legend of his existence proved a continual stimulus to mediæval exploration.

Preston, tn., Lancashire, England (53° 46′ N., 2° 42′ W.), near mouth of Ribble; Scots Royalists here defeated by Cromwell (1648); gave support to Jacobites in 1715 and 1745; important railway centre; cotton spinning; iron and brass foundries; electrical engineering; shipbuilding; docks; exports coal. Birthplace of Arkwright. Pop. 117,100.

Prestonpans, tn., N.W. coast of Haddingtonshire, Scotland (55° 57′ N., 2° 59′ W.); breweries and coal mines. Scene of defeat of Sir John Cope by Prince Charles Edward (Sept. 21, 1745). Pop. 2,000.

Prestwich, tn., and residential place for Manchester merchants, Lancashire, England (53° 32′ N., 2° 17′ W.), 4 m. N. by W. of Manchester; cotton industry. Pop. 17,200.

Prestwick, burgh, Ayrshire, Scotland (55° 30′ N., 4° 36′ W.), 3 m. N. by E. of Ayr; golf links. Pop. 4,900.

Pretender, The. See Charles Edward Stewart, Prince; and James, the Old Pretender.

Pretoria, cap. of Transvaal prov., S. Africa (25° 53′ S., 29° 6′ E.); laid out (1855) and named after Pretorius; became seat of Transvaal government in 1863; was surrendered to Lord Roberts (1900). Well laid out; wide streets; administrative cap. of Union of S. Africa; Parliament House and other government buildings. Pop. 48,600.

Pretorius, Andries William Jacobus (1799–1853), Boer general; led Boers in Great Trek; settled in Natal (1838) and founded republic of Natalia, which became Brit. colony (1843). Headed revolts (1848, 1851) and secured establishment of Orange Free State. His son, Marthinius (*d.* 1901), became first president of Transvaal Republic (1857–60); president of Free State (1859–63), and of S. African Republic (1864). See under Transvaal.

Pretyman, Ernest George (1860–), British politician; M.P. since 1895; civil lord of Admiralty (1900–3); secretary to Admiralty (1903–6); parliamentary secretary, Board of Trade (1915–16); civil lord of Admiralty (1916–19); P.C. (1917).

Secured Repeal of Land Clauses of Budget of 1909 in 1920.

Prévost, MARCEL (1862–), Fr. author and dramatist; member of Fr. Academy (1909). His works include *Lettres de Femmes*, *Les Demi-Vierges*, *Le Jardin Secret*, *L'Accordeur Aveugle*, *Monsieur et Madame Moloch*, *La Fausse Bourgeoise*, *Les Anges Gardiens*, *Mon cher Tommy* (1920), some of which he has dramatized. Other plays include *La Plus Faible*, *Pierre et Thérèse*, *L'Adjudant Benoît*, *D'un Poste de Commandement* (1918).

Prévost d'Exiles, ANTOINE FRANÇOIS, ABBÉ PRÉVOST (1697–1763), French author; produced 200 novels, of which *Manon Lescaut* (1733), his masterpiece, is a classic history of Parisian Bohemianism.

Priam (Gr. legend), aged King of Troy, father of Hector, Paris, Troilus, Cassandra; only once mentioned in Homer, when he begs Hector's body from Achilles.

Priapuloidea, a class of unsegmented wormlike animals, with mouth and anus at opposite ends of body. They have a retractile introvert bearing the mouth at its tip, and live in mud and sand in the sea.

Pribram, tn., Czecho-Slovakia (49° 42′ N., 14° 1′ E.), 47 m. S.S.W. of Prague; silver and lead mines; mining academy; Heilige Berg, place of pilgrimage, in vicinity. Pop. 13,300.

Pribylov Islands, group in Bering Sea, Alaska, U.S. (58° N., 170° W.); centre of seal fishing. See BERING SEA CONTROVERSY.

Price may be defined as the amount of money at which a commodity changes hands. It represents the adjustment between the interest of two parties, the seller and the buyer. The seller in fixing his 'supply price' will be governed by a number of motives, among which cost of production will play an important part. The buyer will be chiefly influenced by the utility of the commodity to him. The amount of the commodity of which the seller can dispose will vary with the price in the great majority of cases, for demand is elastic—*i.e.*, more will be sold at the lower price and less at the higher. Prices will tend to fall when sellers compete with one another in offering commodities for sale, for they will reduce their profits to a minimum in trying to secure a market. On the other hand, prices will tend to rise when buyers compete with one another for the available supply. Such movements in the prices of single commodities are familiar enough. When supply is irregular, as in the case of fish, or abundant at a particular season, as of fruit, this price movement is obvious also. The general movement of prices, however, is a more complicated question. It is due to changes in the purchasing power of money. (See MONEY.) The precious metals, which are employed as a means of measuring the value of other commodities, themselves are subject to the laws of supply and demand. A considerable increase in the output of gold, for instance, will tend to lower the value of gold in relation to other commodities, or, in other words, will lead to a rise in prices, for a greater quantity of gold will have

to be given in exchange for a given amount of the other commodities. Such a change in the general level of prices may be demonstrated by the construction of *Price Index Numbers*. The principle is to take the prices of a number of commodities and average them. If this is done for a series of years, one of which is taken as the basis and represented by 100, the percentage rise and fall becomes clear. There are varieties of such Index Numbers. That of the *Economist* is based on the wholesale prices of twenty-two representative commodities, taken twice a year. Sauerbeck's Index Number, however, is constructed from the wholesale prices of forty-five articles, the prices for each month of the year being averaged. Each of these Index Numbers is weighted—that is, the more important commodities are given greater weight than the less important in making the calculations. The Board of Trade Index Number includes a much larger variety of commodities, and is chiefly based on the declared value of imports and exports. By means of Index Numbers the price movements of the 19th cent. may be traced in a general way. For the forty years following Waterloo prices were falling; in the third quarter of the century they were rising, and for the last quarter they were falling. During the first fourteen years of the 20th cent. they were rising, but after the outbreak of the Great War they made rapid progress until they reached a phenomenal height. The social effects of rising and falling prices are far-reaching. When prices are rising, for instance, the wages of workpeople lag behind the advance in the price of commodities, and the attempted adjustment is accompanied by industrial troubles. Those who live on fixed incomes suffer a definite decrease in purchasing power, while those who are engaged in trade can often take advantage of the rise to increase their profits to more than a proportionate extent. The reversal of the process means that prices fall more rapidly than wages; those with fixed incomes stand to gain and traders suffer. The latter, however, has an adverse effect on enterprise, and general depression ensues. It follows, therefore, that any device which would secure the stability of general prices would be of the highest social value. So far such a discovery seems too much to hope for.

The steep rise in prices during 1915 stimulated a demand for control of prices by the government. At first it was resisted, because control seemed impracticable or undesirable. In the end, however, the task was undertaken. Steps were taken to secure the supplies at home and abroad, and a system of rationing was enforced. The state made extensive purchases—*e.g.*, of sugar, wheat, wool, etc. It had to provide that these should be distributed according to certain principles, for price control in such circumstances—when demand was keen—necessitated rationing. State purchase, controlled prices, and rationing all held together. The system was

applied to certain commodities, and only when the price had already become high. It did prevent a further rise in these commodities, but probably accentuated the rise in the prices of the uncontrolled commodities. People had more to spend in these directions. Complaints of 'profiteering' were ultimately met by the passing of an Act to repress it, and the establishment of tribunals to examine specific charges against retailers. A distinction was suggested between profit-making and profiteering, and the attempt was made to attach a certain moral reprobation to the latter which did not apply to the former. Profits themselves were legitimate, while profiteering—*i.e.*, the exaction of excessive profits—was not. This raised the question of what constituted reasonable returns on enterprise. In normal times the competition between producers is supposed to safeguard consumers from high prices and to operate to limit profits. The war created in many instances a condition of virtual monopoly. To this extent it was the wider problem of the social control of monopolies which was at the bottom of the matter. For the most part, however, the public outcry did not rest on any close analysis of the industrial system. It was a protest against overcharging for certain commodities based on a subjective impression of what overcharging was. The belief that there is a fair or just price for each commodity has a long and honourable history. It was an essential part of the teaching of the Church in the Middle Ages, and governed the policy of municipalities and states in forbidding engrossing, forestalling, and regrating—*i.e.*, taking advantage of a favourable position in the market to charge more than was considered right. When the craftsman made and sold the article himself, it was much easier to assess a just price than when division of labour and function created a number of claimants for some share in the product. An elaborate inquiry would now be needed to discover whether the price charged for a given commodity was reasonable. The costs of raw material, of transport, and of labour would, among others, have to be examined. In each case an adequate inducement would be necessary to secure the co-operation of the factors in production. Complications of this kind led to the acceptance of the principle of supply and demand—*i.e.*, the producer was allowed extensive freedom from state control in making commodities for the market, the responsibility for the risk involved resting with him. He had the prospect of securing high profits, and, as long as competition was free, he was regarded as having a right to them. The limitation of competition by the evolution of great businesses which aim at ruling it out naturally opens up a different problem. The state, as representative of the whole body of consumers, may feel it necessary to establish a permanent means of regulating prices. If and when such regulation is adopted, the account of prices given by the economists will need considerable revision.

Jevons, *Investigations in Currency and Finance;* W. T. Layton, *An Introduction to the Study of Prices;* Edwin Cannan, *Money, its Connection with Rising and Falling Prices;* J. H. Jones, *Social Economics.*

Price, G. Ward, war correspondent; has written *The Story of the Salonica Army* (1917).

Price, Julius Mendes, official war correspondent to the Ital. Government (1917); artist-correspondent to *Illustrated London News;* in Bechuanaland campaign; served in S. Africa; with exploring expeditions in Siberia, Mongolia, Gobi Desert, and N. China (1890–1); with Gr. army during Græco-Turkish War (1897), and with Russian army in Manchuria (1904–5). Publications include *Six Months on the Italian Front* (1917); has exhibited at Royal Academy and Paris Salon.

Price, Richard (1723–91), Welsh philosopher and author; Nonconformist minister, Stoke Newington, London; opposed war with America and welcomed Fr. Revolution; his sermon *On the Love of our Country* fiercely denounced by Burke; wrote on morals, economics, and politics.

Prickly Pear. See Cactus.

Priego de Cordova, tn., Cordova, Spain (37° 28′ N., 4° 14′ W.), 45 m. S.E. of Cordova; stronghold of the Moors; oil, silk, and wine. Pop. 17,000.

Priest. A priest is the head of a religious body, initiated into the mysteries of his religion, a teacher of its tenets, one who performs a sacred office, very often with the idea besides of divine sanction or authority. In early times the functions of priest and chief ruler were combined, but in later times, in Greece and Rome, priestly functions were performed by ordinary magistrates. It is among the Jews that the office of priest had its fullest significance. With them religion was identified with the national life, and the priest was the concrete representation of it. The office of high priest, which was hereditary, was at one time invested with almost kingly power. In the early days of the Christian Church, no elaborate system of priesthood was needed, but as the Church advanced a more complicated form of government naturally followed. The development from the primitive state until its culmination in the magnificence of the Popes is a prominent feature in the history of the Christian Church. Generally speaking, the name 'priest' has ceased to be associated with the Reformed Church, and with the exception of the Anglican Church is now more correctly applied to clergymen of the Church of Rome and of the Greek or Eastern Church.

Priestley, Joseph (1733–1804), English scientist and Unitarian divine; minister in Birmingham (1780–91), when, on account of his advanced political views, his chapel and house, books and apparatus were burnt by the mob; later, migrated to America; renowned for his discovery of oxygen; invented the pneumatic trough; first to apply carbon dioxide in 'aerating' waters; pub. *History of Electricity* (1767), *Experiments on the Generation of Air and Water* (1793).

Priestley, Sir William Overend (1829–1900), Eng. physician; prof. of obstetric med. at King's College, London, and obstetric physician at King's Coll. Hospital (1862–72). Pub. *Lecture on Development of the Gravid Uterus* (1860), and *Pathology of Intra-uterine Death* (1887).

Prilep, or Prilip, tn., Jugo-Slavia (Macedonia) (41° 2′ N., 21° 35′ E.), 25 m. N. by E. of Monastir; citadel. During the Great War was captured by the Bulgars (Nov. 16, 1915); retaken during the Allied advance (Sept. 23, 1918). Pop. 11,000.

Primate, title in Roman Empire, both civil and eccles.; now only eccles.; used of a chief bishop in West (like patriarch in the East). In Church of England Archbishop of Canterbury is Primate of All England; the Archbishop of York, Primate of England. In the Episcopal Church in Scotland the presiding bishop is known as the Primus; in Ireland the R.C. Church terms the Archbishop of Dublin Primate of Ireland, and the Archbishop of Armagh Primate of All Ireland, whilst the Prot. Archbishop of Armagh is also Primate of All Ireland.

Primates, an order of mammals: lemurs, monkeys, apes, and man—the order which, on account of its highly developed brain, and its watchfulness over offspring, is placed highest in the animal kingdom. The majority of monkeys are familiar on account of their semi-erect gait, and their faces caricaturing the human countenance, but the less specialized individuals, and the lemurs, have little external resemblance to their man-like relatives. The following characteristics which Primates have in common will serve to distinguish them from the other orders of mammals. The eyes, instead of lying at the side of the head, are in front, and look almost straight forward, and the eye socket, or orbit, is completely surrounded by a ring of bone. The brain cavity is large, and the cerebral hemispheres of the brain are often much convoluted. The limbs are long, and neither the thigh-bone nor the upper arm-bone is hidden in the body. Both hands and feet are grasping organs (except the human foot), and both have five digits, the great toe, at least, having a flattened nail, except in the orang-utan, where the nail is sometimes absent. Again, the thumb or the great toe, or both, lies away from and can be opposed to its fellow-digits; and, lastly, all the females, except the aye-aye, with inguinal mammæ, have at least two mammæ on the breast.

The Primates are on the whole fitted for life in forest regions, where they are to be found in companies, climbing by hands, feet, and often tails, roosting in the trees, but seldom traversing ground. They live mainly upon fruits and leaves, but some devour spiders, insects, eggs, young birds.

Primates are warmth-loving animals, found only in tropical and sub-tropical regions, although some venture among the snows of the Himalayas. They are scattered over both Old and New Worlds, but the inhabitants of the one differ in marked characters from the inhabitants of the

other (see classification below). In Europe the only representatives are the Barbary apes, which dwell on the rock of Gibraltar.

The order Primates falls into the following natural groups:

Sub-Order 1. — *Lemuroidea*, monkey-like animals with fox-like faces; orbit opens freely into temporal fossa; front teeth separated in the middle line; brain poorly convoluted: lemur, galago, indri, potto, loris, etc.

Sub-Order 2. — *Anthropoidea*, man and monkeys; monkey-like animals with more or less flat faces; orbit separated from temporal fossa by bony partition; front teeth in contact in middle line; brain usually highly convoluted; falls into two groups:

Group 1. *Platyrrhini*, New-World monkeys; broad internasal septum; nostrils directed outwards; no bony external auditory meatus; three pre-molars; tail usually prehensile. Family 1. *Callitrichidæ* (marmosets), small, furry monkeys, with two molars on each side; claws on all digits but great toe, which has flat nail; tail bushy, non-prehensile; found in tropical forests of Central and S. America; feed on insects and fruit; 35 species in two genera: *Hapale* and *Midas*. Family 2. *Cebidæ* (75 species of spider-monkeys, howlers, squirrel-monkeys, capuchin monkey, etc.); flat nails on all toes; three molar teeth on each side.

Group 2. *Catarrhini*, Old-World monkeys; narrow internasal septum; nostrils directed downwards; bony external auditory meatus; two pre-molars; tail not prehensile, or absent. Family 1. *Cercopithecidæ* (174 species of macacques, mandrill, proboscis monkey, vervet, Barbary ape; see CERCOPITHECIDÆ), with arms shorter than legs; hairs on arm all pointing towards wrist; usually good tail; bare, often coloured, patches on buttocks. Family 2. *Hylobatidæ* (16 species of gibbons), with erect gait; arms reaching ground; hairs on arm all pointing to elbow; no tail; feed on fruits, young birds, insects, etc., in forests of S.E. Asia. Family 3. *Simiidæ* (3 species—gorilla, orang-utan, and chimpanzee), semi-erect gait; arms longer than legs; hairs on arm all pointing to elbow; no tail. Family 4. *Hominidæ* (man), with erect gait; arms shorter than legs; soles of feet set flat on ground; great toe in line with other toes; no tail; large, highly convoluted brain.

Prime Minister, or PREMIER, the member of the Brit. Parliament who, at the summons of the sovereign, forms an administration, of which he is the head. Although each member of the cabinet has general control of his own department, all important matters connected therewith are brought before the prime minister, while no appointment of moment can be made without his concurrence. The office carries with it an extensive patronage, including the selection of those who are to fill the various offices in the state, subject to the approval of the crown, the appointment of archbishops, bishops, and principal judges, the filling of crown livings, the recommending of those upon whom titles, honours, and high appointments are proposed

to be conferred. He is (normally) leader of that House of Parliament of which he is a member; and as prime minister he has (by royal warrant, Dec. 1905) precedence next to the Archbishop of York.

Primitive Methodists. See METHODISM.

Primrose (*Primula vulgaris*), an abundant indigenous species, possessing a rosette of crinkled sessile leaves, and bright yellow flowers on separate stalk. The flowers are dimorphic, one type showing a long style with anthers inserted midway up the corolla tube; the other short-styled, with anthers at the top. The cowslip (*P. veris*) has drooping flowers in stalked umbels.

Primrose, NEIL (1882–1917), British politician and soldier, younger son of Lord Rosebery; M.P. (1910–17); during Great War, served with Yeomanry on Western front; parl. under-secretary of the Foreign Office (1915); accompanied his regiment, the Bucks Hussars, to Palestine (May 1917); killed in the second of two charges made by Yeomanry during the advance on Jerusalem (Dec. 1917).

Primulaceæ, order of herbaceous perennials, with pentamerous flowers, the five stamens being opposite the petals; ovary is formed by five carpels, with free central placentation; include primrose, cowslip, cyclamen, pimpernel, and water violet.

Prince Edward Island (from 1534 to 1798 known as *Isle St. Jean*), Maritime Province; smallest and most densely populated (42·91 to sq. m.) of the provinces of Canada; in Gulf of St. Lawrence; separated from New Brunswick and Nova Scotia by Northumberland Strait (9 to 30 m. wide); very irregular in outline; arms of sea divide it into three peninsulas; shores low and sandy; surface undulating (400 ft.); originally heavily forested with beech, maple, fir, etc.; most now cleared and used for agricultural purposes. Cereals are chief products; dairy farming is important (cheese and butter are largely exported); fisheries valuable (mackerel, cod, herring, lobsters, and oysters). Silver fox ranching is making great progress (see FUR). Mild climate; ports closed by ice Dec. to May. Cap. Charlottetown. Lieut.-governor is appointed by Dominion and Legislative Assembly (30 members, for four years). Four senators and four members of House of Commons in Dominion Parliament. There are two colleges, one affiliated with M'Gill Univ.; 278 m. of railway; linked with Intercolonial Railway by car ferry steamer. Inhabitants mostly of British descent. Education free and obligatory. Settled by French *c.* 1719; captured by British (1755); passed into Brit. possession (1763); separate prov. (1769); entered Confederation (1873). Area, 2,184 sq. m.; pop. 93,700.

Prince of Wales. See WALES, PRINCE OF.

Princes Islands, group of nine islets in E. of Sea of Marmora (40° 52′ N., 29° 5′ E.), 15 m. S.E. of Constantinople. PRINKIPO, Antigoni, Khalki, and Proti are inhabited; frequented for their beauty and mild climate. Pop. 10,000.

Princess Royal, Brit. battle-cruiser of *Lion* class; tonnage

26,350; h.p. 70,000; speed 31 knots; built at Barrow in 1912; armament, eight 13·5-in. guns and sixteen 4-in. She fought in the action off HELIGOLAND, in the DOGGER BANK affair, and in the battle of JUTLAND.

Princeton, bor., New Jersey, U.S. (40° 18′ N., 74° 42′ W.), 10 m. N.E. of Trenton. Seat of Princeton Univ. (first charter obtained 1746; evolved from coll. of New Jersey; removed to Princeton, 1754) and Princeton Theological Coll. Contains Nassau Hall, in which Continental Congress met (1763); Washington here defeated British (1777); home of Grover Cleveland (public monument part of graduate coll. of univ.). Pop. 5,100.

Principal and Agent. In law the relationship of principal and agent arises by direct appointment or may be implied from the conduct of the parties, and may be general or special. Usually the agent does not make contracts on his own behalf, but is merely the representative of his principal, and the latter alone is usually bound by the agent's acts, and the agent himself does not incur any liability. If an agent acts for a principal without disclosing the fact that he is an agent, the other party may sue either principal or agent. The principal is liable even for the fraud of the agent, although in fact the agent has exceeded his authority—unless, of course, the other contracting party had notice of his excess of authority.

Prinkipo, one of PRINCES ISLANDS, Sea of Marmora (40° 50′ N., 29° 8′ E.); came into prominence in 1919 in connection with a proposal to hold a conference on the island between representatives of the Soviet Government of Russia and the Allies. The conference was never held.

Prinsep, VALENTINE CAMERON (1838–1904), English artist and author; R.A. (1894); prof. of painting to Royal Academy; painted *Declaration of Queen Victoria as Empress of India* (1880); constant exhibitor at Royal Academy; wrote novels and plays.

Printing, the art of stamping impressions of letters, figures, characters, or other designs with ink or pigment on paper, parchment, or similar substance. When such stamping is done on cloth, the process is known as *Textile Printing.* Printing may be said to be of three kinds: (1) *Copperplate,* the basis of which is a metal plate, generally copper, having the necessary letters or design sunk or engraved on its otherwise smooth surface (see ENGRAVING). (2) *Lithographic Printing,* or *Lithography,* in which a perfectly flat and polished stone surface is used. This process, invented by Aloys Senefelder in 1796, though in some respects similar to letterpress printing, gives more beautiful results, and is very suitable for the reproduction of works of art. (3) *Letterpress Printing,* by far the commonest and most used process of the three. In this process raised letters are used, their surfaces inked, and the ink transferred to paper. Printing from fixed type seems to have been used more or less in very early times, and the rudiments of letterpress printing were known to the ancients; printing with movable types was

probably practised in China about the 12th or 13th cent., while books were printed in Korea by means of movable types of clay or wood in the early 13th cent.

Johannes Gutenberg, if not the actual inventor of movable type, certainly did a great deal to set printing on a firm footing. L. J. Coster started business between 1420 and 1430 at Haarlem; his first types were of wood, but later he used lead and tin. Perhaps the earliest specimen of printing with movable types was *Speculum Nostræ Salutis*, by P. Schoffer. Gutenberg, with Fust and Schoffer, set up a printing house at Mainz, and about 1455 they published a Lat. Bible, called sometimes 'the forty-two line Bible,' because each column had 42 lines.

Printing now made rapid strides in Europe. Workmen left the original printing houses and carried their art with them, either taking service with other employers or setting up business for themselves. Printing was established at Naples in 1465; at Rome by Sweynheim and Pannartz (1467); at Venice and Milan (1469); at Paris (1470); at Nuremberg and Verona (1472); at Westminster by WILLIAM CAXTON (first printing establishment in England), 1476, and at Oxford in 1478 by Theo. Rood; and at Constantinople in 1490. After this the art spread to almost every continental city, and also to Russia. Some of the early printers other than those above mentioned were: the Aldi of Venice (1490–1597), Baden of Paris (1502–98), Plantin of Antwerp (1514–89), Wechel of Paris and Frankfort (1530–72), Elzevir of Leyden and Amsterdam (1588–1680), and Bodoni of Parma (1768–1813).

A censorship of printing was established in 1530 for England, and printers were so abused and imprisoned that for a time the art almost became extinct in the country. In 1694, however, the censorship was abolished, and a revival in printing followed. No radical improvements were effected until mid-19th cent., when machines to lighten labour were introduced; the improvements in speed and the introduction of machine printing rendered the daily newspaper a possibility.

Printing Presses.—The first printing press was probably some sort of contrivance used by Gutenberg, and no doubt it was constructed of wood. The presses used in the early part of the 17th cent. were wooden ones, and resembled the old winepress in design. An upright frame held in place a flat table of smooth wood or stone. The paper was held in a frame parallel to the table, and was screwed down upon the inked type resting on the table. Joseph Moxon wrote *Mechanick Exercises as applied to the Arte of Printing* (1683), and the existing kind of press was improved by Blaeu. The earliest illustration of a press, dated 1607, shows how primitive the press was. It remained in this state until the close of the 18th century. In 1800 Charles Mahon, third Earl of Stanhope, invented the iron printing press. It had an upright frame, but in design was different from its predecessors, enabling a greater power to be obtained. With this press some 200 copies per hour, printed on one side, could

be taken. In 1823 the Albion press was invented, by R. W. Cope of London, and soon after, Clymer, an American, introduced the Columbian. Both these machines were capable of turning out 250 copies per hour printed on one side. In 1772 Adkin and Walker invented a rotary press, the forerunner of modern printing machines. Several improvements were suggested by W. Nicholson of London, embracing cylindrical formes and inking devices. In this machine the type was fixed on one cylinder, while another roller, covered with leather, pressed the paper into contact. The paper was carried through the rollers—or 'fed'—with tapes moving to and fro. It was feared that the rotating movement of the rollers would tend to blur the impression of the type on the paper, but in actual practice it was found that it did not differ appreciably from the impressions obtained with flat press machines.

Probably the first newspaper to be printed by steam-driven printing machine was the *Times* of Nov. 28, 1814, 900 sheets per hour being printed on both sides, but by two distinct operations. Small iron hand-presses are still used at the present day for pulling proofs, while small platen machines worked by treadle (or by power, when employed continuously) are used for printing cards, circulars, etc. The design of these machines is practically the same as the old Albion and Columbia machines, although minor improvements have been added as experience suggested. Single-cylinder machines are used where one side of the sheet only is printed, and machines which print both sides of the sheet are called perfecting machines. The sheet is perfected before leaving the press, but is printed on both sides by different operations. There are now many different kinds of printing machine in common use, among which may be mentioned the Wharfedale, the Huber, and the Miehle. Two-colour machines have only one cylinder, which, however, has two printing surfaces and two sets of inking apparatus. Rotary printing machines are used for that class of work in which rapid dispatch is required, as in newspapers and periodicals. The paper is contained on great reels, and is wound in at one end of the machine, only to issue from the other in printed, cut, and folded copies. The cycle of operations is too complex to give here.

Letterpress Printing is the process mostly used for general work. The letters or characters are cast on pieces of metal. A complete set of type is called a *fount*; each type is notched, so that the compositor may place it properly. The fount is contained in trays or *cases*, which stand on a frame. The trays are divided into compartments, each of which contains types of a certain letter. These compartments are so placed that those types which are most often used are close to the compositor's hand. The names of types in general use are given on p. 320, but as these tend to vary slightly in size, the point system has come into use as the standard, with 72 points to an inch, pica being 12 point.

Signs and Abbreviations.

⁄	Delete; take out marked type, word, or sentence.	⌐	Move to right.
⌀	Reverse type.	⌐	Indent line.
#	Insert a space, or more space.	⌐	New paragraph.
⌊	Less space.	‖	Range lines.
⁀	Close up.	—	Range letters or lines.
⁄	Take out and close up.	⊥	Push down appearing space.
⌐	Move to left.	X	Change broken type.

w.f., wrong font; *tr.*, transpose; *l.c.*, lower case type or small letters; *s.c.*, small capital letters; *caps.*, capital letters; *rom.*, change italic to roman; *ital.*, change roman to italic; *stet.*, retain what is crossed out.

Specimen 'First Proof.'

caps
s.c.

JOHNSON.

By Thomas Carlyle.

As for Johnson, I have always considered him to be, by nature, one of our *great* English souls. A strong and noble man; so much left undeveloped in him: in a kinder element what might he not have been. Poet, Priest, sovereign ruler! On the whole, a man must not complain of his 'element,' of his time,' or the like; it is thriftless work doing so. His time is bad; well, then, he is there to make it better.

Johnson's youth was poor, isolated, hopeless, very miserable; indeed, it does not seem possible that, in any ~~the favourablest~~ outward circumstances, Johnsons life could have been other than a painful one. The word might have had more of ~~profitable~~ *work* out of him, or less, but his effort against the world's work could never have been a light one. Nature, in return for his nobleness, had said to him, live in an element of diseased sorrow. Nay, perhaps the nobleness and the sorrow were intimately and even inseparably connected with each other. At all events, poor Jonson had to go about girt with continual hypochondria, physical and spiritual pain. Like a Hercules with the burning Nessus's shirt on him, which shoots in on him dull, incurable misery: the Nessus'-shirt not to be stript off, which is his own natural skin;

Proof-reader's Marks. 319

This type is called			Pica
,,	,,	,,	Small Pica
,,	,,	,,	Long Primer
,,	,,	,,	Bourgeois
,,	,,	,,	Brevier
,,	,,	,,	Minion
,,	,,	,,	Nonpareil.

In hand-setting the compositor picks up the required letters, places them in a setting stick, a kind of box-like arrangement which holds them in place; when sufficient lines have been arranged they are transferred to the galley, a brass tray with wooden sides. A proof is now 'pulled' by a hand-press and read over by a printer's reader, who corrects any errors and returns it to the compositor for amendment. A 'clean proof' is then taken for the author, who makes his alterations thereon. These alterations are technically known as 'author's corrections.' A book with a small number of copies is printed direct from the type, but if, on the other hand, a large number of copies are required, the type is stereotyped—*i.e.*, a metal plate of each page is made, and copies are printed from these plates.

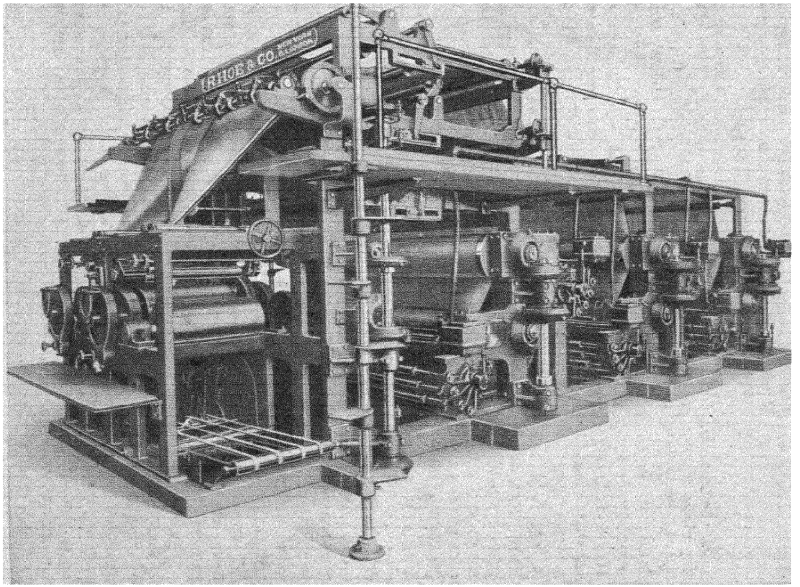
Type-setting by hand has now to a great extent been superseded by mechanical composition. Various machines have been invented and patented for this purpose, from that of Church in 1822 to the marvellous machines of to-day; but the principal ones now in use are the linotype and the Lanston monotype machines. The first of these, invented by O. Mergenthaler, is now very largely used in newspapers, for which it is most suitable. It produces the types in a solid line. The monotype machine casts the types separately, and is used by some newspapers and by most large printing houses engaged in book production. This Encyclopædia has been 'set' by monotype in brevier (8 point).

In *Three-colour Printing* by the letterpress method, fully coloured pictures are produced from three blocks, printing yellow, red, and blue respectively. Remarkably good results are thus obtained. Great care must be taken to obtain exact 'register' of the different colours. See under PROCESS WORK (*Three-colour Work*).

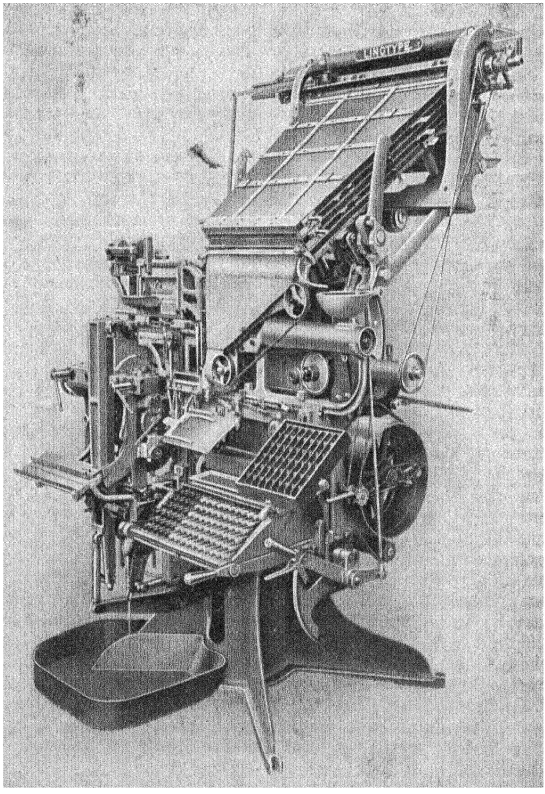
Textile Printing is the art of ornamenting woven fabrics by printing designs in colour. The art is of very ancient origin. The design may be imprinted by stencil, wood blocks, or engraved plates or rollers. The ink is thickened and specially prepared to prevent its running and spoiling the design, while it is also rendered 'fast' to prevent washing out.

Prior, MATTHEW (1664–1721), English poet and diplomatist; helped to negotiate treaties of Ryswick (1697) and Utrecht (1713); commissioner of trade (1700–7), of customs (1711–14); impeached and imprisoned (1715); wrote long poem, *Solomon on the Vanity of the World*, but is greatest in his 'amorous odes' and in his verses to children.

Pripet, or PRIPYAT, river, Ukraine, one of the chief tribs. of the Dnieper; rises in N.W. of Volhynia, flows N.E., E., and S.E., and joins the Dnieper 50 m. N. of Kiev; in its middle stretch forms the southern boundary of



A Modern Newspaper Printing Machine.



A Linotype Type-setting Machine.

Russian prov. of Minsk; length, 486 m. It traverses a vast, marshy dist. (51° 50′ N., 25° 28′ E.), estimated to cover 30,000 sq. m., of which over 20,000 sq. m. have been drained and reclaimed. During the Great War the Germans in their campaign of 1915 drove the Russian armies back as far as the *Pripet Marshes*, where the pursuit could not advisably be pressed farther (Aug.–Sept. 1915).

Prishtina, or PRISTINA, tn., Kossovo, Jugo-Slavia (42° 30′ N., 21° 18′ E.); occupied by Balkan Allies (1912–13). Evacuated by Serbian army during Great War (Nov. 23, 1915); recovered in course of great advance (Oct. 1918). Pop. 15,000. See SALONICA.

Prison. The aim of prisons has varied considerably; originally they were provided merely for the detention of persons wanted by justice; punishments were then death, fines *in re*, corporal chastisement, and torture. Later, imprisonment became the chief form of punishment for wrongdoers; prisoners were treated like wild beasts, left in damp, disease-ridden, and filthy quarters, in rags and with insufficient food. John Howard, who in 1769 began a personal investigation of the jails of the U.K., drew public attention to their shocking state, and a Prison Society was formed (1817). Differentiation of sex was the first object attained (1823); separate cells and the provision of occupation followed (1839). In 1840 the first 'new model' prison was built at Pentonville on the separate cell system. From about 1790 to 1850 transportation to penal settlements akin to those planted in the Amer. colonies was an integral part of prison administration; the criminal was sent beyond the seas for his country's good, and still more, as it generally proved, for his own. Its abandonment brought about the system of penal servitude in prisons especially designed for the purpose. The theoretical aim of modern prisons is not so much to inflict personal punishment as to remove the subject from his criminal surroundings, protect society from him for a time, and give him a chance of fitting himself out for honest livelihood on his release. It is as yet largely a theory, but progress is being made towards its accomplishment. This is particularly the case with youthful offenders; BORSTAL institutions and training ships have replaced prisons in numbers of these cases.

Prisoners of War. Public enemies armed or attached to the hostile army and falling into their captors' hands either by individual surrender or capitulation are distinguished from non-military enemy subjects resident in the hostile state during war. Formerly prisoners of war might lawfully be killed unless exchanged or liberated on ransom. This barbarous practice has been long discontinued by civilized nations. Hague Conventions have codified such principles of international law as are applied by such nations. Prior to the Great War it was customary to exchange prisoners; this practice was not observed during the Great War except in the case of the

badly wounded, as not being to Germany's advantage. By the Hague Regulations prisoners of war are in power of hostile government, not of capturing corps; must be humanely treated; personal belongings, except arms, horses, and military papers, remain their own property. Can only be confined as an indispensable precaution. State may utilize their labour according to rank and aptitude; tasks must not be excessive nor in connection with military operations; work done should be paid for according to tariffs in force for soldiers of national army similarly engaged, or, if privately employed, by agreement with military authorities. Insubordination warrants adoption of such measures of severity as may be necessary. Breach of parole given by officers may involve the extreme penalty, if paroled officer recaptured in arms before regularly exchanged. On beginning of hostilities each belligerent state should institute bureau of information, and regularly constituted relief societies should be afforded every reasonable facility. Letters, money orders, and valuables sent to prisoners of war should be free of all postal duties, and gifts and relief in kind of duty or payments for carriage by government railways. Every latitude, consistent with regulations for order, should be given to prisoners in exercise of their religion. During Great War inspections of internment camps by neutrals showed that these rules were observed in Britain, France, and Italy, but not in Germany, which urged plausible excuses as to rations due to shortage partly produced by the blockade and to the huge numbers of prisoners to be fed. Nevertheless, Amer. consul-general at Berlin in 1914 reported authentic cases of cruelty to captured officers and men on their way to Torgau, while at Crefeld some officers were killed after capture. Specially harsh treatment was meted out to British. No pleas could avail to excuse horrors of camps at Wittenberg, where men died wholesale from typhus, or abominations at Minden, Limburg, and Holzminden (officers' camp). At the latter place the prisoners constructed a tunnel, and twenty-nine of their number escaped, ten managing to reach the frontier (see H. G. Durnford, *The Tunnellers of Holzminden*, 1920). Later, as result of good offices of U.S. (notably of Mr. Gerard), there was considerable improvement in the attitude of Germans towards prisoners, though in the working camps and mines there were many subsequent acts of brutality. Turks treated the 16,583 Brit. officers and men in their hands with characteristic cruelty; 3,290 died in captivity, and 2,222 have never been traced. Kut rank and file prisoners were treated horribly. (See *Report on the Treatment of British Prisoners of War in Turkey*, Misc. No. 24; 1918.) Austro-Hungarian authorities as a rule treated their prisoners in a satisfactory manner. (See *Reports* issued by Comité International de la Croix Rouge.)

Pristis. See under RAYS.

Private Bill Legislation. Large and important part of legislation of Parliament consists of private bills introduced and passed in

the interest of individuals, public companies or corporations, or particular localities. So called because they are not measures of public policy in interests of whole community. Some private bills, however, owing to magnitude of interests involved, are treated as public bills. (See PARLIAMENT.) Others again, though introduced as public bills, are treated as private when they reach committee stage, including bills confirming PROVISIONAL ORDERS. By Standing Orders of House of Lords private bills are either local or personal (estate, divorce, naturalization, and name bills). No such distinction in Standing Orders of House of Commons, yet contain special provisions regarding bills classed by Lords as personal. Private bill is introduced on petition and must be applied for by parliamentary agent; after presentation of petition it is endorsed by examiners of private bills stating that Standing Orders have been complied with; then presented to the House by a member, and when ordered to be brought in, deposited in the Private Bill Office and laid on the table for first reading. Bill then read a second time and sent to select committee; if unopposed, promoters must satisfy committee as to general expediency; preamble being thus proved, bill is gone through clause by clause, read a third time, and sent to the other House, where it undergoes much the same procedure. If opposed, counsel appears, opens the case, calls witnesses, who are cross-examined by opponents. If committee finds preamble not proved, bill is thrown out; if proved, clauses are considered. It is not usual to challenge finding of Private Bill Committee in the House, but this was done in the case of the Edinburgh Boundaries Bill in 1920. For procedure as to Scot. Private Bills, see PROVISIONAL ORDERS.

Privy Council, nominally assembly of advisers of the crown in matters of state. It dates back to the Norman period, when a group of the tenants-in-chief of the king, the *curia regis*, composed of officers of state and of the royal household, exercised a mixture of advisory, executive, and judicial functions; existed as a separate body (*concilium regis*) in the 14th cent.; under Tudors and Stewarts sought to usurp powers of Parliament and the courts of law; its interference abolished in 1640; with growth of cabinet ceased to exercise even its anc. function of advising the sovereign. During the last hundred years the council has been nominated by the sovereign on the advice of his ministers; its numbers are unlimited; the whole body never meets, but only those members who are specially summoned from time to time; and its function is to give formal sanction to Orders in Council made under authority of an Act of Parliament. But on the judicial side a committee of the Privy Council acts as the final court in Admiralty matters and as a court of civil and criminal appeal from the courts of the Dominions. The Boards of Trade and of Education are nominally

other committees of the Privy Council, although really separate departments of state; the Scot. Education Dep. is also theoretically a committee of the council, which nowadays never meets, the control being entrusted to the secretary for Scotland and the lord advocate. The only actual committees are the Universities Committee, the Committee for the Affairs of Jersey and Guernsey, the Charters of Incorporation Committee, and committees which promulgate Orders in Council. The lord president of the Council is an important cabinet minister. The rank of P.C. entitles members to be addressed as 'Right Honourable.' Ireland has its own Privy Council: the Privy Council of Scotland was merged in that of Great Britain after the union of 1707.

Prize-fighting. See BOXING.

Prize of War is property captured by a belligerent at sea, either from vessels of the hostile nation, or from vessels violating neutrality, or from subject vessels having dealings with the enemy. The right to prize is determined by a prize court according to the rules of international law. To constitute the authority of the Brit. court in every war a commission is issued under the Great Seal. By the Judicature Act, 1891, the High Court of England was declared to be a prize court, and the business was assigned to the Admiralty Division. The sitting of this court as a court of prize (Sept. 4, 1914) was the first since the Crimean War sixty years earlier. An appeal lies to the Judicial Committee of the Privy Council. Prize courts were also set up in the Dominions by notification of the Colonial Office (Oct. 8, 1914). Prize bounty, not to be confused with prize money, the proceeds of the sale of a prize, is awarded those who effected the capture. Prize bounty amounting to £5 for each person on board the enemy's ship at the beginning of an engagement which resulted in its capture or destruction was instituted by the Naval Prize Act, 1864, and an Order in Council declaring the intention of the crown to grant it in the Great War was pub. March 2, 1915. After the war regulations were issued by Royal Proclamation (Feb. 11, 1919) for the distribution of prize money in proportions varying from a thousand shares to the commander-in-chief of the Grand Fleet to three shares for the ordinary seaman and two shares for supernumeraries. A prize court can also determine questions of *booty—i.e.*, prizes taken on land.

Prizrend, or PRISREN, tn., Jugo-Slavia (42° 8′ N., 21° E.), 90 m. N.N.W. of Monastir; archbishop's see; weapons, steel, glass, pottery, leather. During Great War occupied by Bulgars (Dec. 1915); recaptured (Oct. 1918). Pop. 21,200.

Prjevalsky (or PREJEVALSKI), NIKOLAI MIKHAILOVICH (1839–88), Russian Asiatic traveller and writer; sent out by Russian Imperial Geographical Society, and penetrated to China, Mongolia, and Tibet; died at Karakol, renamed Prjevalsk in his honour; made important collections of plants and animals.

Probability, a branch of algebra which deals with the chance of occurrence of any one of a number of possible events, one at least of which must occur. The usual definition of probability, or *chance*, is as follows: If an event can happen in a ways, and fail in b ways, and all these ways are *equally likely* to occur, then the probability of its happening is $\frac{a}{a+b}$, and the probability of its failing is $\frac{b}{a+b}$. Events are said to be *equally likely* when we have no reason to expect one any more than the other—*e.g.*, drawing a ball from a bag containing only black and white balls in unknown proportions, there is no reason to expect one more than the other; so the drawing of a black ball and of a white one are equally likely, and the probability of drawing either is $\frac{1}{2}$. Again, if *in the long-run* events occur equally often, we may say they are equally likely—*e.g.*, in tossing a coin, the ratio of the number of times *heads* occurs to that of *tails* is in the long-run little different from unity. So we get another definition, consistent with the first, that the probability of an event occurring is the ratio of the number of times in which the event occurs, in the long-run, to the sum of the number of times in which events of that description occur, and in which they fail to occur.

If an event is certain, it will occur always, and its probability is 1. Hence, if p is the probability of an event occurring, $1-p$ is the probability of it failing. If the ratio of the probability of an event occurring to that of it failing is $a : b$, it is said that *the odds* are a to b for the event, or b to a against it, according as a or b is the greater.

When different events are *mutually exclusive* (*i.e.*, if one occurs, other can not occur), the chance that one or other of the different events occurs is the sum of the chances of the separate events.

Probabilities are important in connection with annuities, insurances, etc., and many problems require the Integral Calculus, but a few may be solved by simple geometrical methods.

Whitworth, *Choice and Chance*; Bertrand, *Calcul des Probabilités*; Todhunter, *History of the Theory of Probabilities*.

Probate, the proving of a will. The Probate Registry is now at Somerset House. Letters of administration cannot be taken out till a week after testator's death, but must be taken out within six months, or executors are liable to penalties. Where the will is not disputed, it can be proved cheaply by common form at Somerset House. To be proved in solemn form it must be done in court. The sealed certificate annexed to a copy of the will is the executor's authority to collect and distribute the estate. In Scotland what corresponds to probate is 'confirmation' granted by the commissary, who is usually the sheriff.

Probation. Under the Probation of Offenders Act, 1907, any person charged before a court of summary jurisdiction may

be released on probation, when the court thinks the charge proved, but that it is inexpedient to inflict punishment; the offender entering into a recognizance to be of good behaviour

Procavia, or CONIES (Procaviidæ or Hydracoidea), a suborder of small ungulate mammals confined to Syria, Arabia, and Africa. They are small, brownish-grey, rabbit-like animals, with short snout, ears, and legs, and very small tail. They live in the crevices of rocks and feed upon foliage and tree shoots. Many are arboreal and expert climbers. Formerly known as *Hyrax* and *Dendrohyrax*, all are now grouped in genus *Procavia*.

Procellariidæ. See PETREL FAMILY.

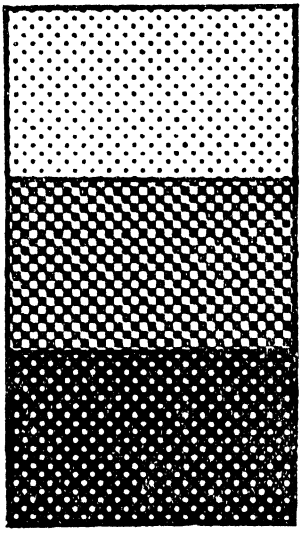
Process Work. What are called 'process' relief blocks are of two kinds: (1) those reproducing black-and-whites or line drawings by pen and ink, and (2) those reproducing half-tone photographs or wash drawings.

Line-etching.—(1) Subject photographed to required size; negative is placed in contact with sensitized plate of copper or zinc, coated with albumin, fish glue, bichromate of ammonia, chromic acid, and ammonia. When printing exposure has been sufficiently long, plate is carefully washed. Parts not affected by light are washed away. Printed parts of coating which remain are dyed to bring out design clearly. Next step is to guard design from acid with which the plate will be bitten. Fish glue is burnt over bunsen burner till it becomes deep brown and is impervious to water. Back of plate is then coated with shellac varnish to protect it from acid. Plate then wiped with roller and immersed in water, then rubbed with sponge; all soluble portions rubbed away; design left protected by ink. Next plate is etched: if zinc, by weak nitric acid; if copper, by perchloride of lime. This now usually done by machine which forces liquid against plate; after etching is complete, plate is ready for printing.

(2) *Half-tone.*—The only difference mechanically between line-etching and half-tone lies in the use of the screen in the latter process. A half-tone screen is a thick plate of glass ruled vertically and horizontally with very fine black lines varying from 50 to 400 to the inch. The light reflected from the subject on the screen has to work its way through this screen before it reaches the negative. Let us take a single square of the half-tone screen and see its effect. Even the faintest light will at once penetrate through the very centre of the square, and will make a small dot on the negative. If a little more light strikes the particular square, the dot will be enlarged. Still more light, and it will mark the negative to the very edge of the square, and will even eat its way under the single lines at the sides. By this time the only spots on the negative not affected by light will be those guarded by the thick crossings of the lines on the screen, and the stronger the light the smaller these spots will be. Where the reflected light is very bright the negative will be almost black. In printing from

the negative on the sensitized zinc plate, the blacks of the negative will be represented by whites on the zinc, and vice versa.

There are many other slightly differing processes for producing the same result, but all are founded more or less on the same principle. In what is known as



Enlarged Portions of half-tone Print, showing light, medium, and dark tints.

Photogravure an intaglio of the subject is formed on the copper itself. The finished plate presents a roughened surface all over, consisting of minute cavities holding more or less ink. Fine photogravures are printed in a hand-press, the paper being pressed against the plate by a thick blanket. The photogravure process has recently been applied to the production of picture paper illustrations by means of a special rotary machine.

Three-colour Work.—The printing surfaces for three-colour work are mechanically made in the same way as half-tone blocks, except that they require repeated etchings of certain parts to correct the imperfections of the present method. By means of coloured screens, or light-*filters*, three separate negatives of the subject are taken, reproducing the colour values of the yellow, red, and blue rays respectively. The colours of the filters generally used are: for the yellow printing block, blue; for the blue printing block, strong red; for the red printing block, green. The yellow and red negatives are made easily with comparatively short exposures, but the blue requires a long exposure. The yellow forms the groundwork of the finished reproduction; on it is printed the red, and on the red the blue. The success of the process depends greatly on the printing, as the wrong amount of pressure on any block or any part of the block may entirely alter the colour desired. Great care must also be taken to get the three colours exactly in register. Many very fine examples of the process have been produced, in which every touch of the brush is faithfully reproduced. The invention of the three-colour process has greatly simplified and cheapened the reproduction of paintings.

Procida. (1) Volcanic island, Italy, w. of Gulf of Naples (40°

56′ N., 14° 2′ E.), 2 m. from mainland; wine, fruit, fishing. Pop. 15,000. (2) Tn., on E. coast of island; castle. Pop. 3,700.

Procter, BRYAN WALLER (1787-1874), Eng. poet and biographer; metropolitan commissioner of lunacy (1832–61); pseudonym 'Barry Cornwall'; wrote *Dramatic Scenes, Mirandola: a Play,* etc., memoirs of Edward Kean and of Charles Lamb, also *English Songs;* best as a song-writer.

Proctor, a shortened form of PROCURATOR, meaning one who acts on behalf of another. In the law courts solicitors have taken the place of proctors (who formerly were officers in eccles. courts), but the king's proctor survives in England and Wales to intervene in divorce cases, and prevent a decree being made absolute when collusion or concealment of facts has taken place. Proctors at the universities have powers of discipline over undergraduates.

Proctor, RICHARD ANTHONY (1837–88), Brit. astronomer; founder of *Knowledge* (1881); author of *Saturn and his System, Old and New Astronomy,* popular treatises, *Half-hours with a Telescope, Other Worlds than Ours,* etc.; also of *How to Play Whist.*

Procurator Fiscal is, in Scotland, an officer appointed by the lord advocate (since 1907) to inquire into all cases of reported crime, and, if he finds sufficient evidence, to obtain the arrest and ensure the trial of the accused before the proper court. His sanction must be given to all criminal proceedings, and he receives payment of all fines.

Procyon. See under RACCOON FAMILY.

Producer Gas, a gaseous fuel made by forcing air through a bed of incandescent coke or coal, in specially constructed furnaces termed producers; the resulting gas contains about 30 per cent. of carbon monoxide (CO) as heat constituent, in addition to about 63 per cent. of nitrogen from the air, and a little carbon dioxide, which reduce its calorific intensity. It is extensively used as fuel because of its cheapness, cleanliness, and regularity of temperature.

Profiteering, term popularly applied to the exaction of excessive profits, which aroused great outcry during and after the Great War, when the peculiar circumstances created what was in many instances a virtual monopoly. Cases of excessive profiteering were so glaring that legislation on the lines of what existed before 1844, when 'to engross' the market was a crime, became necessary, and an Act was passed repressing it (Aug. 1919). Tribunals were established to examine into specific charges, but they were popularly regarded as ineffective. See PRICE.

Profit-sharing. See CO-PARTNERSHIP IN INDUSTRY.

Progression (in maths.). See SERIES.

Prohibition. See LICENSING LAWS; TEMPERANCE.

Projectiles. A knowledge of the laws of flight of projectiles is the basis of gunnery, and is the subject of the science of *ballistics* (from Gr. *ballo,* 'throw'). The projectile is the thing thrown: its path, the trajectory. Considering only the action of gravity, acting vertically down-

wards, and of the driving force that impels the projectile, the trajectory is a parabola, the path to the highest point being exactly reproduced on the opposite side of the origin. But under the resistance of air the trajectory loses its symmetry, the descent from the highest point being sharper than the path to it. The resistance depends on the velocity, shape, size, and mass of the projectile.

The earliest authority on projectiles was Tartaglia in *Nova Scientia* (1537); Galileo followed, but neglected the resistance of the air, and, indeed, this governing factor was not accurately investigated until 1864, when the Rev. F. Basforth commenced to measure the resistances experimentally over long ranges. For velocities lower than 1,000 ft. and above 1,300 per second, the resistance, as Newton deduced, varies as the square of the velocity; but between these limits the resistance is very much higher. With projectiles of the same shape the resistance varies as the square of the diameter, but inversely with the weight.

The velocity of shot had been measured as early as 1742 by the *ballistic pendulum* of B. Robins, and nearly a century passed before the invention was superseded (see CHRONOGRAPH). The science is now so complete that time of flight, elevation, and penetration (factors included in tables drawn up for every weapon) can be computed as well as the charge, size of chamber, shape of projectile, length and thickness of weapon.

The part of ballistics which treats of the gun's properties is called *interior ballistics*. It has for its problems the pressure of the explosive gas and the strains produced in the gun. From one point of view the gun is merely a heat engine (see ENGINE), the cycle of operation being completed in a single stroke. Its problem is therefore the general one of THERMO-DYNAMICS. The pressures inside the gun bore were discovered by accurate experiments, and the first were carried out by Robins. Among the advantages of modern explosive charges, as compared with the abandoned black gunpowder, are the evolution of greater volumes of gas at an increased pressure and temperature. The charges are therefore smaller. Cordite is used in Brit. artillery and small arms.

Ingalls, *Exterior and Interior Ballistics*; Lessak, *Ordnance and Gunnery*.

Projection. If all the points of any figure be joined to any fixed point in space (O), the joining lines form a cone with O as *vertex*. The section of this cone by any plane gives a figure called the *projection* of the given figure. The plane cutting the cone is called the *plane of projection*. Different positions of the vertex give rise to different types of projection: (1) *Orthographic projection*—vertex is infinitely distant, so that projecting rays are parallel. (2) *Orthogonal projection*—rays parallel and perpendicular to plane of projection. (3) *Projections of Sphere* (of great importance in map-making)—(*a*) *Stereographic projection*, vertex on surface of sphere; plane of

projection is perpendicular to diameter through vertex; (*b*) *Globular projection*, vertex is at distance $\sqrt{2}$ × radius from surface; plane of projection is perpendicular to diameter through vertex; (*c*) simple and modified conic projection, where projection is orthogonal on the surface of a cone which envelops the hemisphere; (*d*) in *Mollweide's equal area projection*, which is not a true projection, the spherical map

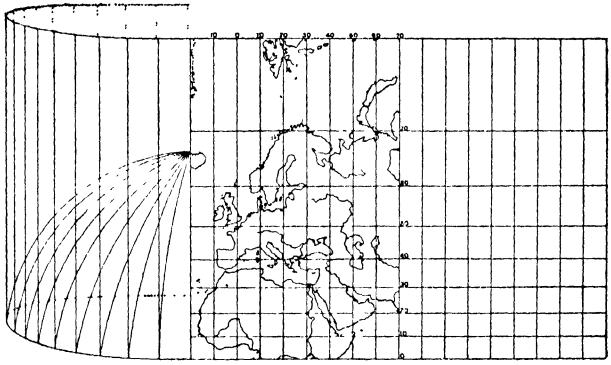


Diagram illustrating Mercator's Projection.

is represented on an ellipse whose axes are respectively $2r\sqrt{2}$ and $r\sqrt{2}$, (where r is radius of sphere). The area of the ellipse is, therefore, $4\pi r^2$, the same as the area of the surface of the sphere; (*e*) *Mercator's projection* is, likewise, not a true projection; in this case the surface of the sphere might be said to be projected on a cylinder touching it at the equator, the cylinder being afterwards unrolled. See also GEOMETRY.

Prome, chief tn., Prome dist., Lower Burma (18° 43′ N., 95° 15′ E.), on l. bk. of Irawadi, 155 m. N.N.W. of Rangoon; silk, cotton, rice, and sugar; ornamental woodwork. Pop. 27,000.

Prometheus (Gr. myth.), one of the Titans, brother of Atlas and Epimetheus; is represented as helping men against Zeus and teaching the arts; brought fire to mortals, and as punishment was chained to Mt. Caucasus, where an eagle by day devoured his liver, which grew again by night; delivered by Heracles; subject of many legends (see Hesiod's *Works and Days* and Æschylus's *Prometheus Bound*).

Promissory Note is an unconditional promise in writing signed by the maker, whereby he engages to pay on demand, or at a fixed or determinable future time, a certain sum in money to or to the order of a specified person, or to bearer. An instrument payable to the maker's order does

not become a promissory note until it is endorsed by the maker. A promissory note is inchoate and incomplete until delivery thereof to the payee or bearer.

Prongbuck. See ANTILOCAPRA.

Propaganda, WAR. As a means of aiding the cause of a belligerent, propaganda in an organized and directive form is of modern growth. It was practised by the Germans in the Franco-German War, with the effect that opinion in other countries was for the time being largely misled or confused, and in the Great War they employed it in a much more systematic and bold manner. They hoodwinked their own people as to the real character of the war, and their propaganda was not without effect abroad, especially in America. It was based, however, on the assumption of a short war; it was reckless in telling untruths and half-truths; and as the war proceeded its effect gradually diminished. At first the Allied governments made but feeble efforts to counter Ger. propaganda. It was only in the later stages of the struggle that the potency of this novel weapon of warfare was fully realized. In Feb. 1918 a dep. was created at Crewe House, London, under Lord Northcliffe, to undertake a definite campaign of propaganda in enemy countries with a view to making the truth known there. A line of policy was laid down, and it was supported by statements that were truthful and consistent one with another. Care was also taken to conceal as far as possible the propagandist purpose of the statements, as well as their origin and means of transmission. The turn of the tide of war in favour of the Allies made the enemy more responsive to outside influence of this character, and the Ger. leaders have testified to the effectiveness of the campaign. The propaganda was directed first against Austria-Hungary. A polyglot printing press was acquired, and a weekly journal was pub. in the Czech, Polish, Southern Slav, and Rumanian languages. Issues of this journal, along with leaflet manifestoes, were dropped behind the Austro-Hungarian lines, and even in Vienna itself, by means of aeroplanes. Patrols composed of deserters from the subject nationalities were also useful in the work of distribution among the troops. Gramophone records of Czecho-Slovak and Southern Slav songs were played in 'No Man's Land,' where the words and music could be heard in the enemy's trenches. The Ger. campaign was hampered by the Brit. military decision that aeroplanes were not to be used as a distributing agency because the Germans had threatened to punish airmen caught performing such duties. Other devices were, however, brought into action. Hand and rifle grenades were used in showering leaflets among the enemy troops; trench mortars were made to serve a similar purpose; and, after experiments, specially adapted small balloons were employed, fitted with a time fuse which automatically released the leaflets at a calculated time and place. Subsequently the military objection to the use of the aeroplane for this purpose

was withdrawn, and millions of leaflets were scattered over a large part of Germany. In addition to leaflets containing news of Allied successes, illustrated with shaded maps and diagrams, a 'trench newspaper' was prepared in a style which exactly resembled a Ger. publication, with a head of the Kaiser as title decoration. From 250,000 to 500,000 copies of each weekly issue were distributed. Religious pamphlets were also used, one of which expatiated on the text, 'Be sure your sin will find you out.' Besides, numerous leaflets were smuggled into Germany by devious methods. Operations were also undertaken against Bulgaria, and the activities of the Allies were carefully co-ordinated. Undoubtedly the propaganda campaign was instrumental in helping on the Allied victory.

Sir Campbell Stuart, *Secrets of Crewe House* (1920).

Propertius, SEXTUS (*fl.* 28–15 B.C.), Roman elegiac poet; belonged to the literary circle of Mæcenas, friend of Virgil and Ovid; four books of his verse extant, mainly tone-poems to one 'Cynthia'; best-known describes the appearance of Cynthia's ghost to the poet.

Property. See INHERITANCE.

Prophet. The Heb. terms for 'prophet' mean one who speaks from God, with the idea that he is possessed by a supernatural power. At the beginning he was regarded as endowed with the gift of prediction. In the times of Samuel, Elijah, and Elisha there were 'schools of the prophets,' where the gift could be nurtured and directed: but from the 8th cent. onwards the prophet received his call and equipment direct from God. 'Literary prophets' were those whose utterances were committed to writing. Like certain of their predecessors, they appeared at critical junctures in the history of their country, and spoke to the people 'of righteousness, temperance, and judgment to come,' as well as of the ultimate triumph of the Divine purpose among the nations.

Propithecus. See SIFAKAS.

Proportional Representation is an electoral device suggested for the rectification of a glaring flaw in the ordinary methods of political election. In countries where the ordinary methods obtain, a substantial minority of voters may only elect a contemptible minority of members, and may in practice be tyrannized over. Some 300 devices have been suggested for remedying this evil, and to these the general term 'proportional representation' has been applied. They are practised in Portugal, Spain, Japan, Belgium, Sweden, Australia, and other countries. One of the most effective methods is that known as the 'cumulative vote.' Each elector is given as many votes as there are numbers to be elected, but he may allot them as he pleases. Organized minorities, by massing their votes, thereby secure the election of at least some members favourable to their views. Still another term is the 'transferable' (or alternative) vote. By this device an elector can indicate on his ballot paper not only his first choice, but also his second or third, etc.

A certain number, known as the 'quota,' is sufficient to secure election. At the first count first choices only are reckoned, and those candidates who have received a 'quota' or more are duly elected. If all the seats have not then been filled up, the surplus votes of those candidates who have received more than the 'quota' are transferred according to the names marked (2) on them. If these transfers still do not bring the requisite number of candidates up to the 'quota,' the lowest candidate is eliminated and his votes transferred according to the next preferences, and so on till all the seats are filled. This plan, which has been adopted successfully in Irish munic. and Scot. Education Authority elections, has received a growing amount of support in recent years.

Prorogation. See under PARLIAMENT.

Proscription, term applied, chiefly in Roman history, to the banishment or condemning of citizens to death as public enemies and confiscating their goods—*e.g.*, the celebrated proscription of Sulla, *c.* 82 B.C., and that by the second triumvirate, 43 B.C.

Proserpine (called by the Greeks *Persephone*), daughter of Zeus and Demeter · was snatched away by Pluto, king of the underworld; her mother, in her grief, forbade the earth to bring forth, and the crops ceased, until Zeus interceded with Pluto, and Persephone was set free under a promise that thenceforward she should spend half the year in the land of the living, and the other half with Pluto among the dead; an allegory of spring and autumn.

Proskurov, or PLOSKUROV, tn., Podolia, Ukraine (49° 25′ N., 27° E.), 56 m. N. by E. of Kamenets-Podolsk, on S. Bug; bishop's see; cathedral with famous 'Virgin'; oil works, brick kilns, potteries, copper foundries, candle factories. Pop. 23,000.

Prosody, the art of versification. Terms used are: *verse*, line of poetry; *stanza*, set of verses 'standing' together; *foot*, a single syllable, or a group of syllables; *accent*, stress of voice on syllable; *quantity*, time occupied in pronouncing a syllable, essential in class., not in Eng. prosody; *scansion*, act of counting feet in a verse; *metre*, measure of a verse; *alliteration*, recurrence of an initial sound in a verse.

Common feet in Eng. prosody are *iambus* (⏑–), *trochee* (–⏑), *spondee* (––), *dactyl* (–⏑⏑), *anapæst* (⏑⏑–).

See under CÆSURA; COUPLET; SONNET.

Prossnitz, tn., Moravia, Czecho-Slovakia (49° 29′ N., 17° 7′ E.), 32 m. N.E. of Brünn; clothing, shoes, agricultural implements, beer; geese largely reared. Pop. 30,000.

Prostitution may be defined as promiscuous fornication for the sake of gain. It is not to be confounded with *concubinage* or *adultery*, for the concubine may be the lawful, though unmarried, wife of a bigamous or polygamous husband; and adultery being the violation of marriage, requires that one at least of the offending parties shall be married.

In Continental countries, prostitution, though forbidden, is tolerated by law, and its control is left in the hands of the police.

Women are accordingly registered, and are required to live in certain houses and to be subject to medical examination. In Great Britain there is no recognition by law, and houses utilized for prostitution—houses of ill fame, or disorderly houses—are not permitted (by law) to exist. Neither is the prostitute allowed by law to solicit. In spite of the law, houses of ill fame abound, and thousands of prostitutes ply their trade in Brit. cities. The Criminal Law Amendment Act, 1912, aims at suppressing some of the worst features of what is known as the *white slave traffic* (procuring of girls for purposes of prostitution).

W. F. Amos, *State Regulation of Vice : The Social Evil* (1907).

Protagoras. See SOPHISTS.

Proteaceæ, natural order of shrubs and trees of W. Africa and Australia ; includes Banksia.

Protection. See FREE TRADE ; TARIFF REFORM.

Protective Coloration and Resemblance, schemes of colouring or peculiarities of shape which tend to render animals inconspicuous in their natural surroundings, and thus protect them from the observation of their enemies. This aspect of evolution is exceedingly common, and is all but universal among birds and fishes, the paler under parts of the former and silvery bellies of the latter counteracting the effect of the shadow cast by strong overhead light and merging the body as a whole into the monotone of an average background. Or there may be more patent general resemblances to environment, such as the tawny tints assumed by many desert animals; the greens of many arboreal forms, such as tree-frogs, tree-snakes, and parrots; the blue transparencies of pelagic organisms, or the varying coats of Arctic creatures such as the mountain hare, the Arctic fox, the stoat, the ermine, and the ptarmigan, which change to white when snow covers the ground. Again, more particular resemblances to immediate environment are frequent, most common of these being the colour changes which many creatures—*e.g.*, some shrimps, the octopus, plaice, trout, the chameleon, and several other lizards—undergo as they pass from one set of colour surroundings to another. See also MIMICRY.

Protectorate, a country which, as regards its foreign relations, is under the exclusive control of the sovereign of another power, so that its government cannot hold direct communication with any other foreign power. The protectorates of the Brit. Empire include Brit. Central Africa, Brit. E. Africa (Kenya), Uganda, and Nigeria. In a few of them chartered companies have done their work; in others, however, such as N. Borneo, they are still at work. The mandatory system has introduced a new form of protectorate. See under MANDATE.

Protein. See DIETETICS.

Proteomyxa, minute animals, parasitic in living organisms, or saprophytic, included in a suborder of Amœba, an order of primitive Protozoa. It comprises elemental forms which reproduce only by simple division, such as

Protogenes, a marine creature found in the Mediterranean, 0·1 to 0·2 mm. in diameter, with fine pseudopodial rays which seize protozoa or diatoms for food; or more complicated forms, which form cysts from which amœboid individuals issue, such as *Vampyrella*, which inhabits the sea or fresh water, living on and penetrating algæ, furnished with fine direct pseudopodial rays. It measures 0·5 to 0·7 mm. *Proteomyxa* belongs to a still more advanced type, for the cysts to which it gives rise produce minute flagellated individuals which later become amœboid. For an amœba, *Proteomyxa* is large—1 mm. across; it is furnished with many much-branched pseudopodia and lives in the sea.

Protestant, name given to Reformed Churches in distinction to the R.C. Church. Luther and his followers 'protested' against the decree passed at the second Diet of Spires (1529). The Church of England is called Protestant, but many of its members repudiate the term.

Protestant Episcopal Church, a title officially adopted by the Anglican communion in America (1780). The liturgy is practically the same as that of the Church of England, with certain slight alterations in the Book of Common Prayer, and a Communion Office which is akin to the Scot. Office. The Church is governed by a house of bishops and a house of clerical and lay deputies, in which each diocese is represented by four clerical and four lay deputies. There are 18 divinity schools, 7 colleges, and over 100 academies directly or indirectly affiliated with the Church. There are 5,704 clergy, including 98 bishops, 8,200 churches, and over a million communicants.

Proteus (Gr. myth.), 'the old man of the sea,' tender of the flocks—the seals—of Poseidon; had prophetic powers, but hated prophesying, and to escape an inquirer assumed various forms. When caught he resumed his true form and prophesied.

Proteus, a blind, newt-like amphibian, sometimes a foot in length, found in limestone water caves of Carinthia and Dalmatia.

Prothero, GEORGE WALTER (1848–), British historian; prof. of history, Edinburgh Univ. (1894–9); Rede lecturer at Cambridge (1903) and Chichele lecturer at Oxford (1915); director of Historical Section, Foreign Office (1918–19); member of the British Peace Delegation (1919). Works include *Life and Times of Simon de Montfort* (1877), *Memoir of Henry Bradshaw* (1889), *Select Statutes and other Documents bearing on Reigns of Elizabeth and James I.* (1894), *German Policy before the War* (1916); editor of the *Quarterly Review*.

Protobranchia. See LAMELLIBRANCHIATA.

Protogenes. See PROTEOMYXA.

Protomyxa. See PROTEOMYXA.

Protoplasm is the living matter of organic things, plants, or animals. It is contained in cells which in animals may be naked or bounded by a delicate membrane, and in plants have strong walls of cellulose. To the naked eye and under a microscope of moderate magnifying power protoplasm in its simplest known state,

cytoplasm, appears to be a homogeneous, transparent, semi-fluid substance; but high magnification and the use of suitable staining materials reveal a complicated structure. This appears to differ in different cells and at different times, but in general it is fibrillar—interspersed with minute filaments of denser material; reticular—with a meshwork of delicate threads; granular—with exceedingly minute particles scattered in the substance; or alveolar—with a foam-like structure of liquid containing vacuoles round which the protoplasm streams.

The chemical composition of protoplasm is complicated, for it contains albumins, fats, alcohols, compounds of iron, as well as phosphates of sodium, potassium, magnesium, and calcium. Protoplasm, besides forming cytoplasm, builds the nucleus and other ingredients of a cell, the unit of organic structure.

Protopopoff (*d.* 1918), Russian minister of state; quitted army on coming into a fortune; displaying liberal tendencies, became provincial delegate of the Zemstvo and marshal of nobility for one of the Volga provinces. Elected to the Duma, he was appointed vice-president of the fourth Duma, thanks to the support of the 'Octobrists.' In the spring of 1915 he visited the Allied countries, and it is said that he entered into relations with a Ger. agent in one of the Scandinavian capitals. Soon after his return his appointment as minister of the interior was welcomed as giving hopes of a more liberal régime; but his rigorous enforcement of the censorship and his arbitrary handling of the supply problem made him hated, and fomented the troubles caused by shortage of food. He became the leader of the reactionaries, and deliberately provoked the disturbances in Petrograd which led to the revolution. Arrested under the Provisional government, his trial began in July 1918, and he was shot in the following September.

Prototheria. See MAMMALS.

Protozoa (Gr. *protos*, 'first'; *zoon*, 'an animal'), the simplest animals; the most primitive of all animals, standing with the simplest plants (*Protophyta*) at the base of the tree of life. They are to be distinguished from other animals by the simplicity of their structure, for as a rule they consist of a single cell or bead of jelly-like protoplasm; even where many single cells are united into a colony, as in *Volvox*, each cell is similar to its neighbours and is more or less independent of them —a congregation very different from the tissues of cells which make up the bodies of other animals. So simple, however, is the structure of Protozoa that it is almost impossible to distinguish them from the simplest plants.

The single usually microscopic cell of a protozoon consists essentially of a body-mass of protoplasm-cytoplasm, containing one or more nuclei, contractile vacuoles which eject waste products, food vacuoles with digestive ferments, and many small granules in the cell substance. So the cell is complete in itself, possessing the powers of life, of growth, and of reproducing its like; for

when it has reached its maximum of size the cell splits into two (in *Amœba* the entire process lasts only 15 minutes), and each daughter cell is a new individual. In some higher forms, such as *Paramœcium*, a sort of conjugation and interchange of nuclear material takes place previous to division, a primitive sexual union; while in others, such as the Mycetozoa and Sporozoa, spore formation is the rule.

Even within the limits of a single cell there is much room for variation. Some forms have naked bodies, others have a rind of tougher protoplasm; some have skeletons of lime or silica, others build for themselves protecting shells of similar materials, of chitin, or of diatom valves and other debris. The simplest Protozoa merely crawl over the substratum by a flowing motion of their bodies, which project into finger-like processes of pseudopodia; but others swim or glide with ease and rapidity by the action of one or a few whip-like filaments or flagella, or by the rhythmical movement of hundreds or thousands of cilia. Besides being used for locomotion, the cilia also serve the purpose of wafting food particles to the 'mouth,' as in the case of a large variety of types included in the group Ciliata.

Protozoa are found all the world over. Some occur in fresh-water pools, many in the sea, and such feed upon bacteria, diatoms, or even upon Protozoa more minute than themselves. Others live upon decaying vegetation, absorbing the organic solutions resulting from the breaking down of tissues, while a few contain coloured grains (*chromatophores*, or *chromoplasts*), by the aid of which they can, like plants, utilize sunlight for the decomposition of carbon dioxide into usable substances. But many are parasitic, living in the bodies of larger animals, and even of man, feeding upon the ready prepared substances in which they lie, and so occasionally interfering with the health of their hosts, and sometimes causing death.

Apart from their relation to disease (see especially under TRYPANOSOMES and SPOROZOA) Protozoa have little apparent economic significance. The Infusorians and Mastigophora, or Flagellates, however, purify waters by their destruction and assimilation of harmful bacteria, while the Foraminifera and Radiolaria of past ages have contributed to the building of great formations of limestone and chert.

The Phylum Protozoa is divided into four classes:

Class I. *Sarcodina*, with naked bodies, which feed and move by means of indeterminate, changing lobes or threads (pseudopodia).

Class II. *Mastigophora*, or *Flagellata*, with bodies naked or having a definite rind, which feed and move by whip-like filaments or flagella.

Class III. *Sporozoa*, with bodies having definite rind, but without feeding or motile organs in the adult.

Class IV. *Infusoria*, with bodies having definite rind, which feed and move by means of numerous close-set short filaments or cilia.

Proudhon, PIERRE JOSEPH (1809-65), Fr. Socialistic writer

and politician; pub. *Qu'est-ce que la Propriété* (1840); founded paper, *Représentant du Peuple* (1847); imprisoned for attacks on government (1849); held that society should rest on a basis of equality and reciprocity of service; followers called Mutualists. See a selection of his writings in *Morale et Politique* (Nelson's Edition Lutetia).

Provence, anc. prov., S.E. corner of France (43° 40′ N., 5° 30′ E.), now forming deps. Bouches-du-Rhône, Var, Basses-Alpes, and E. part of Vaucluse. Earliest inhabitants were Iberians and Ligurians; *c.* 600 B.C. the Gr. colony of Massalia (Marseilles) is said to have been founded; Romans entered Gaul *c.* 125 B.C. founded *Provincia Romana*, with Aix as cap.; after Cæsar's conquest of Gaul, in 50 B.C., Arles became leading town; Provence was attacked by Visigoths and Burgundians in 5th cent., and in 8th cent. by Arabs from Spain; two centuries later region was overrun by Saracens; country was ruled by counts of Provence; in 1245 it passed into hands of Charles of Anjou, King of Naples, and was joined to France in 1486, under Charles XIII. District is remarkably rich in Roman and mediæval remains, finest being at Aix, Arles, Avignon, Nîmes, and Orange.

Provençal Language and Literature.—Provençal is the language which was spoken in France S. of the Loire during earlier Middle Ages. It was called *Langue d'Oc*, and was spoken also in Catalonia, joined to Provence under Raymond Bérenger (1092). The literature of the *Langue d'Oc* was very different from that of the *Langue d'Oil*, because Roman civilization had left a deeper mark, and Ger. and Norman invasions were less felt. Roman learning revived in Toulouse, Bordeaux, Narbonne, and Arles; S. France (the E. part under the counts of Toulouse and the W. under the kings of England) enjoyed for many centuries more peaceful government than N. France; mild climate and frequent intercourse with Moors of Spain contributed to give the *Langue d'Oc* its harmony and colour, to which the name of *gaye science* or *gay savoir* is due. Poets of the north were called *Trouvères*, the Provençal poets *Troubadours* (*robar*, 'to find,' 'invent'). They were often nobles, even kings, sometimes poor vassals. Their chief subjects were love in all its phases, the joys of home, war, and sometimes personal satire; they composed *cansos* (songs), *pastourelles*, *tensos* (poetical dialogues), and *sirventes* (satires). Some troubadours went from castle to castle; they wore many-coloured dresses, and carried a guitar or other musical instrument.

None of those poets left masterpieces, therefore the *Langue d'Oc* could not become a literary language. Soon the religious war of the Albigenses broke out; North seized the opportunity to attack South; Raymond, Count of Toulouse, was defeated and all the country sacked; the troubadours disappeared and Provençal poetry ceased. In 1323 Toulouse made an attempt to recall it to life by instituting the *Jeux floraux*.

In the 17th cent. the *Jeux floraux* formed an academy which exists to this day. It takes its name from flowers distributed to the laureates. This presentation, called *fête des fleurs*, takes place at Toulouse, May 3.

Towards the middle of the 19th cent. there was a renaissance of Provençal language and poetry, under the association called *Félibriges*, its members being the *Félibres*. The first impulse was given by Jasmine; founded (1854) by Mistral (1830–1914), Roumanille (1818–91), Anselme Mathieu, Théodore Aubanel (1829–86), and others.

Cook, *Old Provence* (1905); Hallays, *Provence* (1912); and Daudet's novels generally.

Proverbs, Book of, a collection of Heb. didactic poetry, of varied character and date, which was brought together between 400 and 300 B.C. The book forms an important part of the 'Wisdom' literature of the O.T., and concerns itself for the most part with the advancement of integrity and purity in thought and action, several things being taken for granted, such as the existence of God, man's responsibility, the happiness of the good, and the punishment of the bad. A high ideal of life is presented. The book falls into the following sections: (1) Ch. 1–9, in praise of wisdom—this bears the stamp of one author, and is hortatory rather than proverbial in character; (2) 10–22 : 16, proverbs of Solomon and probably the original nucleus of the book; (3) 22 : 17–24 : 22, the words of the wise or professional sages; (4) 24 : 23–34, an appendix to (3); (5) 25–29, proverbs of Solomon which the men of Hezekiah copied; (6) the appendix, containing the words of Agur and those of Lemuel.

Peronne, in *Cambridge Bible*; Martin, in *Century Bible*.

Providence, cap. Rhode I., second city in New England, U.S. (41° 47′ N., 71° 27′ W.), 35 m. from Atlantic and 44 m. S.W. of Boston, on Providence R. (navigable arm of Narragansett Bay; built on hilly ground, and less regularly laid out than most Amer. cities; fine public buildings, including state house (1900), Brown Univ., Federal government building, and Union ry. station; statues; eighteen parks (530 ac.); public and Athenæum libraries; hospitals; R.C. and Prot. Episc. bishoprics; R.C. cathedral and other noteworthy churches; many educational institutions. Formerly important seaport; now more important as industrial centre; foundry and machine-shop products; woollen and worsted goods; jewellery; silverware, etc. Pop. 198,600.

Provisional Orders, orders made by certain government departments which require confirmation by Parliament. Usually dep. concerned is petitioned; local inquiry held, and if case made out order made and scheduled to a Provisional Orders Confirmation Bill, which is introduced as a public bill brought in by government dep. making the order. After second reading bill goes to select committee as in case of private bill; the same procedure. The Private Legislation Procedure (Scotland) Act, 1899, greatly extended the system. Persons in

Scotland desiring parl. powers such as are contained in private bills, present petition for provisional order to secretary for Scotland. Copy of draft order considered by Chairman of Committees of House of Lords and Chairman of Ways and Means in Commons. If they report that bill does not raise any question of policy or principle which ought to be dealt with by private bill, an order is issued, usually after inquiry and report by commissioners. If order is made, confirming bill is introduced which goes before (if opposed) joint committee of both Houses. The act does not apply to estate bills.

Provost, anc. title of certain eccles. and secular officers. It survives in Scotland, where the principal magistrate of a royal burgh (corresponding to the Eng. *mayor*) is called a provost or (in the case of Edinburgh, Glasgow, Aberdeen, Perth, and Dundee) 'lord provost.' The governing officer of certain univ. colleges, notably Oriel, Queen's, and Worcester at Oxford, King's at Cambridge, and Trinity, Dublin, is also called provost.

Provost-marshal, in the army, an officer who acts as head of the police in a town or district or camp, to repress offences committed by soldiers, to arrest offenders, and to carry out decrees of courts-martial.

Proxy, voting by representation. The authority to vote for another and the person who exercises that authority are both called the proxy. Its commonest use is at meetings of companies under Companies Acts. Act of 1908 prescribes form of instrument appointing a proxy. Creditors of a bankrupt may vote by proxy. In certain cases the parl. vote may thus be exercised—in the case of naval and military voters in distant places, merchant seamen, pilots, and fishermen. Members of House of Lords (but not of Commons) *may* vote by proxy, but practice has been discontinued since 1868. Electors of Scot. representative peers may vote by proxy.

Prudnik. See NEUSTADT.

Pruning, removal of branches from fruit trees, so as to improve fruit supply, or from hedges, etc., for ornamental purposes, and to stimulate the development of dormant buds and so improve lower parts of hedges. *Winter pruning* is done in Jan. or Feb., and the spur left must have one or two buds. Red currant bears fruit on old branches; black currant and gooseberry on young shoots; raspberry old wood is cut away. Cherry, holly, ivy may be pruned in summer. When pruning fails, root-pruning may be tried.

Prussia, republic of Ger. Empire (50°–55° N., 6°–22° 50′ E.); mainly situated in great N. Ger. plain; bounded N. by North Sea, Denmark, and Baltic; W. by Holland, Belgium, Luxemburg, and France; S. by Bavaria, Saxony, and Czecho-Slovakia; E. by Poland. Prussia contains thirteen provinces: W. Prussia, E. Prussia (detached), Silesia, Pomerania, Posen, Brandenburg, Saxony, Schleswig-Holstein with Heligoland, Hanover, Westphalia, Rhineland, Hesse-Nassau, Hohenzollern. Large parts of Posen, E. and W. Prussia, have been ab-

sorbed into Poland; part of W. Prussia into Free City of DANZIG; part of Schleswig has reverted to Denmark; part of Rhineland given to Belgium, Plebiscite areas remain in E. Prussia and Silesia. Seaboard is *c.* 900 m.—750 on Baltic, rest on North Sea. Baltic islands are Rügen, Fehmarn, Usedom, Wollin; FRISIAN ISLANDS in North Sea.

Surface is generally level; large stretches of moorland (Lüneburger Heide, in Hanover), sandy plains (Brandenburg), and marshland along coast. Mountains lie in s. and s.w.; Riesengebirge (with Schneekoppe, 5,255 ft.), in Silesia; Harz Mts. (with Brocken, 3,750 ft.), in province of Saxony; Hunsrück, Taunus, Eifel, Westerwald, etc., in Rhineland; and other ranges. The principal rivers are: Rhine, Weser, Elbe, Oder, Havel, Saale, Ems, Pregel; many navigable and linked by canals; Kiel Canal zone is under League of Nations; numerous lakes, especially in Pomerania, W. and E. Prussia; vast lagoons on coast—Kurisches Haff, Frische Haff, and Stettiner Haff. Climate generally healthy; N.E. much exposed and coldest; ann. mean temp. of Berlin, 48° F.; average ann. rainfall is *c.* 21 in. Extensive forests of fir, spruce, larch, beech, birch, oak, etc., especially in Hesse-Nassau, Brandenburg, and Hohenzollern.

Resources and Industries.—The total railway mileage is 24,763; electrification of lines begun. Republic has important agricultural, mining, and manufacturing industries. Principal products are cereals, beet, hemp, flax, potatoes, hops, oil-seed, live stock, timber, etc.; famous wines m[illegible] in Nassau and Rhineland; va[illegible]able horses bred in E. Prussi[illegible] Prussia is rich in minerals—coal, iron, zinc, copper, lead, cobalt, arsenic, sulphur, nickel, etc.; important mining centres are Westphalia, Silesia, Rhine Province, Harz, Prussian Saxony, Brandenburg, Nassau. Manufactures include textiles, iron and steel goods, leather, glass, china, earthenware, chemicals, musical instruments, paper, etc.; celebrated Krupp works at Essen; extensive breweries and distilleries; valuable salmon, herring, cod, oyster, etc., fisheries; many mineral springs.

Government.—By the Constitution of April 1920 the Prussian Constituent National Assembly is elected for four years by universal vote; ministry, with powers of former king, consists of premier, who is also minister of agriculture, and ministers of interior, justice, public worship, finance, national welfare, railways, and commerce. The principal towns are: Berlin (cap.), Cologne, Breslau, Frankfort-on-Main, Düsseldorf, Hanover, Essen, Magdeburg, Königsberg, Duisburg; Altona, Stettin, Swinemünde, important seaports. Two-thirds of pop. are Prot.; *c.* one-third R.C. Elementary education is compulsory from six to fourteen, and maintained by local taxation and state aid. There are eleven universities, besides five technical high schools, mining, agricultural, forestry, art, music, and other schools. Area, *c.* 103,384 sq. m.; pop. *c.* 32,200.000.

History.—Prussia was erected into a Prot. duchy (1525); in

1618 the Elector of Brandenburg (Hohenzollern house) became the Duke of Prussia. Frederick William (1640–88), the Great Elector, obtained at the Peace of Westphalia the secularized bishoprics, Minden, Kammin, Magdeburg, Halberstadt, and secured Prussian sovereignty by Swedish-Polish War (1655–60). During his reign Prussia became a well-organized state and important military power. His successor, Frederick III. (1688–1713), assumed the title of king (1701) as Frederick I. Frederick William I. (1713–40) was a careful and thrifty monarch; he obtained Guelders and Limburg at Peace of Utrecht, and Swed. Pomerania and Stettin (1720). Frederick II., the Great (1740–86), increased his possessions enormously, annexing greater part of Silesia (without Danzig and Thorn) (1740–2); E. Friesland (1744); received W. Prussia and Netze dist. at the first partition of Poland (1772). His successor, Frederick William II. (1786–97), lost many valuable possessions on Rhine, but gained Slavonic territory at second and third partitions of Poland (1793, 1795). During the reign of Frederick William III. (1797–1840) took place disasters of Jena and Auerstädt, and Napoleon entered Berlin (1806). Prussia lost most of her territory W. of the Elbe, and the greater part of Prussian Poland (1807).

Then began a great national revival, and Prussia shared largely in Napoleon's overthrow at Waterloo (1814). At Congress of Vienna (1815) she regained most of her old possessions W. of Elbe, and part of Saxony, Rügen, Swed. Pomerania, etc. In Frederick William IV.'s reign (1840–61) took place abortive revolution of 1848. Under William I. (1861–88) Bismarck became prime minister (1862). For subsequent history, see GERMAN EMPIRE. For Prussia's part in the Great War, see WAR, THE GREAT. Prussia was proclaimed a republic on Nov. 3, 1918.

Baedeker, *Northern Germany* (1913); Marriott and Robertson, *The Evolution of Prussia* (1915).

Prussian Blue. See under FERROCYANOGEN.

Prussic Acid. See HYDROCYANIC ACID.

Pruth, riv., Rumania, rising on N. side of Carpathians (48° 7′ N., 25° 3′ E.); flows N.E., S.E., S.S.E., and S., and joins Danube below Galatz. Length, *c.* 500 m.; area of basin, 10,700 sq. m. During Great War played an important part in the fighting in Bukovina.

Pryce, RICHARD, Brit. novelist and dramatist. His most recent works include *Christopher* (1911), *David Penstephen* (1915), and *The Statue in the Wood* (1918). Plays: *Little Mrs. Cummin* (comedy), *The Visit* (1909, from stories by Mary E. Mann), *Helen with the High Hand* (from Arnold Bennett's novel), etc.

Przasnysz, vil., Poland (53° 0′ N., 20° 30′ E.), 27 m. N. of Pultusk; centre of roads to Mlawa, Czechanov, Pultusk Ostrolenka, Willenberg, etc. Captured by Germans, but recovered by Russian counter-attack (Dec. 1914); changed hands several times during the war.

Przemysl, tn., Galicia, Poland (49° 47′ N., 22° 47′ E.), on riv. San,

56 m. w. of Lemberg; seat of R.C. and Gr. bishopries; two cathedrals; wood, leather, corn, and linen. Before the Great War the strongest fortress in Galicia; strategically important as railway node on main trunk line connecting Lemberg with Cracow and giving railway access to the Lupkow and Uzsok passes. Russians invested it (Sept. 27, 1914); forced to retire beyond the San; reinforced by Austrians (Oct.); again besieged by Russians (Nov. 1914); after attempts to relieve it, surrendered to Russians (March 22, 1915) with 120,000 prisoners and 1,000 guns. Recaptured by Mackensen after a break-through on the Donajetz (June 2, 1915). Given to Poland with Galicia by Treaty of Versailles. Pop. 54,000 (mostly Poles and Jews).

P.S.A. (PLEASANT SUNDAY AFTERNOON), term used for the movement started by John Blackham of West Bromwich in 1875 to bring men under religious and moral influences. Meetings were held on Sunday afternoons, usually in church premises, although the organization was separate from the Church, and self-governed. Out of this the modern Brotherhood movement sprang. The movement is non-political and non-sectarian, but the great majority of meetings are held in churches. The Brotherhood numbers 2,000 societies, with a membership of 250,000. The aim of the movement is 'to lead men and women into the kingdom of God, to unite in Brotherhoods of mutual help, to win the masses of the people for Jesus Christ, and to encourage the study of social service.'

Psalms, BOOK OF, in the Heb. Bible begins the Hagiographa or Sacred Writings, forming the third part of the Heb. Scriptures. In Hebrew it is called Tehillim (Songs of Praise). Our word psalm means a song or hymn accompanied by a stringed instrument. In the Hebrew the psalms are divided into five books, containing respectively Psalms 1–41, 42–72, 73–89, 90–106, 107–150. Most of the psalms are furnished with one or more titles. Some of these indicate authorship, as, *e.g.*, David, who is credited with seventy-three; Asaph with twelve; Sons of Korah with eleven; Solomon with two; Heman, Ethan, and Moses one each. The titles giving the writers' names are certainly ancient, but in most cases considerably later than the compositions to which they are prefixed. Among the seventy-three attributed to David, there are some the original language of which precludes so early a date, and certain features in others—such as the mention of the temple—speak against the Davidic authorship. Modern scholars give to David forty psalms, some much less. To David, Delitzsch assigns forty-four, Ewald seventeen, and Schultz ten; while Wellhausen, Cheyne, and Duhm doubt whether any extant psalm existed before the Exile. The presumption is strong that several collections existed, and that these were brought together and arranged much in the same way as a modern hymn-book would be compiled, the collection being completed and recognized as authoritative previous to 130 B.C.

Davison and Davies in *Century Bible*; Kirkpatrick in *Cambridge Bible*; Briggs in *International Critical Commentary*; Maclaren in *Expositors' Bible*; M'Fadyen, *The Psalms in Modern Speech*, *Messages of the Psalmists*; Prothero, *Psalms in Human Life*.

Psalterium. See PECORA.

Psaltery. See DULCIMER.

Pseudonym, a pen-name; well-known pseudonyms are Mark Twain (S. L. Clemens), George Eliot (Marian Evans), Lewis Carroll (Rev. C. L. Dodgson), Currer Bell (Charlotte Brontë), Boz (Charles Dickens), Elia (Charles Lamb), Fiona Macleod (William Sharp), Christopher North (Prof. John Wilson), Mark Rutherford (William Hale White).

Psittaciformes. See PARROT TRIBE.

Pskov, PLESKOV, or PLESKAU, cap. Pskov government, N.W. Russia (57° 51′ N., 28° 26′ E.), 171 m. s.s.w. of Petrograd; seat of archbishop; cathedral of the Trinity (1689–98); here the late Tsar learned of his deposition; good educational centre; Kremlin (1138) contains museum of antiquities, law courts, and a convent. Flax raising is almost the only industry. Pop. 36,000.

Psocidæ. See BOOK-LICE.

Psyche (class. myth.), a maiden so beautiful that she awoke the jealousy of Venus, who sent Cupid to inspire her with love for the meanest of men. Instead, Cupid fell in love with her himself, charging her not to inquire who he was. Psyche disobeying, the god left her; they were reunited in Elysium.

Psychiatry is a term which designates the study of the subject of mental diseases in all its departments — causation, classification, symptomatology, treatment. During the last thirty years an enormous amount of work has been done in this branch of med., and to-day all medical students receive special instruction in the subject. Special diplomas in psychiatry are granted by the principal teaching bodies; to Edinburgh Univ. belongs the distinction of being the first Brit. medical school to institute a professorship of psychiatry (1919). Efforts are constantly being made in this country to improve hospitals for the insane by giving special training to the medical officers, increasing their opportunities for research, and adding to their numbers; but such efforts in the majority of cases meet with apathy on the part of governing bodies and government officials. Brit., and especially Scot. mental hospitals, are, however, unsurpassed in their arrangements for the care and comfort of the insane, and particularly in the high standard of training afforded to male and female nurses; the female hospital nurse is employed to a much greater extent than formerly, with a consequent improvement in the recovery rate. Of late years the most important scientific results have been contributed by continental alienists, notably by Sigmund Freud of Vienna and Emil Kraepelin of Munich. Certain schools of psychiatry in the U.S. have a high reputation, and Italy has contributed largely to our systematic knowledge of the subject. At the present time in the U.K.

there are upwards of 700 medical men who are engaged permanently in the mental hospital service. See INSANITY.

Psychical Research is a recent development of scientific or (as some would say) of pseudo-scientific thought. It is concerned with all those phenomena —thought-transference (or telepathy), hypnotism, clairvoyance, crystal-gazing, poltergeists, apparitions, etc.—which are not ordinarily explicable and the occurrence of which is often set down to fancy or superstition. The Society for Psychical Research was founded in 1882, and similar organizations exist in America and elsewhere. Its object was to investigate these phenomena without presuppositions of any kind. It has examined a large mass of evidence, and telepathy at least seems to have been proved. 'Ghosts'—*e.g.*, haunted houses—and automatic writing are psychic phenomena much studied. The receipt of messages by mediums from another world is still open to doubt.

See *Proceedings of Society for Psychical Research;* Myers, *Human Personality and its Survival of Bodily Death;* Podmore, *Studies in Psychical Research.*

Psycho-analysis has come to mean the process by which an investigator is able to discover the mental content of a person. The process is usually applied in order to remove mental trouble that has arisen because of certain combinations of ideas that have been suppressed, and have exercised a deleterious influence in the 'unconsciousness.' Psycho-analysis is usually associated with the name of Prof. Freud of Vienna Univ., and his theory (Freudism) regards human life as a struggle between two principles —the pleasure principle and the reality principle. In life we find it necessary to suppress a great many desires because we have no means of gratifying them. These are driven out of our consciousness, with the result that they gather below the threshold, forming 'complexes' in the unconscious, and often influencing our conduct without our being aware of the origin of the influence. Psycho-analysis is the study of the content of this unconsciousness in ourselves or others

It is very difficult to get at the content of unconsciousness, because an endeavour is always made to prevent the complexes from coming into consciousness, where they may be examined. During sleep the resistance is much less vigorous than during waking hours, and Freud holds that by careful analysis and interpretation of dreams we may get at this content. Skilled psycho-analysts claim that they are able to discover, from an honest account of dreams, the various complexes that thus express themselves in a more or less symbolical way. Apart from dreams, there is the method of psycho-analysis that consists in getting the patient to become quite at his ease in the presence of the investigator, and to allow his mind to wander in reverie, following up whatever ideas occur without exercising any control over them. In this way the analyst is able to gather a great deal without the patient being,

at the time, aware of the information he is communicating.

In the field of criminology more and more attention is now being directed to the subject, and psycho-analysis is proving an important means of investigation.

Freud, *The Interpretation of Dreams* (trans. 1913); O. Pfister, *The Psycho-Analytic Method* (trans. 1917); Bousfield, *Elements of Practical Psycho-Analysis* (1920).

Psychology means by derivation the 'theory of soul.' But the term is not now usually so defined, and is indeed rather ambiguous. Most commonly by psychology is meant an empirical study, scientific—or at any rate on the way to become scientific—in method, of actual mental activities and states. It treats, we may say, of the behaviour of minds, or of the behaviour of living things, so far as that behaviour depends on their exercise of mental activity in any degree. As an empirical study, it deals with mental behaviour as we find it actually occurring in ourselves and believe it actually to occur in others; as a positive study, it does not inquire into the validity of such distinctions as good and bad, true and false, but concerns itself equally with all manner of conduct, considering any act or state not as having logical or moral value, but simply as an event in time whose conditions and consequences need to be assigned; and, finally, as a scientific study, it tries to start from accurate observation and analysis, and to arrive at well-established general principles of mental behaviour.

The whole subject may be divided into departments in a variety of ways. For instance, we may distinguish the investigation of the human from that of the animal mind; abnormal from normal human behaviour: within the latter, study of childhood or of adolescence from that of adult life; again, the study of individual differences, and the study of the behaviour of masses of men and of the characteristics of peoples (*Social Psychology* and *Folk Psychology*). As a rule, when the word psychology is used without any qualification, it refers to the study of the normal human being. Again, attention may be given mainly to the analysis, description, and explanation of a particular stage of mental behaviour, or to the development of mental behaviour; in the latter case we speak of *Genetic Psychology*. *Physiological Psychology* studies the connection between mental and bodily processes.

The psychologist must start, of course, with investigation of the normal adult mind, for until he has learned to reflect on his own activities and states he cannot consider those of other beings with profit. This process of reflection is technically called *Introspection*, a somewhat misleading name. It is fundamental in psychology, but it needs to be supplemented, first by the reports of others concerning the results of their reflection; secondly, by observation of the conduct of others and inference therefrom to the mental processes which occasioned and are occasioned by that conduct; and, thirdly, by examination of such products of mental activity as tools, works of

art, and institutions, from which also we may be able to argue to the character of the activities that produced them. In recent years the use of experiment in psychology has been much extended, so that some speak of it as a special branch of the subject: but it is rather an application, requiring special knowledge and skill, of any of the above methods, or of them all in combination, under conditions which admit of accurate statement and produce more or less accurately measurable results.

The first aim in the investigation of mental behaviour must be to analyze its complexity in such a way as to make description as accurate and simple as possible. Ordinary language embodies a considerable amount of such analysis, when we speak of perceiving, thinking, feeling, desiring, willing, and so on, as so many powers or faculties of mind. But this popular analysis is not very systematic: sometimes it duplicates what is really a single function, sometimes it omits, and sometimes it speaks of a single function where several are involved. Nevertheless, it does imply that mental behaviour involves the activities of a subject which is aware of and acts upon objects, and it is thus superior to any theories which assume that psychology is concerned with 'states of mind' rather than with functions of mind. Yet the reaction against the unsystematic classification of popular thought led to prolonged dominance of mechanical theories of this kind. It was supposed that any concrete 'state of mind' may be exhaustively described by the enumeration of a number of mental elements consisting in it, and the general tendency was to find these elements solely in sensations. External stimulation occasions the simple states of mind known as sensations (of colour, sound, movement, etc.); these may be retained in Mind and revived by Memory ('the mental revival of conscious experience') as less vivid images; and all other states of mind consist of varied combinations of these images, associated together according to a few ascertainable principles.

In more recent years psychologists have generally recognized that mental behaviour is predominantly purposive, not in the sense, of course, that it always makes to the fulfilment of ends consciously forethought and designed—for that would obviously be false of the behaviour of the lower animals and of small children, and indeed of much adult behaviour also—but in the sense that it does nevertheless make towards ends the gradual attainment of which gives satisfaction, whilst obstruction and failure occasion annoyance, anger, or some kind of dissatisfied feeling. The recognition of this truth has been a great step in advance. On the other hand, it cannot be said that general agreement has been reached in the solution of the first analytical problem of psychology, which is usually stated as: What are the ultimate modes of being conscious, or the ultimate functions or faculties of mind? The commonest view is that we must, in

the first place, distinguish three attitudes of the mind towards its objects: it is aware of or apprehends them (*Cognition*), is affected by them (*Feeling* or *Affection*), and strives to bring about some alteration in them or in their relation to itself (*Conation*). It is usually added that most, if not all, concrete mental behaviour includes these three attitudes at once. On the other hand, some have argued that feeling and conation are so closely inbound with one another that they should not be called distinct functions; others, with more plausibility, that cognition is not an activity distinct from conation, but every awareness of objects is the issue of an impulse or volition, or generally of some conative process.

If the usual threefold division be accepted, we have to ask further whether within each of its heads there are irreducible modes of consciousness to be distinguished. Some writers distinguish, for example, under cognition, Perceiving, Imagining, Conceiving, Judging, Reasoning; others distinguish only Simple Apprehension, or Awareness, and Judgment. It is pretty clear that apprehending a present sensible object (*Perception*) and apprehending one that is not present (*Imagining* or, better, *Imaging*) are psychologically the same function, though there are physiological differences and usually differences also in the characters of the object apprehended. Some would say the same also of *Conception*, the apprehension of universals. On the other hand, Conception, Judgment, and probably Reasoning also, are inseparable in their development; and it should be added that they involve a power of comparison and discrimination which specially deserves to be called ultimate, if any mental function deserves that title more than others. As to simple awareness of any kind, in the adult mind thought reacts so constantly on perception and other modes of apprehension that it is difficult to discover indisputable instances of it.

In the further analysis of affection it is generally admitted that we have to distinguish feelings of pleasure and unpleasure, and probably there are also several other feelings on the same level as these. It is to such feelings that the term 'states of mind' may most justifiably be applied. The emotions too are to be reckoned here, and also moods. Most writers regard only a few *emotions* as 'primary' (*e.g.*, fear and anger), and the rest as derivative or composite (*e.g.*, admiration and reproach). But whilst it is true that such emotions as these latter are each akin to more than one 'primary' emotion, and do not arise until the primary emotions have been experienced, they are nevertheless unitary states of mind and not merely the presence of two or more primary emotions at once.

The further analysis of *Conation* is also matter of dispute. From one point of view, we may safely distinguish the two modes of appetite towards an object and aversion from it; from another, some maintain, whilst others with more probability deny, that the act of *volition* is at all capable of analysis.

As soon as the psychological problem is stated in this way, it becomes apparent that we have to consider, not only the mind's powers of perceiving, feeling, willing, etc., at any moment, but in addition its power of benefiting by experience. Past is continually modifying present experience, even though the past be not recalled, and even when it can no longer be recalled. Another mode of statement is that as the result of growing experience there are gradually formed *mental dispositions* to behave in certain ways. The problem then becomes that of tracing the growth of special dispositions, and showing how they become differentiated or inter-connected.

Certain dispositions are evidently inherited. Action consequent upon the exercise of dispositions commonly inherited by all normal members of a species is usually called *instinctive*. It must be noted, however, that not only the reaction, but also the interest in and attention to a particular type of object, deserves to be called instinctive—*e.g.*, the chicken would not peck at small objects on the ground unless it instinctively noticed them. Moreover, it has lately been argued with much force that a train of instinctive behaviour includes not only this preferential attention to certain objects and the consequent reaction, but also some special affective state; and the 'primary' emotions have been connected in this way each with a special instinctive tendency. There are, however, also certain *inherited tendencies*, of which that to imitate is the most important, which do not seem to involve specific emotions; and in addition we must recognize that individuals have *congenital dispositions* and capacities not common to the whole species. Musical capacity may serve as an instance.

If we survey the development of mental behaviour to the human stage from lower levels, it seems at first sight to have involved the acquisition of totally new powers (*e.g.*, of judging, reasoning, willing); and in the small child also capacities seem after a time to appear which were not manifest before. But in observing the child's growth we are never really able to say, 'This is the moment at which a totally new power has first been exercised,' so gradual is the development; and perhaps, as has already been suggested, we ought throughout to think rather of a development of capacities out of more rudimentary forms in which we observers fail to recognize their existence. However that may be, it does not seem that in the history of the human race totally new powers have been developed, though many have been enormously heightened. Apart from the origination of new capacities, mental development presents two main features—increasing breadth and increasing organization of interest. The growth of intellect is not only acquisition of new information, but also the systematization of thought in such a way that what has been acquired can be effectively utilized, whether for practical or for theoretical purposes. The growth of feeling is exhibited in the formation

of sentiments or complex emotional dispositions towards objects. Lastly, on the conative side there can be traced a similar and closely connected growth and organization of desires and purposes.

The main result of the study of *animal behaviour* has been to throw light on the importance of congenital instinctive dispositions as the basis of mental development. These dispositions and their modifications in response to varying circumstances are more easily observed in the lower animals than in human society, where they are almost from the outset altered by imitation and tradition and social influences generally.

The study of *abnormal* and *diseased state of minds* has given psychology more problems than it has solved. The interpretation of these 'natural experiments' is usually very difficult, largely owing to the unreliability of patients' statements about themselves, which is specially marked in cases of hysteria. One result of this study has been to emphasize very strongly the influence of emotions and moods on thought and action. This has been brought out, for example, by cases of *alternating personality*, in which patients seem to lead two (or more) alternate lives, with different temperament and character and interests. As a rule, they do not remember their abnormal life in their normal periods, and often they also forget events of their normal in their abnormal conditions, though they either retain, or at any rate very rapidly regain, many dexterities, the power of speech, ability to recognize common things, and the like. It seems fairly well ascertained that in a great number of these cases the change of interest and memory rests on an extreme alteration of mood.

Obsessions or *Insistent Ideas* are also abnormalities which seem frequently to arise from exaggerated emotional conditions—*e.g.*, from extreme anxiety. When, as is frequently the case, they are ideas of action, they are interesting examples of impulsive tendencies, not, like instinctive behaviour, prompted mainly by perception, but guided by thought and yet not voluntary. Thus a person may be impelled by the idea of killing another against whom he has no grudge, though all the time he does not wish to do so, and is tortured by the belief that he is going to commit the crime.

Closely related to certain parts of abnormal psychology is the study of *hypnotic phenomena*. This is a very promising field of research, but at present the interpretation of the facts, and even the exact statement of the facts to be interpreted, are very much disputed.

(1) For Introductory survey: M'Dougall, *Psychology, the Study of Behaviour*. (2) General: Angell, *Psychology*; W. James. *The Principles of Psychology*; G. F. Stout, *Manual of Psychology* and *Analytic Psychology*. (3) Experimental: Myers, *Introduction to Experimental Psychology* and *Text-Book of Experimental Psychology*; Titchener, *Experimental Psychology*. (4) Physiological: M'Dougall, *Primer of Physio-*

logical Psychology. (5) Social: M'Dougall, *Introduction to Social Psychology.* (6) Abnormal: Hart, *Abnormal Psychology;* Störring, *Mental Pathology in its Relation to Normal Psychology.* (7) Educational: Loveday and Green, *Introduction to Psychology for Teachers;* Welton, *Psychology of Education.* (8) Animal: Groos, *The Play of Animals;* Lloyd Morgan, *Animal Behaviour* and *Habit and Instinct;* Thorndike, *Animal Intelligence.*

Psychophysics, the study of the relations between physical stimuli and sensations, especially in respect of intensity. See WEBER'S LAW.

Ptarmigan (*Lagopus mutus*), a member of the grouse family; is found on the mountains of Scotland and of Europe generally; colour of coat changes from brown to white in winter.

Pteridophyta, or VASCULAR CRYPTOGAMS, the most highly developed group of flowerless plants, including all the existing ferns, horsetails, and club-mosses, as well as a large number of extinct forms. They exhibit a characteristic alternation of generations, the sexual, termed the gametophyte or prothallus, bearing male and female organs, the antheridia and archegonia respectively, and the asexual, termed the sporophyte, arising from the fertilized egg, and in its turn producing asexual spores. These reproduce the sexual generation again, thus completing the cycle. The prothallus is always minute and insignificant, and may, as in the ferns, resemble a small thalloid liver-wort, or be an underground, tuberous structure, as in *Lycopodium.* The antheridia are usually globular structures producing numerous motile sperms, and require the presence of water for their further function as fertilizing agents. The archegonia are flask-shaped, and contain a single ovum. When mature they exude mucilage apically, this, owing to its chemical properties, attracting the sperms, one of which fuses with the ovum. The fertilized egg then surrounds itself by a delicate wall, and divides up, producing the stem apex, and the first leaf and root of the sporophyte. In addition, an organ termed the 'foot' is developed, which absorbs nutriment from the prothallus until the young structures are capable of self-support.

The mature stem varies considerably in the different groups, and may be aerial, creeping, climbing, or subterranean. On it are borne large numbers of adventitious roots and leaves, both of which are essentially similar in structure to those of flowering plants, and, together with the stem, are traversed by highly differentiated conducting strands or vascular bundles, which exhibit a concentric structure. The spores are borne in special receptacles, the sporangia, which may be developed on the backs of the ordinary vegetative leaves, or on specially modified leaves, termed sporophylls. The spores are usually of one kind, but in certain cases (*e.g., Selaginella*) are differentiated into large megaspores, producing female prothallia, and small microspores, producing male prothalli only.

The Pteridophyta are classified as follows: (1) *Lycopodiales*, including four orders—(*a*) *Lycopodiaceæ*, or *Club-mosses*, homosporous forms, mainly tropical in distribution, with small leaves and a dichotomously branched stem. The prothalli are subterranean. (*b*) *Selaginellaceæ*, heterosporous forms commonly grown in greenhouses. (*c*) *Isataceæ*, or *Quillworts*, heterosporous forms growing in deep lakes. (*d*) *Lepidodendraceæ*, extinct tree-like forms. (2) *Psilotales*, tropical forms intermediate in character between the Lycopodiales; and (3) *Sphenophyllales*, an extinct homosporous group, which were in their heyday during the Carboniferous and died out in the Permian. (4) *Equisetales*, including the *Horsetails*, plants with verticellately branched stems, and the *Calamariaceæ*, gigantic tree-like forms with secondary thickening, which flourished in Coal-Measure times. *Equisetum* bears its sporangia in cones at the apex of special fertile shoots. The spores produce green unisexual prothalli. (5) *Ophioglossales*, forms allied to the ferns proper, and including two Brit. genera: *Ophioglossum* (adder's tongue) and *Botrychium* (moonwort). As a rule only one leaf is produced annually, this showing characteristic division into a sterile and a fertile segment. The prothalli are subterranean. (6) *Filicales:* this order includes all the true ferns, and is to-day the dominant group of flowerless plants. The leaves are usually very large in proportion to the size of the plant, and when young are folded in a crozier-like manner. They may bear the sporangia on special fronds, or on the backs of the vegetative leaves. The sporangia are often arranged in little groups, or sori, protected either by specialized outgrowths, as in the male fern, or by the inrolling of the modified leaf margin, as in the bracken. Vegetatively they show immense variety of structure, the filmy ferns of the tropics being extremely minute, whilst the tree-ferns attain a palm-like stature, and may be 70 or 80 ft. high. The gametophyte is usually heart-shaped and green, and bears the sexual organs on the lower surface.

Pterobranchia, an order of Hemichordata or Enteropneusta, containing the genera *Cephalodiscus* and *Rhabdopleura*. These are small marine animals associated in colonies and protected by an external gelatinous or chitinous skeleton composed of tubes. *Cephalodiscus* colonies (some 9 in. long) occur in Antarctic and Pacific Oceans, off S. Africa, and in Magellan Straits; *Rhabdopleura* exceedingly small in the North Sea and Atlantic. They possess in common short bodies, the collar on the anterior of which bears two or more paired, tentacle-bearing arms. There is a proboscis which builds the tubes wherein the animals dwell and is flattened into a disk at the base; there are never more than two gill-slits, and the short food canal is U-shaped, the vent opening near the mouth. In both genera the bodies are borne on long narrow stalks.

Pterodactyls. See REPTILES.

Pteropod. See GASTEROPODA.

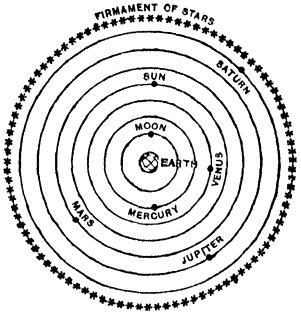
Pteropodidæ. See FLYING FOXES.

Pterosauria. See REPTILES.

Ptolemies, Macedonian rulers of Egypt (323–30 B.C.). Ptolemy I., *Soter,* became satrap of Egypt on division of kingdoms of Alexander the Great (323); abdicated (285); memorable as the founder of the museum and library at Alexandria. His son, Ptolemy II., *Philadelphus,* developed resources of Egypt; made the museum of Alexandria centre of literature and science. The Septuagint is said to have been made by his order.

Rome claimed Egypt by bequest of Ptolemy X., Alexander II., but agreed (51) to joint rule of Ptolemy XII. and his sister Cleopatra, whom, after Egyptian custom, he was to marry. In the Alexandrian War of 48–47 Ptolemy XII. died, and a younger brother, Ptolemy XIII., was associated with Cleopatra till his death in 44. Cleopatra and her son Cæsarion (putative child of Cæsar), known as Ptolemy XIV., then ruled till both perished during Roman attack (30). Cleopatra's daughter by Mark Antony left son, Ptolemy, who died childless (A.D. 40).

Ptolemy, CLAUDIUS PTOLEMÆUS, famous astronomer, geographer, and mathematician, was a native of Egypt and worked at Alexandria from A.D. 127 to 151. As an astronomer celebrated as author of the *Almagest,* a summary of his own and his predecessors' work. The *Ptolemaic system,* herein set forth, assumes the earth—a sphere, and stationary on its axis—at the centre of the heavens, with the planets, including the sun and the sphere of the fixed stars, revolving round it. To explain the apparent motion of these bodies Ptolemy, following Apollonius, used a system of eccentrics or epicycles and deferents. The unity and coherence which this system gave to a multitude of observed facts secured for it implicit acceptance for fourteen centuries.



The Spheres of the Ptolemaic System.

His *Geographike* was based on Marinus of Tyre and was only gradually corrected by the discoveries of the 15th and 16th centuries. His mathematical skill is illustrated in the *Almagest.*

Ptomaines, organic bases or alkaloids formed by the action of putrefactive bacteria on organic matter; some of them are poisonous, and to them is due the poisonous action of putrefying sausages, tinned meats, etc.

Public Debt. See NATIONAL DEBT.

Public Finance means, according to our accepted usage, the principles governing state revenue and expenditure. It covers (1) the study of the finan-

cial necessities of the state, which is merely another side of the discussion of the proper functions of the state; (2) the inquiry into the sources from which the state has, does, or may derive a revenue, which raises all the questions of taxation, public loans, and state ownership (see TAXATION and NATIONALIZATION); and (3) the description of the methods by which the money is granted, collected, and expended, which involves constitutional and administrative questions. State functions are admitted to include national defence, public security, and the enforcement of justice. To these the extension of state activity has added many more, especially since the middle of the 19th cent. Public education, for instance, has become a considerable imperial charge in addition to being a local one. Social reforms of various kinds (*e.g.*, Old Age Pensions) have increased the annual expenditure. The sources of state income have been greatly modified in the course of history. In the Middle Ages the maxim was that 'the king should live of his own'—*i.e.*, that he had a sufficient revenue from crown lands, profits of justice, and the feudal dues to meet all the normal charges of government. When special expenditure was necessary, mostly for conducting a war, taxation was levied, but it was exceptional. By the 16th cent., however, the crown became dependent on taxes, for the ordinary sources of revenue had become quite inadequate. In the next century the annual tax revenue was greatly increased, and before its close the funding system (borrowing against the future yield of specific taxes) was established. The bulk of the taxes were indirect—*i.e.*, charged on the consumption of certain commodities. Opinion was opposed to any direct tax which involved assessment. It was not until 1799 that Pitt imposed an income tax, and it did not survive the war, being repealed in 1816. The simplification of the tariff in a free trade direction reduced the number of indirect taxes between 1823 and 1860. The income tax was reintroduced by Sir Robert Peel in 1842, and has been retained ever since, though at first intended to be temporary. At times of special pressure the state has raised extensive loans (see NATIONAL DEBT), the payment of the interest on which is now the heaviest charge on the annual revenue. The chief service from which the state has in the past derived a profit has been the Post Office. It has been suggested that the state ought to acquire and run other enterprises, such as the railways and the coal mines.

The technique of public finance deals with the means by which the money needed for the public services is estimated, collected, and allocated. It does not touch questions of policy, for they come under the two heads already mentioned. The annual financial statement is called the BUDGET. It is the estimated balance sheet of income and expenditure. The chancellor of the Exchequer reviews the past year and reveals how he proposes to meet the charges of the coming year. The Budget speech is made in a committee of the whole House called

the Committee of Ways and Means. When the resolutions of the committee are approved they are embodied in the Finance Bill. This bill goes through the usual stages in the House of Commons; in the House of Lords its course is regulated by the provisions of the Parliament Act, 1911 (1 & 2 Geo. v. c. 13). The Budget is based on an elaborate system of Estimates which aims at an approximately correct forecast of expenditure for the ensuing financial year. These Civil Service Estimates are prepared by the various government departments, and submitted to and checked by the Treasury officials. When fully examined and adjusted they are presented to the House of Commons. The procedure with regard to Admiralty and War Office Estimates is different, as they involve questions of future policy. Briefly, these departments draw up a statement and confer with the chancellor of the Exchequer, the ultimate figures being settled upon by the cabinet. The resultant Estimates are also presented to the House of Commons. Discussion of the Estimates is possible when the House goes into Committee of Supply, the Army Estimates, the Navy Estimates, and the Civil Service and Revenue Estimates being taken separately. The stages are therefore: preparation of Estimates, submission of them for sanction to the Treasury, presentation to and approval by the House of Commons, embodiment of them in an Act of Parliament, which makes the expenditure legal. Then machinery is provided for the issue of the money authorized to the spending departments. This is regulated by the comptroller and auditor-general, who is the head of the Exchequer and Audit Department. He is directly responsible to the House of Commons, and is independent of the Treasury. When a requisition signed by two Lords of the Treasury reaches him he has to satisfy himself that it is in order and based on a statutory grant before he allows the money to be transferred to the bank to the credit of the Treasury. The accounts of the comptroller and auditor-general are submitted to the Public Accounts Committee of the House of Commons. It goes into the details of expenditure—particularly where the Estimates have been exceeded—and presents its report to the House. In this way the whole process of supply, audit, and control is complete.

C. F. Bastable, *Public Finance;* C. Plean, *Public Finance;* Henry Higgs, *The Financial System of the United Kingdom,* and *A Primer of National Finance.*

Public Health, Law of. See Health, Ministry of.

Public-houses. See Inn; Licensing Laws.

Public Libraries. See Free Libraries.

Public Schools. See under Education.

Public Trustee, official created by Act of Parliament in 1906 to act as executor or trustee to any person who may desire it, either under a will or a settlement. Operations began on Oct. 1, 1907, and value of estates placed in care of public trustee now exceeds £120,000,000. In 1914 an ad-

visory committee was appointed. The fees charged are very low, and a pamphlet giving full information can be obtained from the Head Office, Kingsway, London, W.C.2.

Publishing, producing books or periodicals and issuing them for the market. Originally authors were to a great extent publishers and booksellers as well. Next change saw publishing booksellers contracting with authors and printers. To-day the division of labour usually is author, publisher (doing his own printing or contracting out), and bookseller. Authors either sell MS. and copyright for lump sum, or (more commonly) issue on royalty system, retaining copyright; on half-profits system or commission system, in which publisher is employed to issue the book, receiving commission on sales. Literary agents now undertake business arrangements between author and publisher. The Authors' Soc. looks after interests of authors, and Publishers' Association of Great Britain and Ireland, formed in 1896, is analogous soc. on the other side. Bookselling has divided itself into wholesale and retail, of which former mainly deals with publishers. The beginning of last century saw this separation of production and distribution completed, and subdivision has since gone on the lines of specialism. Few publishers to-day publish indiscriminately, but have their own sphere or spheres of work; they tend to employ specialists as readers. The Publishers' Association, in common with the Booksellers' Association, has put trade interest on a sound footing. Their last big fight was with *Times* Book Club (1905–9). Latest tendency is issue of cheap editions, both fiction and educative, in order to satisfy the large increase of reading public. Such cheap editions, however, have greatly increased in price since 1914 owing to enhanced cost of material and labour. See BOOK.

Pubna. See PABNA.

Puccini, GIACOMO (1858–), Ital. operatic composer; *b.* Lucca; educated under Ponchielli at Milan Conservatorio di Musica. Chief works: *Le Villi* (1884), *Edgar* (1889), *Manon Lescaut* (1893), *La Bohême* (1896), *La Tosca* (1900), *Madame Butterfly* (1904), *La Fanciulla del West* (1910), *La Rondine* (1916), *Il Tabarro, Suor Angelica, Gianni Schicchi* (1918).

Pudsey, munic. bor., W. Riding, Yorkshire, England (53° 47′ N., 1° 39′ W.); woollen and worsted goods; leather; iron and brass founding, electro-plating, and engineering. Pop. 14,000.

Pudukottai, chief tn. of feudatory state (area, 1,101 sq. m.; pop. 380,000), Madras, India (10° 23′ N., 78° 52′ E.); silk, cotton, and perfumes. Pop. 20,000.

Puebla, cap. of state of same name, Mexico (18° 59′ N., 98° 2′ W.), 65 m. E.S.E. of Mexico city; is one of oldest cities in republic; fine Doric cathedral, state coll., episc. palace, and Palafoxiana library; cotton and woollen mills, etc. Pop. 101,200.

Pueblo, city, Colorado, U.S. (38° 18′ N., 104° 40′ W.), on Arkansas R., 100 m. S.S.E. of Denver; alt. 4,680 ft.; fine climate; mineral springs; nineteen parks and

arboretum ; collection of minerals worth *c.* £200,000 ; extensive oil fields and deposits of coal and other minerals near city ; steel and iron works ; largest smelting centre in U.S. for gold, silver, copper, zinc, and lead. Pop. 44,400.

Puenteareas, tn., Galicia, Spain (42° 10′ N., 8° 32′ W.), 17 m. S. of Pontevedra ; porcelain, tanning, and distilling. Pop. (comm.) 13,000.

Puente Genil, tn., Cordova, Spain (37° 25′ N., 4° 45′ W.), on Genil R., 48 m. S. of Cordova ; olive oil. Pop. 13,000.

Puerperal Fever, term formerly applied to an acute disease affecting women at the lying-in period, now known to be a septicæmia due to septic infection by various organisms, and prevented, first by Semmelweiss, by antiseptic methods ; it now rarely occurs in midwifery practice. See under OBSTETRICS.

Puerperium. See OBSTETRICS.

Puerte Real, seapt. and bathing resort, Cadiz, Spain (36° 30′ N., 6° 10′ W.), 6 m. E. of Cadiz ; dry dock ; shipbuilding ; salt, wine, and oil. Pop. 12,000.

Puerto Cabello, seapt., Carabobo, Venezuela (10° 23′ N., 67° 52′ W.), on the Caribbean Sea, *c.* 90 m. W. of La Guayra ; railway to Caracas ; exports beans, coffee, cacao, cotton, hides, tobacco, dyewoods, timber, and indigo. Pop. 16,000.

Puerto de Santa Maria, seapt., Cadiz, Spain (36° 37′ N., 6° 20′ W.), on Bay of Cadiz, opposite the city ; harbour and saltpans ; exports sherry ; important fisheries ; leather, glass, and soap. Pop. 21.000.

Puerto Principe, or CAMAGÜEY, city, cap. Puerto Principe prov., Cuba (21° 23′ N., 77° 56′ W.), 169 m. N.W. of Santiago and 40 m. N.E. of Nuevitas, its port (railway) on N. coast ; large sugar plantations in vicinity ; largest inland city of Cuba ; modern conveniences, but mediæval in aspect ; cattle, hides, sugar, honey, tropical fruits, precious woods. Pop. 40,000.

Puerto Rico. See PORTO RICO.

Pufendorf, SAMUEL, BARON VON PUFENDORF (1632-94), Ger. jurist ; rival of Leibniz ; followed Hobbes and Descartes ; pub. *Elementa Jurisprudentiæ Universalis* (1661) ; prof. of law of nature and nations at Heidelberg ; treatise *De Statu Imperii Germanici* (1667) got him into trouble ; retired to Sweden and wrote chief work, *De Jure Naturæ et Gentium* (1672) ; historiographer of Elector of Brandenburg (1688-94).

Puff-adder (*Bitis arietans*), highly poisonous African snake, 4 ft. or more long ; structurally related to viper ; yellowish to orange-brown above, black markings, white below. So called because when alarmed it inflates the body and produces characteristic puffing sound. Haunts dry and sandy ground ; nocturnal habits.

Puff-ball. See FUNGI.

Puff-birds (Bucconidæ), a family of about fifty species of Picarian birds found in Central and S. Amer. forests ; arboreal and insectivorous.

Puffers. See GLOBE-FISHES.

Puffin. See GUILLEMOT.

Pug-dogs. See DOG FAMILY.

Pugh, EDWIN WILLIAM (1874–), Brit. novelist, employed

in a city office for eight years. His most recent works include *The City of the World* (1912), *The Dickens Originals* (1912), *Harry the Cockney* (1913), *Punch and Judy* (1913), *The Proof of the Pudding* (1913), *The Cockney at Home* (1914), *The Quick and the Dead* (1914), *Slings and Arrows* (1916), *A Book of Laughter* (1916), *The Eyes of a Child* (1917), *The Great Unborn* (1918).

Pugilism. See BOXING.

Pugin, AUGUSTUS WELBY (1812–52), Eng. architect; helped to design new Brit. Houses of Parliament (1836); became R.C., and designed many churches for that communion, including the cathedrals of Southwark and Killarney; pub. *True Principles of Christian Architecture* (1841).

Pug-mill. See BRICKS.

Puisne Judge. See JUDGE.

Puket, or TONKA, seapt. and chief tn. of Junk Ceylon (Ujong Salang), isl. N.W. of Malay Peninsula belonging to Siam (7° 55′ N., 98° 25′ E.); tin mines (annual yield, 3,000 tons); edible birds' nests. Pop. 20,000.

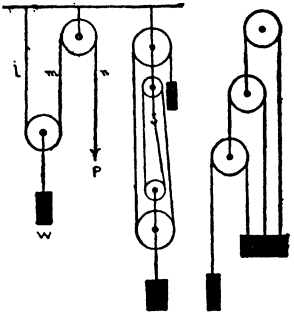
Pulborough, par. and mrkt. tn., Sussex, England (50° 57′ N., 0° 30′ W.), 10 m. S.W. of Horsham. Pop. 1,700.

Pulex. See FLEAS.

Pulitzer, JOSEPH (1847–1911), Amer. journalist; began the characteristic 'publicity' of the Amer. newspaper when the *New York World* passed into his hands (1883); supported many worthy causes; left £200,000 to Columbia School of Journalism.

Pulkovo, or PULKOWA, vil., Petrograd government, Russia (59° 46′ N., 30° 19′ E.), 10 m. S. of Petrograd. On adiacent hill (248 ft.) is famous observatory; univ. attached (library, 15,000 vols., 20,000 pamphlets). Cannon fired in fortress of St. Peter and St. Paul at Petrograd by electric current from observatory.

Pulley, a wheel rotating on an axle. A groove is cut in the circumference and a rope passed over it. The wheel is called the sheave and the rope the tackle. A pulley may be fixed or movable. Fixed pulleys are those in which the axle is fixed to some stationary



Pulleys: 1st, 2nd, and 3rd Systems.

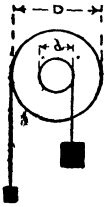
spot. In movable pulleys the extremes of the axle are supported on a block of wood.

Pulleys may be used either singly or combined. When the former, they give no mechanical advantage, merely changing the direction of the force. When combined, however, they give a greater purchase and leverage, and may be used for such operations as raising weights, small boats, etc. There are many methods of combining pulleys, and theoretically the more pulleys

used the greater the mechanical advantage, but in practice it is found that the friction is so great when a large number is used (the rope can never have perfect flexibility) as to counteract largely any advantage of mere number.

Pulleys are used also in engineering shops and factories. These have a flat circumference over which a broad leather belt passes and transmits power from the engine to the loom or to other machinery. Such pulleys are generally made of metal, but the smaller varieties are of wood.

Differential Pulley.—In this form the broad upper pulley consists of two coaxial wheels joined together, one being a little smaller than the other. An endless rope



Principle of Differential Pulley.

passes over these in such a way that when it is raised by the one it is lowered by the other. By making D and *d* nearly equal, a small load will support a large load. If the efficiency of a machine with a great velocity ratio is less than ·5 it will not overhaul—*i.e.*, the load will not fall when there is no effort applied. See MECHANICS.

Pullman Car. See RAILWAYS.

Pulmonata. See under GASTEROPODA.

Pulque, a drink of Central America and Mexico; fermented from agaves and cacti.

Pulsatilla, or PASQUE FLOWER (*Anemone pulsatilla*), plant of order Ranunculaceæ; mauve-coloured; poisonous.

Pulse. (1) The common name for the edible seeds of leguminous plants—*e.g.*, peas and beans. (2) The throbbing of the arteries due to the additional quantity of blood forced through them by the contraction of the ventricles of the heart. The pulse-beat assists in the diagnosis of a patient's condition, being usually taken at the wrist, where an artery lies close to the surface. Normally it is quicker in women than in men. It is also quicker in small people. A man's pulse generally beats seventy to seventy-five times per minute, but may be as low as forty. It increases about ten beats in the minute for every degree rise in body temperature.

Pulsometer. See PUMPS.

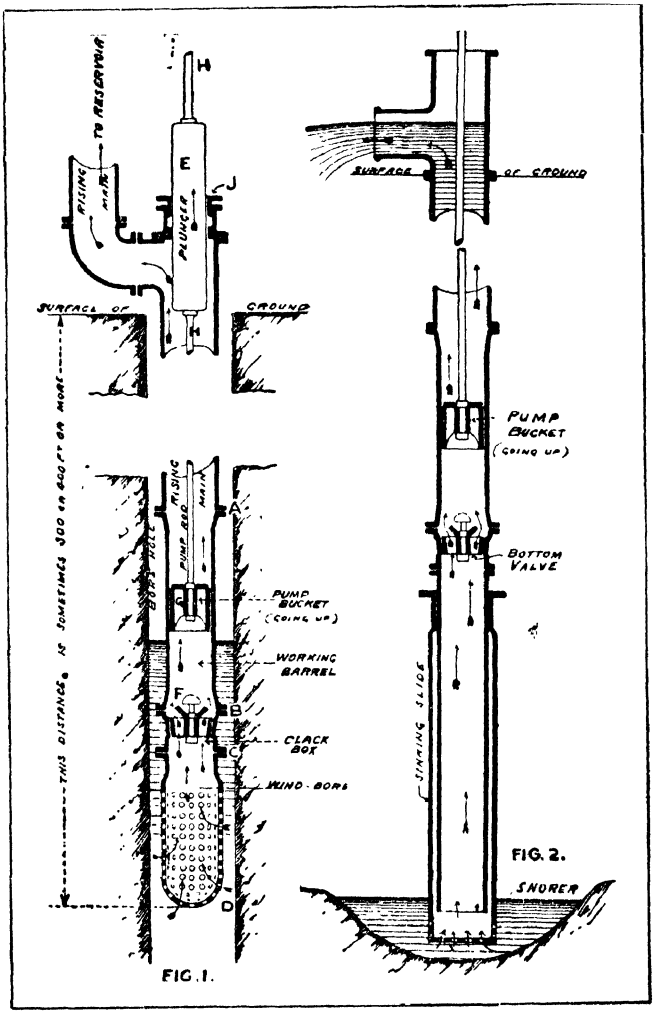
Pulteney, WILLIAM. See BATH, W. PULTENEY, 1ST EARL OF.

Pulteney, SIR WILLIAM PULTENEY (1861–), British general; commanded 6th Division, the Irish Command (1910–14). During Great War commanded 3rd Army Corps, B.E.F., from its landing in France to close of hostilities. Appointed Black Rod (1920) in succession to Admiral Sir Henry Stephenson.

Pultowa. See POLTAVA.

Pultusk, tn., Poland (52° 43′ N., 21° 12′ E.), on r. bk. of Narev, 32 m. N. of Warsaw. Busy, well-built place, with fine castle; woollens, linens, hosiery, copper wares, and pottery. Pop. 16,000.

Puma. See under CAT FAMILY.



Pumps for Underground Service.

Fig. 1. Double-acting. Fig. 2. Single-acting.

Pumice, lava composed of silica and alumina, ejected by volcanoes; colours: grey, white, brown, or black; varieties: glassy, common, and porphyritic; hard, rough, and porous—floats in water; used for polishing wood, ivory, marble, etc., and for toilet purposes.

Pump, machine for raising fluids; the commonest, the suction pump, consists of a piston working air-tight inside a barrel, and moved up and down by a handle attached by a rod. The piston has a valve opening upwards, and a similar valve is fitted at the bottom of the barrel, covering the mouth of a tube sunk into the water. As the piston is raised the air below is rarefied, and the atmospheric pressure on the surface of the water forces it to rise in the tube until equilibrium is regained. After some strokes the water gets above the piston, and being raised with it is discharged by a spout. Other pumps are the force pump, a more effective form of suction pump; rotary pumps, including the centrifugal pump, in which water is driven by rotatory motion along the vanes of a wheel, from centre to circumference, thus gaining sufficient velocity to force it through the discharge pipe; another rotary pump is the drum pump—a displacement pump with tight-fitting parts by means of which a theoretically constant volume of water is discharged per revolution. Neither of the types of rotary pumps is adapted for very high lifts owing to the difficulty of keeping the working parts tight in the casing. In the *pulsometer* pump there is no bucket, plunger, or rotating fan. The water is discharged by the pressure of steam acting directly on the surface of the water in the pump chamber. The air-pump is used to exhaust the air in, or pump air into, a vessel. See AIR-PUMP.

P. R. Bjorling, *Pumps and Pump Motors* (1895); Davey, *The Principles, Construction, and Application of Pumping Machinery—Steam and Water Pressure* (1900); Innes, *The Centrifugal Pump, Turbines and Water Motors* (1901).

Pumpkin. See GOURD.

Punchestown, racecourse, Rathmore par., co. Kildare, Ireland (53° 13′ N., 6° 41′ W.), near Naas; well known for its April steeplechases.

Punctuation, the art of dividing a sentence by conventional signs. The 'stops' are: full stop (.), colon (:), semicolon (;), comma (,). Other signs are: mark of interrogation (?); mark of exclamation (!); brackets ([]), and dashes (— . . . —), used in parenthesis.

Rules for punctuation are useless; the sentences of good writers should be studied. See *The King's English* (1906).

Punic Wars, wars between Romans and Carthaginians—*i.e.*, descendants of Phœnicians (*Pœni*, adj. *punicus*)—in 3rd and 2nd centuries B.C.

In the *First Punic War* (264–241 B.C.) Carthage lost Sicily, and soon after Sardinia. To make up for the loss, Hamilcar, the hero of the first war, with his son Hannibal, and his son-in-law Hasdrubal, developed Carthaginian power in Spain. This led

to the *Second Punic War* (218–201), the chief features of which were Hannibal's crossing of the Alps, and winning of several great battles, notably Trebia, Lake Trasimene, and Cannæ; his failure to disintegrate the Roman confederacy, and final defeat at Zama. This war cost Carthage Spain and all possessions outside her own immediate territory. The *Third Punic War* (149–146), begun by Rome on very inadequate pretexts, ended in the utter destruction of Carthage.

Punjab, or PANJAB ('the land of five rivers'—*i.e.*, Jhelum, Chenab, Ravi, Beas, and Sutlej), on N.W. frontier of Brit. India (30° N., 74° E.); is bounded on the N. by Kashmir, on the E. by Himalayas and United Provinces, on the S. by Rajputana and Sind, and on the W. by Baluchistan and N.W. Frontier Prov. Area, 135,880 sq. m.; pop. 23,807,700 (*c.* one-thirteenth of area and pop. of Indian Empire). Native states (34) occupy 36,551 sq. m.; pop. 4,212,800. Vast alluvial plain from Jumna in the W. to Suleman Range in the S.; N.E. occupied by Himalayas. Five natural divisions: Himalayan tract, with scanty pop. and over 22,000 sq. m.; Salt Range tract, broken and confused, similar to Himalayan tract; narrow submontane tract, skirting base of hills and including low range of Siwaliks, very fertile and thickly populated (4,000,000); E. plain (36,000 sq. m.; pop. 10,500,000; irrigation not necessary in favourable seasons; population largely urban); W. plain (59,000 sq. m.; pop. 6,000,000; irrigation necessary; includes colony areas on the Lower Chenab and Lower Jhelum canals—fertile, wealthy, and populous). Chief towns: Sialkot, Lahore (cap.), Amritsar, Multan, and Lyallpur. About half pop. is Mohammedan, three-eighths Hindu, and one-eighth Sikh. Jats number *c.* 5,000,000, and are most important of landed classes; next come Rajputs (1,500,000). Jats and Rajputs provide best recruits for Brit. army. Agriculture is the staple industry. Lower Chenab Canal irrigates *c.* 1,900,000 ac., Lower Jhelum 390,000 ac., and Lower Bari Doab Canal (when complete) 1,200,000 ac. of what was formerly waste. Wheat is most important crop; other staples barley, rice, millet, maize, oil-seeds, cotton, and sugar-cane. Live stock very abundant. Mineral wealth small; *c.* 184 factories for cotton ginning, cleaning, and pressing. Administration in hands of lieut.-governor, executive council, and legislative council. See INDIA for local government. Education has recently made great strides; government college at Lahore; nine arts colleges and professional schools.

Purcell, HENRY (1658–95), Eng. musician; organist, Westminster Abbey (1680), Chapel Royal (1682). *Te Deum* and *Jubilate,* and *King Arthur* are among his best works; wrote also *Dido and Æneas* (opera), twelve sonatas for two violins and bass, besides anthems, songs, cantatas, etc. *Purcell's Sacred Portfolio* was issued by Novello (1829–32).

Purgatory. The R.C. doctrine of purgatory has grown out of the belief in an intermediate state

which was commonly held by the primitive Church. Purgatory is the place where the souls of such penitent people as are not pure enough to go straight to heaven are purified; it is believed that they may be helped by the prayers of those on earth and through the sacrifice of the MASS.

Puri, JAGANNATH, or JUGGERNAUT, chief tn., Puri dist., Orissa, India (19° 48′ N., 85° 31′ E.), with temple of Vishnu containing idol of Jagannath; great car festival (held annually) formerly associated with cruel rites. Pop. 50,000.

Purification, a practice found in most religions of cleansing by ritual acts, by which the person subjected to it is purified from a ceremonial uncleanness. Many different kinds could be enumerated, such as expiatory sacrifice, vicarious sacrifice, ablution, and anointing with oil. The idea is found in higher religions in the shape of ethical liberation from sin.

Purim, a Jewish festival, observed on the 14th and 15th Adar, and intended to commemorate the deliverance of the Jews in Persia from the plot of Haman (Esther 9 : 20–32). The 13th Adar is the Fast of Esther.

Puritans, Church reforming party owing its origin to Wyclif and the Lollards, but prominent after formulation of constitution, articles, and ritual of Church of England by Archbishop Parker in Elizabeth's reign. Serious differences thereupon manifested themselves among the clergy, those who demanded greater strictness of life and doctrine being called in derision *Puritani*. Party was not united; extreme section led by Thomas Cartwright (1535–1603), who preferred Presbyterial to Episcopal system; moderate section simply wished to draw strongly marked line of doctrinal demarcation between the standards of the two Churches. Later (1580) the Independents (afterwards most powerful of all), under leadership of Robert Browne (1550–1633), advocated congregational system. Puritans only became a political power when constitutional offences of Charles I. forced them to oppose him. Laud and High Church party, with tendency to Arminianism, led Puritans to emphasize Calvinistic element in their doctrines. During Commonwealth Puritanism supreme. After restoration moderate Puritans made their peace with the Church, and in later days became Evangelicals. Other sections refusing to accept Act of Uniformity (1662) resolved themselves into various groups, and developed into Nonconformist party of to-day, or crossed the Atlantic and joined expatriated brethren in New England. In Scotland Puritanism, as Presbyterianism, took firm root and was systematically formulated into the Church of Scotland, and was the leaven which led to what is known as the 'second reformation' (1638), later on inspiring the various secessions from the Church of Scotland of 1733, 1752, and 1843. 'The Puritan divines,' Richard Sibbes, John Owen, Thomas Goodwin, Thomas Adams, John Howe, Stephen Charnock, Richard Baxter, and Matthew Henry, set forth the distinctive doctrines and principles.

Gardiner, *The Puritan Revolution* (1876); Nichol, *Puritan*

Divines (ed. by Dr. T. Smith, 26 vols. 1861 *ff.*).

Purley. See TOOKE, HORNE.

Purple Emperor. See under LEPIDOPTERA (*Butterflies*).

Purpura. See GASTEROPODA.

Purston cum South Featherstone, eccles. dist. and vil., W. Riding, Yorkshire, England (53° 42′ N., 1° 21′ W.), 2 m. W.S.W. of Pontefract. Pop. 5,800.

Purston Jaglin, par., W. Riding, Yorkshire, England (53° 41′ N., 1° 21′ W.), 2 m. S.W. of Pontefract. Pop. 2,000.

Purton, par. and vil., Wiltshire, England (51° 36′ N., 1° 52′ W.), 5 m. W.N.W. of Swindon. Pop. 2,500.

Pusey, EDWARD BOUVERIE (1800–82), Eng. theologian; prof. of Hebrew, Oxford (1829); leader of the Oxford High Church movement; author of tracts on Fasting and Baptism in celebrated *Tracts for the Times* (hence 'Tractarian movement'); sought to bring Anglican Church more into harmony with Catholic traditions; wrote *Doctrine of the Real Presence,* and *What is of Faith as to Everlasting Punishment.*

Pushkin, ALEXANDER SERGEIEVICH (1799–1837), famous Russian poet and novelist; *b.* Moscow; entered lyceum, Tsarskoye Selo, near Petrograd (1811); received post in ministry of foreign affairs (1817); was killed in duel in Petrograd. Pushkin wrote excellent lyrics; greatly influenced by Byron; best works are *Eugene Onegin* and *Poltava* (narrative poems); *The Captain's Daughter, History of the Revolt of Pugachev* (prose works); *Boris Godunov* (tragedy); *The Prisoner of the Caucasus* (epic).

Pushtu, PUSHTO, or PASHTU, language of Pathans, Afghanistan; considered to be a true Iranian language, but greatly modified by Indian influences; literature is modelled on Arabic and Persian originals.

Puteaux, tn., Seine, France (48° 50′ N., 2° 18′ E.), on l. bk. of Seine, 7 m. W. of Paris, of which it is a suburb; woollens and dyeing extracts. Pop. 32,200.

Puteoli, anc. tn., on site of modern Pozzuoli, Italy (*c.* 40° 48′ N., 14° 8′ E.); colonized by Romans (194 B.C.); became an important port of Rome; was sacked successively by Alaric (A.D. 410), by Genseric (455), and by Totila (545); contains interesting Roman ruins and remains; has medicinal springs, which were known in Roman times. Modern town has shipbuilding yards, with arsenal and navy yard. Pop. 24,000.

Putnam, GEORGE HAVEN (1844–), head of publishing house of G. P. Putnam's Sons (from 1872); served in Civil War; played an important part in securing international copyright; a worker for municipal reform, free trade, civil service reform, etc. His many books include *Memories of a Publisher, 1865–1915.*

Putney, metropolitan suburban dist., Wandsworth, London, on Thames (51° 28′ N., 0° 13′ W.); bridge is usual starting-place for Oxford and Cambridge boat race; Putney Heath, large open common. Pop. 28,200.

Putnik, FIELD-MARSHAL (1847–), Serbian generalissimo; *b.* Kragujevatz; studied at Belgrade military academy; received baptism of fire in war

against Turkey (1876–8); rose rapidly in rank, but sympathy with Radical party during reign of King Milan brought about his downfall, and until the accession of King Peter (1903) he devoted himself to military studies and writing. On restoration of the Karageorgevitch dynasty he was promoted general and held portfolio of minister of war. He reorganized the army, and the successes of Serbia against Turkey and Bulgaria were due to his strategy and skill. On the outbreak of the Great War he was arrested in Vienna, but after two days' imprisonment was given his freedom. He immediately took his place as commander-in-chief, and was responsible for the gallant stand made by Serbia until the retreat in 1915. See SERBIA (*Campaign against*).

Putting the Weight, sport; 16-lb. iron ball thrown from shoulder with one hand; competitor stands in 7-foot circle or throws from a mark; at the Olympic Games (1912), the record throw of 50 ft. 4 in. was registered.

Putumayo, unorganized terr. of Colombia, adjoining Ecuador (*c.* 1° S., 79° W.); dominated by Peruvian Amazon Co., whose atrocious treatment of natives engaged in rubber collection led to official investigation and strongly condemnatory report by ROGER CASEMENT (July 1912).

Puvis de Chavannes, PIERRE (1824–98), Fr. painter; famous for mural decorations—*e.g.*, those at Amiens Museum, *Labour* and *Repose*, *Ave Picardia Nutrix* (1865), *Ludus pro Patria* (1881); decorated Panthéon (with subjects from *Life of Ste. Geneviève*), Hôtel de Ville, and Sorbonne, Paris, staircase of fine art gallery at Lyons, Rouen Museum, Longchamp palace at Marseilles, the Boston (U.S.) library, etc. His supreme merit is to have found a keynote of absolute decoration; work distinguished by exquisite serenity and austere beauty.

Vachon, *Puvis de Chavannes* (1900).

Puy, LE. See under LE PUY.

Puy-de-Dôme. (1) Central dep., France (45° 40′ N., 3° E.), on N.E. edge of Auvergne plateau; surface generally mountainous (Puy-de-Sancy, 6,188 ft.); watered by Allier, Cher, Dordogne; rich plain of Limagne produces wine, fruits, and sugar-beet; dep. rich in coal and silver lead; mineral springs (Mont Dore). Cap. Clermont-Ferrand. Area, 3,090 sq. m.; pop. 535,000. (2) Mt., Auvergne, France (45° 46′ N., 2° 58′ E.), chief peak of volcanic group, covering 80 sq. m. Alt. 4,800 ft. Observatory (1876).

Pwllheli, seapt., Carnarvonshire, Wales (52° 53′ N., 4° 26′ W.), on Cardigan Bay; harbour of refuge; fishing centre; exports slates. Pop. 3,800.

Pyæmia. See SEPSIS.

Pyatigorsk, tn., Terek Terr., Caucasia, S.E. Russia (44° 5′ N., 43° 10′ E.), in centre of five mountain peaks, and in sight of Elbruz; one of the noted spas of N. Caucasus. Pop. 32,000.

Pycnogonida (Gr. *puknos*, 'thick'; *gonu*, 'the knee'), SEA-SPIDERS, PANTOPODA, or PODOSTOMATA, spider-like marine Arthropods with (except in the case of an Antarctic species) four pairs of long legs into which the food-canal runs. They

clamber upon sea-weeds and zoophytes near the shore, but some large forms occur at great depths in the sea.

Pygmalion (Gr. myth.), grandson of Agenor, King of Cyprus, who, falling in love with the ivory statue of a maiden, which he himself had made, persuaded Aphrodite to breathe life into the statue, and married her; statue called Galatea in Sir W. S. Gilbert's comedy, but without class. authority.

Pygmy. See DWARF; RACES OF MANKIND.

Pylorus. See STOMACH.

Pylos (modern Navarino), anc. Greek tn., in Messenia (36° 54′ N., 21° 43′ E.), on N. side of Bay of Pylos. In the *Iliad* Nestor is King of Pylos. The modern town and seaport stand at S. end of bay. See NAVARINO, BATTLE OF.

Pyramids, structures of stone or brickwork, standing on a square base and tapering upwards to an apex. Commonly erected in anc. times to the memory of some dead ruler. The Egyptians were particularly noted as pyramid-builders, and about forty pyramids, erected between 4000 B.C. and 2000 B.C., still stand in Egypt. In most cases they are built over a chamber containing the sarcophagus of a king. Limestone was the chief material used, but huge blocks of granite formed the outer casing. In every instance the four points at the base were so placed as to face the four points of the compass. An intricate passage was left during the raising of each pyramid, leading to the central chamber. The best-known group of pyramids is that of Gizeh, a few miles N. of Cairo. The most famous is that of Cheops, which is about 450 ft. in height, and contains over 80,000,000 cubic ft. of masonry, being the largest and most imposing in the country. The pyramids suffered considerably from the Arab spoliations in 7th cent. A.D.

Pyrazole, $C_3H_4N_2$, a colourless crystalline substance which acts as a weak base, forming unstable salts; antipyrin may be looked upon as a complex derivative.

Pyrenees, great mountain chain of Europe stretching from S.E. corner of Bay of Biscay westwards to Mediterranean (42° 40′ N., 2° W.–3° E.); boundary between France and Spain; total length, *c.* 280 m.; width varies from 90 m. to *c.* 25 m. at Mediterranean end. Highest peaks not on main axis but part of great transverse ridges on S. or Spanish side. Chief summits: Maladetta or Pic de Néthou (11,170 ft.), Pic de Posets (11,277 ft.), and Mont Perdu (11,168 ft.). Limit of perpetual snow, 9,000 ft. on N. and 10,000 ft. on S. Characteristic features are gulleys enclosed on all sides by towering crags (*cirques*). Fifty passes, four practicable for carriages. Pyrenees are intensely folded range of comparatively recent elevation; poor in minerals; crystalline core comes to surface in Monte Aneto, while Mont Perdu is cretaceous. Iron mines at Biscay end of chain are prosperous. Slopes magnificently wooded with box, fir, and pine.

Belloc, *The Pyrenees* (1909).

Pyrénées-Orientales, most S.E. dep. of France (42° 20′–42° 55′

N., 1° 44′–3° 10′ E.); almost entirely consists of main chain of E. Pyrenees and offshoots; climate cool on mountains, dry on undulating plain along Mediterranean (*tramontane* wind from N.N.W.); wine; oranges and other sub-tropical fruits; iron mined; coast lagoons produce salt. Amélie-les-Bains has sulphur springs. Cap. Perpignan. Area, 1,598 sq. m.; pop. 213,000.

Pyrethrum, genus of plants, order Compositæ; best-known species is common feverfew (*P. parthenium*).

Pyrgos, tn., Achaia and Elis (Peloponnesus), Greece (37° 40′ N., 21° 26′ E.), 42 m. S.W. of Patras; devastated by Turks (1825); fishing and viticulture. Pop. 14,000.

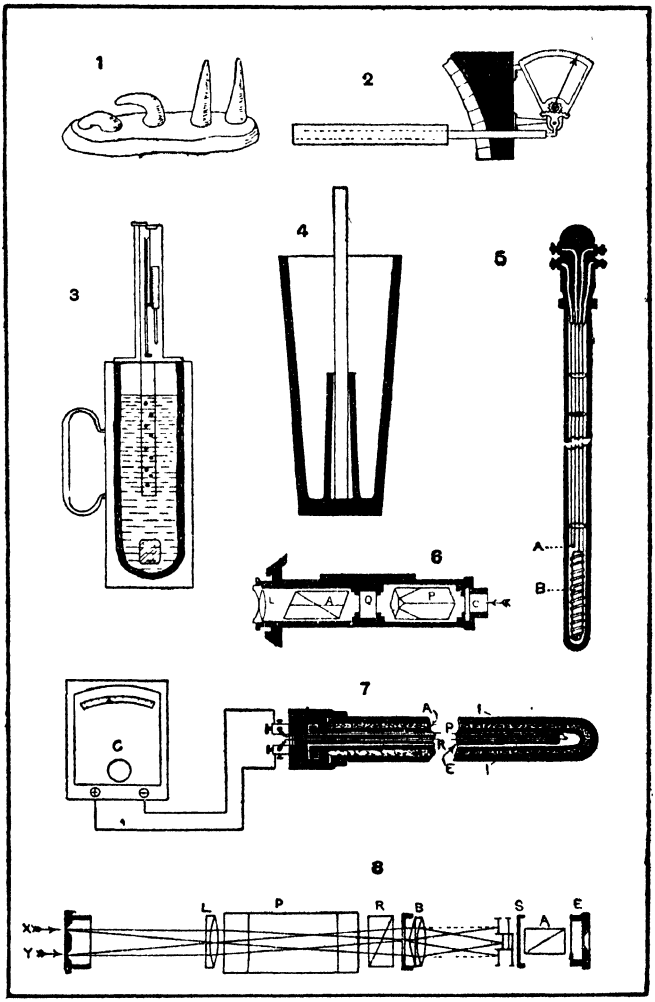
Pyrheliometer, an instrument devised by Pouillet to measure the heat radiated by the sun. It consisted of a thin, disk-shaped metal box containing water, to act as a calorimeter, supported by an axial tube containing a thermometer. The box was blackened, and fixed so that its flat surface was normal to the sun's rays, the direction being known by the shadow of the box exactly coinciding with a disk of the same size fixed at the other end of the tube. The temperature was taken before and after the exposure, and the heat received was calculated by multiplying the rise of temp. by the mass and by the specific heat of the box and its contents. The temp. of the sun has been deduced from the results; but different formulæ give widely differing temperatures, varying from 1,300° to 1,000,000° C. The most recent determinations agree in assigning values between 5,000° and 6,000°. There are indications of periodic fluctuations in the intensity of the radiation. For this purpose platinum-resistance thermometers, thermo-couples, and optical pyrometers have now superseded the pyrheliometer.

Pyridine, C_5H_5N, a basic compound occurring in coal-tar and in the oil obtained by the distillation of bones, from both of which substances it may be separated by distillation of the basic portion. Pyridine is a strong-smelling liquid (sp. gr. ·99) that mixes with water and boils at 116·7° C. It forms salts with acids, and is of similar structure to benzene, five CH groups being united in a ring by a nitrogen atom. It is the parent substance of a large number of derivatives, including some of the natural alkaloids, such as nicotine and piperine. Pyridine is used on the Continent for 'denaturing' alcohol, to render it unfit for use as a beverage.

Pyrites. Iron pyrites, FeS_2, is a yellow mineral occurring crystallized in the cubic system in quartz veins, slate, coal, etc.; probably formed by reduction of ferrous sulphate by organic matter. Often contains copper (copper pyrites), cobalt, nickel, arsenic, and gold. Found chiefly in Spain, France, and the U.S., and used for sulphuric acid manufacture. Copper pyrites or chalcopyrite, $CuFeS_2$, is similar, but softer and darker in colour.

Pyrmont. See under WALDECK-PYRMONT.

Pyrocatechin, or CATECHOL, $C_6H_4(OH)_2$, is ortho-dihydroxy-



Various forms of Pyrometer.

(For key to plate, see opposite page.)

benzene; formed when catechin and similar bodies are distilled, and is prepared from the guaiacol, $C_6H_4(OH)(OCH_3)$, occurring in beech tar by heating with hydriodic acid. Pyrocatechin forms white crystals (sp. gr. 2·34) that dissolve in water, melt at 104° C., and boil at 246° C. Its solution is turned green by ferric chloride, and acts as a reducing agent, particularly in alkaline solution. For this reason it has some employment as a photographic developer.

Pyrogallol ($C_6H_3(OH)_3$), usually known in photography as 'pyro'; prepared by heating gallic acid and obtained as white shining crystals; m.p. 133° C. It has a strong reducing action, is used in photography as a developer, and for the estimation of oxygen.

Pyrolusite (MnO_2), an iron-black coloured mineral occurring in opaque masses; not known in crystals. It is the chief ore of manganese, and is extensively mined in Australia, Japan, India, U.S., and Central Europe.

Pyrometer, an instrument for measuring temperatures exceeding those capable of registration by the mercurial THERMOMETER —*i.e.*, above 550° C. Instruments used depend on a variety of principles, of which the following are the chief: (1) Expansion of a gas; (2) point of fusion or softening of a solid; (3) heat evolved by the cooling of a known mass of metal; (4) electromotive force set up on heating the junction of two dissimilar metals; (5) change in the electrical resistance of a heated wire; (6) determination of the colour; (7) of the intensity of light emitted by a glowing body; and (8) the permanent deformation of a special test piece on heating. Different kinds are indicated on p. 368. Devices based on (4) and (5) are probably the most widely used and exact methods of pyrometry. By means of the Uhling pyrometer (based on the expansion of air) it is possible to construct a scale of temp. reaching as high as 1,500 C.

Pyrotechny. See FIREWORKS.

Pyroxenes, group of important rock-forming minerals, including augite, diallage, enstatite, bronzite, and hypersthene; they belong to three different crystalline systems.

Pyroxylin, or COLLODION COTTON, is a nitrated cellulose in which the nitration has not been carried so far as in gun cotton. It is prepared by adding purified cotton wool to a mixture of concentrated nitric acid and sulphuric acid, and afterwards thoroughly washing with water. The temperature, the time of nitration, and the concentration of the acids have their effect on the product. The product is inflammable, and should be entirely

KEY TO PLATE ON PAGE 368.

1. 'Seger's cones.' 2. Brougniart's pyrometer. 3. Siemens's water pyrometer. 4. Wedgwood's pyrometer. 5. Callendar's electric pyrometer: A, platinum wire; B, strip of mica; C, porcelain tube. 6. Mesuré and Nouel's optical pyrometer: L, lens; A, analyzing prism; P, polarizing prism; Q, quartz; C, flat piece of plate glass. 7. Le Châtelier's electrical pyrometer: G, pyrometer galvanometer; I, iron tube; A, asbestos packing; P, platinum wire; R, platinum-rhodesium wire; E, porcelain insulator. 8. Wanner's optical pyrometer: X, light from 6-volt electric lamp; Y, light from the object whose temperature is to be found; L, lens to render the two beams parallel; P, direct vision prism, to disperse the beams into a continuous spectrum; R, Rochon prism, to separate beams and polarize them at right angles; B, biprism bringing two oppositely polarized disks of light before slit S; A, analyzer; E, eye-piece.

soluble in a mixture of alcohol and ether. It is used for the preparation of collodion, celluloid, and some kinds of smokeless powders.

Pyrrhula, bullfinch. See under FINCH FAMILY.

Pyrrhus (*c.* 318–272 B.C.), King of Epirus; one of the greatest generals of the anc. world; helped Tarentum against Rome, and won battle of Heraclea (280), first encounter of Greeks with Romans, a success dearly bought—hence the phrase 'a Pyrrhic victory'; further successes (279), but decisively beaten at Beneventum (274); a chivalrous figure in history.

Pyrrol (C_4H_4NH), liquid obtained from bone oil and coal tar; b.p. 131° C.; with hydrochloric acid colours wood red; smells like chloroform and turns brown when exposed to air.

Pytchley, par. and vil., Northamptonshire, England (52° 22′ N., 0° 44′ W.), 3 m. S.W. of Kettering; famous Pytchley Hunt established in 18th cent.; kennels at Brixworth, near Northampton. Pop. 500.

Pythagoras OF SAMOS (6th cent. B.C.), Gr. philosopher, of whose life little is known; settled at Crotona in Magna Græcia, and there founded a society, mainly of aristocrats. It came into conflict with established political custom, and after a period of power was in 5th cent. ejected from Crotona and in part dispersed throughout the Gr. world.

Of the teaching of Pythagoras himself little is certainly known; but he undoubtedly believed in transmigration of souls and inculcated abstinence from flesh; he seems to have preached a 'way of life' or 'way of purification'; and he was much interested in (and perhaps was the first scientific student of) harmonies and arithmetic. In astronomy he recognized the circular focus of the earth, and his followers realized that it and the planets revolve round a central point. Pythagoras left no writings, but certain *Fragments*, attributed to his disciple Philolaus, are extant, and were pub. by Böckh (1819).

Benn, *The Greek Philosophers*, vol. i.; J. Burnet, *Early Greek Philosophy*; Gomperz, *The Greek Thinkers*, vol. i.; Zeller, *Pre-Socratic Schools*.

Pytheas OF MASSILIA (Marseilles) (*fl.* early 3rd cent. B.C.), Gr. navigator and astronomer; visited Britain and Thule (? Orkney or Shetland Isles); coasted N. Europe from Cadiz to mouth of the Elbe; fragmentary writings edited by Fuhr (1835).

Pythias. See under DAMON.

Python. See under SNAKES.

Pyx, TRIAL OF THE, periodical testing of gold and silver coins issued by the Mint to ascertain whether they come up to the legal standard of weight and fineness. Pyx is the chest in which coins for trial are deposited. By various Orders in Council, under the authority of sec. 12 of the Coinage Act, 1870, trial must be made once in every year in which coins are issued by Mint, or as often as lords of Treasury determine. Trials are usually held in hall of the Goldsmiths' Company.

Q

Q, the seventeenth letter of the alphabet, denotes in Semitic languages what may roughly be described as a guttural *k*; Greeks gave it power of *k*, and it is found only in earliest of Gr. inscriptions. Among Latin peoples and in English it is employed along with *u* only. The form of the letter has not varied very greatly. In the Morse Code used for army signalling it is written thus: — — · —

Quadragesima (Fr. *Carême*), an early name for the forty days' fast of Lent, and especially applied to the first Sunday in Lent —that is, the Sunday after Ash Wednesday. The Advent fast has also been sometimes known as Quadragesima Sancti Martini, thereby connecting the feast of St. Martin with the preparation for Christmas, as though the Advent season had formerly lasted for six weeks instead of four.

Quadrant. See SEXTANT.

Quadratic Equation. See under EQUATION.

Quadrature, finding a square of area equal to the area bounded by any lines, straight or curved; finding the quadrature of a circle is the old game of 'squaring the circle.'

Quadrilateral, in geom., any four-sided figure of which the square, parallelogram, rhombus, and trapezium are particular cases. A quadrilateral may be plane, or it may have its sides not in one plane. In this case it is usually called a *gauche* quadrilateral. The middle points of the sides of *any* quadrilateral lie in one plane, and form indeed the corners of a parallelogram.

Quadrilateral, THE. (1) Dist. between rivers Mincio and Adige, N. Italy (c. 45° 20′ N., 10° 50′ E.), defended by the four fortresses of Peschiera, Mantua, Verona, and Legnago, which have figured largely in wars of N. Italy, especially in 19th cent. wars between Italy and Austria. (2) Warsaw, Novo-Georgievsk, Ivangorod, and Brest-Litovsk are sometimes described as the Polish Quadrilateral. (3) During Great War name was severally applied to fortified network of trenches held by Turks E. of head of Kereves Dere, Gallipoli, captured by the French in June 1915, and to a Ger. fortification, commanding approach to Morval, which was captured during third phase of battle of Somme (Sept. 1916).

Quadruple Alliance. (1) Between the Triple Alliance (Britain, France, Holland) and Austria (1718), to counteract Spanish schemes and to enforce terms of Treaty of Utrecht. (2) Between Russia, Austria, Prussia, and Great Britain (1815), to support Bourbons. (3) Formed by the same countries (1840), to support the Sultan against Mehemet Ali.

Quagga. See HORSE FAMILY.

Quail. See PHEASANT FAMILY.

Quain, SIR RICHARD (1816–98), Irish physician; practised

in London; physician to Brompton Hospital for Diseases of the Chest (1855); an authority on heart disease, and author of *Dictionary of Medicine*. His cousin, JONES QUAIN (1796–1865), was author of the well-known *Elements of Anatomy*, and RICHARD QUAIN (1800–87), brother of Jones, was president of Royal Coll. of Surgeons (1868), and endowed the Quain professorships of bot., Eng. language and literature, law, and physics in Univ. Coll., London.

Quakers. See FRIENDS, SOCIETY OF.

Quantock Hills, Somerset, England (51° 8′ N., 3° 12′ W.), stretch 10 m. S.E. from Bristol Channel; reach 1,261 ft. in Will's Neck.

Quarantine (Fr. *quarantaine*, 'forty days'), the time during which those exposed to infection on a given date must wait, without further exposure to infection, before it is known whether they have taken the disease or not. The time varies with each infectious disease. When a vessel arrives from a port where infectious disease is prevalent she is not permitted to land her cargo, nor is any one on board allowed ashore except at appointed places, and under special regulations. The vessel is 'in quarantine,' and may be thus secluded for forty days.

Quarrying. In Britain quarries are distinguished from mines by being carried on in daylight, but on the Continent distinction depends on material obtained. Methods employed in a particular quarry depend on nature of rock and on uses to which it is to be put. Limestone, sandstone, and other stratified rocks are usually split right through the stratum by use of steel wedges, while in case of such rocks as granite and whinstone the method employed is blasting. Among famous Brit. quarries are those of Aberdeenshire (granite), Portland (limestone), and Bethesda (slate).

Quart, an Eng. measure of capacity, equal to the fourth part of a gallon (two imperial pints), containing 69·3185 cub. in., and weighing 2½ lb. avoirdupois of distilled water. The old Eng. quart for wine and spirits contained 57·75 cub. in., and that for beer 70·5 cub. in. In the dry quart there were 67·2 cub. in.

Quartan Fever. See MALARIA.

Quarter Days. In England these are Christmas Day, 25th Dec.; Lady Day, 25th March; Midsummer, 24th June; and Michaelmas, 29th Sept. See under TERMS.

Quartermaster. In the Brit. army the quartermaster-general (third military member of the Army Council) is at the head of the dep. responsible for transport and remounts, railways, supply, equipment, and movements of troops. A quartermaster in the army is an officer with the honorary rank of captain or lieutenant attached to a regiment or battalion, and his duty comprises all matters connected with the supply and equipment of the unit. He is not directly concerned with quality, but is responsible for quantity. He is debarred from performing any cash duties, except in circumstances in which he is by regulation recognized as a sub-accountant. In the navy a quartermaster is a petty officer.

appointed by the captain of the ship, who assists the navigating officer in the care of the sounding leads, the lights, the bunting, the storing of ballast and provisions, the coiling of ropes, and the reading of the compasses. He deciphers and hoists signals, and stands a regular watch in the ship, night and day, whether the vessel is at sea or at anchor.

Quarter Sessions. See under SESSIONS OF THE PEACE.

Quartz is silica, SiO_2, crystallized in the hexagonal system; sp. gr. 2·65, hardness 7. The purest form is rock crystal; impure varieties are milk, rose, smoky, and amethystine quartz; is a constituent of granite, etc., and itself forms a massive rock; sand and sandstone are chiefly quartz grains. Quartz is used for making spectacle lenses, pivots, balance fittings, etc. Fused quartz is made into fine threads for suspensions, and tubing and laboratory vessels, which stand sudden changes of temperature.

Quartzite, or QUARTZ ROCK, a greyish or yellowish sandstone generally found in such anc. rocks as the pre-Cambrian; specially large blocks have been found in Reading Beds. It is also found filling veins and fissures.

Quartz Porphyry, acid igneous rock containing crystals of quartz and felspar scattered in compact mass of same minerals, and occurring in intrusive lavas. Non-porphyritic varieties are known as felsite; owing to earth movements, many of the quartz porphyries have become schistose, especially in Palæozoic rocks.

Quartz Trachyte. See under RHYOLITE.

Quassia, a genus of tropical Amer. trees belonging to the order Simarubaceæ. There is only one species, *Q. amara,* the bitter ash or bitterwood, the wood of which is used in med. as a bitter tonic. It bears terminal clusters of large scarlet flowers, and is occasionally cultivated as a stove tree.

Quaternions. A quaternion is the mutual relation of two *vectors* with respect to *quantity* and *direction.* The sum of a *scalar* and a *vector* is called a quaternion because it involves four independent numbers, such as the scalar and the three coefficients of the vector when that is resolved along three given directions. The quaternion analysis was invented by Sir W R. Hamilton in 1843. The *tensor* of a vector α is the number of units contained in its length, and is denoted by Tα. The *versor* Uα of a vector α is a vector of unit length having the same direction as α. Hence $\alpha = T\alpha . U\alpha$, and $T\alpha = T(-\alpha)$, $U\alpha = -U(-\alpha)$. More generally, n being a real scalar, $Tn\alpha = nT\alpha$, and $Un\alpha = U\alpha$ if $n > 0$; $Tn\alpha = -nT\alpha$, $Un\alpha = -U\alpha$ if $n < 0$.

The product of the length of one vector (α) into the length of the projection of another (β) upon it is denoted by $-S\alpha\beta$, and $S\alpha\beta$ is called the *scalar* of $\alpha\beta$. By similar triangles it follows that $S\alpha\beta = S\beta\alpha$. Further, $S\Sigma\alpha\Sigma\beta = \Sigma\Sigma S\alpha\beta$, and the function is doubly distributive. A unit of length having been assumed, let a vector be drawn at right angles to two given vectors α and β, so that rotation round this vector from α to β is positive,

and let the length of this vector be numerically equal to the area of the parallelogram determined by α and β. This vector, called the *vector* of $\alpha\beta$, is denoted by $V\alpha\beta$. The axis of a rotation is the direction of advance of a right-handed screw turning in a fixed nut. We have $V\beta\alpha = -V\alpha\beta$, and further $V\Sigma\alpha\Sigma\beta = \Sigma\Sigma V\alpha\beta$.

The *product* of the vectors α and β is defined by the equation $\alpha\beta = S\alpha\beta + V\alpha\beta$, and since both terms $S\alpha\beta$ and $V\alpha\beta$ are doubly distributive the product is also, $\therefore \Sigma\alpha\Sigma\beta = \Sigma\Sigma\alpha\beta$. But $\beta\alpha = S\alpha\beta - V\alpha\beta$, and so multiplication of vectors is not commutative. The product of a pair of vectors is a quaternion, since it is the sum of a scalar and a vector. Conversely, every quaternion may be expressed as the product of a pair of vectors. If q is a quaternion, Sq its scalar part and Vq its vector part, $q = Sq + Vq$. If α and β^1 are two vectors at right angles to one another and to Vq, so that $V\alpha\beta^1 = Vq$, and if $\beta - \beta^1$ is the vector parallel to α for which $S\alpha(\beta - \beta^1) = Sq$, then $q = \alpha\beta$. The sum of any number of quaternions is defined to be the sum of their scalar parts plus the sum of their vector parts. The product of a quaternion and a vector is distributive with respect to the scalar and the vector of the quaternion. Thus $\gamma q = \gamma(Sq + Vq) = \gamma Sq + \gamma Vq$; $q\gamma = (Sq + Vq)\gamma = Sq \cdot \gamma + Vq \cdot \gamma$. Hence $\gamma Sq = Sq \cdot \gamma$. Consideration of three mutually perpendicular vectors ijk (with the right-handed notation) leads to the results $i^2 = j^2 = k^2 = -1$, $jk = i = -kj$, $ki = j = -ik$, $ij = k = -ji$, and we may deduce that multiplication of vectors, and hence of quaternions, is associative. Division of vectors may be reduced to multiplication, for $\alpha^2 = S \cdot \alpha^2 = -(T\alpha)^2$; so that $\frac{-\alpha}{(T\alpha)^2} = \frac{1}{\alpha} = \alpha^{-1}$. Thus $\frac{-\alpha}{(T\alpha)^2}$ is the reciprocal of α. Hence the reciprocal of any product of vectors is the product of their reciprocals taken in the reverse order. The same applies to quaternions.

The *conjugate* Kq of a quaternion q is defined by $Kq = Sq - Vq$. So if $q = \alpha\beta$, $K\alpha = \beta\alpha$, and $qKq = T\alpha^2 T\beta^2 \cdot = (Tq)^2$, Tq is the *tensor* of the quaternion. Again, $q = \alpha\beta = T\alpha \cdot U\alpha \cdot T\beta \cdot U\beta = T\alpha \cdot T\beta \cdot U\alpha \cdot U\beta = Tq \cdot Uq$, where $Uq = U\alpha U\beta$, and is the *versor* of the quaternion. If $\pi - \angle q$ is the angle between α and β which is $< \pi$ and measured from α to β, $Sq = Tq \cdot \cos \angle q$, $TVq = Tq \sin \angle q$. The angle $\angle q$ is called the *angle* of the quaternion, and is independent of any particular set of vectors. A plane at right angles to Vq is called the *plane* of the quaternion, and UVq is called the *axis*.

Regarding a quaternion as an operator, it turns vectors *in its plane* through a given angle, and alters their lengths in a given ratio. For applications of quaternion analysis to geometry, statics, dynamics, electromagnetics, etc., see text-books: C. J. Joly, *Manual of Quaternions;* P. G. Tait, *Elementary Treatise on Quaternions;* Sir W. R. Hamilton, *Lectures on Quaternions* and *Elements of Quaternions.*

Quatre-Bras. See WATERLOO.

Quéant, comm., Pas-de-Calais, France (50° 14′ N., 3° 5′ E.),

was a point of great importance on Hindenburg Line, which ran from near Arras past Bullecourt, below Quéant, and thence eastward, to which Germans retreated (1917); was scene of Brit. success during battle of Cambrai (Nov. 1917); during final Allied advance, was the pivot of the Quéant-Drocourt switch, which was broken through by Canadians (Sept. 2 and 3, 1918), Quéant being entered by Naval Brigade.

Quebec, eastern prov., Dominion of Canada (45°–62° 40′ N., 59° 7′–79° 40′ W.), lies along lower course of the St. Lawrence R.; surface is generally undulating; drained by St. Lawrence and its tributaries; principal towns are Montreal and Quebec (cap.). Much of surface is forested, and produce is important, Quebec having more than half Canadian production of pulpwood; cereals, flax, fruits, potatoes, and maple products; live stock largely raised; dairy farming carried on; minerals include asbestos, iron, gold, copper, lead, silver, platinum; fisheries are extensive; manufactures cement, textiles, leather, hardware, paper, etc.

Administration is carried out by lieutenant-governor, aided by a responsible ministry and by legislative council and assembly. Quebec sends 24 senators and 65 representatives to the Dominion Parliament. Education is free and nominally obligatory; Montreal, Quebec, and Lennoxville are seats of universities. Inhabitants are mainly of Fr. extraction. Area (since acquisition of Ungava, 1912), 706,834 sq. m.; pop. (exclusive of Ungava) 2,003,200. For history, see under CANADA.

Quebec, cap. of Quebec prov., Canada (46° 48′ N., 71° 13′ W.); founded in 1608 by Fr. traveller, Samuel Champlain; taken by British under Wolfe, who, like Fr. leader, Montcalm, fell during action (1759); battlefield is now a national park, and there is a monument to Wolfe and Montcalm; great Tercentenary celebrations (1908); three times cap. of Canada. City consists of Upper and Lower Town, former residential, latter devoted to commerce. Steep streets, deep-eaved Fr. houses, many churches, citadel, and Château Frontenac (hotel). Quebec is the seat of a cardinal archbishop, of an Anglican bishop, of Laval R.C. Univ., and of Morrin Coll. Among its principal buildings are Prot. and R.C. cathedrals, the Parliament House, and the archiepiscopal palace. Excellent harbour and large dry dock (1,150 ft. long), completed 1918; exports timber, lumber, grain, cattle, cheese, etc.; important railway centre; manufactures woollens, hardware, leather goods, etc. The St. Lawrence is crossed at Quebec by a great cantilever bridge (completed 1918) with a span of 1,800 ft. Pop. 78,200.

Parker, *Old Quebec* (1903).

Quedlinburg, town, Saxony, Prussia (51° 47′ N., 11° 7′ E.); was founded by Henry the Fowler; birthplace of Klopstock the poet (1724) and Ritter the geographer (1779); flower and vegetable seeds, cloth, wire goods, starch, aniline dyes. Pop. 27,200.

Queen Anne's Bounty. See BOUNTY, QUEEN ANNE'S.

Queenborough, munic. bor., Isle of Sheppey, Kent, England


Hudson Strait
Mansel
Resolution I.
C. Chidley
HUDSON BAY
Ungava Bay
Nain
Okkak B.
Mugford
Indian House
Hopedale
Adlavik Is.
Harrison
Hamilton Inlet
Cape Wright
Mealy Mts.
Petitsikapau L.
Lobstick L.
Hamilton R.
CANADA
QUEBEC
Mistassini
Portage
Gaspé
C. Gaspé
C. St. George
Bonaventure
Gulf of St. Lawrence
Cape Rosier
Bic
Rimouski
St. John
Chicoutimi
Quebec
Levis
Three Rivers
Joliette
Montreal
NEW BRUNSWICK
Newcastle
Moncton
Prince Edward I.
Cape Breton I.
Sydney
Louisburg
C. Canso
Halifax
Liverpool
Yarmouth
Sable I.
Parry Sound
OTTAWA
Toronto
Lake Ontario
Kingston
Rochester
Buffalo
NEW YORK
Albany
Boston
MAINE
VERMONT
Portland
Lewiston
Augusta
Bangor
Calais
St. Andrews
St. John
Fredericton
Woodstock
Houlton
Edmundston
Rivière du Loup
Lake St. John
Roberval
Mingan
Anticosti I.
Port au Port B.
Bay of Islands
Cape Ray
Port aux Basques
Belle Isle
Labrador
Hudson Strait
Lake Superior
Lake Huron
Lake Michigan
Lake Erie
Detroit
Chicago
Cleveland
Buffalo
Rochester
Syracuse
Albany
Boston
Portland
Augusta
Bangor
Halifax
Liverpool
Yarmouth
Sable I.
QUEBEC
English Miles
0
100
200
300
B to E. 370 miles

(51° 25′ N., 0° 44′ E.); a packet station for Flushing; chemical manure and cement. Pop. 2,500.

Queen Charlotte Islands, off coast of Brit. Columbia, Canada (53° N., 132° 10′ W.); important fisheries; rich in timber; gold, copper, iron, and anthracite coal exist, but have not been worked. Pop. *c.* 700.

Queen Elizabeth, Brit. battleship, completed at Portsmouth in 1914; displacement 27,500 tons; speed 25 knots; armament eight 15-in., sixteen 6-in., and four 3-in. guns, with five torpedo tubes; gives her name to class of five ships; first in Brit. navy to carry 15-in. guns, and also first battleship to be entirely oil fueled. Early in 1915, when Allied fleets bombarded Dardanelles forts, *Queen Elizabeth* took part with telling effect. She was afterwards the flagship of Admiral Sir David (now Earl) Beatty.

Queen Mary, British battle-cruiser, completed at Jarrow (1913); displacement 28,000 tons; speed 31 knots; armament eight 13·5-in. and sixteen 4-in. guns; took part in battle of Heligoland Bight (Aug. 1914); was sunk by explosion in battle of Jutland (May 31, 1916).

Queen Mary's Army Auxiliary Corps, name given to corps of women war-workers formed in 1917 when man-power was becoming dangerously reduced, to provide women substitutes for certain work in army units and offices at home, and at bases and on lines of communication overseas. Principal classes of employment were: clerical, domestic (cooks, laundresses, etc.), motor transport driving, storehouse work (checkers and packers), tailoring, shoemaking, messengers, baking, auxiliary technical work with Royal Flying Corps and Army Service Corps motor transport, and telephone and postal services. Number enrolled was about 45,000, of whom 17,000 served in France and Flanders, while others were employed in Salonica, Italy, and Ireland. Khaki uniform was worn overseas and by those serving in barracks at home. There were several casualties among members serving in France and Flanders during air raids, and conduct of the women on these occasions received warmest praise from commanding officers with whose units they co-operated. Technically the W.A.A.C.'s, as they were popularly called, were not under military discipline, and injuries received overseas were compensated for under a special Act. Corps was disbanded early in 1920, the comptroller, Dame Florence Leach, and officials and personnel receiving thanks of the Army Council. Some three hundred awards were made to members for long service and devotion to duty.

Queensberry, JOHN SHOLTO DOUGLAS, 8TH MARQUESS OF (1844–1900), Brit. authority on prize fighting; drew up a new set of rules to regulate fighting in prize ring, which have since regulated its contests; known as the 'Queensberry Rules.'

Queen's County, inland co., Leinster prov., Ireland (52° 58′ N., 7° 25′ W.). In N.W. are Slieve Bloom Mts. (1,733 ft.), and in S. and S.E. various scattered ranges or hills; centre generally level. Principal rivers, Barrow

(N. and W.) and Nore (S.). There are several anc. remains. Agriculture and dairying are the chief industries. Coal occurs in the S. The county returns one M.P. Area, 664 sq. m.; pop. 54,400.

O'Hanlon and O'Leary, *History of Queen's County* (1907).

Queensferry, NORTH, vil., Fifeshire, Scotland (56° 1′ N., 3° 23′ W.), at N. end of Forth Bridge; is fortified for the protection of the bridge; golf links; ferry to S. Queensferry. Pop. 600.

Queensferry, SOUTH, seapt. and royal burgh, Linlithgowshire, Scotland (55° 59′ N., 3° 23′ W.), at S. end of Forth Bridge; of historic interest, and is mentioned by Scott and Stevenson; had formerly forts for protection of Forth Bridge; during Great War a centre of naval and military activity. Port Edgar is a destroyer station. Pop. 2,800.

Queensland, second largest state of Australian Commonwealth (*c.* 10° 40′ S.–29° S., 138°–153° 30′ E.), is bounded N. by Gulf of Carpentaria and Torres Strait, N.N.E. by S. Pacific, S. by New South Wales, and W. by S. Australia. Queensland is separated into two areas by Great Dividing Range, which follows coast-line at distance of from 100 to 300 m., country between range and coast consisting of alluvial areas and rich river valleys. The Brisbane, Mary, Burnett, Fitzroy, Burdekin, and Johnstone rivers are most important of E. watershed, while W. watershed has rivers flowing N. to Gulf of Carpentaria, S. to Murray-Darling system, and W. to S. Australian lakes. Climate varies with latitude and height, N. being tropical and sub-tropical, S. having mean temp. of 67° F. Discovery of gold (1867) led to a great influx of settlers, and prosperity of the state has of recent years greatly increased. Tapping of water beds by artesian wells has been of great service in agriculture and stock raising. Chief towns are Brisbane, Ipswich, and Rockhampton. Charters Towers, Gympie, and Mt. Morgan are the most important gold-mining centres.

Queensland has a governor, a legislative council of 49 members appointed by crown, and an assembly of 72 members elected by popular vote. There is adult suffrage for both men and women. Education is gratuitous and obligatory; a univ. of Queensland was founded at Brisbane (1910). There is no state religion, the principal denominations in order of numerical importance being Anglican, R.C., Presbyterian, Wesleyan, Lutheran. Queensland produces cereals, sugar-cane, wine, cotton, tea, fruits, timber; sheep, cattle, and horses are extensively reared, and form one of chief sources of wealth; and dairy farming is a rapidly expanding industry. Minerals are of great importance, including gold, copper, tin, coal. Industries include manufactures of sugar, tobacco, leather, boots, spirits, flour, machinery, textiles, soap; and meat preserving is largely carried on. Railway mileage exceeds 5,000. The population is more mixed than in any other part of Australia, and includes English, Germans, Chinese, Japanese, Polynesians. Area, *c.* 670,500 sq. m.; pop. 605,800.

Queensland Official Year Book;

Russell, *The Genesis of Queensland* (1888); Wvedon, *Queensland, Past and Present* (1892).

Queenstown. (1) Mrkt. tn., seapt., and naval station, co. Cork, Ireland (51° 51′ N., 8° 17′ W.), situated on Great I., Cork Harbour; is port of call for U.S. mail steamers; naval docks. Pop. 8,200. See CORK HARBOUR. (2) Tn., Tasmania, Australia (42° 10′ S., 145° 35′ E.); smelting works. Pop. 5,000. (3) Tn., cap. of dist. of same name, Cape of Good Hope, S. Africa (31° 53′ S., 26° 52′ E.), on railway, midway between E. London and Aliwal North. Pop. 9,000.

Quelpart, isl. off S.W. of Korea (33° 20′ N., 126° 30′ E.); was long used as convict station; large pony farms. Length, 40 m.; breadth, 10 to 20 m. Pop. 100,000.

Queretaro. (1) Central state of Mexico, between Guanajuato and Hidalgo; produces maize, cotton, grain, and fruits, and has silver, copper, lead, and iron mines. Area, 3,556 sq. m.; pop. 243,500. (2) City, cap. of above (20° 36′ N., 100° 10′ W.); is historically interesting as scene of beginning of movement for independence; here Emperor Maximilian was shot (1867); opals; cotton and woollen goods. Pop. 35,000.

Quero, vil., Belluno, N. Italy (45° 55′ N., 11° 56′ E.); scene of heavy fighting during Austro-Ger. attempt to force passage of Piave, and was occupied by Austrians (Nov. 1917); retaken by Italians (Oct. 1918).

Quetta, chief tn. of dist. of same name, Brit. Baluchistan, N.W. of Bolan Pass (30° 10′ N., 67° 1′ E.). A great strategical position commanding W. gate to India, it is strongly fortified, and is connected with railway system of India; headquarters of the administration, and seat of Indian Staff Coll.; coal in neighbouring Sor hills. Pop. 25,000.

Quezaltenango. (1) Dep. S.W. Guatemala; coffee, sugar-cane, wheat, and maize. Pop. 110,000. (2) Tn., cap. of above (14° 51′ N., 91° 35′ W.); in neighbourhood are sulphur baths of Almolonga; coffee, sugar, rubber, hides, and horn. Pop. 29,000.

Quiberon, BATTLE OF (1759), episode of Seven Years' War. Fr. plan was to unite Brest fleet under Conflans with Toulon fleet under La Clue, and invade England; Boscawen defeated La Clue at Lagos on Aug. 17, while Hawke kept watch off Brest and brilliantly defeated Conflans in Quiberon Bay, on S. coast of Brittany, E. of Lorient, on Nov. 20.

Quicksilver. See MERCURY.

Quilimane, seapt., Port. E. Africa (17° 50′ S., 36° 44′ E.); Livingstone's starting-point for Lake Nyasa (1861); has copra, ground-nuts, rubber, wax, and skins. Pop. *c.* 2,800.

Quiller-Couch, SIR ARTHUR THOMAS (1863–), Eng. novelist and critic; writes under the pseudonym 'Q'; prof. of Eng. literature, Cambridge (1913); has pub. novels, including *Dead Man's Rock* (1887), *Troy Town* (1888), *The Splendid Spur* (1889), *The Blue Pavilions* (1891), *The Ship of Stars* (1899), *Laird's Luck* (1901), *Hetty Wesley* (1903), *Fort Amity* (1904), *The Mayor of Troy* (1906), *Lady Good-for-Nothing* (1910), *Brother Copas* (1911), *Hocken and Hunken* (1912), *Nicky-Nan, Re-*

servist (1915), and *Foe-Farrell* (1918); has edited several anthologies, including the *Oxford Book of English Verse;* his critical works include *On the Art of Writing* (1917), *Shakespeare's Workmanship: Studies in Literature* (1918), and *The Art of Reading* (1920); in 1897 he completed Stevenson's romance of *St. Ives.*

Quillota, tn., prov. of Valparaiso, Chile (32° 58′ S., 72° 51′ W.); wine; copper mines. Pop. *c.* 12,000.

Quilon, seapt., Travancore state, Madras, India (8° 53′ N., 76° 36′ E.); timber, coco-nuts, pepper, and cardamoms. Pop. 15,000.

Quimper, tn., Finistère, France (48° N., 4° 4′ W.); 13th cent. cathedral; pottery and paper; sardine fisheries. Pop. 19,400.

Quince (*Pyrus cydonia*), a tree cultivated largely for its fruit, which has an extremely acid flavour; differs from the apple in the larger number of seeds; used for giving sharpness to more mild-flavoured fruit, and also for making preserves.

Quincey, De. See De Quincey.

Quincy. (1) City, Illinois, U.S. (39° 51′ N., 91° 20′ W.); machinery, vehicles, stoves, ironware, bricks, flour, and tobacco. Pop. 36,600. (2) City, Massachusetts, U.S. (42° 15′ N., 71° W.); residential suburb of Boston; granite quarrying and shipbuilding; foundry products, and boots and shoes. Pop. 32,600.

Quinine, $C_{20}H_{24}N_2O_2$, the chief alkaloid in cinchona bark (from Java, India, Ceylon, etc.), was first prepared by Pelletier and Caventou in 1820. It is extracted by dilute sulphuric acid, and separated from cinchonine and numerous other alkaloids by fractional crystallization of the sulphate. Anhydrous quinine melts at 177°; crystalline quinine contains $3H_2O$; its chief salts are the sulphate $(C_{20}H_{24}N_2O_2)H_2SO_4$, $8H_2O$, and dihydrochloride, $C_{20}H_{24}N_2O_2$, $2HCl$, $3H_2O$. Solutions of salts have an intensely bitter taste, and give an emerald green colour with chlorine or bromine water and ammonia; dilute solutions show a light blue fluorescence. A valuable tonic and antipyretic, and an antidote to malaria.

Quinoline, C_9H_7N, a basic compound of double ring structure, like naphthalene, but with one of the CH groups in the *a*– position replaced by a nitrogen atom. Quinoline occurs in coal tar and bone oil, but is best prepared synthetically by heating aniline, nitro-benzene, and glycerol with sulphuric acid. It is a colourless liquid (sp. gr. 1·09) with a strong smell, boiling at 239° C. It forms salts, and is the parent substance of a number of dye-stuffs.

Quinones are benzene (or anthracene) derivatives containing two CO groups. Quinone ($C_6H_4O_2$) consists of yellow needles which melt at 116°; it is formed by oxidation of aniline, or hydroquinone.

Quinsy. See Tonsillitis.

Quintal, a weight, generally of 100 lb., corresponding in its uses to the hundredweight of Great Britain and the zentner of Germany, but of various weights in different states. The metrical quintal contains 100 kilograms, or 220·49 lb. avoirdupois.

Quintilian (Marcus Fabius Quintilianus) (*c.* A.D. 40–100),

Roman rhetorician; instructed the younger Pliny; favoured by Vespasian; chief work, *Institutiones Oratoriæ* (commonly called *The Institutes*), a complete system of rhetoric dedicated to Marcellus Victorius.

Quito, city, cap. of Ecuador, S. America (0° 14′ s., 78° 40′ w.); situated on plateau of Andes (alt. 9,350 ft.); one of the oldest cities in S. America and at one time cap. of Incas; has repeatedly suffered from earthquakes; cathedral and univ.; carpets, blankets, shoes, saddles, woollen and cotton goods; rubber and hides. Railway connecting it with Esmeraldas and Rio Bamba is now under construction (1920). Pop. 70,000.

Quoad Sacra. In Scotland a parish erected under the provisions of 7 and 8 Vict. c. 44, for eccles. purposes only, is called a parish *quoad sacra* ('with respect to sacred things'), to distinguish it from a civil parish, which is a parish for all purposes.

Quoits, a popular Brit. game. The quoit is a direct descendant of the Roman *discus*, a ring of iron or stone from 10 to 12 in. in diameter. The modern quoit is an iron ring averaging 6 lb. in weight, flattish in shape, but convex on the upper side to form sufficient edge for the quoit to stick in the ground when falling. The ring is about 2½ in. broad and 9 in. in diameter, with a hollow dint on the outer rim for the forefinger or the thumb. Two 'hobs,' or pins, are placed in the ground, generally 19 yds. apart, and the players endeavour to ring the 'hob,' or pin, or to place their quoit as near it as possible. A 'ringer' counts 2, the nearest quoit 1, as in bowls or curling. A circle of clay is placed round the hob to receive the quoit.

R

R. Older Eng. lingual trill of this letter lost in S. English, but widely used by Scots and Welsh. Parisian *r* is uvular (standard Fr. *r*). In S. English *r* is silent or nearly so ('army,' 'father'), but exercises marked influence on preceding vowel ('doe,' 'door'; 'fee,' 'fierce'; 'day,' 'dare'). A voiceless *r* occurs in French at end of words such as *quatre*, and in Welsh in combination *rh* (*e.g.*, 'rhos'). Gr. P is early Semitic form with loop transferred from left to right. ר retains top stroke on left, but has lost loop. In Morse (army) system of signalling represented by · — ·

R 34. See ATLANTIC FLIGHT.

Raab, or GYŐR, cap. Raab co., Hungary (47° 41′ N., 17° 40′ E.), 70 m. S.E. of Vienna; 12th cent. cathedral; horse fairs; machinery, agricultural implements, oil. Pop. 44,300.

Rabat, seapt., Morocco (34° N., 6° 15′ W.), 110 m. W. of Fez; has sultan's palace; manufactures carpets and pottery; exports skins, olive oil, wax, etc. Pop. 30,000.

Rabbit (*Lepus cuniculus*), relative of hare, with smaller body, shorter ears, and characteristic habit of burrowing; found widely distributed in Old World, probably often through man's introduction, as in Australia and New Zealand. Unlike those of the hare, its young are naked and helpless at birth.

Rabbit-fish. See BURBOT.

Rabbit-fishes. See under PORCUPINE-FISHES.

Rabelais, FRANÇOIS (*c.* 1483–1553), Fr. writer; *b.* Chinon; soon showed his love for science; studied Gr. and Lat. authors, natural history, law, maths., and professed med. at the univ. of Montpellier (1530), Lyons (1532); made remarkable anatomical discoveries; member of chief literary circle; went to Rome as medical adviser of Jean du Bellay (1533). Rabelais pub. *Pantagruel* (1533), *Gargantua* (*c.* 1535, *et seq.*); his other writings are of no intrinsic interest. Characteristics of Rabelais' style are frankness, wonderful power of expression (which is aided by vast vocabulary enriched by archaisms, *patois*, classicisms), pervading spirit of mockery, a simple broad humour, and indecency. His influence was strong on Fielding, Smollett, and Swift. Sir Thomas Urquhart made a remarkable translation of Rabelais (1653).

Sir W. Besant, *Rabelais* (1879); Tilley, *Rabelais* (Fr. Men of Letters): Millet, *Rabelais* (Grands Ecrivains Français); Fleury, *Rabelais.*

Rabies. See HYDROPHOBIA.

Raccoon Family (Procyonidæ), a family of carnivores whose members have clumsy bodies, short necks, and sharp muzzles. They include the carnivorous raccoons (*Procyon*) of America, the beaver-like fur of which is much used by man; the vegetarian

panda (*Ailurus*), found in the Himalayas above an altitude of 7,000 ft.; and the coati and kinkajou.

Race, CAPE. See CAPE RACE.

Race Meetings. Of all horse-racing meetings the most popular is the Derby (Epsom), the most fashionable Ascot, the most select Goodwood. The great races, as laid down by authority, are: the Lincolnshire, the Brocklesby Stakes (Lincoln); the Liverpool Grand National; Newbury Spring Cup; Great Metropolitan and the City and Suburban (Epsom); Craven Stakes, Two Thousand Guineas, One Thousand Guineas (Newmarket); Chester Cup; Jubilee Handicap (Kempton); Newmarket Stakes; Woodcote Stakes, Derby, Oaks (Epsom); Salford Borough Handicap; Manchester Cup, Coventry, Prince of Wales, Ascot, Coronation, New, Hardwicke, and Rous Memorial Stakes, with the Gold Vase, Royal Hunt Cup, Gold Cup, and Alexandra Plate (Ascot); Northumberland Plate (Newcastle); July, Prince of Wales, and Chesterfield Stakes (Newmarket); Eclipse and National Breeders' Foal Stakes (Sandown); Liverpool Summer Cup, Goodwood Plate, Goodwood Cup, Chesterfield Cup, Prince of Wales Stakes (Goodwood); Brighton Stakes, Brighton Cup, Lewes Handicap, City of London Breeders' Foal Stakes (Kempton); Great Ebor Handicap, Great Yorkshire Stakes (York); Champagne Stakes, Great Yorkshire Handicap, St. Leger, Portland Plate, Doncaster Cup (Doncaster); Newbury Autumn Cup, Great Eastern Handicap, Great Foal Stakes, Newmarket October Handicap, Jockey Club Stakes (Newmarket); Imperial and Duke of York's Stakes (Kempton); Cesarewitch, Challenge Stakes, Middle Park Plate, Champion, Criterion, and Cambridgeshire Stakes, Dewhurst Plate, Jockey Club Cup (Newmarket); Liverpool Autumn Cup; Derby Cup; Manchester November Handicap.

The 'Metropolitan' Club meetings are those held at Sandown, Kempton, Hurst, Gatwick, Lingfield, Alexandra Park, and Newbury. The chief steeplechase is the Grand National, run at Aintree in March. The most fashionable race meetings in Scotland are those held at Ayr (especially the Sept. gathering), Eglinton Hunt Meeting (Bogside in the spring), Edinburgh (Musselburgh), Lanark, Kelso, and Paisley. The chief meeting in Ireland is held at the Curragh of Kildare; other racing at the Dublin Phœnix Park, Leopardstown, Punchestown, and Dundalk; steeplechasing is held pretty nearly all over the island. In Wales there is steeplechasing at Cardiff, Monmouth, Ross, Chepstow, Carmarthen, and Bangor.

In France there are meetings at Auteuil (Grand Steeplechase), Nice, St. Cloud, Maisons-Laffitte, Paris (at Longchamp: Grand Prix de Paris in June), Chantilly (Prix du Jockey Club), Boulogne, Deauville, Dieppe, and Pau. Racing does not flourish in Germany, but the Hungarians are keen sportsmen, and in normal times there is racing at Budapest. In Australia and New Zealand great interest is taken in breeding

and racing. Valuable prizes are run for in Melbourne and Sydney, and also in S. Africa. In U.S. racing is continued throughout the year; in the eastern states in spring, summer, and autumn, and in the southern states and California in winter.

During 1919 the war restrictions on RACING were removed, and a large programme was arranged. The public welcomed the resumption with enthusiasm, though the number of horses in training had been reduced by more than one-half. The winners of the 'classic' races in 1920 were as follows:

Two Thousand Guineas (Newmarket, April)—Tetratema (Major M'Calmont).

One Thousand Guineas (Newmarket, May)—Cinna (Sir Robert Jardine).

Derby (Epsom, June)—Spion Kop (Major G. Loder).

Oaks (Epsom, June)—Charlebelle (Mr. A. P. Cunliffe).

St. Leger (Doncaster, Sept.)—Caligula (Mr. Gocusdas).

Racemic Acid, a mixture of dextro- and levo-tartaric acids occurring naturally, and formed also when tartaric acid is prepared synthetically. Its crystals are efflorescent, and have no action on polarized light. Though differing from tartaric acid in solubility, melting-point, and crystalline form, it closely resembles it in many respects.

Races of Mankind. Mankind has been divided by modern ethnologists into these races: (1) *Negro*, or black; (2) *Red Indian*, or brown; (3) *Malayan*, and (4) *Mongolian*, yellow; (5) *Indo-European* or *Caucasian*; and (6) *Semitic*, white. The total population of the world is, according to estimation, 1,646,000,000, of whom 190,000,000 are Negro, 23,000,000 Red Indians, 52,000,000 Malayan, 655,000,000 Mongolian, 645,000,000 Caucasian, 81,000,000 Semitic. The race of many other peoples, especially those of apparently Malayan or Negroid type, has not yet been determined, and the data upon which ethnological judgments should be made is imperfect, but it has been clearly demonstrated that neither environment nor language is a test of race.

The races of the world may be roughly ethnogeographically divided into (1) the *black* races of the tropics, (2) the *yellow* and *brown* men of Southern and Central Asia and of America, (3) the *white* peoples of temperate climes. The best test, however, is held to be the build of a man, especially with regard to the proportions of his skull.

The chief reasons for believing in a common origin are: (1) physiological similarities and the power of cross-breeding; (2) modern philology has resolved the thousand tongues of the world into a few parent speeches, though the search for one original language has been unsuccessful; (3) there are common phenomena of social development, so that every race has its Stone Age, etc. Comparative mythology, law, etc., give the same result as comparative philology.

The earliest relics of man in Europe, found in Somme valley and at Taubach in middle of 19th cent., proved that he existed in the Drift period (*Palæolithic Age*);

later discoveries of Fraas were made at source of Schussen. Moreover, palæolithic implements are found in France, Britain, Russia, the countries of S. Europe, N. Africa, America, S. India. It is an old theory that man spread over the world from Asia; Asiatic fauna are found with remains of palæolithic man in Drift Beds. Dubois's discovery of *Pithecanthropus erectus* (1892) has led those who accept it to place the cradle of the race in Java, and to trace the first migration therefrom. If so, man must have started on his wanderings when the Eastern Archipelago was part of the Asian mainland, when no Indian Ocean separated Asia from Africa, when no Pacific Ocean lay between Asia and America, and Java had land communication with Australia.

Neolithic, who followed Palæolithic, man, still exists. The Neolithic Age represents the stage in social development through which every race has not yet completely passed. Egypt, Babylonia, and Chaldæa, followed by 'Mycenæans,' were the first to emerge from Stone Ages into Copper, Bronze, and Iron Ages. From the civilized countries of the Mediterranean basin later European civilization has descended. In the earliest writings of Egyptians and Greeks it may be seen that the great human races had already taken their later forms, and men were already speculating on their origin.

The *Negro race* may be subdivided into African negroes, Negritos, Melanesians, perhaps Papuans, Australians, and Tasmanians. The relation of these peoples is yet only matter of conjecture. Andaman tribes of Sea of Bengal represent, it is suggested, the primitive negro type. *African negroes*, whose home is s. of the Sudan, have spread all over Africa, Madagascar, and into W. Indies, southern United States, and S. America. They are possibly not an indigenous African population, but conquerors of the Negritos (Span. 'little negroes') or *pygmies*, and made their entry into Africa through Arabia. Pygmies are believed to have occupied the whole equatorial region before the subsidence of the Indo-African continent cut them into two divisions, that of Africa and that of the Malay peninsula.

The *Red Indian race* is confined to America, and is described under INDIANS, AMERICAN.

The *Malayan race* inhabits the Malayan peninsula and 'Malaysia' (the E. Indies). Believed until lately to be Mongolians, they are now considered a separate race of southern conquerors. It is suggested that they belonged to the same race as the Polynesians, from whom they were separated at the subsidence of the Indian continent.

Mongolians probably made their early home on the tableland of Tibet, from which they soon spread over Mongolia, China, and Siberia, and ultimately over Central Asia, parts of Armenia, Caucasia, Irania, Russia, Finland and Lapland, Manchuria, Japan, Siam, Formosa, Korea, parts of Hungary and Balkan peninsula, Madagascar, and the Philippines.

To the *Indo-European* (formerly

called *Caucasian*, and lately *Indo-Germanic*) *race* belong most of the peoples of India and Europe. In historical times this race has colonized a large proportion of America and much of Africa and Australia. The Indo-European tongue comprises Sanskrit, Greek, Latin, Romance tongues, Persian, Slavonic, Teutonic, Celtic, etc.

Arabia or N. Africa is assigned as the home of the *Semitic race*; thence it spread over Syria and Palestine. See ANTHROPOLOGY.

Rachel, ELISA (1821–58), Fr. actress; from 1838 onwards enjoyed phenomenal popularity in tragic parts such as Phèdre. *Adrienne Lecouvreur* was written specially for her.

Rachitis. See under RICKETS.

Raciborz. See under RATIBOR.

Racine, city, Wisconsin, U.S. (42° 44′ N., 87° 48′ W.), on Lake Michigan; manufactures agricultural machinery, motors, etc.; shipping trade in lumber and coal. Pop. 38,000.

Racine, JEAN (1639–99), Fr. dramatist; *b.* at La Ferté-Milon; educated first at the coll. of Beauvais, then at Port-Royal. Verses on the king's marriage (1660) won for him a pension and began his fame. *La Thébaïde* (1664), his first tragedy, and *Alexandre le Grand* (1665) recalled the style of Corneille. His masterpieces are *Andromaque* (1667), *Britannicus* (1669), *Bérénice* (1670), *Bajazet* (1672), *Mithridate* (1673), *Iphigénie* (1375), *Phèdre* (1677). Racine had a perfect knowledge of Greek. His characters are true, and their passions are finely depicted, though his plays have preserved the manners and language of Louis XIV.'s court. *Les Plaideurs* (1668), imitated from Aristophanes' *Wasps*, is an amusing satire on the legal profession, written in exquisite verse. At the request of Madame de Maintenon he wrote *Esther* (1689), which was acted several times before the court, and *Athalie* (1691), of greater force and character. Racine is the greatest tragic writer after Corneille (whom he sometimes equals) of the Fr. class. school.

Canfield, *Racine and Corneille in England* (1904); Larroumet, *Racine* (Grands Ecrivains Français); Lemaître, *Racine* (1908).

Racing. In Great Britain horse-racing is a favourite sport with all classes. Newmarket and Epsom are the oldest courses, dating from the times of James I.

It was not till the 18th cent. that racecourse regulations were specifically formulated with regard to weight of jockeys and stakes; in that century also 'handicap' races took the place of the old 'give-and-take' race, the object of the innovation being to equalize the weighting of horses. In the reign of George III. the tax of two guineas was first levied on every horse started. It was not, however, till the closing decades of the 19th cent. that the turf became an object of universal interest in the country. The breed was temporarily vitiated in recent years owing to the popularity of the two-year-old short race. This forced immature animals, and preventive measures had to be taken. In the modern selling-races the owner fixes the selling-price on entering the horse. Should the winner on being put to auction after the race realize a larger sum, the

difference is divided between the owner of the 'proxime accessit' and the general funds.

Steeplechasing was originally a race for hunting horses which tested both speed and jumping, and was run from one church steeple to another. The first mention of the sport is of a steeplechase match in Ireland in 1752, and in Ireland to-day the sport is still much more cultivated than in Great Britain. Steeplechases were formerly run at St. Albans, and it was at that town that the first regulation matches were held. See under RACE MEETINGS.

Rackarock, an explosive invented by Sprengel, consisting of a mixture of potassium chlorate and nitro-benzene, with or without picric acid. The mixture was intended to be made on the spot, and thereby avoid the dangers of storage, but it has not secured an extensive use.

Rackets, or RACQUETS, wall game, somewhat similar to FIVES, except that it is played with a racquet and not with gloved hand. The modern form of the game came into force some sixty years ago, when the four-walled enclosure superseded the back-walled or one-walled court.

The game is played by two or four persons, and, like fives, consists of fifteen points; the server or 'hand-in' is the only player who can score points: his opponent must first 'get him out'—*i.e.*, win a stroke—then the positions are reversed. The dimensions of the court are usually 60 ft. long, 30 ft. broad, 40 ft. high, though courts vary in size; there is a 'cut line,' which corresponds in function to the net in tennis, on the front wall, 9 ft. 6 in. from the floor. Half-way up the court are the service-boxes, a square marked off against the wall on either side. Behind the half-way line the court is divided into two. The racquet is lighter and shorter than that used in tennis.

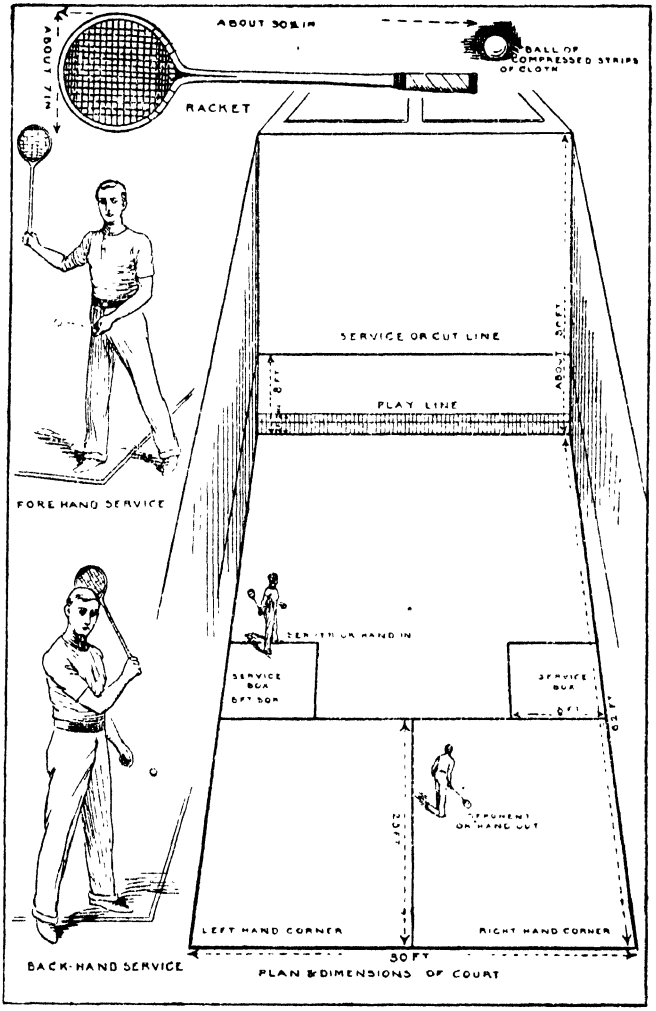
Standing in one of the service-boxes, the server delivers the ball so that it hits the front wall and drops into the opposite back court. Play is then open, but in every case the ball must strike the front wall above the prescribed height, and must be taken not later than first rebound. When the server wins a stroke he scores a point; when he loses one he is down, and changes places with his opponent. The game is extensively played at Oxford, Cambridge, and the public schools.

Rackham, ARTHUR (1867–), Brit. artist and illustrator; associate, Société Nationale des Beaux Arts, Paris (1912); drawings purchased for national and municipal collections, Barcelona, Vienna, Melbourne, the Luxembourg, Paris, Tate Gallery, London, etc.; illustrated *Rip Van Winkle* (1905), *Peter Pan* (1906), *Undine* (1909), *Mother Goose* (1913), *English Fairy Tales* (1918), *Cinderella* (1919), etc.

Radautz, tn., Bukovina, Rumania (47° 50′ N., 25° 54′ E.), 32 m. S. of Czernowitz; glass and paper works. Pop. 16,500.

Radcliffe, tn., Lancashire, England (53° 33′ N., 2° 19′ W.), on the Irwell; cotton spinning, fustian weaving, dyeing and bleaching, iron foundries and collieries. Pop. 26,100.

Radeberg, tn., Saxony (51° 10′



The Game of Rackets.

N., 13° 55′ E.), on Röder, 12 m. N.E. of Dresden; glass, enamels, beer, paper, etc.; cattle markets. Mineral springs in vicinity. Pop. 13,400.

Radetzky, JOHANN JOSEF, COUNT (1766–1858), Austrian soldier; distinguished in Napoleonic invasions; helped to reorganize army; commander-in-chief of army of Italy (1831); won high praise in campaign (1834); made field-marshal (1836); the Ital. insurrection, in which he crushed the Sardinian forces at Custozza (1848) and Novara (1849), and captured Milan and Venice, made his name famous.

Radevormwald, Rhineland, Prussia (51° 12′ N., 7° 15′ E.); hardware manufactures. Pop. 11,500.

Radiation is the term applied to the stream of energy which, in one form or another, can be emitted by a body, transmitted through the luminiferous medium or ether, and absorbed by another body. It may take a form which can affect the optic nerve, and we then know it as LIGHT. It may also produce an appreciable rise of temperature in a body which absorbs it, and we then call it radiant heat. It may take the form of electro-magnetic waves, such as are used in wireless telegraphy, and it is then termed Hertzian radiation. These are not distinct forms; they are only aspects of the same phenomenon which differ in respect of one common quality—viz., wave-length. The properties of radiation may be most clearly understood by reference to the two forms familiar in all experience, and with these we shall deal here. That radiant heat and light are identical in nature may be readily believed. They travel through space with the same speed, are reflected and refracted according to the same laws, and their intensity diminishes with distance according to the same law of the inverse square. We have, therefore, every reason for the belief that radiant heat, as well as light, is due to an undulatory motion in the ether.

The only difference between them is that of wave-length. The human eye is sensitive to light whose wave-length is more than $\frac{1}{65000}$ of an inch and less than $\frac{1}{36000}$. In this range we have all the colours of the visible spectrum, the violet rays having the least and the red rays the greatest wave-length. But the spectrum does not stop at either of these limits. For instance, a solution of quinine fluoresces strongly when placed beyond the violet end of the spectrum; and a thermopile, bolometer, or other microradiometer will show that heat not only accompanies colour in the visible spectrum, but also continues past the red end into the invisible ultra-red. In this way waves up to a length of $\frac{1}{4000}$ of an inch have been observed. (Beyond this length there is a gap in observed wave-lengths until we come to the shortest Hertzian wave produced, which is several inches long.)

Now these radiation waves are emitted by bodies in conditions which are determined chiefly by the temperature. Taking a body at ordinary air temperature and heating it gradually, we find that, to begin with, the radiation emit-

ted consists of waves of greater wave-length beyond the visible part of the spectrum. As the temperature increases, waves of shorter wave-length appear, until, when the body has attained a temperature of about 700° C., visible rays of red light appear. This is the temperature of dull red heat, as it is termed. At higher temperatures the wave-lengths are smaller, until, when the highest attainable temperature has been reached (that of the electric arc), the radiation includes all known wave-lengths. The stream of radiation from a body, and also the energy of radiation of each particular wave-length, thus depend on temperature. As regards the total amount of energy emitted, different surfaces have, of course, different emissive powers at the same temperature, that of a carefully blackened surface being the highest and a highly polished surface the lowest. Different surfaces have also different absorptive powers, blackened surfaces being again the highest. Hence radiating and absorptive powers go together; this being true, however, only for each particular kind of radiation—*i.e.*, for each wave-length.

We have, however, to take a more general view of the matter. Suppose a body is placed inside a hollow sphere whose inner surface is maintained at a constant temperature. The body will ultimately acquire that temperature. When it has done so, it does not stop radiating or absorbing, but must be radiating as much as it absorbs in each second. Further, this statement must be true, not only for the total amount radiated or absorbed, but also for the radiation of each particular wave-length. Another conclusion is that the radiation at that temperature must be the same, both as regards total amount and amount for each wave-length, in any other enclosure at the same temperature. From these results we conclude that in any enclosure at a constant temperature radiation must be streaming in all directions, and that the amount of this stream for each wave-length depends only on the temperature. This is known as the *black body radiation* or *full radiation* for that temperature. Clerk-Maxwell showed in 1873 that, according to the electro-magnetic theory of light, radiation should exert a mechanical pressure on any surface upon which it falls perpendicularly, and that this pressure should be equal to the energy per unit volume of the radiation. The difficulty of proving this experimentally was not overcome for more than thirty years, when it was shown by Lebedew to exist. The term *pressure of radiation* has been applied to explain the curious way in which the tail of a comet is always directed away from the sun.

Suppose a particle in the tail of a comet is cubical in shape. The sun's gravitational attraction will be proportional to its volume—*i.e.*, to the cube of the length of an edge. The pressure of radiation will be proportional to the surface, and therefore to the square of the length of an edge. If the cube is very small, the radiation pressure may be greater than the gravitational attraction, and the

particle will tend to recede from the sun.

The pressure of solar radiation on the earth's surface is equal to the weight of about 100,000 tons. Radiation pressure may be viewed in the same way as the pressure of steam in the cylinder of a steam engine, and we may therefore apply to it the principles of THERMO-DYNAMICS. In this way it has been shown that the energy emitted by a radiating body is proportional to the fourth power of the absolute temperature. This, known as *Stefan's law*, had been previously deduced from the results of Dulong and Petit's experiments on the cooling of a body in a vacuum.

P. Phillips, *Radiation;* E. Edser, *Heat for Advanced Students* (chapters on radiation); E. Edser, *Light for Advanced Students* (chapters on the spectrum).

Radinghem, vil., Nord, France (50° 38′ N., 3° E.), 5 m. W. of Lille; scene of fighting during first battle of Ypres (Oct. 1914).

Radioactivity. The discovery in 1895 of the Röntgen rays led physicists to examine those substances which are phosphorescent after exposure to light, in order to ascertain whether they gave out rays with properties similar to the Röntgen rays. While so engaged, BECQUEREL discovered in 1896 that the double sulphate of potassium and uranium emitted rays which affected a photographic plate when wrapped in black paper, and also ascertained that all the compounds of *uranium* possessed this property. But further investigation showed that *pitchblende* (the mineral from which uranium is extracted) was more active in the above respect than could be accounted for by its uranium content, and this led to the belief that the action of uranium was due to some substance, present in minute quantity in uranium, to which the phenomenon was due. Monsieur and Madame CURIE undertook the search for this substance, and after most laborious work extracted from pitchblende ore two new elements, *polonium* and *radium*. These elements are present in excessively minute quantities in the ore, several tons of which are required in order to supply a few grains of radium. The activity of the radium was found to be more than a million times that of uranium, and it is the principal radioactive substance known. It emits rays which can pass through metal and other substances which are opaque to ordinary light, can affect a photographic plate, can discharge the electricity of an electrified body, and can cause phosphorescence in bodies exposed to them. All this it does *spontaneously;* that is, external agencies, such as heat, pressure, etc., have no influence in altering the emission of the rays. Any substance which emits rays in this manner is said to be *radioactive*.

The rays emitted by radium are of three distinct kinds, known as the α, β, and γ rays. The distinction between them can be demonstrated in various ways, but that which will be most readily understood is the action of a magnet. Suppose a small quantity of radium be placed at the bottom of a short cylindrical leaden tube, standing vertically,

and that a strong magnetic force be made to act horizontally on the rays as they emerge from the upper end of the tube. It is then found that the α rays are very slightly deviated to one side of the vertical, the β rays are strongly deviated to the other side so as to describe circular paths, while the γ rays proceed vertically upwards without deviation. This difference in behaviour is connected with the fact that the α rays consist of positively charged corpuscles, the β rays are exactly similar to *kathode* rays (see RÖNTGEN RAYS), and therefore consist of negatively charged corpuscles, or electrons, while the γ rays are in reality Röntgen rays. They also differ in their power of penetrating metals. Roughly speaking, if the power in this respect of the α rays be represented by 1, that of the β rays is 100, and that of the γ rays is 10,000. The speed of the α rays is about one-fifteenth that of light—*i.e.*, about 12,500 miles per second; that of the β and γ rays is nearly that of light.

In addition to these rays, radium also evolves a considerable quantity of *heat*. In one hour the amount evolved from a given weight of radium is sufficient to raise an equal weight of water from the freezing-point to the boiling-point. Lastly, there is given off a gaseous emanation which is itself radioactive. But the most interesting feature of radium is revealed when we study the later history of these rays and consider what is left behind after their emission. The facts may be briefly summarized as follows: The changes exhibited by radium form only a few of the stages in the process of atomic disintegration which, beginning with uranium, finally ends in lead. The atom of uranium first loses three α particles, and radium is produced. These particles form what is known as *helium*, a gas which is found in ores containing uranium. The α particle is known to carry two atomic charges of electricity, and its atomic weight is therefore 4, which is also the atomic weight of helium. Now the atomic weight of uranium is 238 (approximately), and if we subtract from this the equivalent of three helium atoms—*i.e.*, 12—we get 226, which is the atomic weight of radium. Next, the radium atom passes through several further stages, including polonium, and in the course of these it loses four α particles. This would leave behind an element whose atomic weight would be 16 less than 226, and the atomic weight of *polonium* is, in all probability, very close to this figure. Again, the loss of one α particle by polonium would result in lead, whose atomic weight is 206.

No general theory of atomic structure has as yet been worked out which will fully account for this process of disintegration or explain the conditions in which a radioactive substance emits electrically charged particles. But the tendency is to suppose that the electrons constituting an atom are in a state of rapid vibration or circulation about the centre of the atomic system; that they are therefore subject to accelerative forces, and consequently radiate energy; that when this energy loss has become consider-

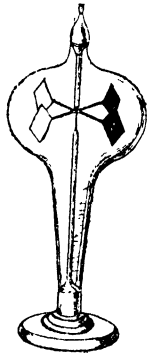
able the system becomes unstable, and a β particle is expelled, this expulsion producing the pulsational disturbance in the ether which we know as the γ ray or Röntgen ray. The α particles are expelled in proportion to the β particles.

In addition to uranium, radium, and polonium, other elements exhibit radioactive properties. Among these may be mentioned *thorium* and *actinium*. There is also reason to believe that all metals are more or less radioactive. Evidence has been obtained of the almost universal presence of radium in the earth's crust and in the atmosphere, and it is believed that the total quantity present is sufficient to account for the present temperature of the earth.

Detailed information on the subject may be obtained by consulting Rutherford's *Radioactivity* (1905), Bragg's *Studies in Radioactivity* (1912).

Radiolaria, sub-class of the Sarcodina group of Protozoa, microscopically minute animals with a body which may be globular, disk-like, or elongated, but from which the flesh streams in long, fine, radiating threads or pseudopodia (hence the name Radiolaria). These threads never form a network. Radiolaria are further characterized by the presence of a membranous 'central capsule.' Almost all are furnished with skeletons, generally composed of silica, and these are structures of wonderful complexity and beauty.

All are marine, and are to be found floating near the surface of the sea, where they drift at the mercy of wind and waves. A simple contraction of the flesh or sarcode, however, enables them to sink in the waters, and on the bottom they creep slowly by means of their pseudopodia. The deepest portions of the ocean are coated with ooze formed almost wholly of empty radiolarian shells which have sunk to the bottom, and the oozes of past geological ages have consolidated to form the rocks known as Radiolarian Cherts. In spite of their small size these insignificant Protozoa, by reason of their multitude, form an important constituent in the food of minute pelagic animals. Examples are *Thalassicola* without skeleton, *Actinomma*, *Eucyrtidium*, and the colonial *Collozoum*.



Radiometer.

Radiometer, an instrument invented by Sir W. Crookes to show the effect of a rarefied gas on unequally heated surfaces. It consists of four small disks of mica mounted on the ends of arms, which project radially from a vertical rod. This rod is pivoted

at top and bottom so that it can rotate upon its own axis. Each disk is coated with lampblack on one face, and the blackened faces are so arranged that when the rod rotates all the disks have either their blackened faces in front and their non-blackened faces behind, or *vice versa*. The system of disks, projecting arms, and rod are mounted within a glass bulb, in which the air pressure has been reduced to a very low amount, and the whole is placed on a suitable stand. When the instrument is exposed to radiation from any source (*e.g.*, a ray of sunlight) the arms revolve.

Radish (*Raphanus sativus*), a cruciferous biennial which stores food in the root. This has a pungent taste, and is used in salads.

Radium. See under HELIUM; RADIOACTIVITY.

Radius. See under ARM.

Radnorshire, inland co., S. Wales (52° 16′ N., 3° 15′ W.), between Cardigan on W. and Hereford on E.; drained by Wye and Teme; except in the vale of Radnor, surface is very hilly, Radnor Forest reaching 2,186 ft.; mineral springs at Llandrindod and elsewhere; oats and wheat grown, but three-fourths of the land under permanent pasture; sheep-rearing and breeding of Welsh ponies very successful, also butter-making; sandstone and limestone are quarried; Wye fishing excellent; one M.P.; co. tn., Presteigne. Area, 470 sq. m.; pop. 22,600.

Radom, tn., cap. of gov., Poland (51° 23′ N., 21° 13′ E.); coal, leather, machine shops; pop. 50,000. During Great War was taken by Austrians (Sept. 1914), retaken by Russians (Oct. 23, 1914), and lost by them (July 20, 1915).

Radomysl, or MYCHEK, tn., Volhynia, Ukraine (51° 15′ N., 29° 10′ E.), on Teterev, 60 m. W.N.W. of Kiev city; tanneries, breweries, flour mills, and brickfields. Pop. 12,000.

Raeburn, SIR HENRY (1756–1823), Scot. portrait painter—the Scottish Velazquez; began career as a miniaturist; spent two years in Italy, then settled in Edinburgh (his native city); sitters included most of the notable Scotsmen of his day—Lord President Dundas, Sir W. Scott, Christopher North, etc., also Mrs. R. Scott Moncrieff. President, Soc. of Scot. Artists (1812), R.A. (1815), knighted and made H.M. Limner for Scotland (1822); recent years have witnessed a growing appreciation of his works; good collections in Scot. National Gallery, Edinburgh, and in Glasgow and Tate (London) galleries.

Raemaekers, LOUIS (1869–), Dutch cartoonist; was director of an art school in Gelderland; painted chiefly portraits and landscapes; became a cartoonist (1908). His war cartoons achieved a wide celebrity, an exhibition of them being held in London (1915); has pub. *The Great War in 1916*, *The Great War in 1917*, *Devant l'Histoire* (1918), and *Cartoon History of the War* (1919).

Rafts or PONTOONS when carried as life-saving appliances by vessels are not lowered from davits, but thrown overboard or merely allowed to float away when the

ship sinks. They are not recognized as part of the equipment of foreign-going ships, but may be placed on home-trade vessels. No definite form is specified, but the type used must be approved by the Board of Trade. They must have 3 cub. ft. of enclosed buoyancy per person carried. One pontoon described had a number of cylindrical metal cases placed side by side and enclosed in a wooden frame. When carrying twenty-five persons its platform was 9 in. above water-level.

Buoyant seats are carried on the decks of excursion steamers. These are double seats with metal tanks secured underneath, by means of which they are able to support a number of people.

Raglan (FITZROY JAMES HENRY SOMERSET), 1ST BARON (1788–1855), Brit. soldier and diplomatist; distinguished in wars against Napoleon, losing arm at Waterloo; commander-in-chief of Crimean army (1854), leading at Alma, Balaklava, and Inkerman; made field-marshal (1854); died before Sevastopol, heart-broken by censures at home.

Kinglake, *Invasion of the Crimea* (1863–87).

Ragusa. (1) Tn. and seapt., Dalmatia, Jugo-Slavia (42° 37′ N., 18° 7′ E.), on E. shore of Adriatic, 105 m. S.E. of Spalato; walled city; cathedral and interesting churches; was independent republic in 15th cent., famous for its maritime enterprise (argosy = vessel of Ragusa), and for literary activity. Pop. 14,200. (2) Tn., Syracuse, Sicily (36° 56′ N., 14° 45′ E.), 76 m. W.S.W. of Syracuse; oil, wine, and cheese; cottons and woollens; rock caverns and grottoes in vicinity. Pop. 32,000.

Ragwort (*Senecio*), composite plant with yellow florets; common ragwort (*S. jacobæa*) is a Brit. weed.

Raia. See under RAYS.

Raichur, tn., Nizam's Dominions (Haidarabad), India (16° 12′ N., 77° 21′ E.); has cotton presses, and is famed for its glazed pottery; once a fortress of the Moguls. Pop. 23,000.

Raiffeisen, FRIEDRICH WILHELM (1818–88), Ger. economist; founder of the mutual loan societies called 'Raiffeisen Banks,' the loans being for some definite object, such as buying agricultural machinery or seed. The principle has been adopted in Ireland, Italy, Switzerland, Austria, France, and Russia.

Raigarh, feudatory state, Central Provinces, India (21° 42′–22° 33′ N., 82° 57′–83° 48′ E.); cap. Raigarh; grows rice and pulses; it has 1,800 irrigation tanks; manufactures silk. Area, 1,486 sq. m.; pop. 175,000.

Raikes, ROBERT (1735–1811), founder of Sunday schools; proprietor of the *Gloucester Journal*. His attention having been called to neglected children, he started, with the Rev. Thomas Stock, a Sunday school about 1780, which proved so successful that the idea was taken up all over the country.

Rail Family (Rallidæ), a world-wide family of birds, including the common land-rail or corncrake (*Crex pratensis*), the moor or water hen (*Gallinula chloropus*), with red and yellow bill and greenish legs, and the coot (*Fulica atra*), a common pond

bird easily distinguished by the white bald patch on its forehead. The Rallidæ are unready fliers frequenting well-vegetated localities, most species, apart from the land-rails, preferring the neighbourhood of lakes and rivers.

Railton, HERBERT (1857–1910), Eng. etcher; contributed drawings to the illustrated magazines, and illustrated works on *Westminster Abbey* (1889), *Windsor Castle* (1886), the jubilee ed. of *Pickwick* (1887), and, with Hugh Thomson, *Coaching Days and Coaching Ways* (1888).

Railways. Railways originated in the tramways used in mining districts round Newcastle-on-Tyne for conveying coal from the pits to the Tyne. The date of invention of these tramways is not certain, but they were probably in use as early as the middle of the 16th cent. The first rails were simply wooden beams, flanges being added later to prevent the wagons from leaving the rails. The wagons were drawn by horses, and one horse could draw a load of 42 cwt., as compared with 17 cwt. along the ordinary road. Up to the end of the 17th cent. little or no advance was made in construction, but c. 1700 the wooden beams were covered with a thin sheathing of iron in order to add to their life.

This sheathing was found to be incapable of resisting the weight of the loaded wagons, and c. 1740 rails consisting entirely of cast-iron were substituted. This kind of railway became fairly general in mining districts, but it attracted little attention for general traffic, and, moreover, it had to face the opposition of those interested in the promotion of canals. A further improvement was made by placing flanges on the wagon wheels instead of on the rails, and trains of small wagons linked together superseded the single large wagon. The Surrey Iron Ry., sanctioned by Parliament in 1801 and opened in 1804, was first public railway built under parl. powers. It ran from Wandsworth to Merstham, and was operated in parts until 1845. Horse power only was used.

The possibilities of the railway system gradually became realized, and efforts were made to utilize steam instead of horse traction. In 1802 an engineer named Trevithick obtained a patent for a steam carriage, and in 1804 this, the first practical locomotive, was used for wagon haulage on the Merthyr Tydfil Ry. This locomotive was to a certain extent successful, but it could haul only a load of 10 tons at a rate of about 5 m. an hour. No immediate improvements upon this invention were made, largely owing to the belief that locomotives with plain wheels running on plain rails could not draw heavy loads or ascend moderate inclines, and that cogged wheels and rack rails were necessary. In 1811 it was demonstrated on the Wylam Ry. that the weight and friction of a locomotive were sufficient for the purpose, and from that time steady progress was made.

The present railway system may be said to date from 1821, when an Act was passed for the construction of the Stockton and Darlington Ry., which was opened in 1825. Carriages for

conveying passengers were used for the first time on this railway, but they were usually hauled by horses. The locomotives used for coal and goods could draw 90 tons at a rate of from 10 to 15 m. an hour. In spite of this success the general public remained indifferent or even hostile, and it was not until the Liverpool and Manchester Ry. was opened in 1830 that the opposition was finally broken down. This line, which for that time was a great engineering triumph, was immediately successful, and other railways were quickly begun. During the years 1844–6 an absolute railway mania prevailed, and reckless speculation and overcompetition resulted in the financial panic of 1847.

The example of England was quickly followed by U.S., and with characteristic enterprise the railway mileage increased between 1840 and 1880 from 2,818 to 87,801. Railways were speedily opened on the Continent, many of them being constructed by Brit. engineers, and largely by Brit. capital. France, Belgium, and Holland took the lead, Germany, Austria, and Russia being somewhat behind. Great railway developments were also made in the Brit. Colonies, Canada, Australia, and India, and in 1877 about 5,000 m. of railway were in construction throughout the Brit. Empire.

In the U.K. railways are owned by independent companies. They are constructed and worked according to Acts of Parliament, but the government takes no part in initiating them or in providing the necessary capital. During the war period, however, they were taken over and administered by a committee of general managers on behalf of the state in consideration of a government guarantee of net receipts. This guarantee has been continued under the Ministry of Transport Act (1919), but a scheme for grouping railways, and the position which will eventually be held by the Ministry of TRANSPORT, will materially alter the situation in the future.

Under ordinary circumstances the promoters of a contemplated railway engage an engineer to make an exhaustive survey, and then proceed to ascertain the agreement or opposition of every proprietor whose land is involved. The claims for compensation of all proprietors and tenants are then settled, and any special stipulations for bridges, level-crossings, drainage, and other matters are arranged. The scheme is then submitted to Parliament in the form of a Private Bill. In the Act which authorizes the scheme, the company is constituted a corporation, the members of it being responsible only to the extent of their shares. There are now in existence many statutes dealing with railway matters, and railway law has become extremely complicated. In 1844 an Act was passed giving the government power to purchase all railways after they had been in existence for 25 years from that date, but in 1872 a Parliamentary Committee reported that the Act was then impracticable. Since then state purchase has frequently been urged, but, owing to the enormous expense which

would be involved and to other considerations, the proposal has not found favour.

The ideal railway line would be quite straight and perfectly level, but this is seldom if ever practicable. Elevations and depressions have to be negotiated, and while in some cases they may be avoided by means of curves, in others the constructor has to resort to cuttings, tunnels, and bridges. Efforts are made to arrange matters so that the earth excavated in cuttings shall be sufficient for the construction of the embankments, but this is not always possible. Small streams are conveyed through embankments by culverts of brick or masonry, bridges or viaducts being used for crossing rivers, roads, or deep narrow valleys. Bridges are also used to carry public roads over the line, or to carry one line over another. Level-crossings are now as far as possible avoided in thickly populated districts where the traffic is heavy, on account of their danger and general inconvenience for cross traffic.

When the levels are determined and the embankments and cuttings are complete, a special track is laid down to carry the line. This is formed of a layer of small stone, gravel, slag, and other material, called ballast. On this are laid the sleepers, to support the rails. Sleepers are usually made of wood, but steel is also employed, especially where wood is scarce or liable to be attacked by white ants. Before being laid down wooden sleepers are usually treated with creosote. The rails are of two chief types, the bull-headed rail and the flat-footed or Vignoles rail. Bull-headed rails are wedged in cast-iron chairs bolted to the sleepers, and flanged rails, which have a flat base, are attached to the sleepers by hook-headed spikes, the heads of which project over the flanges.

Rails formerly were made of iron, but steel of special toughness and hardness is now used. The distance between the two rails forming the line is called the *gauge*, that used in Britain being 4 ft. 8½ in., and known as the standard gauge. The old broad gauge of 7 ft. formerly used on the Great Western Ry. was done away with in 1892. The standard gauge is not universal. It is fairly general on the Continent, but the normal gauge in Russia is 5 ft., and in Spain and Portugal 5 ft. 5½ in. In India and S. America 5 ft. 6 in. is very general, together with the metre gauge; Australia has 3 ft. 6 in., 4 ft. 8½ in., and 5 ft. 3 in., and in many Brit. colonies the gauge is 3 ft. 6 in. In Ireland it is 5 ft. 3 in.

The rate at which a line rises or falls from the horizontal is called the *gradient*, and is usually expressed by stating the amount of rise or fall occurring in a certain distance, such as 100 ft., or by the horizontal distance in which the difference in level amounts to 1 ft. Gradients may also be expressed in percentages. The load which an engine can haul over any stretch of line is determined by the steepest gradient, and this is therefore known as the ruling gradient. The adhesion between the wheels and the rails is lessened in damp weather, and the maximum

gradient must be such as can be negotiated with a full load under all weather conditions. In theory gradients of 1 in 16 are possible, but practically 1 in 22½ is about the limit, and this is too great for general use. For the steep slopes of mountains rack railways are necessary. In these the engine is fitted with a cogged wheel engaging in a toothed rack along the line, and gradients of 1 in 2 are possible. For excessively steep inclines cable railways are employed.

In the U.K. curves are expressed by stating the length of their radius. The early main lines had few curves with a radius of less than a mile, but now curves are made with a radius of as little as 30 chains, or 1,980 ft. The outer rail of a curve is placed at a slightly higher level than the inner one, to resist the tendency of centrifugal force to overturn a train rounding the curve. Its increased height is known as *super-elevation.*

Trains are transferred from one set of rails to another, as for instance from a main line to a siding, by *points* or *switches.* At the junction of the four rails the inner two are tapered to a point, and fixed so far apart that if one point is pushed against the outer rail of the main line or of the siding, there is room left between the other point and the remaining outer rail to allow of the passage of the wheel flanges on one side of the train. The opposite wheel flanges travel along the other tapering rail, and thus take the required direction. Where a branch line leaves the main line, or where one set of rails crosses another set, check rails are placed to guide the wheel flanges. Lengths of check rail are usually laid inside the running rails on curves to safeguard any tendency to derailment. Switches are usually connected with the signal cabins by means of iron rods passing over grooved wheels fixed on supports close to the ground, and are worked in conjunction with the signalling. Points may also be set by small hand levers, as in shunting yards.

Signalling is done mainly by disks and *semaphores,* with lamps. The common semaphore signal is a movable arm working on a spindle, and fixed to an upright post so that it is horizontal and at right angles to the line. The normal or horizontal position indicates that the train must stop, and the arm is pulled down or raised at an angle when the train may proceed. At night the movements of the arm are indicated by the colours shown by a lamp, usually red for stop and green for go ahead. In addition to the main or home signals there are also distant or cautionary signals, usually placed from 600 to 1,000 yds. before the home signals, the distance varying with the gradient.

Distant signals are worked in conjunction with the home signals, so that when the driver reaches a distant signal its position tells him how to expect to find the home signal, and accordingly he goes ahead or slackens speed ready to stop at the home signal. In practice there are usually, and especially at stations, starting signals beyond the home signals, and sometimes there are

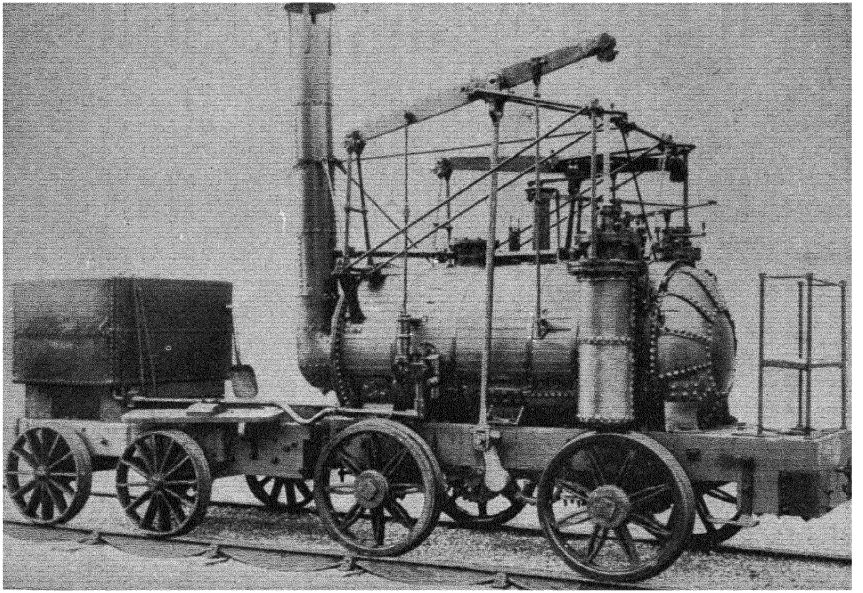
outer and inner home signals, and starting and advanced starting signals. Together these control a train within station limits, and the distant signal is not cleared until the entire series is clear. Distant signals are distinguished by having fish-tailed ends, and they are sometimes painted yellow. Frequently their lamps show by reflection an illuminated > alongside the light, red (or yellow) when 'on' and green when clear. In order to prevent one train following another at a dangerously close interval, the line is divided into sections, and no train is allowed to enter a section until the preceding train has passed into the next section. These sections are called blocks, and the method of working is known as the *block system*.

The signal boxes are telegraphically connected, and are provided with indicating disks showing 'train on line' and 'line clear,' sometimes also 'line closed.' If a signalman were quite independent he might through oversight cause dangerous situations, by displaying signals over points not set accordingly, and to avoid this danger the points and signals are interlocked. The signalman is also prevented by the interlocking from showing conflicting signals simultaneously. Single lines are usually worked on the staff or tablet system. In the simple form the line is divided into blocks, each of which has a tablet or staff assigned to it, and the possession of this constitutes the driver's right to pass through the section. There are many modifications of this system, to allow of several successive trains in one direction without any return train, and to ensure that no train in the opposite direction can be given a staff or tablet. The tendency now is to use electric staff or tablet instruments, thus effectively safeguarding incorrect issue. Signals and points are interlocked as on double lines.

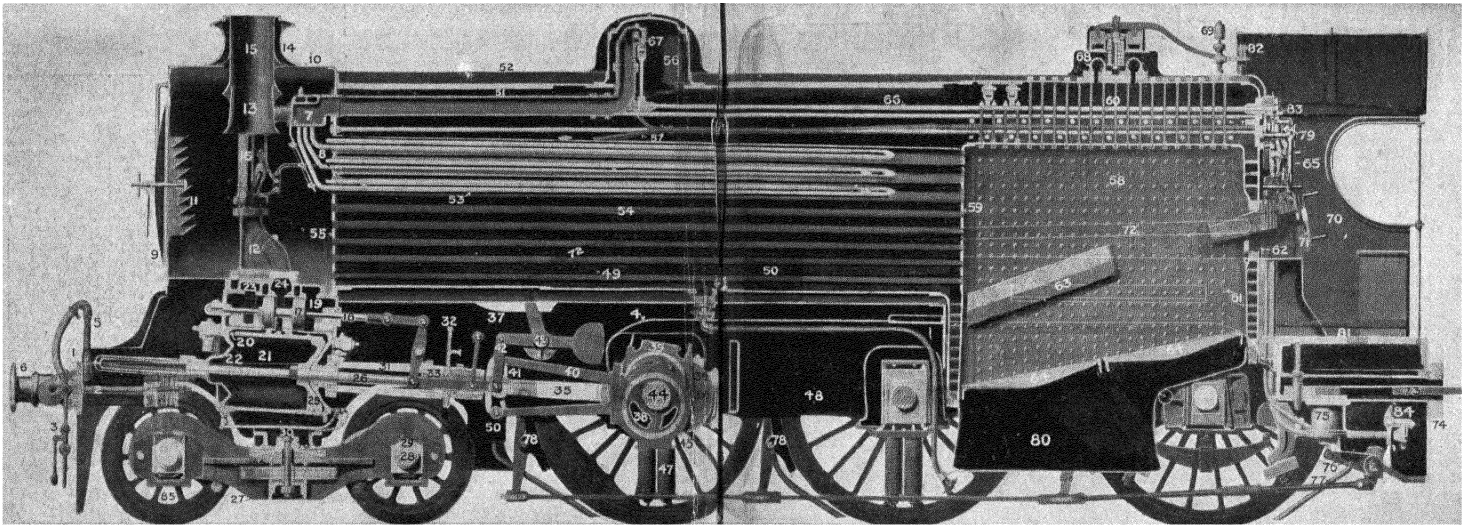
The work of moving signals and points is now frequently done by electricity or compressed air, the mechanism being controlled by small levers moved by the signalman. Many attempts have been made to eliminate the possibility of accidents due to mistakes by signalmen, and automatic electric systems, which do away with the signalmen altogether, are now in use to a growing extent. In such systems the train itself controls the signals, setting them to danger as it enters a section, and keeping them there until it leaves the section. To prevent overrunning of signals a trip appliance is often fitted alongside the rails, contact with which causes the brakes to be applied.

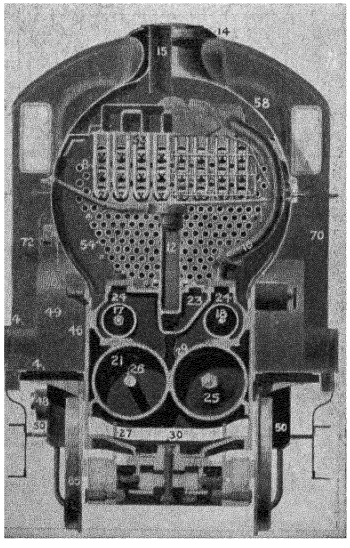
In foggy weather the ordinary signals are insufficient, and are supplemented by detonators placed on the line and exploded by the wheels, or by fog-horns blown by men stationed at the distant signals. These methods involve some risk to the men employed, and automatic fog-signalling appliances are now largely used.

Railway locomotives may be divided roughly into two classes—tank engines, in which the fuel and water are carried on the engine itself, and tender engines, with a larger quantity of supplies



Puffing Billy—Wylam Railway (1811).
The first engine to run on smooth rails.

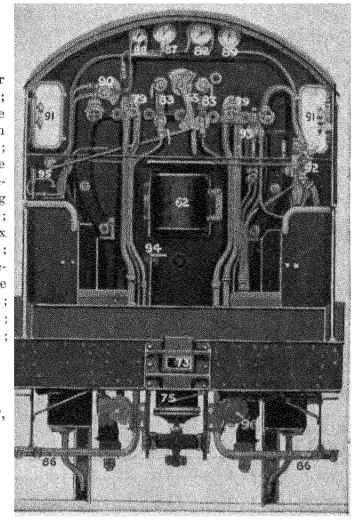


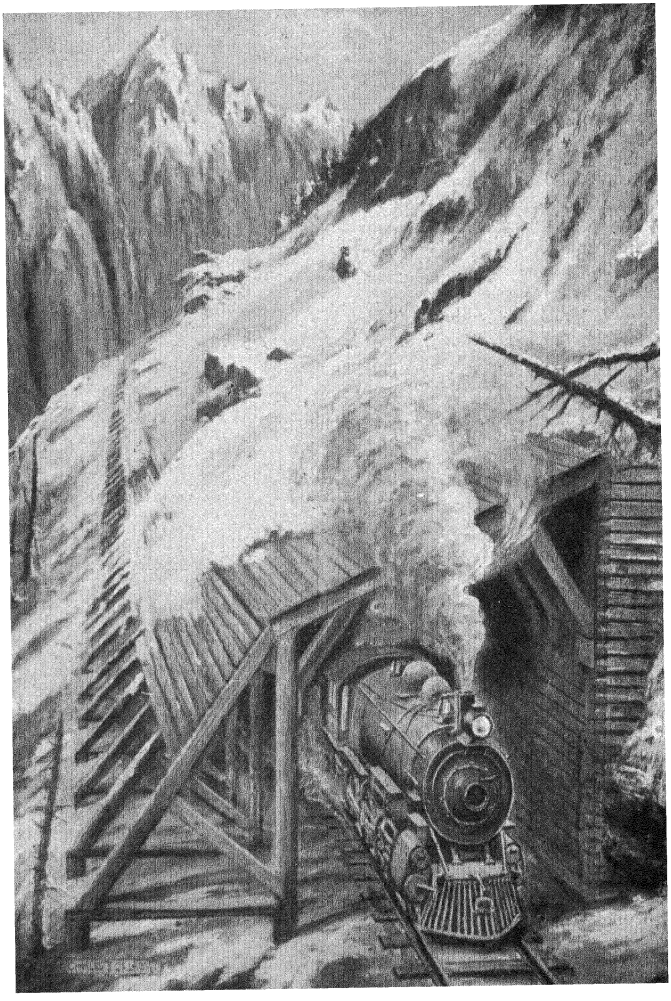


The Interior of a Locomotive.

1. Buffer plate; 2. Draw bar; 3. Screw coupling; 4. Platform; 5. Vacuum brake pipe; 6. Buffer; 7. Superheater header; 8. Superheater elements; 9. Smoke box door; 10. Smoke box wrapper plate; 11. Smoke box door baffles; 12. Blast pipe; 13. Petticoat pipe; 14. Chimney; 15. Chimney liner; 16. Steam pipe; 17. Piston valve; 18. Valve spindle; 19. Steam chest; 20. Steam port; 21. Cylinder; 22. Cylinder front cover; 23. Exhaust ports; 24. Steam port; 25. Piston; 26. Piston rod; 27. Bogie frame; 28. Bogie wheel axle; 29. Bogie wheel axle box; 30. Bogie pin; 31. Slide bar; 32. Motion plate; 33. Cross head; 34. Crank web; 35. Connecting rod; 36. Crank pin; 37. Main frame plates; 38. Eccentric sheave; 39. Eccentric strap; 40. Eccentric rod; 41. Expansion link; 42. Lifting link; 43. Reversing shaft; 44. Driving axle; 45. Driving axle box; 46. Driving wheel; 47. Driving wheel springs; 48. Coupling rod; 49. Wheel splashers; 50. Sand boxes; 51. Boiler shell; 52. Boiler clothing plate; 53. Superheater flue tubes; 54. Boiler flue tubes; 55. Smoke box tube plate; 56. Dome; 57. Injector delivery pipe; 58. Fire box; 59. Fire box tube plate; 60. Fire box crown stays; 61. Fire box side stays; 62. Fire door; 63. Brick arch; 64. Fire bars; 65. Regulator lever; 66. Regulator rod; 67. Regulator slide valve; 68. Safety valve; 69. Whistle; 70. Cab; 71. Reversing handle; 72. Reversing rod; 73. Drawbar; 74. Back buffer beam; 75. Steam brake cylinder; 76. Steam brake lever; 77. Brake pull rod; 78. Brake blocks; 79. Live steam injector; 80. Ash pan; 81. Footboard; 82. Steam gauge; 83. Water gauges; 84. Train pipe; 85. Bogie wheel; 86. Injector overflow; 87. Pyrometer; 88. Steam heating gauge; 89. Vacuum gauge; 90. Steam heating valve; 91. Lubricator; 92. Combination ejectors; 93. Steam brake valve; 94. Ash pan watering cock rod; 95. Sand box pull rod; 96. Feed water pipe.

Great Central Railway 4-6-0 *Express Passenger Locomotive*, '*Sir Sam Fay*' *class. Diameter, driving wheels,* 6 *ft.* 9 *in. Diameter and stroke, cylinders,* 21½ *in. by* 26 *in.*





AN ALPINE RAILWAY PROTECTED AGAINST AVALANCHES.

carried in a separate vehicle. There are various types of engines for passenger and goods traffic and for shunting purposes. Oil-firing has been successfully experimented with in this country, and may be adopted in the future.

Vehicles for passenger traffic usually consist of first, second, and third class carriages, restaurant and sleeping cars. In Great Britain the second class is becoming obsolete, but on Continental lines there are sometimes four classes. In the U.S. there is usually only one class, but extra charges for sleeping and other accommodation have much the same effect as different classes. In England sleeping cars date from 1873, and dining cars from 1879. In America and on the Continent such cars are often owned by an independent company, which takes the extra fares charged for use of the cars. Prominent among these companies are the Pullman Car Co. and the Compagnie Internationale des Wagon-lits. In Great Britain vehicles for goods traffic are called goods wagons or trucks, and in the U.S. freight cars. Vehicles are joined together by couplers, which may be automatic and operated by the impact of two vehicles, or non-automatic and coupled by hand.

At one time trains were brought to a standstill by shutting off steam at a considerable distance from the desired stopping place, some assistance being given by feeble screw brakes on the guard's van and the engine. This process was dangerously inadequate for fast passenger traffic, and more powerful brakes affecting the whole length of the train came into use. Practically all passenger trains are now fitted with automatic continuous brakes, the most used being the vacuum automatic brake and the Westinghouse compressed-air brake.

Railway lines are provided with stations at the termini and at suitable intermediate points. Large stations are subdivided into passenger and goods stations, the two usually being kept quite distinct, and are furnished with depots for locomotives, passenger carriages, and goods wagons. Passenger stations are on the main line itself, goods stations generally being approached by a branch line. The equipment of a passenger station consists of booking offices, refreshment and waiting rooms, left and lost luggage offices, inquiry office, etc. In Great Britain station platforms are not less than 2½ ft. above the rail, the standard height being 3 ft. In other countries the height is usually less, and in the U.S. the platforms are often at the rail level, or raised only a few inches.

At the close of 1919 the total railway mileage of the world was estimated at 720,000, the approximate figures being: Europe, 223,000; N. America, 323,000, S. America, 52,000; Asia, 69,000; Africa, 29,000; Australasia, 24,000.

The mileage of Great Britain and Ireland at the end of 1919 was estimated at 23,700.

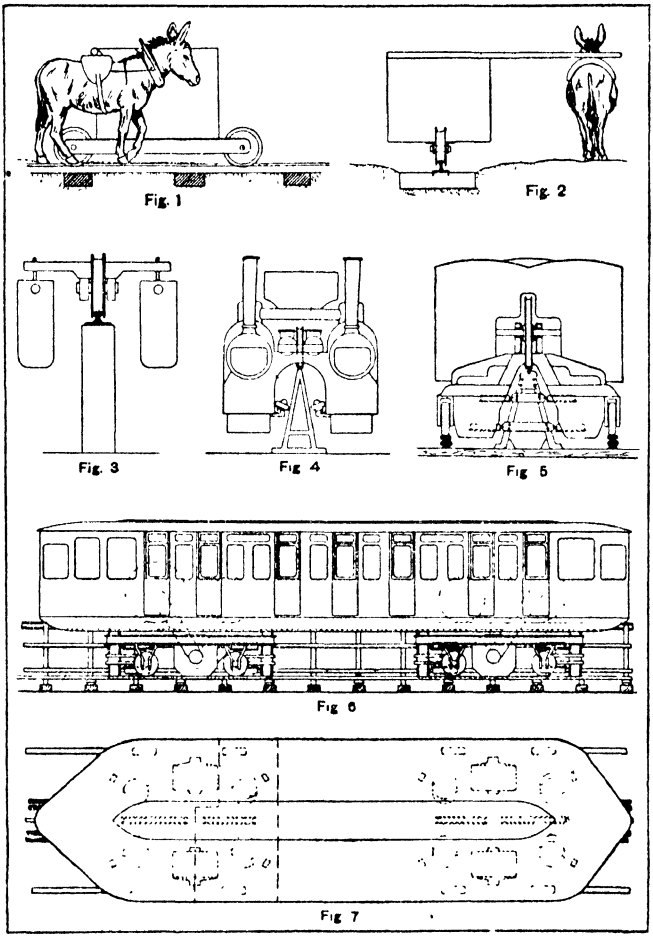
In past wars railways had shown a degree of usefulness, but in the Great War of 1914–18 they were of vital importance. To serve the fighting fronts hundreds

of miles of new standard gauge lines were built, while thousands of miles of light railway were constructed to connect up the bases and distributing points with the main sources of supply. Special railway corps were formed in conjunction with the Brit., Fr., and Amer. armies, with contingents directly raised for, and allocated to, the Canadian, S. African, and Australasian forces. These were in two classes, constructional and operating, the latter being principally known as the R.O.D. (Railway Operating Division), their work relating to the operation of trains and traffic. To serve the standard gauge lines hundreds of new locomotives were built, and the Brit. railway companies also sent large numbers of engines from their own systems. Goods wagons were sent over or specially built in thousands, and over thirty ambulance trains for conveying wounded were supplied by Brit. railways, to serve the Amer. armies as well as the British, whilst the Fr. railways also provided a number. The light railways were operated by small steam locomotives, and, where visible to the enemy, by petrol tractors, small bogie wagons of good capacity being mainly used. Travelling workshops, ammunition trains, and rail-travelling guns of great size constituted other developments. The home railways not only contributed men and material on a large scale, but they also did much important war work in their shops, and carried enormous traffic, under the general head of 'munitions,' to and from factories and workshops in all parts of the country. They also contributed steamers, road vehicles, and the use of up-to-date docks and warehouses.

Special Railway Types.—In addition to the foregoing, there are a number of other types of railways, such as light railways, mono railways, elevated and underground railways, and rack railways. *Light Railways* are constructed under the authority of the Light Railways Act, 1896, which applies to Scotland, but not to Ireland. A light railway differs from a tramway in that it generally runs, not along roads, but over land acquired for the purpose; and it differs from a railway in that it is constructed and worked under an order of the Board of Trade, and not directly under an Act of Parliament. It does not require to be fenced; may be worked without continuous brakes on its rolling stock, and without the absolute block system of working and signals; and may be of less gauge than the standard.

Elevated and Underground Railways.—The problem of quick transit within large cities has been overcome by means of overhead and underground railways. Such lines are intended almost wholly for conveyance of passengers, and as compared with trunk lines are characterized by shortness of length and great initial cost per mile. During recent years electricity has in most cases superseded steam traction in underground railways, on account of the gas and fumes given off by the latter.

Mono Railways consist essentially of a system in which only a single rail is used to support the



Railways—Mono-rail Systems.

Figs. 1, 2. Caillet's system. Fig. 3. Palmer's system. Fig. 4. Lartigue's system (Ballybunnion Railway). Figs. 5, 6, 7. Liverpool and Manchester system.

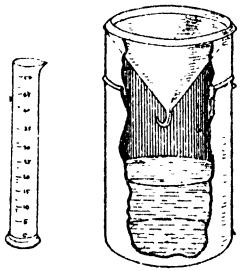
weight of the car, although there may be additional guide rails. They were suggested by attempts to cheapen construction, and to increase the adherence of the locomotive to the track by concentrating the weight on fewer wheels. The first mono railway constructed in the U.K. was from Ballybunnion to Listowel in co. Kerry, Ireland.

Rack Railways constitute a special constructional type used for steep-grade mountain lines, where gradients of 8 per cent. or over are to be employed. A toothed bar (rack) laid along the track midway between the rails, in conjunction with gear wheels on the locomotive, driven by steam engine, is the means of propulsion, in place of frictional adhesion and smooth-rimmed wheels.

Rain. See RAINFALL.

Rainbow, caused by the sun shining on falling rain, the sun's rays being bent and split up into their primary colours on passing through the falling raindrops. Sometimes several bows are seen, the brightest, called the Primary Bow, being red on its outer and violet on its inner edge. A larger and fainter bow (Secondary Bow), often seen outside the primary, is coloured red on its inner and violet on its outer edge. The amount of the circle visible is determined by the altitude of the sun. The primary bow subtends an angle of 41° at the observer's eye, and the secondary an angle of 52°.

Rainfall is the water which is precipitated from the atmosphere on the surface of land either in a liquid or solid state. The quantity is measured by means of the *rain-gauge* (see illustration). The quantity of water which can exist in the atmosphere as vapour varies with the temperature. When the amount of water vapour exceeds that which produces saturation, some of it condenses, forms particles of liquid water, or snow if the temp. is below freezing-point. When the particles have sufficient weight to overcome friction they descend as rain or snow. The same condensation effect is produced by lowering the temp. Thus, in an



Rain-gauge and measuring glass.

upward movement of air the temp. falls, and water vapour is condensed. Such upward movements may take place (1) in the cyclonic swirl round a low-pressure centre; (2) by the forcing of a mass of air into high elevations, owing to the presence of a barrier of mountains athwart the prevailing winds; (3) by the horizontal movement of vapour-laden air from warmer to colder regions. This gives the key to the distribution of rainfall. Rain falls all over the stormy, westerly wind belt, where it is interrupted

only in the wide northern continents in winter, when anticyclonic conditions prevail, and then precipitation is usually confined to the coasts. Rain falls in the equatorial low-pressure belt of ascending air. It also falls on the eastern side of the continent in the trade-wind belts, especially when the coasts are bordered by high mountains, and in summer when the air over the land is rising. West of the eastern wet strips of the trade-wind regions are the great deserts of the world. In Asia the central parts of Turkestan, Taklamakan, and Gobi, surrounded by lofty mountains on the windward sides, are also arid.

Owing to seasonal temperature changes there is (1) an alternation of inflowing and outflowing winds from the continents, and (2) the belts of pressure and rainfall move northwards and southwards. The maximum precipitation takes place in the summer half-year, except in (1) the regions about 30° to 40°, which lie in the W. of the continents in the trade-wind belt in summer, but receive rain from the stormy W. winds in winter (Mediterranean regions); (2) the W. *coasts* of the stormy wind belts, which are affected by the intense winter storms; (3) the E. coasts of monsoonal lands, such as Ceylon or Annam, which are sheltered from the S.W. and N.W. monsoons, but are exposed to the N.E. and S.E. trades, which have crossed a considerable stretch of warm oceans. On the other hand, the regions about 12° to 20° are in the desert area when the sun is highest in the opposite hemisphere, and in the wet area when it is highest in their hemisphere, and have summer rains.

Rainfall decreases steadily from the coast inland where the land remains relatively flat, and increases normally from the sea-level upwards. There is, however, a superior limit to this increase, and from the colder *upper* air of high altitudes less vapour is condensed. This inversion level, as it has been called, varies with the position of the mountains and with the season.

The intensity of rainfall varies, and it is in the hottest regions of the world that the heaviest precipitation is to be expected. Cherra Punji in the Khasi Hills, Assam, which has the largest recorded annual rainfall—viz. 464 in. (33 years' mean)—receives 115 in. in July and 300 in. in the three months June, July, and August, but over 30 in. per day have been measured for five successive days. Heaviest falls occur during thunderstorms or tornadoes.

In temperate climates a rainfall of less than 12 in. per annum produces semi-desert conditions. Grazing may be profitable in areas receiving between 12 and 18 to 20 in. per annum; above that agriculture becomes possible; while above 40 in. or so in the colder parts, above 60 in. in the warmer parts, of the temperate zone the climate is too wet. Between the tropics the most favourable rainfall is between about 30 and 60 in.; while in areas with over 80 or 100 in. the vegetation becomes too rank. The seasonal distribution, however, is of great importance. The best conditions are those which prevail over a considerable area

in the wheat and maize growing districts of N. America, where late spring and early summer rains fall.

Buchan, Bartholomew, and Herbertson, *Atlas of Meteorology* (1899); A. J. Herbertson, *Distribution of Rainfall over the Lands* (1901).

Rainy, ROBERT (1826–1906), Scot. ecclesiastic; prof. Church history, New Coll., Edinburgh (1862–1900); principal (1874–1906); took a prominent part in the negotiations for union between the Free and United Presb. Churches, which took place in 1900. He possessed dialectical powers of the first order as a debater in eccles. courts. His works include *Life of Principal Cunningham; Delivery and Development of Christian Doctrine; The Ancient Catholic Church.*

Raipur, chief tn., Raipur dist., Central Provinces, India (21° 14′ N., 81° 39′ E.), 160 m. E. of Nagpur; exports grain and cotton; has a leper asylum; fort dates from 1460. Pop. 30,000.

Raisin, the sun-dried fruit of the grape vine (*Vitis vinifera*). The varieties known as valencia and sultana are the best known in England. The former come chiefly from S. Europe and Asia Minor, the latter chiefly from Turkey. Muscatels are dried while still attached to the vine.

Raisuli, MULAI BEN MOHAMMED (*c.* 1867–), Moroccan bandit; kidnapped (1903) W. B. Harris, *Times* correspondent, and others, and to obtain their release Sultan was forced to make him governor of Tangier district (1904); lawlessness caused his removal (1906). Was largely responsible for uprising of tribesmen which forced Fr. interference in Morocco (1907). With Ger. aid again raised revolt (1918).

Rait, ROBERT SANGSTER (1874–), Scot. historian; educated at Aberdeen and Oxford; tutor of New Coll., Oxford (1903–13); appointed prof. of Scot. history and literature, Glasgow Univ. (1913), and Historiographer-Royal for Scotland (1919); served in the War Trade Intelligence dep. (1915–18); his publications include *Universities of Aberdeen: a History* (1895), *The Scottish Parliament* (1901), *Scotland* in 'The Making of the Nations' series (1911), *Life in the Mediæval University* (Cambridge Manuals, 1912), *History of Scotland* (Home University Library, 1914).

Rajkot, chief town, Rajkot state, Kathiawar, Bombay, India (22° 18′ N., 70° 50′ E.); has a coll. for the sons of Ind. chiefs, also female training coll.; headquarters of political agent for Kathiawar. Pop. 36,000. Area of state, 283 sq. m.; pop. 50,000.

Rajputana ('land of the Rajputs'), tract of Ind. territory (23° 3′–30° 12′ N., 69° 30′–78° 17′ E.), bounded on W. by Sind, on N.W. by Bahawalpur, on N. and N.E. by Punjab, on E. by United Provinces and Gwalior; S. boundary runs across central region of India in zigzag line. Area (*c.* 120,462 sq. m.) includes eighteen native states, two chiefships, and Brit. prov. of AJMERE-MERWARA. Chief administrative control vested in political officer who supervises relations between the native states and government of India. Aravalli Hills intersect country almost from end to end. Tract to N.W. of hills is generally

sandy and unproductive, but relatively fertile in N.E. To S.E. of the hills lie higher and more fertile regions traversed by considerable rivers (Banas and Chambal, tribs. of Jumna). Total length of railways, 1,576 m. Over half pop. engaged in agriculture; most of the remainder engaged in preparation and supply of material services. Among castes and tribes, the most important are Brahmans, Jats, Mahajans, Chamars, RAJPUTS, Minas, Gujars, Bhils, Malis, and Balars. Cattle are extensively reared. Ores and cobalt, zinc, copper, iron, and lead are found. The manufactures include cotton, woollens, ivory, and metal goods. Pop. 10,530,000.

Rajputs, race of N. India, not confined to Rajputana, mostly of Hindu persuasion, but including many Mohammedans. The Rajputs are a fine race, pre-eminently fighters, and form the landlord or ruling caste. They claim to be the representatives of the anc. Kshatriya.

Rákoczy, princely Hungarian family; principal members were: (1) SIGISMUND (1544–1608), Hungarian patriot; supported insurrection of BOCSKAY, on whose death he was elected Prince of Transylvania (1607). (2) GEORGE I. (1591–1648), son of above; took part in rising of Gabriel Bethlen; Prince of Transylvania (1630); went to war with Austria and won religious liberty for Hungary. (3) FRANCIS II. (1676–1735); led Hungarian revolt (1703) until defeated at Trencsen (1708); retired to Poland (1711); wrote *Mémoires sur les Révolutions de Hongrie* (1738).

Raleigh, city, N. Carolina, U.S. (35° 48′ N., 78° 29′ W.), 69 m. S.E. by S. of Danville (Virginia); cotton mills; wood-working industries; railway shops; cottonseed oil, fertilizers, etc. Centre of important cotton and tobacco district. Important educational establishments, including normal school, institute, and university for coloured students. Pop. 19,200.

Raleigh, CECIL (1856–1914), dramatic author; became acting manager at the Royalty Theatre, and afterwards dramatic critic for *Vanity Fair* and the *Sporting Times*; the first of his plays, which were all melodramas, was *The Great Pink Pearl* (1885), written in conjunction with R. C. Carton; he also collaborated with G. R. Sims, Sir A. Harris, and H. Hamilton; perhaps his best plays, written alone, were *The Flood Tide* (1903), *The Sins of Society* (1907), *The Whip* (1909), and *Sealed Orders* (1913).

Raleigh, SIR WALTER (1552–1618), Eng. courtier, traveller, and author; born in Devonshire; left Oxford to aid Huguenots (1569); took part in rising of Netherlands against Spain; sailed in unfortunate voyage of half-brother, Sir Humphrey Gilbert (1579); served in Ireland (1580); became a personal favourite of Elizabeth; planted Eng. flag in 'Virginia,' but failed in several attempts at colonization; brought home hitherto unknown potato and tobacco plants; in 1588 fought against the Armada; fell from favour by marriage (1593), but was ultimately restored; expedition to Guiana (1595); commanded in 'Essex' Cadiz expedi-

tion (1596), and attack on Azores (1597). Imprisoned on charge of treason, Raleigh wrote in captivity part of projected *History of the World*, of no historical value but in lofty prose; persuaded James I. to allow him to lead an expedition to gold mine on Orinoco; failed to find it, burned Span. town against king's orders, and, returning, was executed.

Raleigh, Sir Walter (1861–), Eng. man of letters; prof. of English since 1914 at Oxford; works include *The Eng. Novel* (1894), *Style* (1897), *Shakespeare* (1907), *Six Essays on Johnson* (1910), *Romance* (1917), etc.

Ralik Islands. See Marshall Islands.

Ramadán, the ninth month of the Mohammedan year, in which Mohammed, before his call, always retired to the cave at Hira for prayer and meditation; and it was in this month that the Koran was communicated to him. For these reasons it has become a season of great sanctity. During this month the Koran is to be read through, and a severe fast maintained between dawn and sunset.

Ramadie, vil., Mesopotamia (33° 21′ N., 43° 20′ E.), on the Euphrates, 60 m. W. by N. of Bagdad. After the fall of Kut-el-Amara (Feb. 24, 1917), a Turkish force retreated up the Euphrates to Ramadie, where it was attacked by Brit. troops from Feluja; the advanced positions were driven in (July 11, 1917), but a dust storm and excessive heat compelled a retirement. In Sept. the operation was renewed by the 15th Division, under Major-general Sir H. T. Brooking, which by a brilliant assault carried the Mushaid ridge; over 3,500 Turks and Arabs surrendered to the British (Sept. 29, 1917). In 1920 hostile Arabs cut off the communications of the Brit. garrison.

Ramayana, Ind. epic poem, which assumed its present form at the end of the 4th or beginning of the 3rd cent. B.C.; the author was a Brahman named Valmiki; it describes the diffusion of Hinduism throughout the country lying S. of the Ganges valley, and, because it deals with and lays stress on the simple joys of homely life, has always made a powerful appeal to the Hindus.

R.A.M.C., Royal Army Medical Corps.

Ramée, Louise de la. See Ouida.

Rameswaram, tn., Madura dist., Madras, India (9° 17′ N., 79° 19′ E.), on island of Rameswaram; contains one of most venerated Hindu shrines, and is resort of thousands of pilgrims. Pop. 7,200.

Ramie, also called Rhea, and China Grass, a valuable fibre derived from the inner bark of *Bœhmeria nivea*, a member of the Urticaceæ, largely cultivated in China. The fibre is exceptionally long and tough, being one of the finest textile fibres, but the gum with which it is impregnated renders it unsuitable for certain types of work.

Ramillies, vil., Brabant, Belgium (50° 39′ N., 4° 55′ E.); scene of Marlborough's victory over French (1706).

Rampolla, Mariano, Count del Tindaro (1843–1913), Ital. ecclesiastic; entered the papal service (1869); served as coun-

sellor of the papal embassy and papal nuncio at Madrid between 1875 and 1887; in the latter year was made cardinal and appointed papal secretary of state, a position which he resigned on the death of Pope Leo XIII. (1903).

Rampur, tn., feudatory state of same name, United Provinces, India (28° 48′ N., 79° 5′ E.), 38 m. N.W. of Bareilly; damask, sugar, and jewellery. Pop. 74,300.

Rampur-Beauleah, chief tn., Rajshahi dist., Bengal, India (24° 22′ N., 88° 39′ E.), 125 m. N. by E. of Calcutta; silk and indigo. Pop. 22,000.

Ramsay, HON. ALEXANDER ROBERT MAULE (1881–), captain, R.N., son of the Earl of Dalhousie; served in the Dardanelles (1914–15); married Princess Patricia, daughter of the Duke of Connaught; appointed naval attaché at Paris (1919).

Ramsay, ALLAN (1686–1758), Scot. poet; *b.* Leadhills, Lanarkshire; about 1719 he set up as a bookseller in Edinburgh; he pub. *The Tea-Table Miscellany* and *The Evergreen*, collections of poems, but it is as the author of *The Gentle Shepherd*, a dramatic pastoral of the realistic type, that he is chiefly remembered. In 1730 he published a *Collection of Thirty Fables*, and in 1736 a collection of *Scots Proverbs;* in 1746, largely through his exertions, the first regular theatre was opened in Edinburgh; he revived vernacular poetry, and prepared the way for Fergusson and Burns.

Life by Smeaton (1896).

Ramsay, ALLAN (1713–84), Scot. portrait-painter; son of Allan Ramsay the poet; settled in London (1756); portrait-painter to George III. (1767).

Ramsay, SIR WILLIAM (1852–1916), Scot. chemist; *b.* Glasgow; appointed prof. of chem., Univ. College, Bristol (1880); prof. of chem., Univ. College, London (1887–1912); made investigations on 'evaporation and dissociation,' which led later to researches on 'molecular surface energy of liquids'; discovered, jointly with Lord Rayleigh, the element ARGON; in the investigation of possible sources of this substance, he also discovered HELIUM; subsequently isolated three other gaseous elements, xenon, krypton, and neon; discovered that radium in its apparent disintegration gives off helium; was awarded the Nobel prize in chem. (1904). He pub. text-books of marked originality on chem., a treatise on the *Gases of the Atmosphere* (1902), and *Essays, Biographical and Chemical* (1908).

Ramsay, SIR WILLIAM MITCHELL (1851–), Scot. archæologist; prof. of humanity, Aberdeen Univ. (1886–1911); works include *The Historical Geography of Asia Minor* (1890), *The Church in the Roman Empire* (1893), *The Education of Christ* (1902), *The Cities of St. Paul* (1907), *The Revolution in Constantinople and Turkey* (1909), *The Life and Letters of William Black* (1918).

Ramsbottom, tn., Lancashire, England (53° 39′ N., 2° 19′ W.), on riv. Irwell, 4 m. N. of Bury; cotton and woollen factories, calico printing, bleachworks, iron and brass foundries. Pop. 15,000.

Ramscapelle, vil., W. Flanders, Belgium (51° 8′ N., 2° 44′ E.),

3 m. S. of Nieuport on single-line railway to Dixmude; scene of terrific struggle when Würtembergers during the thrust for Calais partly occupied the place and seized the railway line (Oct. 30, 1914), but were foiled by the opening of Yser sluices and a dashing counter-attack.

Ramsey. (1) Seapt. and bathing resort, N.E. of Isle of Man (54° 19′ N., 4° 23′ W.), with park, Albert Memorial Tower, and House of Keys building. Pop. 4,700. (2) Par. and markt. tn., Huntingdonshire, England (52° 27′ N., 0° 9′ W.), 10 m. N.N.E. of Huntingdon. Ramsey Mere, 2 m. N.E., has been drained and produces fine crops of wheat. Pop. 5,300.

Ramsgate, munic. bor., Cinque port, wat.-pl. and residential tn., N.E. coast of Kent, England (51° 20′ N., 1° 25′ E.), 17 m. E.N.E. of Canterbury; handsome esplanade, Marine Drive, promenade piers, and recreation grounds; harbour of refuge; was attacked by aircraft during Great War. Pop. 29,600.

Ranchi, tn., Ranchi dist., Chuta Nagpur div., Bengal, India (23° 22′ N., 85° 22′ E.); dist. produces rice, tea, shellac, and myrobalans. Pop. (tn.) 26,000.

Rand (*i.e.*, low range of hills), popular and abbreviated name for *Witwatersrand*, rich gold-mining dist. W. of JOHANNESBURG, Transvaal, S. Africa (26° S., 27° 30′ E.); most important beds worked are those of 'Main Reef Series'; deepest shaft (1917), 5,500 ft.

Randazzo, tn., Catania, Sicily, Italy (37° 50′ N., 14° 57′ E.); alt. 2,500 ft., at N. foot of Mt. Etna; fine palaces and picturesque churches; wine, oil, cheese. Pop. (comm.) 12,000.

Randegger, ALBERTO (1832–1911), Austrian musical composer, conductor, and teacher of singing; *b.* Trieste; settled in London (1854), and became prof. of singing at the Royal Academy of Music (1868), and the Royal Coll. of Music (1896); composed operas, cantatas, and many songs; conducted the first performances in England of *Carmen*, *Lohengrin*, and *Tannhäuser*; won a very high reputation as a teacher of singing.

Randers, tn., Jutland, Denmark (56° 27′ N., 10° E.), on Gouden-Aa, 23 m. N.W. of Aarhus; has a 14th cent. church; iron foundries, machine and railway carriage shops, glove and watchmaking factories. Pop. 23,000.

Randolph, THOMAS, 1ST EARL OF MORAY (*d.* 1332), Scot. patriot; nephew and follower of Robert Bruce; scaled and captured Edinburgh Castle from the English (1314); second in command at Bannockburn (1314); defeated English at Milton (1319); regent of Scotland (1329–32).

Range-finder, a modern term used both for (1) instruments for finding the distance, or 'range,' of objects to be fired at; and (2) the observer trained in their use and detailed for this duty. 'Range-finders' (formerly known as 'telemeters') are optical instruments depending on the principle that given the base and two angles of a triangle all its other elements can be determined by a simple trigonometrical formula. In the earlier systems of range-finding two

observers were necessary. The base was measured by their keeping taut between them a line of 50 or 60 yds. of cord. The instruments were an adaptation of the box sextant. One of them kept the target in view on a bearing at right angles to the base cord, while the other sighted it through his range-finder, and read off the result from a scale marked, not with the angle of observation, but with the distance corresponding to this angle. It was not easy to get the two observers to work accurately together, and the results were only approximately reliable. Efforts were made by many inventors to produce an efficient single instrument range-finder. This was especially important for infantry work, for it was an easier matter to carry out range-finding observations from a comparatively long base with artillery. The first single instrument range-finders were, however, devised for artillery in coast defences and in naval work. In these cases the problem was simplified by placing the observing station on a mast or on high ground. Range-finding then became the automatic solution of a right-angled triangle, of which one side was the height of the station above sea level. This height being known, it was only necessary to determine the angle of observation of the enemy ship, and this could be measured and the range indicated on a scale attached to a sextant telescope mounted in the vertical plane, and depressed until the target appeared on its cross wires. Various devices were proposed for a single instrument for the infantry. In the Fr. army for a while a field-glass was in use with a transparent scale behind the object glass, marked to show the apparent height of an average man at various distances. The difficulty of providing an angular range-finder arose from the fact that the base provided by a single instrument must be a short one, and the triangle to be solved would therefore be a very elongated one with a very small apex angle even at short ranges. A surveyor working with a theodolite would not attempt to determine accurately the distance of an object about a quarter of a mile away by taking its angular direction from the ends of a base a yard or two in length. Attempts were made to solve the problem by means of instruments with a delicate adjustment by micrometer screws, which, apart from other drawbacks, would become worn and make accurate results impossible.

In 1888 the War Office advertised for an infantry range-finder that would fulfil certain conditions, and Messrs. Barr and Stroud of Glasgow succeeded in producing an instrument that fulfilled them. This range-finder, with many improvements and special adaptations to various purposes, is now in use in our own navy and army and in many of the armed forces of other countries. To give a general idea of one of its simplest and most widely used forms, omitting many details, one may say that it consists of two telescopes mounted in the same horizontal line, object glasses outwards.

Outside each object glass is placed a prism which bends the ray from the object observed inwards along the axis of the

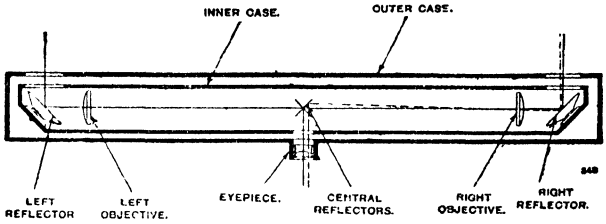
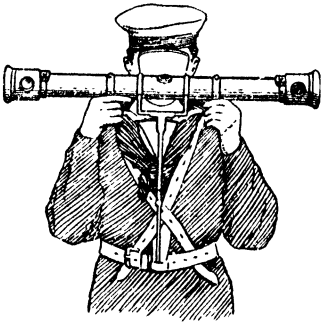


Diagram showing principle of Barr and Stroud Range-finder.

range-finder. At the central point of it the two images thus produced are reflected to an eyepiece. In the infantry range-finder one image shows the upper, the other the lower part of the object. When first sighted these will usually not coincide—*e.g.*, a tree or a flagstaff will appear broken in two at the line that divides the upper and lower half of the image at the eyepiece. The observer then turns a milled head which moves a prism in the right side of the tube and deflects the rays on this side until there is sharp coincidence in the image. The movement of the prism gear actuates that of an indicator on a scale of yards, and on obtaining coincidence the range is read off from this scale. Instruments vary in size from the infantry range-finder about 3 ft. long to fortress range-finders with a base of 50 ft. With the infantry range-finder the approximate uncertainty at 1,000 yds. is only 4 to 5 yds. During Great War the Barr and Stroud range-finders became most widely used service instruments in the army and navy, and efficient range-finders were devised on the same principle for submarines and for anti-aircraft gunnery. Besides their use for war, long-distance range-finders have been of great service in rapid surveys, especially in hilly and mountainous countries, and in mapping regions where an elaborate triangulation is not possible. Range-finders are also



The Barr and Stroud Range-finder of 80 cms. base on a Belt Mounting for Navigational or Infantry use.

of use in coastal navigation, and for ships keeping station in fleet sailing.

Rangifer, reindeer. See under DEER FAMILY.

Rangoon, cap. and chief port, Burma, India (16° 53′ N., 96° 4′ E.), on Hlaing or Rangoon R. (E. delta stream of Irawadi), 20 m. from sea; port under commissioners; river training works, comprising wall 10,000 ft. long and dredging of channel, completed 1918; largest trade of any Ind. port except Calcutta and Bombay; many pagodas, including Shway-Dagon (6th cent.), height 370 ft., covered with gold leaf and plates of gold. Victoria Memorial Park and Royal Lake in environs; rice mills, sawmills, wood and ivory carving, petroleum refineries (pipe line to oil fields). Chief exports: rice, petroleum, teak, hides, and skins. Pop. 293,300.

Rangpur, chief tn., Rangpur dist., Eastern Bengal and Assam, India (25° 45′ N., 89° 17′ E.), 235 m. N. by E. of Calcutta. Pop. 16,000.

Ranidæ. See FROGS.

Ranjit Singh (1780–1839), Sikh prince, who became monarch of the Punjab, and maintained its independence against Afghanistan; throughout his career the faithful ally of Great Britain; seized Lahore (1799), Amritsar (1802); by treaty (1809) surrendered dist. south of Sutlej to Britain.

Ranjitsinhji, PRINCE KUMAR SHRI (1872–), Ind. prince, Maharajah Jam Sahib of Nawanagar; educated Rajkot, India, and Trinity Coll., Cambridge; headed the batting averages for All England (1896 and 1900); distinguished himself with Stoddart's All England Eleven in Australia (1897–8); confirmed by the Brit. government on the throne of Nawanagar as Jam (governing prince) in succession to his uncle, the late ruler, who had conditionally adopted him as successor (1907); revisited England, and played for Sussex in 1908, 1912, and 1920; during the Great War offered troops to the government and served with them at the front (1914–15); received the K.C.S.I. (1917); author of *The Jubilee Book of Cricket* (1897), and *With Stoddart's Team in Australia* (1898).

Ranke, LEOPOLD VON (1795–1886), Ger. historian; *b.* Wiehe, Thuringia; became schoolmaster; pub. *Geschichte der Romanische und Germanische Völkerschaften von 1494–1514* (1824); appointed prof. extraordinary of history at Berlin Univ. (1825), and won distinction by original researches; *Fürsten und Volker von Südeuropa im 16 und 17 Jahrhunderts* (1827) shows modern historical methods; produced famous *Die Römischen Päpste, ihre Kirche und ihr Staat im 16 und 17 Jahrhunderts* (1834–6), exhibiting deep insight into eccles. history, width of view, and excellent literary style; many other books, widely translated; *Französische Geschichte vornehmlich im 16 und 17 Jahrhunderts* (1852–61), and *Englische Geschichte vornehmlich im 16 und 17 Jahrhunderts* (1859–68; trans. 1875), never superseded; ennobled in 1866.

Rannoch. (1) Dist., N.W. Perthshire and N.E. Argyllshire, Scotland (56° 37′ N., 4° 32′ W.);

elevated moorland; one of the loneliest parts of Britain. (See R. L. Stevenson's *Kidnapped.*) Rannoch station is 5 m. w. of head of (2) LOCH RANNOCH, fresh-water loch, N.W. Perthshire, 9½ m. long by ¼ to 1⅛ m. wide; alt. 668 ft.; fed by Ericht and other streams; drains by Tummel into Tay.

Ranunculaceæ, a natural order of herbaceous dicotyledons, many species being indigenous to Britain. The plants often possess underground parts stored with food, and many show palmatisect leaves (*Ranunculus bulbosus*), although in others (*R. hederaceus*) they are merely lobed. The flower, in the BUTTERCUP, has five sepals and petals, and numerous spirally arranged stamens and carpels. Some forms, such as *Aconitum* and *Delphinium*, diverge considerably from this type, being zygomorphic, with petals represented by nectaries.

Rapallo, seapt. and winter resort, Genoa, Italy (44° 22′ N., 9° 13′ E.), on Gulf of Genoa, 16 m. E.S.E. of Genoa; lace, olive oil. Pop. 11,000. Here was signed Treaty of Rapallo (Nov. 13, 1920) between Italy and Jugo-Slavia, which settled Adriatic question. By it boundaries between the two countries were fixed to run from Mount Pec to head of the Quarnero, following delimitations of Pact of London (1916) with a few exceptions. Cities of Zara, Borgoerizzo, Cerno, Boccagnazzo, and part of Diclo, as well as minor islands and rocks of Istria, together with islands of Lagosta, Pelagosa, and small adjacent islands, to belong to Italy; other islands to go to Jugo-Slavia. Freedom and independence of Fiume to be recognized.

Rape (*Brassica napus*), a member of the Cruciferæ, allied to the cabbage. *Rape Oil* or *Colza* is derived from its seeds; when refined, light yellow, nearly odourless; sp. gr. ·915; uses—burning, lubrication, soapmaking. *B. campestris*, the wild variety, cultivated on the Continent, gives an inferior yield of oil.

Rape, the carnal knowledge of a woman by a man, not her husband, by violence and against her will. Was formerly a capital offence, but now punishable as felony by penal servitude. In Britain consent of the female is no excuse if she is under sixteen.

Raphael Santi, or RAFFAELLO SANZIO (1483–1520), Ital. painter, greatest of Roman school; *b.* at Urbino; father, a poet and painter, died when son was only eleven; studied first under Timoteo Viti; his *Vision of a Knight* (National Gallery, London) and *St. Michael and St. George* (Louvre) belong to this period; later, under Perugino, produced famous *Marriage of the Virgin;* next went to Florence and came under the influence of Leonardo da Vinci and Michelangelo; here he began long series of Madonnas—the *Ansidei, Belle Jardinière,* etc.—and painted the splendid *Entombment;* summoned to Rome by Pope Julius II. (1508) to decorate the Vatican stanze, for which task he called around him a school of artists; with their aid decorated ceiling and walls of four apartments; amongst subjects chosen were: *Poetry, or the Parnassus, The Dispute of the Sacrament, Phil-*

osophy, or the School of Athens, Deliverance of Peter from Prison, etc., the whole depicting philosophical and historical evolution from paganism to Christianity; he also designed long-lost tapestry cartoons, now in S. Kensington Museum; other works of this period were the *Sibyls* in the Chigi Chapel, portrait of Pope Julius II., and the Del Sedia and Sistine Madonnas; died whilst painting *The Transfiguration;* mourned by all Rome.

Felix Lavery, *Raphael* (1920).

Raphoe, par. and mrkt. tn., co. Donegal, Ireland (54° 52′ N., 7° 36′ W.), 5 m. W.N.W. of Lifford; cathedral; episc. palace; tweeds and other woollens. Pop. 1,200.

Rare Earths are oxides of the following metals: scandium (Sc, 44·1), yttrium (Y, 89·0), lanthanum (La, 139·0), cerium (Ce, 140·25), praseodymium (Pr, 140·6), neodymium (Nd, 144·3), samarium (Sm, 150·4), europium (Eu, 152·0), gadolinium (Gd, 157·3), terbium (Tb, 159·2), dysprosium (Dy, 162·5), erbium (Er, 167·4), thulium (Tm, 168·5), neo-ytterbium (Yb, 172·0), and lutecium (Lu, 174·0).

They occur in rare and complex minerals in Scandinavia, Siberia, N. and S. America, etc.—such as cerite, gadolinite, samarskite, lanthanite, monazite—and are separated by fractional crystallization, precipitation, etc., of their salts. Auer von Welsbach divided didymium into praseo-dymium and neo-dymium, and Crookes fractionated yttria into about eight slightly different components. It is consequently difficult to pronounce on the elementary nature of some of the rare earth metals, or to classify them in the periodic system. Ceria finds application in med., and, mixed with 99 parts of thoria, forms the material of the incandescent gas mantle.

Raspberry (*Rubus idœus*), member of the Rosaceæ, commonly cultivated for its fruit, which is, technically, an aggregate of drupes, or stone fruits; plant propagates largely by means of suckers, which produce new 'canes' some distance from parent stem.

Rasputin, GREGORY (1871–1916), dissolute, ignorant Russian 'lay' monk, who until his 'conversion' in his 34th year, was an ordinary peasant. He then visited Mt. Athos, Jerusalem, Kiev, Moscow, and Petrograd, where he became known as a 'healer.' He obtained great influence over the Tsarina, and through her played an important political rôle, becoming one of the most active of the 'dark forces.' Lured to a supper party by Prince Yussupov Sumarokov Elsten, a nephew of the Tsar by marriage, he was shot, and his body buried beneath the ice of the Neva. He was the author of *My Thoughts and Reflections* (1915), which describes his pilgrimages.

Rastatt, tn., Baden, Germany (48° 52′ N., 8° 12′ E.), 14 m. S.S.W. of Karlsruhe; lace, beer, stoves, and cigars; palace on model of Versailles. Pop. 15,200.

Rat, the larger species of the rodent genus *Mus,* the smaller members of which are known as mice. The larger and more abundant of the two common species is the brown rat (*M. decumanus*),

which seems to have originally come from Western China. It is now abundant throughout the greater part of Europe, and has been carried by ships to the New World. Its distribution by involuntary human agency may indeed be compared with that of the cockroach, which man has likewise carried with him over the globe. In Europe the brown rat was a comparatively late comer, for it is known to have entered Russia in large numbers in the early part of the 18th cent. by crossing the Volga. Prior to this great migration, the European area was occupied by the smaller black rat (*M. rattus*), which is supposed to have travelled from its Eastern home before the 13th cent. In England, and over much of the Continent, the brown rat has been successful to a large extent in exterminating its weaker ally. The black rat appears to be indigenous both to India and other parts of the East, and also to Northern Africa; but, like the brown rat, it has been carried over the globe by man.

Rat-catching and *Rat-killing.*— Formerly professional rat-catchers were employed to reduce the numbers of rats, while as a training for dogs rat-catching was indulged in as a sport. Rat poisons were also used to a considerable extent. In 1919 the menace became so pronounced in rural districts, where it was estimated that an annual loss of £15,000,000 was caused by the enormous increase of these pests, that government action was taken. The Rats and Mice (Destruction) Bill, which came into force on Jan. 1, 1920, made owners responsible for rats found on their property. Prior to this, concerted action had been recommended by the Board of Agriculture, and the first National Rat Week was held in October 1919, and a second at the end of December. Advice and facilities were provided officially, and considerable success attended these efforts. Failure to take action in certain districts must, of course, react on adjoining localities. Particular care requires to be exercised at ports to prevent the importation of rats which may carry infection. See under PLAGUE.

Ratak. See MARSHALL ISLANDS.

Ratel. See WEASEL FAMILY.

Rathenow, tn., Brandenburg, Prussia (52° 37′ N., 12° 20′ E.), on Havel, 44 m. w. by N. of Berlin; spectacles, optical instruments, bricks. Pop. 25,000.

Rathfarnham, par. and vil., co. Dublin, Ireland (53° 18′ N., 6° 15′ w.), 3 m. s. of Dublin; many handsome residences in neighbourhood. Pop. 8,900.

Rathkeale, par. and mrkt. tn., co. Limerick, Ireland (52° 31′ N., 8° 56′ w.), 18 m. s.w. of Limerick. Pop. (par.) 3,000.

Rathlin, isl., co. Antrim, Ireland (55° 18′ N., 6° 13′ w.), 6 m. N. of Ballycastle; is of crescent shape (7 m. by 1½ m.); at N.E. end are ruins of castle in which Robert Bruce took refuge (1306); scene of traditional story of the spider. Pop. 350.

Rathmines, southern suburb of DUBLIN. Pop. (with Rathgar) 37,800.

Ratho, par. and vil., Midlothian, Scotland (55° 54′ N., 3° 24′ w.), 8 m. w. by S. of Edinburgh. Pop. 1,900.



RAPHAEL: THE MADONNA DEL CARDELLINO.
(In the Uffizi Gallery, Florence.)



RAVENNA.

Ratibor (Polish *Raciborz*), Silesia, Plebiscite Area (50° 6′ N., 18° 13′ E.), on l. bk. of Oder, 88 m. S.E. of Breslau; railway workshops; paper, tobacco, glass, iron, steel, chemicals, and furniture. Pop. 38,400.

Rationalism, in wide sense, revolt of individual reason against authority; in narrower, the attempt to deduce geometrically all knowledge from certain elementary concepts (Descartes, Spinoza, Leibniz). Kant denied the validity of this mathematical method; rational concepts to yield new truths must be applied to matter of sense given in experience.

Rationing. See under FOOD CONTROL.

Ratisbon. See REGENSBURG.

Ratitæ. See RUNNING BIRDS.

Ratlam, or RUTLEM, chief tn., Ratlam state, Central India (23° 1′ N., 75° E.), 65 m. N.W. of Indore; grain trade. Pop. 36,000.

Rattlesnake. See SNAKES.

Rattray, par. and burgh, Perthshire, Scotland (56° 36′ N., 3° 20′ W.), on riv. Ericht, opposite to and connected with Blairgowrie by bridge; flax and jute spinning. Pop. (par.) 2,100.

Raven. See CROW FAMILY.

Raven-Hill, LEONARD (1867–), Eng. artist and cartoonist; studied at Lambeth and at Paris; first exhibited at Salon (1887), and at Royal Academy (1889); founded, but was unsuccessful with, *The Butterfly*, an artistic journal; well known for his drawings and cartoons in *Punch*, to which he began to contribute in 1896.

Ravenna. (1) Prov., Italy, bounded E. by Adriatic and W. by Bologna; a fertile plain; drained by Po di Primaro and intersected by canals; produces wheat, rice, hemp, chestnuts, and olive oil; manufactures of faience, glass, paper, silk, linen, and leather. Area, 715 sq. m.; pop. 248,600. (2) Tn., cap. of above (44° 25′ N., 12° 12′ E.); contains many fine churches, including the Basilica Ursiana (dating from the 4th cent.), San Giovanni Evangelista (founded 425), and San Francesco (near which is tomb of Dante, who died here in 1321); massive mausoleum of Theodoric stands outside its walls. Ravenna is a town of great historical importance; from its strength it was considered cap. of Italy from 5th until middle of 8th cent.; was seat of exarch of Ravenna, viceroy of Byzantine emperor (539–752); afterwards held successively by Lombards and Venetians, until 1509, when it became a papal possession. Manufactures include silk and lace, musical instruments, and agricultural implements, glass, soap, starch, and wine. Pop. 71,700.

Ravensburg, tn., Donau, Württemberg, Germany (47° 46′ N., 9° 37′ E.), 46 m. S.S.W. of Ulm; flax, cotton and linen goods, leather, machinery, pottery, glass, etc. Birthplace of Henry the Lion. Pop. 15,500.

Ravensthorpe, par. and tn., W. Riding, Yorkshire, England (53° 41′ N., 1° 40′ W.), 2 m. W.S.W. of Dewsbury; woollens, iron, and brass. Pop. 5,700.

Ravi. See PUNJAB.

Rawal Pindi, munic. tn., military station, Rawal Pindi dist., Punjab, India (33° 36′ N., 73° 3′ E.), 90 m. E.S.E. of Peshawar; protected by forts; arsenal and

locomotive works; scene of surrender of Sikhs after Gujarat (1849). Pop. 86,500.

Rawa Ruska, tn., Galicia, Ukraine (50° 18′ N., 23° 39′ E.), 32 m. N.N.W. of Lemberg; during the Great War was captured by the Russians (Sept. 14, 1914); lost in their great retreat (June 1915). Pop. 10,400.

Rawitsch (Polish *Rawicz*), Poland (51° 37′ N., 16° 50′ E.), 55 m. S.W. of Posen; snuff, cigars, combs, carpets, oil, agricultural implements. Pop. 11,500.

Rawka, riv., Poland (51° 38′ N., 20° 10′ E.), trib. of the Bzura, which it enters 40 m. W. of Warsaw; during the Great War Ger. attacks on this front were repulsed with heavy losses (Feb. 1915), but the Russian defences were forced (June 1915).

Rawlinson, HENRY SEYMOUR, 1ST BARON (1864–), British general; educated at Eton and Sandhurst; entered 60th King's Royal Rifles (1884), but exchanged into Coldstream Guards (1892) after a period of service in India. Participated in Sudan and S. African Wars and commanded Mobile Column (1901–2). Subsequently commanded 2nd Brigade, Aldershot, and 3rd Brigade, Salisbury Plain. During 1914 he led the famous but ill-fated 7th Division to Belgium in pursuance of the scheme for holding back the Germans on the line of the Scheldt. How the division was pressed back and the fighting merged into the first battle of Ypres is told in the article WAR, THE GREAT. With the exception of a short period when attached to the Allied War Council at Versailles, he remained in high command during the whole of the war. His crowning exploit was in the great Brit. offensive of 1918, when, with the 4th Army, he carried Brit. arms across the old battlefield of the Somme and the Hindenburg Line, this being instrumental in effecting the Ger. collapse. For his distinguished services he was awarded a peerage and a grant of £30,000 (Aug. 1919). Subsequently he directed the withdrawal of Brit. forces from N. Russia and was appointed to the Aldershot command. In Aug. 1920 he was made commander-in-chief in India, for the purpose, it is understood, of effecting reforms in Ind. army.

Rawmarsh, tn., W. Riding, Yorkshire, England (53° 27′ N., 1° 21′ W.), 2 m. N. of Rotherham; steel and iron works, brickfields, potteries, collieries. Pop. 17,200.

Rawnsley, HARDWICKE DRUMMOND (1851–1920), Eng. clergyman, prose writer, and poet; canon of Carlisle; vicar of Crosthwaite, Keswick, and rural dean (1883–1917); founded the National Trust for the Preservation of Places of Historic Interest and Natural Beauty; a voluminous writer, especially on subjects connected with the Eng. Lake Dist. His works include: *Sonnets at the English Lakes; Edward Thring, Teacher and Poet; Literary Associations of the English Lakes; Memories of the Tennysons; Ruskin and the English Lakes; Sermons on the Sayings of Jesus.*

Rawtenstall, munic. bor., Lancashire, England (53° 42′ N., 2° 18′ W.), 8 m. N. of Bury; cotton, woollen, slipper and carpet-felt factories; coal mines and stone quarries. Pop. 30,500.

Ray (or WRAY), JOHN (1628–1705), Eng. naturalist, 'father' of Eng. natural history; famous for his contributions especially to the science of bot. His scientific work was chiefly systematic, and, in his classification of plants especially, he took some important steps forward. His merits are commemorated by the Ray Society, founded in 1844, for the publication of monographs on natural history.

Rayleigh, par. and vil., Essex, England (51° 36′ N., 0° 36′ E.), 6 m. W.N.W. of Southend; moated mound near village is site of Sweyn's castle. Pop. 1,800.

Rayleigh (JOHN WILLIAM STRUTT), 3RD BARON (1842–1919), Eng. physicist; senior wrangler and Smith's prizeman at Cambridge (1865); prof. of physics, Cambridge (1879–84), and of natural philosophy at the Royal Institution (1887–1905); president of the Royal Soc. (1905); did important work in the evaluation of the fundamental electrical units, in optics and capillarity, on Boyle's Law at low pressures; his very careful determination of the densities of gases led to the discovery (with Ramsay) of the element argon in the atmosphere; awarded the Nobel prize for physics (1904); wrote *Theory of Sound* (1877–8), and numerous monographs collected in *Scientific Papers* (4 vols. 1903).

Rays (Batoidea), group of Selachian fishes with flattened bodies, large pectoral fins, ventral gill-openings, and often a long whip-like tail. Most common are the skates, found in temperate and colder seas, nine species of which are British, best known being the common skate (*Raia batis*), up to 6 ft. long, and the thornback (*R. clavata*), up to 3 ft. The 'sting rays' and 'eagle rays'—armed with a strong spine up to 6 or 8 in. long, placed at the base of the tail, and capable of inflicting grievous wounds—are represented by *Trygon pastinaca* and *Myliobatis aquila* respectively. There is also the electric ray (*Torpedo hebetans*), with strong muscular electric battery hidden between head and pectoral fin. The saw-fishes (*Pristis*) are confined to tropical seas, where, with the strong flat-toothed blade which continues the snout, they do much havoc among other fishes.

Ray Society. See RAY, JOHN.

Razgrad, tn., Bulgaria (43° 30′ N., 26° 30′ E.), 36 m. S.E. of Rustchuk; active agricultural trade. Pop. 15,000.

Razorbill. See under GUILLEMOT AND AUK FAMILY.

Razors. To produce a good razor it is necessary to use the finest steel procurable for the blade; hollow-ground razors, first made in Germany, are the finest samples of the grinder's art, and are lighter and more economical than the flat ground variety. These are now hollow-ground largely by machinery, only a slight amount of finishing being done by hand. Razors are hafted in ivory, celluloid, vulcanite, etc. The safety razor, in which the blade is held in a guide which prevents the skin puckering in front of the edge, greatly reduces the risk of wounding, and has become very popular.

Razor-shell. See under LAMELLIBRANCHIATA.

Ré (or RHÉ), ILE DE, isl., Charente-Inférieure, 2 m. off W. coast of France, opposite Rochelle (46° 11′ N., 1° 25′ W.), 18 m. long, 2 m. broad; area, 28 sq m. Unsuccessfully besieged by Buckingham (1627); oyster culture and salt production. Chief town, St. Martin. Pop. 2,200.

Reade, CHARLES (1814–84), Eng. novelist; first works were dramatic, and include *Masks and Faces* (or *Peg Woffington*), *Christie Johnstone*, *Peregrine Pickle*, *The Lyons Mail*, and *Nance Oldfield*; novels include *It is Never too Late to Mend* (a study of prison life), *The Cloister and the Hearth* (his masterpiece, dealing with the life of the father of Erasmus), *Hard Cash* (a study of asylum life), *Put Yourself in his Place* (dealing with trade unionism), etc.; nearly all treat of social problems, and are written with a purpose.

Reading, co. tn., Berkshire, England (51° 27′ N., 0° 59′ W.), 36 m. by rail W. of London, at junction of Kennet and Thames; Henry I. buried in Benedictine abbey, which he founded (1121); some remains of abbey preserved in Forbury Pleasure Grounds; church of St. Mary (*c.* 1550); St. Lawrence (*c.* 1434); Grey Friars' chapel (restored); munic. buildings (1882), with museum of antiquities; Royal Berkshire Hospital; Agricultural Coll. and Dairy Institute; Univ. Extension Coll. (1892); agricultural produce; biscuit works (Huntly and Palmer's), seeds (Sutton's), engine works, breweries. Laud was a native. Pop. 75,200.

Reading, city, Pennsylvania, U.S. (40° 20′ N., 75° 58′ W.), on Schuylkill R., 50 m. N.W. of Philadelphia; an important industrial centre; railway workshops, brickworks, iron and steel, paper, cotton, hosiery, etc. Pop. 115,000.

Reading (RUFUS ISAACS), 1ST EARL OF (1860–), lord chief justice of England since 1913; was a stockbroker before being called to the bar; Q.C. in 1898 and made great reputation; Liberal M.P. for Reading (1904–13); solicitor-general (1910) and attorney-general (1910–13). His knowledge of finance was of great service during the war crisis, and he was sent to the U.S. on special missions, being high commissioner and special ambassador to U.S. (1918).

Realgar, or RUBY SULPHUR, As_2S_2, occurs native in Hungary in monoclinic prisms, but is usually prepared artificially either by heating sulphur and arsenic together in the proper proportions, or by subliming a mixture of arsenical and iron pyrites. When pure it is a ruby-coloured transparent solid that melts easily and burns with a blue flame. It has been employed as an ingredient of fireworks and as a pigment, but is poisonous and not permanent.

Realism, modern theory that reality exists apart from consciousness. Realism in literature is opposed to romanticism; it shows life as it is, not as an idealist wants it to be. Among realists are Zola, Guy de Maupassant, Tolstoy, Gorki. Ibsen's influence has given realism a strong position in modern drama.

Real Property. English law divides property into real and personal, instead of the more logical division into movable and im-

movable. Freehold estates, rights over minerals, and landed property generally are known as 'real' property; so are incorporeal hereditaments such as easements, sporting rights, title-deeds, heirlooms. The greatest estate which a person can hold is the fee simple, and it arises where land is given 'to a person and his heirs.' In the strict eye of the law, all land in England is held either directly or indirectly from the crown; but the owner of the fee simple is to all practical intents and purposes the absolute owner of the property. He is entitled to hold it for ever, for it is a legal maxim that 'there can be no reversion on a fee simple.' In the case of 'real' property, when the owner dies intestate it descends to the heir-at-law; whereas, with 'personal' property, the next-of-kin inherits. Real property is governed by the law of the place where it is situated, whereas personal property is governed by the law of the owner's domicile.

Reaping Machines. See IMPLEMENTS, AGRICULTURAL.

Reason, a term used in philosophy with many different shades of meaning: (1) mind as drawing or capable of drawing inferences; (2) mind as apprehending or capable of apprehending systematic truth; (3) mind as the source of system and order.

Réaumur, RENÉ ANTOINE FERCHAULT DE (1683–1757), Fr. naturalist and physicist; discovered production of steel from iron, iron tinning, production of opaque glass, artificial incubation, etc.; constructed thermometer with temperature scale bearing his name, in which he divided the interval between the freezing and boiling points of water into eighty degrees. See THERMOMETER.

Recall is a form of referendum obtaining in many towns of the U.S. by which a judge or other public official may, on petition, be called upon to submit himself to re-election. In Colorado there exists a recall of *decisions* of the supreme court declaring acts of the legislature unconstitutional. The topic was prominent in the presidential campaign of 1912. See REFERENDUM.

Recanati, tn., Macerata, Italy (43° 24′ N., 13° 31′ E.), 6 m. from Adriatic; several palaces; cathedral. Porto Recanati, at mouth of Potenza, is connected by rail with Ancona and Bari. Pop. 16,000.

Recessive Character. See under MENDELISM.

Rechabites, INDEPENDENT ORDER OF, a friendly society founded in Britain in 1835, and in the U.S. in 1842, to encourage total abstinence; the order in Britain is organized as the Salford Unity. The name 'Rechabites' is derived from an anc. Jewish organization which, amongst other things, encouraged total abstinence. The membership (1919) was 1,277,874, and the funds in hand £3,576,198.

Recife, or PERNAMBUCO, city state of Pernambuco, Brazil (8° S., 35° 53′ W.), on the Atlantic; three distinct quarters—Bairro Recife (commercial), São Antonio (an island connected with mainland by bridges), and Boa Vista. Railway terminus; government buildings; palaces of governor and bishop; cottons, machinery,

and glass; large export trade in cotton, sugar, rum, dyewoods, rubber, and cacao; improved harbour. Pop. 150,000; with suburbs, 200,000.

Reciprocity. See under TARIFF REFORM.

Reclamation. Round the coasts of Britain and other countries there are considerable tracts of land only partially submerged by the sea, and the term *reclamation of land* is used to describe the process of permanently excluding the sea in order to render such land fit for agricultural purposes. In estuaries, *e.g.*, silt is constantly being deposited at a more or less rapid rate, but owing to the shifting of the channel and the scouring action of the tide little permanent accretion takes place. If, however, the channel is fixed by embankments reaching high above water-level, the deposit goes on steadily and the foreshore gradually rises. Finally, the water is shut out altogether by embankments, which must be higher than the level of the highest tide. It is also possible further to increase the deposit by allowing water to enter at high tide through openings or sluices in the embankments, and permitting it to escape gently after its silt is deposited. Sea marshes also, which are only submerged at high tide, can be reclaimed by high embankments. Holland provides best examples of land reclamation, a large part having been won from the sea.

Beazeley, *Reclamation of Land from Tidal Waters.*

Recklinghausen, town, Westphalia, Prussia (51° 40′ N., 7° 13′ E.), 12 m. N.N.E. of Essen; linen and tobacco; coal mines. Pop. 53,700.

Recognizance, a bond made before, and enrolled in, a court, whereby the party who gives the recognizance admits a debt to the crown, and it is declared that if some act be performed the bond shall become void. Examples of recognizances are those entered into to keep the peace, to come up for judgment if called on, to give evidence, to prosecute an offence at assizes, or to pay the costs of an appeal. In each case a money debt accrues if the act is not performed.

Reconstruction, term used in U.S. history to describe the process by which and the period in which the states which seceded during the Civil War were brought back into the Union. The term was adopted during Great War to denote the social, economic, and political changes incident upon the transformation from a war status to that of peace. In the narrow sense reconstruction is concerned with such problems as demobilization of the military forces and of war industries; problems of the peace settlement; disbanding of emergency instruments of government established during the war; re-education of disabled soldiers; replacement of soldiers and civilian war workers in industry; disposal of war stores; war-debt taxation; cancellation of war contracts; re-establishment of shipping on a commercial basis; deflation of the currency; re-establishment of credit on a normal foundation; normalization of the supply or source of food

and raw materials. In its broader sense it signifies the period or process in which demobilization is followed by rehabilitation. In those countries which have suffered from war devastation, this is a staggering task; but in all combatant countries the problems are many and exigent. Housing and public improvements deferred during the war period must be undertaken; manufacturing plants transformed and enlarged; human wastage made good, as far as possible, by recuperation and re-education, and life and industry restored to normal functions. The third or final stage is one of constructive reform in industry, politics, and human relations, undertaken on a national scale and as national enterprises by the government itself, by voluntary co-operation of great masses of the population, or by both.

It has long been realized that the outbreak of the Great War ended an epoch of history, and that with the conclusion of peace a new and radically different era would begin. This idea was largely fostered by politicians during the progress of hostilities, some of whom predicted, in spite of the terrible impoverishment of the world, a post-war New Jerusalem. The pre-war régime of secret diplomacy, national rivalries, economic exploitations, and *welt politik* was to be thrown upon the scrap-heap of civilization, and the war was one to end war. Democracy—political, social, industrial—was to be triumphant. Disillusion was inevitable, and, so far, these aspirations have not come to fruition in any department.

Early in 1916 a committee of the Brit. cabinet was appointed to consider the probable problems of peace. Its functions were of an advisory character, and it presented reports on such topics as agricultural policy, demobilization, aliens, relations between employers and employees, and women's employment. In March 1917 a new committee, with the prime minister as chairman, was constituted; in addition to the sub-committees of the old committee, new sub-committees were appointed to study adult education, demobilization of war workers, acquisition of land, machinery of government, local government, Ministry of Health, housing and unemployment, physical training, juvenile employment, supply of raw material, and shipping. The importance of the work increased, and on Aug. 21, 1917, a Ministry of Reconstruction was established, to submit to the cabinet and ultimately to Parliament a reasoned policy of reconstruction in all its branches. An advisory committee was set up and an impressive number of sub-committees established. Both the department proper and the advisory committee were organized into five sections: (1) Transitional Economics—*i.e.*, problems created by war shortage of raw material, tonnage, capital, etc.; (2) Commerce and Production; (3) Labour and Industrial Organization; (4) Rural Development; (5) Social Development, including questions of health, local government, housing, education, and other matters relating to the changed conditions of the

transitional period. The ministry pub. many pamphlets and made many proposals, some of which have been adopted — *e.g.*, the establishment of the MINISTRY OF HEALTH, of WHITLEY COMMITTEES for improving the relations of employers and employed, a housing policy, and land settlement for discharged soldiers. In May 1919 it was announced that the ministry was in process of being wound up. The work of reconstruction is now in the hands of the various government departments concerned.

Recorder, judge of the court of quarter sessions of a borough. He must be a barrister of five years' standing; is appointed by the home secretary; holds office during good behaviour; is paid a salary by the borough council; and is a justice of the borough, with precedence next after the mayor. He must hold a court once every quarter, and oftener if he thinks fit or the home secretary so directs. He may not sit in Parliament for the borough of which he is recorder (Municipal Corporations Act, 1882).

Record Office. By the Public Record Office Act (1838) records are defined as 'all rolls, records, writs, books, proceedings, decrees, bills, warrants, accounts, papers, and documents whatsoever, of a public nature, belonging to her Majesty.' These records, which fall into two classes—(1) legal documents, which for the most part are under the statutory custody of the master of the rolls; and (2) state papers, which may be called in by the various departments from which they come, and are only under his charge and superintendence—were formerly kept in many depositories, including the Tower of London, the State Paper Office, the offices of the different courts, and the offices of government departments. Now they are collected in the Record Office, a fine building standing between Chancery Lane and Fetter Lane, London. Queen Elizabeth established the State Paper Office in 1578, which was amalgamated with the Public Record Office in 1854. The records preserved in the Paper Office underwent many vicissitudes through neglect (Thirtieth Report of the Deputy-Keeper of the Records). The legal contents of the Record Office include the anc. Rolls of Parliament, the Pipe Roll or Great Roll of the Exchequer, the records of the superior courts of special and abolished jurisdictions, of the Duchy of Lancaster, of the Palatine Courts of Chester, Durham, and Lancaster, of the principality of Wales, and of the various government departments, etc. (See *Guide to the Public Record Office*, by Scargill-Bird, 1891.) Such historical records as are not retained by the various government departments, and are before certain dates, are open to the inspection of the public (without fee, except in the case of legal documents after 1760). A large number of calendars of the records have been pub. under the direction of the master of the rolls, and there are many MS. indexes in the office. The national records of Scotland, under the Lord Clerk Register (Scotland) Act (1879), are preserved in the General

Register House in Edinburgh, and are divided between the historical dep., in which no fees are charged for literary research, and the General Record Office, which contains for the most part legal records. The national records of Ireland are preserved in the Irish Public Record Office under the care of the Irish master of the rolls, under the Public Records (Ireland) Acts (1867 and 1875).

Rectum, part of the larger intestine; a continuation of the colon, running through the pelvis to the anus or external orifice through which the waste product of digestion is voided. See DIGESTION.

Reculver, vil., Kent, England (51° 23′ N., 1° 12′ E.), 7 m. N.N.E. of Canterbury; former Roman port; Roman remains; Reculver cliff is a noted sea-mark.

Recurvirostra, avocet bird. See under PLOVER FAMILY.

Redbreast. See under THRUSH FAMILY.

Redcar, seaside resort and par., N. Riding, Yorkshire, England (54° 37′ N., 1° 4′ W.), 8 m. E.N.E. of Middlesbrough; fine stretch of sands to Saltburn and to mouth of Tees. Racecourse. Pop. (including Coatham) 10,500.

Red Cross on a white ground is the flag and badge of National Aid Societies, one of the chief of which is the Order of the Hospital of St. John of Jerusalem, established to secure neutral rights and protection for wounded soldiers, irrespective of nationality, and for all places and persons devoted to their care. In war it must be accompanied by flag of country using it. The working of the idea may be traced back to the Order of St. Mary, instituted during the siege of Acre (1190), but in its modern form it owes its origin to sympathy aroused for sufferings of wounded during Crimean and Austro-Italian wars, following upon which general rules were drafted by an international conference at Geneva in 1863. The Red Cross societies, which are centralized at Geneva in an international committee, have done great service in modern warfare, and particularly during Great War (1914–18). The Germans showed their disregard for the convention by such acts as the sinking of hospital ships, bombing of hospitals, etc., and also abused the Red Cross by displaying it over dug-outs, etc., not used as hospitals.

Red Deer. See under DEER FAMILY.

Reddish, par. and urban dist., Lancashire, England (53° 27′ N., 2° 11′ W.), 5 m. S.E. of Manchester. Pop. 8,700.

Redditch, tn., Worcestershire, England (52° 18′ N., 1° 56′ W.), 15 m. S. of Birmingham; needles, fishing tackle, pins, and motor-engineering. Pop. 15,400.

Redesdale, the valley of the Rede, a l. bk. trib. of N. Tyne, Northumberland, England (55° 18′ N., 2° 25′ W.), near S. end of which is the battlefield of Otterburn or Chevy Chase (1388). The men of Redesdale were formerly regarded as a bold and warlike Border race.

Red-eye. See CARPS.

Redfern, suburb of Sydney, New South Wales; boot factories, railway shops, ironworks, etc. Park of 12 ac. Pop. 25,000.

Redlands, tn., San Bernardino, California, U.S. (34° 5′ N., 117° 20′ W.), 60 m. E. of Los Angeles; centre of orange-growing dist.; citrus fruits, olive oil, barley, and wheat; beautiful mountain scenery. Pop. 10,400.

Red Lead, minium, lead tetroxide (Pb_3O_4), prepared by treating either lead or litharge in air, at a temperature between 350° C. and 500° C.; it is used in the manufacture of flint glass, for pottery glazes, in plumbing, and as a pigment.

Redmayne, Sir Richard Augustine Studdert (1865–), Eng. mining engineer; was appointed chief inspector of mines (1908), a position from which he resigned (1919), to devote himself to the work of the Imperial Mineral Resources Bureau, of which he was appointed chairman (1918); gave evidence before the Sankey Commission, and is a member of the Departmental Committee on the Organization of the Coal-mining Industry of Great Britain (1915), the Coal Conservation Committee (1917–18), the Fuel Research Board, and the Committee on Fuel-oil from Home Sources (1918); author of *Coal: its Occurrence, Value, and Method of Boring; The Sinking of Shafts; The Ventilation of Mines.*

Redmond, John Edward (1851–1918), Irish politician; was called to the Eng. bar (1886); entered Parliament as member for New Ross (1881), then represented N. Wexford (1885–91), and, from 1892, Waterford city; on the death of Parnell (1891) was chosen as leader of his followers, and in 1900 became leader of the reunited Irish Nationalist party; in 1909 a small section of his party, disagreeing with his views on the Budget of that year, separated from the main body, and called themselves the Independent Nationalist party; mainly owing to his efforts the Home Rule Bill of 1914 was successfully carried; during the Great War he did much to stimulate recruiting in Ireland, and it was due to him in the beginning that Ireland was excluded from the operation of the Military Service Acts; when the Asquith Coalition government was formed in 1915, he was offered a place in the cabinet, but refused to accept it; with the Sinn Fein movement he was out of sympathy, and probably underestimated its strength, and had nothing but condemnation for the Irish rebellion of 1916; gave hearty approval to the calling of the Convention of July 1917, and tried to secure the agreement of all sections in Ireland.

Redmond, William Hoey Kearney (1861–1917), Irish politician; brother of J. E. Redmond; was M.P. for Wexford (1883–5), N. Fermanagh (1885–92), and for E. Clare from 1892 till his death; was twice imprisoned under the Crimes Act (1888 and 1902); served in the Great War, in the Royal Irish Regiment, being promoted major and mentioned in dispatches; died of wounds received in action near Frezenberg; author of *A Shooting Trip in the Australian Bush* (1898), and *Through the New Commonwealth.*

Redpolls. See Finch Family.

Redruth, mrkt. tn., Cornwall, England (50° 13′ N., 5° 13′ W.),

9 m. w.s.w. of Truro; tin sales are held; safety fuses; boot and bacon factories and railway works. Neolithic settlement on Carn Brea. Pop. 10,800.

Red Sea, or ARABIAN GULF, inland sea (*Mare Rubrum*) between 12° and 30° N. and 32° and 44° E., separating N.E. Africa from Hejaz (Arabia). Gulfs of Akaba and Suez in N. enclose peninsula of Sinai; in S. Strait of Bab-el-Mandeb connects with Indian Ocean; greatest depth sounded 1,240 fathoms (20° 5′ N., 38° 30′ E.), average depth 100–400 fathoms; islands and coral reefs are numerous; heavy gales, variable winds, and intense heat make navigation difficult. Seaports (Arabian coast): Mocha, Hodeida, Loheia, Jiddah, and Yanbo; (African coast): Suez, Kosseir, Suakin, and Massowah. Length, 1,460 m.; maximum breadth, *c.* 250 m. Area (est.), 180,000 sq. m.

Redshank (*Totanus calidris*), a member of the plover family, distinguished by bright red legs, yellow black-tipped bill, and noisy cry. It breeds in tussocky places inland, but in winter frequents the sea-coast. The spotted redshank (*T. fuscus*) is a spring and autumn visitor to Britain.

Red Spider. See under MITES.

Redstart. See THRUSH FAMILY.

Reductio ad Absurdum, indirect method of disproof by showing that the proposition to be disproved necessarily involves consequences which are impossible or absurd, in which case the proposition itself must be erroneous.

Red Water Fever. See under MITES.

Redwing. See THRUSH FAMILY.

Reedbuck, or REITBOK (*Cervicapra arundinaceum*), rare antelope found in the N. portion of Cape Colony; colour, reddish ash-grey; tail, short and bushy; horns, 1 foot long and ringed; height, 3 ft.

Reef, or SHOAL, has been defined by an International Geographical Congress Committee as a submarine elevation which reaches to within eleven fathoms of the surface, and so is dangerous to shipping. (See CORAL.) Reef is also used, chiefly in Australia, to denote a lode or vein—*e.g.*, an auriferous quartz reef.

Reeves, JOHN SIMS (1818–1900), Eng. tenor vocalist; maintained an almost unrivalled reputation both in opera and as a ballad-singer; excelled in oratorio; last appearance 1891.

Referendum, political system by which measures approved by the legislature are submitted to the electorate before they can become law. In theory it represents the most advanced stage of democracy, but in practice it is open to several objections in a constitution such as that of the U.K., which depends upon cabinet responsibility. In the second general election of 1910 it was made part of the policy of reform of the Conservative party, but has since been dropped. In Switzerland, on the demand of 50,000 voters, or of eight cantons, any law passed by the Federal Parliament must be submitted to the general body of the people for acceptance or rejection. Similarly, laws passed by the Parliaments of the separate cantons may be, and in many cantons must be, referred to the cantonal voters. The system, in one form

or another, has been employed in Switzerland for several centuries, but the modern institution dates from about the middle of the 19th cent. The Referendum is embodied in the constitution of the Australian Commonwealth, and alterations in the federal constitution must be submitted to the electors. During the Great War the question of conscription for service abroad was so submitted and rejected. *Local option* implies a local referendum, as in the case of the Temperance (Scotland) Act, 1913. See RECALL.

Reflection. See LIGHT.

Reformation, the eccles. revolution in the 16th cent. by which a considerable number of European states severed themselves from the R.C. Church and adopted some form of Prot. belief and organization. Germany was the scene of the first decisive action; it commenced with Luther's attack on the sale of indulgences, and developed in such a way that in two years the attention of W. Europe was concentrated upon the quarrel between him and the papacy. Luther was excommunicated, and in 1521 the Diet of Worms placed him under imperial ban; then came the Diet of Spires, and the protest which gave the reformers a new and lasting name, the Confession of Augsburg (1530), in which their creed was set forth, the Peace of Augsburg (1555), and the Thirty Years' War, in which Protestants had again to struggle for existence.

Meanwhile, in Switzerland, an independent movement, nearly contemporary with that of Luther, was headed by Zwingli, which issued in the Treaty of Kappel, each canton being allowed to determine its own religion. But this movement was overshadowed in importance by the rise of John Calvin. Zwingli's work was carried on in Zurich, Calvin's in Geneva. The new religion had been received in the town some years before Calvin took up residence there; in the efforts to throw off the yoke of the Catholic Dukes of Savoy, the town was compelled to join with Protestantism, and Calvin threw himself into this work with characteristic zeal, and became the guide and eventually the dictator of the Prot. Church there.

Thus by the middle of the 16th cent. Protestantism had produced two Church organizations—one, Lutheranism, commending itself to those states which adopted the Reformation under the guidance of kings and under the influence of political motives; the other, Calvinism, supplying its creed and organization to those Prot. Churches which had to struggle for their existence against persecution and repression.

These influences spread to the whole of Christendom. Denmark and Sweden declared for Protestantism. In France the Reformation did not assume a national character. The movement was of native growth. The new faith had many adherents, but the Reformation failed, and by the revocation of the Edict of Nantes, in 1685, Protestantism in that country was extinguished.

In England the separation from Rome became an accomplished fact in 1532, its origin and course being to a large extent

determined by the monarchy and political considerations. Henry VIII. carried through Parliament a series of measures which severed the Eng. Church from Rome and established the ecclesiastical supremacy of the crown; doctrinal Protestantism, however, was checked by him. Under Edward VI. progress was made; a reaction followed under Mary; Elizabeth repudiated the papal authority, and in 1571 the creed of the Church was determined by promulgation of the Thirty-nine Articles. In Scotland the Reformation gave rise to prolonged strife, but eventually triumphed; the efforts of the Church to extinguish the new worship were in vain. Knox returned from exile, and in 1560 Protestantism was recognized as the religion of the country. Ireland was regarded by Henry VIII. as a dependent province; he was declared supreme head of the Irish Church, and various changes were effected; Roman Catholicism was restored by Mary; with Elizabeth, Protestantism was established, but the mass of the people adhered to the old faith.

Thus Protestantism prevailed for the most part among the Teutonic peoples of N. Europe, and its influence was felt even in those countries where it was never formally adopted.

Creighton, *The History of the Papacy during the Reformation;* Lindsay, *Luther and the German Reformation;* Hume Brown, *Life of Knox;* Mackinnon, *History of Modern Liberty*, vol. ii.

Reformatory and Industrial Schools. Reformatory schools are institutions certified by the Home Office as fit for the reception of youthful offenders over twelve and under sixteen years of age, detained there under the order of a court of justice, on conviction of an offence punishable in the case of an adult with penal servitude or imprisonment; detention in the school must not be preceded by imprisonment for the offence. The period of detention is from three to five years, but not beyond the age of nineteen. Industrial schools are similar institutions for children under fourteen, committed to the school by an order of magistrates on account of their being (*inter alia*) mendicants, truants from elementary schools, or children whose parents are in prison, or who are the associates of thieves or disorderly persons. Both classes of schools are subject to government inspection. They may be established and maintained by individuals or by the councils of counties and of the larger boroughs. See also BORSTAL SYSTEM; CHILDREN.

Refraction. See LIGHT.

Refractories, materials employed for lining the furnaces used in the manufacture of steel, glass, etc. They must be able to resist the corrosive action of other substances present, and withstand the high temperatures reacted in the furnaces without fusion, softening, distortion, cracking, etc. Among the materials used are certain fire clays, magnesite, carborundum, fused silica, zirconia, and artificially made graphite.

Refrigeration, the cooling of a substance by the transference of some of its heat to another and

cooler substance. Refrigerating machines may be divided into two main classes, liquid machines and compressed air machines. One machine of the former class depends upon the fact that the boiling-point of water varies according to the pressure. Water is placed in an air-tight vessel connected with a vacuum pump, and the pressure is lowered until the water boils. The heat required for evaporation is abstracted from the water, and as the pressure is reduced further and further, the temp. gradually falls to the freezing-point, and ice is formed. In other machines, liquids more volatile than water, such as ammonia, carbonic acid, or ether, are employed as the refrigerating agent. The principle of these machines is much the same as that of the water machine, except that the refrigerating agent is recovered by compressing the vapour. Still another type of liquid machine makes use of the fact that certain vapours are capable of being absorbed in water, and separated again by heat.

Compressed-air machines consist essentially of three chambers —for compression, cooling, and expansion respectively. Air is drawn into the first chamber and compressed. It is then cooled by passing through the cooling chamber, and finally it enters the expansion chamber. Here it is allowed to expand to atmospheric pressure, and during this expansion it is made to perform mechanical work by pressing upon a piston. The air thus loses heat equivalent to the energy expended upon the piston.

Refrigerating machines are used for the production of ice for domestic purposes, and on a commercial scale in special ice factories, and for cooling the air in rooms for the cold storage of meat. They are used also in dairies and breweries, for cooling the magazines on warships, and to some extent for cooling the air blast for blast furnaces. On vessels for the transport of meat ammonia or carbonic acid machines are chiefly used, though some ships still use the compressed-air machine. The water vacuum machine is employed principally in making ice for domestic use.

Refuse Destructors, furnaces for destroying by burning miscellaneous refuse of towns. During recent years great attention has been given to the problem of utilizing this rubbish as a low-class fuel for the production of steam. The value of town refuse varies greatly, being highest in the coal-mining districts. The amount of refuse also varies, the average in Britain being roughly from 5 cwt. to 10 cwt. per head per annum.

The first destructor was erected in Manchester by Mr. Fryer of Nottingham, about 1876, and it was quickly followed by others in Leeds, Birmingham, and Bradford. Fryer's destructor forms the basis of many of the modern garbage-furnaces, while others are on quite different lines, but in all the main features are a furnace designed to consume the refuse with the least possible remainder, arrangements to prevent escape of noxious gases, and appliances for utilizing heat generated for the production of power for pumping, electric lighting and

traction, etc., thus reducing the cost of refuse disposal.

Besides furnaces and boilers, a modern destructor station contains elaborate plant for speedy handling and transport of refuse material. This includes railways or tramways for the removal, and appliances for the utilization of the clinker, centrifugal dust-catchers, solder extraction furnaces, etc. In some places clinker has been utilized for housing material. Destructors are worked in conjunction with the other sanitary arrangements of the town, under munic. control.

Regensburg, or RATISBON, city, Bavaria (49° 1′ N., 12° 6′ E.), on r. bk. of Danube, 86 m. N.N.E. of Munich; exceptionally rich in mediæval remains and works of art; Gothic cathedral (1275); tobacco, machinery, pottery, boats, pencils, and soap. Six miles below town is the Valhalla, or hall of fame for distinguished Germans. History extends from Roman times; annexed to Bavaria in 1810. Pop. 52,600.

Reggio di Calabria, tn., cap. Reggio di Calabria, Italy (38° 8′ N., 15° 39′ E.), on Strait of Messina, 8 m. S.S.E. of Messina; seat of archbishop; fine cathedral; perfumes, silks, and terra-cotta; exports olive oil, dried fruits, and essences. Roman *municipium* in 88 B.C., and headquarters of Roman fleet and army in time of Octavius. Enormous damage by earthquakes in 1783, 1894, and Dec. 1908, when death-roll exceeded 20,000. Pop. 42,800.

Reggio nell' Emilia, city, cap. of prov. of same name, Italy (44° 42′ N., 10° 38′ E.), 35 m. N.W. of Bologna; seat of bishop; numerous churches and cathedral; textiles, brooms, leather, matches, and cheese; silkworms are reared. Ariosto and Secchi were natives. Pop. 70,500.

Regina, city, cap. Saskatchewan, Canada (50° 25′ N., 104° 38′ W.), 357 m. W. of Winnipeg; provincial legislative buildings, mounted police barracks, city hall, and various educational establishments. Headquarters of Royal North-west Mounted Police; wholesale distributing centre; foundries and machine shops, oil works, timber mills, etc. Has adopted municipal ownership of public utilities. In 1912 cyclone caused 200 deaths and did great damage. Pop. 40.000.

Regnault, HENRI VICTOR (1810–78), Fr. chemist and physicist; worked on organic chem., thermometry, expansion of gases, specific heats, hygrometry, steam engines, etc.

Rehan, ADA (1860–1916), actress; *b.* at Limerick, Ireland; made her début at Newark, New Jersey, U.S. (1874), and her first appearance on the New York stage in 1875; in her time recognized as one of the foremost actresses in America; her best parts were in high comedy, and among the rôles by which she won fame were Katharina in *The Taming of the Shrew*, Rosalind in *As You Like It*, and Lady Teazle in *The School for Scandal*; visited England on several occasions between 1884 and 1895; retired from the stage in 1906.

Reichenbach. (1) Tn., Saxony, Germany (50° 38′ N., 12° 17′ E.), 11 m. S.W. of Zwickau; wool spinning, carding, and dyeing; school of weaving. Pop. 29,600.

(2) Tn., Silesia, Prussia (51° 8′ N., 14° 45′ E.), 30 m. S.S.W. of Breslau; cotton goods, carriages, and sausages. Scene of Austrian defeat (1762). Pop. 16,300.

Reichenberg, tn., Bohemia, Czecho-Slovakia (50° 47′ N., 15° 3′ E.), 87 m. N.N.E. of Prague; woollens, carpets, machinery, and leather. Industrial Museum for N. Bavaria. Pop. 36,300.

Reichstag. See under GERMAN EMPIRE.

Reid, SIR GEORGE (1841–1918), Scot. portrait painter; R.S.A. (1878); P.R.S.A. (1891–1902); knighted (1891); his portrait of George Macdonald (Aberdeen Univ.) is notable; other examples are in Manchester and Glasgow.

Reid, THOMAS (1710–96), Scot. philosopher; prof. of moral philosophy, Glasgow (1763–80); founder of Scot. 'common-sense' school. Against Berkeley and Hume, Reid affirmed doctrine of sense perception and denied that objects are perceived through ideas. Pub. *Essays on the Intellectual and Active Powers of Man.*

Reid, THOMAS MAYNE (1818–83), Irish writer of adventure stories; emigrated to U.S., and fought in Mexican War (1847); settled in London (1849); works: *The Rifle Rangers, The Scalp Hunters, The Headless Horseman, The War Trail,* etc.

Reid, WHITELAW (1837–1913), Amer. diplomatist; ed. *New York Tribune* (1872); was U.S. minister to France (1889–92), to Britain (1905–13); ambassador to Queen Victoria's Jubilee (1897); his works include *After the War* (1866), and *A Continental Union* (1900).

Reigate, munic. bor., Surrey, England (51° 14′ N., 0° 12′ W.), 23 m. S. of London; partly Norman Church of St. Mary, with tomb of Lord Howard of Effingham; Redhill, a modern town, on E., is continuous and included in borough. Pop. 28,500.

Reign of Terror. See FRENCH REVOLUTION.

Reims, or RHEIMS, tn., Marne, France (49° 15′ N., 4° 2′ E.), on riv. Vesle and Aisne and Marne Canal, 85 m. E.N.E. of Paris. History goes back to legendary times; was prosperous town when Cæsar invaded Gaul, and under empire was one of great centres of Lat. culture in Gallia Belgica. Clovis, the Frank, baptized here (496); in 12th cent. Pope formally acknowledged right of Archbishop of Reims to consecrate and crown kings of France; all but Louis IV. and Henry IV. were consecrated in the cathedral. Associated with Joan of Arc, who on July 17, 1429, handed over the keys of the city to the king and stood near the altar at the coronation ceremony. City described by La Fontaine:

'No town is dearer to me than Reims,
The honour and glory of our France.'

Cathedral of Notre Dame (begun 1212) was one of finest Gothic edifices in Europe. Six hundred statues adorned triple portal of W. front, and over it were gorgeous rose-windows with exquisite amber-coloured 13th cent. glass. Interior vast, but in perfect symmetry; magnificent tapestry by Gobelin (a native); clock with moving figures; flask of reputed holy oil with which Clovis was baptized. Other notable structures: archbishop's

palace, Romanesque church of St. Remi (11th and 12th centuries), and Porta Martis (one of Roman gates). Prior to Great War had important woollen manufactures; was headquarters of champagne industry; glass, cork, chemicals, machinery, paper, etc. Important ry. jn. In 1870 the city was entered by Prussian troops (Sept. 4), and held to ransom; evacuated Nov. 20, 1872. Forty-four years later Ger. advance troops again entered city, made large requisitions of material and of a million francs; organized pillage. Evacuated during Allied advance from Marne and entered by French (Sept. 13, 1914). Thereafter for nearly four years under Ger. fire. For history of battles in neighbourhood see WAR, THE GREAT. Ger. bombardment lasted from Sept. 4, 1914, to Oct. 5, 1918: bombs were frequently dropped; vicinity of cathedral was believed to be specially aimed at, and its ruin aroused the indignation of Christendom. In 1915 and 1916 it was struck a hundred times, but suffered most during April 15, 19, and 24, 1917, when twelve shells per hour were directed at it. Great havoc was caused on S.W. side; protective measures prevented its irreparable destruction; paintings, tapestries, carvings, and sculptures were removed to place of safety. Archbishop's palace and most of its rich collections were burnt in fire of Sept. 19, 1914; only great chimney-piece of palace proper remains. Most of the other important buildings suffered severely. Children attended underground schools and wore gas masks. A daily paper was pub. throughout the siege, though the printing house was wrecked by shell fire. The Pommery Cellars (11 m. of streets, squares, and boulevards lighted by electricity) gave shelter to many citizens and school classes during the war. Pop. (before the war) 115,200.

Reinach, JOSEPH (1856–), Fr. publicist and politician; chief editor of *République Française* from 1886, he vigorously opposed Boulanger. Elected deputy in 1889 and in 1893; was an energetic defender of Dreyfus. He served on the staff during the Great War. Publications include *Gambetta Orateur* (1884), *Le Ministère Clemenceau* (1885), *Les Petites Catilinaires* (3 vols. 1889), and *Histoire de l'Affaire Dreyfus* (1901–8).

Reinach, SALOMON (1858–), Fr. archæologist; member of the Institute of France; carried out researches in Asia Minor, Greece, and Tunis; publications include *Manuel de Philologie Classique*, *Apollo*, and (with Dr. James Gow) *Minerva*.

Reindeer. See DEER FAMILY.

Reindeer Moss. See LICHENS.

Reinforced Concrete. See CONCRETE.

Reinhardt, MAX (1874–), Ger. theatrical manager, famous for realistic and beautiful stage productions; manager of Deutsches Theater, Berlin, where he produced second part of Goethe's *Faust* (performance lasted seven hours); went to London in 1911 and produced *Sumurûn* at Coliseum (Jan. 1912), *The Miracle* and *Œdipus Rex* in autumn. Retired from stage (Aug. 1920).

Reitbok. See REEDBUCK.

Réjane, 'GABRIELLE RÉJU,' MADAME (1857–1920), Fr. actress; *b.* at Paris; made her début at the Vaudeville (1875); among her productions have been *Ma Camarade, Clara Soleil, Germinie Lacerteux, La Passerelle,* and her best, *Madame Sans-Gêne;* made her first appearance in London, at the Gaiety (1894), as Catherine in *Madame Sans-Gêne;* visited America (1895), and subsequently made many other notable foreign tours; founded the Théâtre Réjane (1905). She made her final appearance in a screen version of Jean Richepin's *Miarka, the Bear Girl.*

Relapsing Fever, an infectious fever, characterized by sudden onset and very high temperatures, declining and returning to normal in from five to seven days, and followed in another week by a recurrent attack. The disease is due to a specific spirillum, the *Spirochæte Obermeieri,* probably conveyed to man by fleas, and usually occurs in times of famine —overcrowding, lack of nutrition, dirty, unhealthy surroundings being predisposing causes. The incubation period varies considerably, the onset is abrupt, with headache and shiverings, and the temperature may go as high as 109°; the skin is dry, there is thirst, pain in the limbs, enlargement of the spleen and liver, and often constipation or diarrhœa. A slight eruption may be present, but it is unusual. The fall of temperature is accompanied by profuse perspiration, and the patient feels quite well in a day or two, a relapse, with renewed rise of temperature, taking place in a week, after which recovery is prolonged, with or without other relapses. The treatment is rest, careful dieting, the administration of quinine in the early stages, while the high fever is relieved by cold packs or sponging. A serum has been prepared which is said to prevent relapse when injected during the period following the first attack.

Relativity. The theory of relativity, as developed by Einstein, is historically the outcome of two great discoveries of the 19th cent. One of these is Clerk Maxwell's theory of the electro-magnetic field (1864), including the identification of light with electro-magnetic vibrations in the ether. The other is the experiment made by Michelson and Morley (1887) in the endeavour to measure the motion of the earth through the ether—that is, through space regarded as the vehicle of light.

In the interpretation of the universe the intelligent observer can find no certain region or point at rest to which he can refer the motions he is studying. The earth, which for practical purposes of life we may regard as fixed, is rotating round its axis, is revolving round the sun, and in company with sun and planets is moving relatively to other stellar systems. We think of all these systems as moving *in space,* but all we can ever hope to measure by the usual astronomical methods is the relative velocity of each system with regard to any other. Michelson and Morley, however, devised an experiment by which they hoped to measure the velocity of the earth through the ether. In accord-

ance with recognized dynamical principles a certain result was expected; but the experiment failed to give this expected result. The negative result obtained was as if the earth and the ether were at relative rest—a conclusion inconsistent with other optical phenomena.

To explain this failure and yet satisfy Newtonian principles, Fitzgerald suggested (1892) that matter moving through the ether contracted by a certain amount in the direction of its motion. Unit length in this direction would become $\sqrt{1-v^2/c^2}$, where v is the velocity of the body relative to the ether and c the velocity of light through the ether. For example, let v be of the order of magnitude of the earth's speed in its orbit (18 or 19 m. per second), then, since c is equal to 186,330 m. per second, the ratio v^2/c^2 is excessively small, about one divided by one hundred million. But obviously whether v be large or small, a contraction of this kind could never be measured in terms of a standard material scale, for the scale when laid along the moving body would have the same velocity and would experience the same contraction per unit length.

The generalization immediately deducible from Michelson and Morley's negative result, and from other experiments of similar import, is that it is impossible by any experiment to detect the uniform motion of matter relative to the ether. And this is the special or restricted principle of relativity. To each observer certain optical phenomena take place as if he were at rest in the ether; and he would naturally infer that every other observer moving relatively to him was also moving relatively to the ether. Yet each of these other observers (say, an observer in Mars), making the same experiments, would come to the conclusion that *he* was at rest in the ether, and all the others in motion. Thus each separate observer conceives of space and time for his own purposes. He uses local space and local time, which differ from those of another observer. Yet no observer can measure his own motion in space. The one quantity measurable by all observers and the same for all, whatever their motions may be, is the velocity of light as it passes from one material system to another. This velocity appears to be an absolute physical constant.

In ordinary affairs we separate space and time, regarding them as being essentially distinct and independent. But a closer inquiry shows that there is no real independence. We deal with events, and each event occurs at a locality in three-dimensional space and at a definite time. It is, therefore, a four-dimensional quantity. When a body passes from position P_1 at time t_1 to position P_2 at time t_2, the 'interval' depends on the two quantities P_2-P_1 and t_2-t_1, the former involving in general three independent space measurements. We may change the time difference into a space difference by multiplying by a velocity; and obviously the fundamental physical constant to be used is the velocity of light. Hence the interval between the two given

events is determined by the position change $P_2 - P_1$, and the time-space change $c(t_2 - t_1)$.

Now, following the analogy of measurement of distance in geometry, we may represent the square of the interval between the two events by the expression

$$s^2 = c^2(t_2 - t_1)^2 - |P_2 - P_1|^2$$

If this same interval of events is measured by a second observer moving relatively to the first, s and c will have the same values for both, but the P's and t's will differ. Each observer uses his own local space and local time; and a certain relation between the two sets of space and time co-ordinates in two systems in relative motion is mathematically deducible from the conditions laid down. This relation, first obtained by Lorentz (1902) by complicated mathematical transformations, constitutes the first general result of the relativity principle. Not only does it include the Fitzgerald contraction, but it welds into one unity the phenomena of Maxwell's electromagnetic field in moving systems.

The special principle of relativity deals only with cases in which the velocities are constant. But in the natural world velocities are not constant. There are accelerations due (as we say) to gravitation. Consequently gravitation is not included.

It is not possible in a short space to give any clear idea of the way in which Einstein developed the general theory (1915) of relativity so as to include gravity. By his principle of equivalence he substituted artificial fields of acceleration for what experience recognized as real fields of force. To take account of these the four-dimensional world of space and time was generalized so as to include other types than the simple type already used. This simple type was Euclidean and Newtonian in the sense that natural paths were straight lines. But just as a two-dimensional being existing in what seemed to him to be a plane surface might nevertheless have as his space of existence a curved surface differing very slightly from the plane, so the four-dimensional space-time world might be such that the natural paths were not straight lines, although they satisfied the more general condition that they were minimum or maximum paths in that type of space-time world. At intervals far removed from gravitating matter this 'curved' four-dimensional world (as it might appear to a super-intelligence living in a five-dimensional world) must approximate to the comparatively simple Euclidean 'flat' world. Led by such considerations, Einstein obtained a generalized law of gravitation differing so slightly from Newton's that only very delicate experiments or observations could distinguish the one from the other. One fact of observation was already to hand in the annual rate of revolution of the perihelion of the orbit of Mercury round the sun, which was greater than could be accounted for on Newtonian principles—Einstein's theory gave exactly the amount of this rate of revolution.

Einstein's theory also required that a ray of light passing near a large gravitating body like the sun would be bent towards it, the velocity of light being slightly diminished in a strong gravitational field. The prediction was tested at the total eclipse of the sun on May 29, 1919. Two parties of Brit. astronomers proceeded to chosen stations in S. America and photographed the stars in the neighbourhood of the sun during the time of eclipse. After a few months the same group of stars was photographed without the presence of the intervening sun. Comparison of the photographic plates established the fact that a ray of light from a distant star passing near the sun's surface was deflected by an amount varying from 1″·61 to 1″·98. Einstein's predicted value was 1″·74.

Another prediction in reference to the effect of the sun's gravitation upon vibrations of molecules at the surface of the sun has not as yet been verified.

The full significance of Einstein's mathematical investigation cannot be expressed in physical language. All that can be said is that, wherever matter is, the medium which transmits energy through space is influenced in a way which can be expressed (by analogy) as a 'curvature' in a four-dimensional section of a five-dimensional world. So far as can be tested, the theory is in harmony with the great dynamical principles of conservation of momentum and conservation of energy. The criticism may be made that it takes no cognizance of the dynamics of rotation, and that it involves extraordinary paradoxes whose enunciation sounds to our limited three-dimensional intelligences as utter nonsense.

Albert Einstein, *Relativity*, a popular exposition (1920); A. S. Eddington, *Space, Time, and Gravitation*, an outline of the general relativity theory (Cambridge Univ. Press, 1920); E. Freundlich, *The Foundations of Einstein's Theory of Gravitation* (1920); and books and papers by Cunningham, Silbertstein, de Sitter, Lorentz, etc.

Religion. A satisfactory definition of religion has not yet been arrived at. An excellent list of those which have been offered may be found in Max-Müller's Gifford Lecture (1891). Two things are chiefly required for a satisfactory definition: on the one hand, a statement which will differentiate religion from the allied forms of human thought, such as art or morality; on the other, a statement which is wide enough to include all the forms which religion has taken, both in the form of subjective emotion and in the form of historical reality. Since we do not yet know all the forms which it has taken, every definition must be still only tentative. When man realizes that he forms part of a world order, the resultant feeling seems to be that which is the basis of religion. This leaves room for the feeble thought of the savage, and also includes all the forms which emotion can take, whether it results in moral conduct or in naturalistic fetishism.

The classification of religions is also still incomplete. Every classification is liable to ignore some

RELIGIONS OF THE WORLD.

Religion.	Continental Distribution.						
	Europe.	Asia.	Africa.	N. America.	S. America.	Oceania.	Total.
Christians:—							
Catholic Churches:							
Roman Catholics .	183,760,000	5,500,000	2,500,000	36,700,000	36,200,000	8,200,000	272,860,000
Eastern Churches .	98,000,000	17,200,000	3,800,000	1,000,000	—	—	120,000,000
Protestant Churches	93,000,000	6,000,000	2,750,000	65,000,000	400,000	4,500,000	171,650,000
Total Christians .	374,760,000	28,700,000	9,050,000	102,700,000	36,600,000	12,700,000	564,510,000
Non-Christians:—							
Jews	9,250,000	500,000	400,000	2,000,000	30,000	25,000	12,205,000
Mohammedans . .	3,800,000	142,000,000	51,000,000	15,000	10,000	25,000,000	221,825,000
Buddhists . . .	—	138,000,000	11,000	—	—	20,000	138,031,000
Hindus	—	210,000,000	300,000	100,000	110,000	30,000	210,540,000
Confucianists and Taoists . . .	—	300,000,000	30,000	100,000	—	700,000	300,830,000
Shintoists . . .	—	25,000,000	—	—	—	—	25,000,000
Animists . . .	—	42,000,000	98,000,000	20,000	1,250,000	17,000,000	158,270,000
Unclassified . . .	1,000,000	6,000,000	130,000	8,000,000	—	150,000	15,280,000
Total Non-Christian	14,050,000	863,500,000	149,871,000	10,235,000	1,400,000	42,925,000	1,081,981,000
Total . . .	388,810,000	892,200,000	158,921,000	112,935,000	38,000,000	55,625,000	1,646,491,000

unstudied form, or to rest on a theory of the origin or end of religion which is implicit in the mind of the classifier. We give two classifications, framed from different points of view. Hegel divides religions into (1) those of nature, which correspond to the childhood of humanity; (2) those of spirituality, which correspond to its youth; and (3) the absolute religion—that of Christ—which corresponds to its manhood. He further divides the religions of nature into (*a*) immediate religion, which includes such forms as sorcery and fetishism; (*b*) pantheism, which is subdivided into (i.) the religion of measure, of that of Confucius among the Chinese; (ii.) the religion of fantasy, or Brahmanism; (iii.) the religion of being in itself, or Buddhism; (*c*) religion of freedom, which is exemplified in or branches into those of light (Zoroastrianism), of sorrow (Syrian), and of mystery (Egyptian). The religions of spirituality are held to be those of sublimity, or the Hebrew; of beauty, or the Greek; of the understanding, or the Roman. The weakness of such a classification is that it fails adequately to recognize how each religion is not merely a stage in a general development, but has its own independent development. As a consequence, each religion is capable of being viewed from several points of view; and Hegel's classification occasionally leaves the impression that the point of view which suits his theory has been unduly pressed.

Professor Tiele makes a broad distinction between (1) nature and (2) ethical religions, according as man is wholly merged in or distinguishes himself from the world order. Nature religions are distributed into (*a*) magical religions which are dominated by animism, but which are still polydæmonistic; (*b*) magical religions which are purified into a polytheism which recognizes superhuman beings of a combined beast and human form, divided into unorganized and organized forms; (*c*) anthropomorphic polytheism, where the superhuman beings are conceived as manlike in form and in some measure as sharing man's ethical nature. Ethical religions, again, are subdivided into (*a*) communities in which the bond of the nation is a law under a divine sanction, such as Jainism, Brahmanism, primitive Buddhism, Taoism, Confucianism, Mazdaism, Mosaism, and Judaism; (*b*) communities which are religious and universalistic—as, for example, Mohammedanism, Buddhism, and Christianity.

Along with Tiele's classification, those of Tylor, Réville, and D'Alviella are deserving of study, because they are closely related to the facts and phenomena of the individual religions which are classified.

What has formed the starting-point in religious development has been variously represented. The question has been further complicated by the fact that it has been sometimes represented as though belief in a primitive monotheistic revelation were of the substance of the faith. Fetishism (Tylor, Comte), a belief in ghosts (Herbert Spencer, Caspari, Le Bon), polytheism (Voltaire,

David Hume), pantheism (Ulrici, Caird), henotheism (Max-Müller, von Hartmann, Schelling), monotheism (Creuzer, Prof. Rawlinson), have all been regarded as the original basis from which the later development arose. There is a sufficient and evident reason for this uncertainty. Primitive man has left no clear record of his belief or practice in these matters, but at best ambiguous emblems, which fall to be interpreted by men who cannot rid themselves of their own preconceptions, and who are often governed in their interpretation by a prior idea of what religion must mean. All theories as to the origin and development of religion are purely hypotheses, based on insufficient and ambiguous data, and frequently implying a theory of human development which is latent in the theories. Yet such a theory, thus conditioned, may be helpful to thought and historical study. Religion can be taken in its simplest form as man's recognition of a world order or a system of things in which he himself was merged. He began by recognizing himself to be a part of this system, on an equal footing with all the other phenomena of his limited world. This was naturism, or a recognition and worship of natural phenomena. But man distinguished himself from the system of which he formed a part. He realized not merely his community of origin, but his difference of nature. What so distinguished him was his possession of a soul. Corresponding with this stage of development is animism. The borders between animism and naturism must always have been fluctuating, since man may have often been unable to deny the existence of a soul like his own in many of the objects among which he was involved, and may have hesitated to deny it to any of these. But gradually he became conscious of how the soul, though involved in the body and influenced by it, was capable of controlling it and was not determined by it. He began to think and judge of other things in the light of this conception of himself, and to construe many phenomena of the world as evidence of an underlying soul. Hence arose spiritism, according to which spirit is the controlling factor and end of the world order. See M'Dougall's *Body and Mind* (1911).

Closely allied to animism, and springing from it, is the primitive form of polytheism, which endowed certain natural phenomena on the analogy of men with spirits, and which, acknowledging the power of these to control the phenomena through which they manifested themselves, strove to propitiate them in the interests of men. It is necessary, however, to distinguish between this primitive polytheism and a refined polytheism such as appears in Brahmanism, which makes the many gods little more than impersonations of the attributes of the one God. Primitive polytheism has not felt the need of unifying these many gods. The dualistic or monotheistic view of the world rose from polytheism through speculative thought, or through ethical judgment. As the philo-

sophic mind strove after a final unity in thought, it made impossible to the religious feeling the worship of any save the one Source of all. And the ethical judgment made incredible the idea of anything save one law, the expression of one eternal Will. This, however, still left the possibility of polytheism in its more refined form, as may be seen both in Hindu Brahmanism and in Gr. Neo-Platonism. Polytheism has only been finally transcended in the great monotheistic religions of Judaism, Islam, and Christianity.

Tiele, *Outlines of the History of Religion*; Newman Smyth, *Religious Feeling*; Thompson, *Religious Sentiments of the Human Mind*; Flint, *Theism* and *Anti-theistic Theories*; Caird, *The Evolution of Religion*.

Remainder, that portion or residue of interest which is made over to some other person, on the creation of a particular estate. It is always the work of certain parties; whereas *Reversion*—that portion of an estate left over, after a grant of less than the whole has been made by the owner to another person—arises by operation of law.

Rembrandt (REMBRANDT HARMENS VAN RIJN) (1606–69), Dutch painter and etcher, born at Leyden; greatest of the Dutch school; a pupil of Peter Lastman; settled in Amsterdam; *St. Paul in Prison* and *The Money Changer* are among early works; married (1634) Saskia van Uylenborch, who appears in many of his pictures; after her death life sombre and distressed; bankrupt (1656); excelled in realistic portraiture and portrait groups, in depicting old age, and in effects of concentrated light; works suggest the mystery that underlies things seen; masterpieces: *The Night Watch* (Amsterdam), *The Anatomy Lesson* (the Hague), portrait of Rembrandt's daughter-in-law, *Magdalen van Loo* (sold in 1920 for £60,000), and in landscape *The Mill* (sold in 1911 for £100,000); religious works: *The Woman taken in Adultery* (National Gallery, London), *Good Samaritan* (Louvre), etc.; fine collection of his etchings in Brit. Museum.

Remington, PHILO (1816–89), Amer. inventor; *b.* at Lichfield, New York; inventor of the breech-loading rifle which bears his name, and constructor of the first typewriting machine.

Remiremont, town, Vosges, France (48° N., 6° 36′ E.); cotton spinning and weaving; manufactures hosiery, boots, iron and copper goods, brushes, and trades in cheese; formerly contained a Benedictine nunnery, of which the abbey church (11th cent.) still remains. Pop. 11,000.

Remscheid, tn., Rhine prov., Prussia (51° 12′ N., 7° 13′ E.); centre of cutlery trade; enormous export business in locks, saws, scythes, skates, tools, etc. Pop. 72,200.

Renaissance (Fr., 'rebirth'), the intellectual development by which modern Europe was evolved from the Middle Ages. Mediæval and Renaissance culture differed in the conscious Humanism of the latter. Humanism struck at the roots of mediæval thought; instead of setting before man an ideal for the realiza-

tion of which his individuality was to be sacrificed, it insisted on the further development of his actual character. The men of the Renaissance chose to be called Humanists from their salient characteristic.

'The first modern man was an Italian'; the Italians, with Lat. blood in their veins and living among the ruins of class. culture, readily revived the pagan spirit. PETRARCH (1304–74), although belonging to the Middle Ages, was one of first to feel the spell of antiquity; he treasured MSS. of Lat. classics and wrote to the Pope begging him to restore Rome to its place as the head of civilization. The Humanistic movement began when the study of Gr. classics was added to that of Latin, and, if any approximate date can be assigned for the dawn of the new day, it was about the time of the visit of Emanuel Chrysoloras to Italy, who came from Byzantium in 1396 to lecture in Florence on Gr. literature. Scholars like the famous Poggio also visited Byzantium, learned Greek, and spread the knowledge in Italy; but the study was attended with difficulty till the fall of Constantinople (1453), when Gr. scholars fled from Turk. rule to Italy.

Closely connected with this Revival of Learning is the movement which produced the REFORMATION. Study of the Gr. Scriptures and Gr. Fathers, known then as the *New Learning*, resulted in the break-up of the mediæval universal Church. The other movements concurrent with the Revival of Learning were chiefly the invention of printing, about 1450; the development of nationalities, which destroyed the mediæval conception of a world-empire; the use of gunpowder, which revolutionized the art of war and dealt a great blow at feudal organization of society; and the astronomical and geographical discoveries associated with COPERNICUS and the Port. and Genoese mariners who discovered America, rounded the Cape of Good Hope, and circumnavigated the globe.

The Ital. Renaissance produced great scholars and archæologists like Giovanni di Conversino, Coluccio de' Salutati, Gasparino da Barzizza, Lorenzo Valla, Bembo, Paulus Jovius, Poggio, Biondo, Pico della Mirandola, and the Aldi, patronized by Humanists like the Medici; but the immortal works of the Ital. Renaissance are seen in ARCHITECTURE, SCULPTURE, and PAINTING; famous names — Brunelleschi, Alberti, Michelangelo, Raphael, Donatello, etc. France and Germany were both influenced by the movement before England, where the Renaissance confined itself almost wholly to literature and scholarship; *cf.* famous Fr. Renaissance buildings, art, printing, etc., and great literary outburst of *Pléiade*. England had its small Oxford school of Humanists, of whom ERASMUS was Dutch and with MORE alone enjoyed European fame. Architecture, etc., was little influenced till 17th cent. Surrey, Wyatt, and others experimented with new verse forms, but true Renaissance outburst in England only came with age of Shakespeare.

J. A. Symonds, *Renaissance in*

Italy; Cambridge Modern History; Sidney Lee, *French Renaissance in England;* Hudson, *Story of the Renaissance* (1912).

Renaix, town, E. Flanders, Belgium (50° 45′ N., 3° 45′ E.); bleachfields, dyeworks, and manufactures of woollen and linen goods. Pop. 21,500.

Renan, ERNEST (1823–92), Fr. philosopher. A Breton fisherman's grandson, he was (owing to his brilliant gifts) trained for priesthood at Saint Sulpice Seminary. Leaving the Church because of religious doubts, Renan began to seek truth in science. His first work, *L'Avenir de la Science,* was written at this time, but not pub. till 1890. He studied philosophy, theology, history of religions, and anc. languages, but never became a great scholar; although he did much service to Biblical criticism, his style is his great merit; his opinions have roused much disputation; *Vie de Jésus* (1863) and *Origines du Christianisme* caused great sensation by rejection of divine elements from history of Christianity; best work, partly autobiographical, *Souvenirs d'Enfance et de Jeunesse* (1883), written in exquisitely simple style; last work, *Histoire du Peuple d'Israel* (1887–93).

Barry, *Renan* (1905, Literary Lives Series).

Rendsburg, tn., Holstein, Prussia (54° 18′ N., 9° 40′ E.), on the Eider and on the Kaiser Wilhelm Canal; breweries, tanneries, and dyeworks; textiles, pianos, and manures. Pop. 17,400.

Renfrew, co. tn., Renfrewshire, Scotland (55° 53′ N., 4° 24′ W.), on the Clyde; shipbuilding yards, largest boiler works in Britain, cabinet-making, dyeing, etc.; gigantic graving dock begun 1911. Pop. 12,600.

Renfrewshire, mar. co., S.W. Scotland (55° 50′ N., 4° 30′ W.), lying along the Clyde; surface irregular, highest point Hill of Stake (1,711 ft.); chief towns, Renfrew, Paisley, Greenock, Gourock, and Port-Glasgow; agriculture, dairy-farming, and stock-raising carried on; produces coal, iron, and shale; manufactures thread, cotton, and chemicals; has shipbuilding, engineering, sugar-refining, print and bleach works, etc. Baron of Renfrew is one of the titles of heir to the throne, granted by Robert III. to his son James (1404). Area, 240 sq. m.; pop. 314,600; density of pop. 1,310 per sq. m.

Reni, GUIDO. See GUIDO RENI.

Rennenkampf, GENERAL (*d.* 1918), Russian soldier of Ger. extraction; served with distinction in Manchurian and Russo-Jap. campaigns, and was, shortly prior to Great War, appointed to command of E. Prussian frontier forces in Vilna military dist.; took offensive against Germans against advice of immediate superior, and driving back forces opposed to him, occuped in succession Gumbinnen and Insterburg (Aug. 21, 1914), from which he pressed on towards Königsberg. These successes produced Ger. reinforcements, which in last week of Aug. defeated Samsonov at Tannenberg, a battle in which Rennenkampf, who could have annihilated Germans by moving down on their flank, took no part, owing to faulty information. Rennenkampf was

forced to retreat, and in this emergency is said to have lost self-control, and departed for frontier by motor, leaving his chief-of-staff in charge. He commanded army before Warsaw (Oct. 1914) during first Ger. attempt on that city, but his delay in sending reinforcements to Ruzsky during fighting around Lodz (Nov. 1914) robbed that general of a signal success, and brought about Rennenkampf's supersession. He was placed upon retired list (1915), was arrested (March 1917), and put to death by Bolsheviks about a year later. His Ger. descent led to general mistrust after his change of fortunes.

Rennes, tn., Ille-et-Vilaine, France (48° 6′ N., 1° 40′ W.), at the conjunction of the rivers Ille and Vilaine; anc. cap. of Brittany, and an archiepisc. see; principal building is the Palais de Justice (1618), the parliament house of the states of Brittany; the Palais Universitaire includes the univ. and an exceptionally fine picture gallery; dairy produce; manufactures sailcloth, table linen, leather, and agricultural implements. Pop. 79,400.

Reno, tn., Nevada, U.S. (39° 32′ N., 119° 55′ W.); reduction works; manufactures machinery and flour. Pop. 10,900.

Renown, Brit. battle-cruiser, launched at Govan (1916); 26,500 tons displacement; length, 750 ft.; 112,000 horse-power; speed, 32 knots. The Prince of Wales made his tours to Canada (1919) and Australia (1920) on board this vessel.

Rensselaer, tn., New York state, U.S. (42° 40′ N., 73° 45′ W.); manufacturing and railway centre; chief manufactures, felt, wool shoddy, shirts. Pop. 10,700.

Rent, in ordinary usage, is applied to a payment closely related to the use of land; it may be for the right to cultivate a given area, to occupy buildings erected on it, or to work the minerals found under it. Political economy has accepted this popular meaning, and has endeavoured to give it greater precision. Ricardo elaborated a doctrine of rent based on the definition that it was the price paid for the use of the ' original and indestructible powers of the soil.' This is often referred to as economic rent. In practice it is impossible to distinguish between the original powers and those arising from the investment of capital in improvements. Other factors also enter into consideration, such as proximity to a market and the possibility of alternative uses. Rent may be said, therefore, to be a periodical payment made by the tenant or present user of immovable property to the landlord or owner of it. How such a relation arose is a matter of history; how it is regulated, a matter of law. Generally speaking, rents were paid in the early Middle Ages by means of services and payments in kind. When the money economy came into being, the service, etc., was commuted. Thus arose the customary rents, which were converted into competitive rents when agriculture was pursued for profit. Competitive rents may become unduly high when the prospects of agriculture seem bright, as, for instance, during the

Napoleonic wars, or when there is no alternative means of employment, as, for instance, in Ireland. There is consequently a serious social question when rents have to be adjusted. In Ireland the tenant was given the rights of fixity of tenure, free sale, and 'fair' rent by the Land Act of 1881—that is, a system of dual ownership was virtually established. The rents were assessed by the Land Court, and as long as they were paid the tenant could not be disturbed. State intervention with the course of free competition was introduced on a large scale during the Great War. Rents were restricted by special legislation (see RENT RESTRICTION ACT), and even after the war increases in rent were regulated. This is an indication of the fact that the income derived from land and buildings on it is regarded as different from other kinds of income. On this difference—often imperfectly apprehended—many claims have been based. Land obviously differs from the other agents of production in that the supply cannot respond to an increased demand. Exclusive ownership is therefore sometimes represented as an anti-social monopoly.

Renton, tn., Dumbartonshire, Scotland (55° 58′ N., 4° 35′ W.), on the Leven; calico-printing, bleaching, dyeing; Tobias Smollett, novelist (1721–71), born close by. Pop. 5,000.

Rent Restriction Act, a war emergency measure, passed in Dec. 1915, restricted increase of rent of dwelling-houses rented at not more than £30. Under the Act no ejectment of tenant was allowed, so long as the rent was paid, except in the case of misconduct or of the landlord requiring the house for himself or for an employee. This Act was extended and amended by the Act of April 1919, the tenant, subject to certain qualifications, being secured in possession till May 1921. The further proviso was added that future rents should not be increased by more than 10 per cent., or mortgage interest by more than ½ per cent. This Act applied to houses of rent not exceeding £70 in London, £60 in Scotland, and £52 in the country. Under the complicated Act of July 1920, for houses rented as above, an immediate increase of 30 per cent. on the standard rent (rent as on Aug. 3, 1914), and a further increase of 10 per cent. at the end of twelve months, is permitted. Mortgage interest may also be immediately increased by ½ per cent.—unless this has been already done under the 1919 Act—with a further increase of ½ per cent. at the end of twelve months, the maximum rate of interest being 6½ per cent. Under the Act the security of the tenant is, subject to certain qualifications, extended to June 24, 1923.

Repertory Theatre, THE, a type of theatre, common in continental cities, where plays of all kinds are produced, not primarily for profit, as in the case of the ordinary theatre, but for cultural purposes and the encouragement of new dramatic writers. In 1908 Miss A. E. F. Horniman, with the purchase of the Gaiety Theatre, Manchester, started the Repertory Theatre movement in

England. Among the many plays produced at this theatre may be mentioned *The Knight of the Burning Pestle*, *Widowers' Houses*, *The Return of the Prodigal*, *The Silver Box*, *Strife*, *Every Man in His Humour*, *Hindle Wakes*, *The Mob*, and *The New Shylock*. Similar theatres have been established at Liverpool and Birmingham. See *The Repertory Theatre*, by P. P. Howe (1911), also ABBEY THEATRE.

Repington, CHARLES A'COURT (1858–), Brit. soldier and military critic; entered the Rifle Brigade (1878), and saw active service in Afghanistan, Burma, Sudan, and S. Africa; lieut.-colonel (1898); military attaché at Brussels and the Hague (1899–1902); as military correspondent of the *Times* wrote series of brilliant articles on Russo-Japanese War; during Great War dispatched telegram from France after battle of Festubert (May 1915), stating that 'the lack of a sufficient supply of heavy ammunition was a fatal bar to our success'; resigned owing to disagreement with his paper's policy (Jan. 1918); he became correspondent of the *Morning Post*, and pub. an article (Feb. 11) for which he was fined under D.O.R.A.: it revealed decisions of the Supreme War Council; in his *Diary* (2 vols. 1920) he stated that the information had been given to him by Clemenceau.

Reporting. See JOURNALISM.

Representation. See ELECTIONS, PARLIAMENTARY; PROPORTIONAL REPRESENTATION.

Reprisals. In international proceedings, the idea of reprisals is that they should be a means of redress short of war; and they are only to be used when compensation cannot be obtained by amicable methods. They do not of necessity connote a state of war, though they often lead to it. They may take the form of sequestration of property belonging to the offending state; sequestration of the property of its citizens; partial or complete suspension of commercial and other intercourse between the two nations; suspension or annulment of treaties in part or in whole; withdrawal of all privileges and rights to domiciled citizens of the offending state; a pacific blockade—*e.g.*, as applied by the Allies during the Great War to Greece, when that country was a neutral. The reasons for such measures may be a refusal to pay debts formally acknowledged; a suspension, without reason, of a treaty obligation; a refusal of reparation for injury, or a denial of evident justice; a refusal to pay a just indemnity for losses caused by the fault of the offending state when its responsibility is plain; a seizure of persons or property of the wronged state, or cruel and unjust treatment of citizens domiciled in a foreign state. In war, reprisals may be adopted by a belligerent for the purpose of requiting infractions of the laws of war on the other side. The Brit. official text-book of military law says: 'They are by custom admissible as an indispensable means of securing legitimate warfare. The mere fact that they may be expected if violation of the laws of war are committed, acts to a great

extent as a deterrent. They are not a means of punishment or of arbitrary vengeance, but of coercion. Acts done by way of reprisals must not be excessive, and must not exceed the degree of violation committed by the enemy.' Early in the Great War the ruthless actions of the Germans brought the question of reprisals into prominence. The Brit. Government declined to take reprisals, arguing that retribution would follow at the close of the war. However, the Brit. military authorities, after the Germans had resort to poison gas in the second battle of Ypres (April 1915), retaliated in kind at the battle of Loos (Sept. 1915), and subsequently gas became a regular weapon on both sides. When, in Jan. 1917, the Ger. Government announced that its submarines would sink hospital ships, Mr. Lloyd George's government threatened reprisals, but at first no action of that nature was taken. Later, Freiburg, a Ger. munition centre, was bombed by Brit. aeroplanes, and leaflets were dropped explaining that the attack was in reprisal for the sinking of hospital ships. The Fr. Government took the more drastic step of placing Ger. officers on board Fr. hospital ships, and this induced the Ger. Government to refrain from such acts (Sept. 1917). The bombing of peaceful towns by aircraft was another form of terrorism practised by the Germans from early in the war. The French retaliated by bombing Ger. towns, but the Brit. Government declined to adopt similar action until near the close of the war, when systematic raids were carried out against Rhine towns. In one instance the Brit. Government was moved to threaten instant retaliation. When Captain Blaikie of the steamer *Caledonia* was captured by the Germans (Dec. 4, 1916), it was announced in the Ger. press that he would be shot as Captain Fryatt had been. In that case, the Brit. Government intimated, a Ger. prisoner of equal or superior rank in this country would be shot. Captain Blaikie's life was saved. The general attitude of Britain to military reprisals was that it would be morally debasing to follow the Ger. example, and that retribution should be exacted among the terms of peace. So far (Nov. 1920) the punishment of the Ger. criminals remains unaccomplished. The military reprisals in Ireland during 1920 provoked much parliamentary discussion.

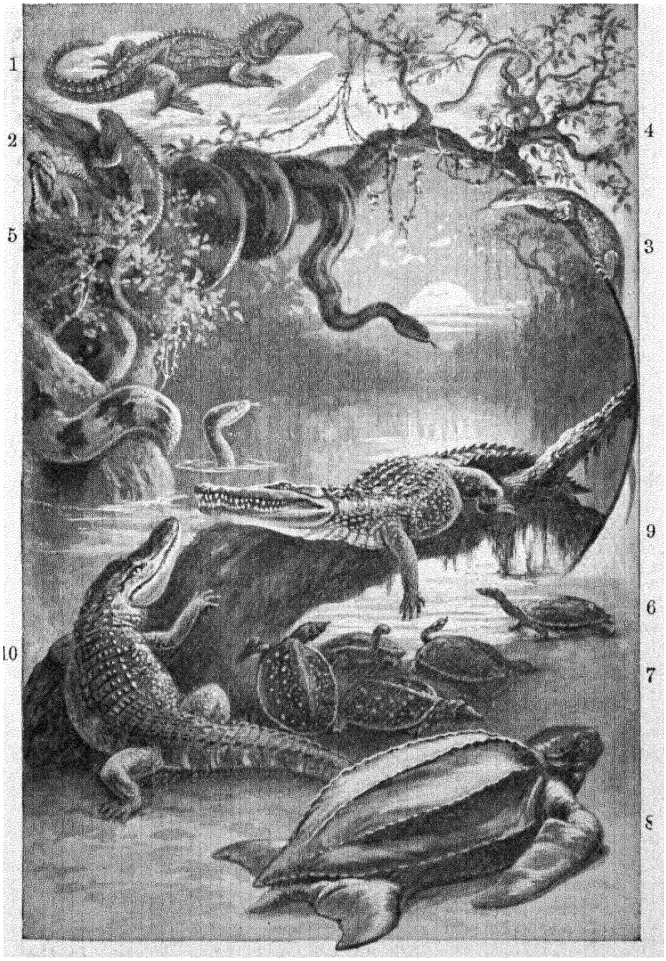
Reproduction and Reproductive System. Reproduction is one of the prime functions of protoplasm, and is intimately related to growth, of which it may indeed be regarded as a special case. The phenomenon occurs in its simplest form in many Protozoa, as in amœba, which grows until it reaches the limit of advantageous size, and then reproduces by dividing into two parts (fission). The reason for this process is that each particle of protoplasm feeds, breathes, excretes, and so on through the surface. But in any spherical body the volume increases faster than the surface, and therefore, once a certain limit, definitely fixed for the spe-

cies, is passed, the chemical interchanges between the internal particles of protoplasm and the surrounding medium are checked, and division follows. But in many Protozoa—*e.g.*, in Paramœcium—both growth and reproduction become impossible unless there is periodically a process of conjugation, or union of two separate masses of living matter. Comparing multicellular forms with the Protozoa, we find that, generally speaking, these, in place of simply dividing, give off two kinds of specially modified cells, known respectively as ova and spermatozoa, which after sexual union has occurred become capable of developing into new organisms. This is the ordinary process of sexual reproduction, as known alike in the higher plants and the higher animals.

Again, in certain of the multicellular animals, and in most of the multicellular plants, another type of reproduction consists in the liberation of clusters of the ordinary body cells, which are capable of growing into a new organism. In animals this type of reproduction is frequently associated with the formation of colonies, the buds remaining in connection with the parental stock, as in sea-firs, colonial tunicates, and so on. In plants vegetative reproduction, as it is usually called, is very frequent—*cf.* the tubers of the potato, the subsidiary bulbs produced by most bulbous plants, the runners of the strawberry, and so forth. The frequency of this type of reproduction in plants as compared with animals is due to the much greater histological simplicity of plants. In animals it is limited to organisms of relatively simple structure, where a liberated bud may contain samples, as it were, of all the cells of the body. The vegetatively produced plant comes very much sooner to maturity, for it starts with more capital than the average seed; and the vegetatively produced offspring resembles the parent exactly. On the other hand, plants arising from seeds, which are the result of the union of two separate cells, may or may not resemble their parents closely; in other words, they display one form of the phenomenon of variation.

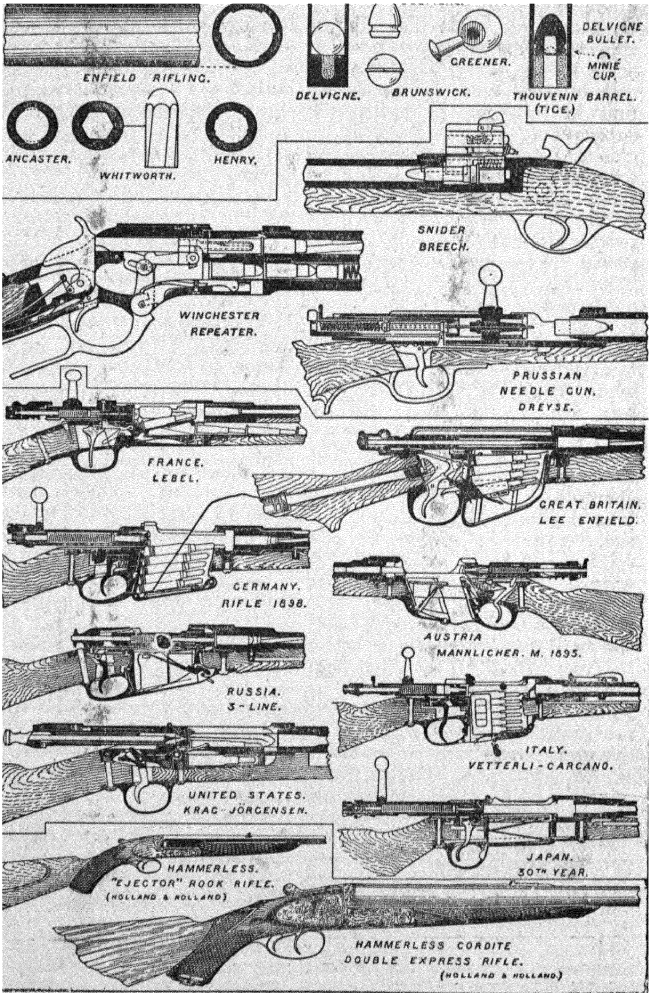
Apart from budding, a peculiar mode of asexual reproduction exists in plants known as spore formation, the vast majority of plants being capable of liberating single cells which develop into a new organism without any previous process of fertilization—that is, of sexual union. As one ascends the plant scale, however, the organism produced by the germinating spore progressively diminishes in complexity, until in the flowering plants it has almost disappeared, and is quite incapable of independent existence.

Sexual reproduction by the union of male and female cells is practically universal in multicellular plants and animals. In some cases, however, female cells are produced which without sexual union are capable of development. Such ova are described as parthenogenetic, and occur, for example, in some insects. In the general case, however, eggs must be fertilized before they can develop, the process consisting in a



Types of Reptiles.

1. Sphenodon (*Rhynchocephalia*). 2. Iguana; 3. monitor (*Lacertilia*). 4. African tree-snake; 5. boa constrictor (*Ophidia*). 6. Snake-necked tortoise; 7. soft-shelled river tortoise; 8. leathery turtle (*Chelonia*). 9. Amazonian caiman; 10. alligator (*Crocodilia*).



VARIOUS PATTERNS OF RIFLES.

union of the egg nucleus with the nucleus of the male cell. Before this can be effected there must be some means of bringing the two cells into contact. It was proved first in the case of ferns, and subsequently in organisms in general, that the female cell exercises a strong attraction on the male cell—an attraction which is due to certain waste products produced by the female cell. This power of being influenced by chemical stimuli is known as chemotaxis, and is a prime property of organisms. In the majority of cases the male cell is a freely moving spermatozoon; and when it is brought within a certain distance of the ovum, the chemotactic action of the latter causes it to swim up to it. In many marine animals it is on chemotaxis alone that fertilization depends. For example, in the common sea-urchin ova and sperms are shed freely into the water, and it is a matter of 'chance' whether the sperms do or do not come sufficiently near the ova for the chemotactic action to assert itself. But this is an obviously wasteful method, for where the chances of fertilization are small, enormous amounts of ova and sperms must be produced. We therefore find, alike in plants and in animals, that means exist whereby the contact of male and female cells is ensured, with a corresponding economy of production. In the higher plants the agency of wind, insects, and so forth is taken advantage of, while in the more specialized animals a process of pairing occurs by which the same result is attained. The elaborate adaptations to ensure pollination in the higher plants, and the no less elaborate development of means of sexual attraction in the higher animals, all serve to emphasize the supreme importance of sexual reproduction to the species. In its mingling of two different germ-plasms we have the proximate cause of variation, and therefore of the process of evolution.

All methods of reproduction are costly to the individual, wherefore reproduction does not normally occur until growth has almost ceased—that is, until the individual has reached its maximum development. Speaking broadly also, it may be said that hypernutrition increases the power of reproduction, as witness the enormous productivity of parasites. It is also a commonplace of biology that the rate of reproduction is highest in unspecialized organisms, and tends to diminish with progressive specialization. This statement, however, requires some qualification. The actual number of eggs or young produced certainly tends to be less in highly specialized organisms, but the survival rate is not less. The bony fish lays an enormous number of small eggs, which are fertilized externally and have no protective investment. The dog-fish and its allies (elasmobranchs) lay relatively few eggs, which are fertilized internally, are protected in a case, and contain a large amount of yolk; but then the survival rate in the latter case is infinitely greater than in the first. At the same time, there is some evidence that decadent or dying stocks manifest a loss of repro-

ductive power. This would seem to be the case with the New Zealand lizard (Sphenodon), which is dying out; perhaps also with the elephant. In the human species, in certain races especially, there is in progress a marked decrease of the birth-rate which is not associated with a very notable rise in the survival rate, but the biological explanation of this phenomenon is meantime difficult to obtain. The reason in the general case for the progressive diminution in higher forms in the number of offspring produced is not, however, far to seek. It is better for the species that relatively few should be produced with increased chance of surviving to maturity, than an enormous number where the chances of an individual surviving are small, because the agents of elimination which act in the earlier stages are largely non-selective in their mode of action. Take, for example, a swarm of young bony fishes. The eliminating agents in this case are organisms which snap up individuals from the swarm without regard to the minor variations existing among them. If it is possible to protect the young through their early stages, as is done by the parents in more specialized forms, until the agents of elimination act selectively—*i.e.*, in picking out the slower, less vigorous, or less intelligent forms—then by leaving the more fit to breed, the standard of the species is always being raised; hence the biological justification of the parental care shown by birds and mammals.

Reptiles constitute a class of the phylum Vertebrata. In spite of the obvious external differences, they are most nearly related to birds, whence the use of the term Sauropsida to include the two classes. If fossil forms be taken into account, however, reptiles occupy a central position in the vertebrate phylum; for they have themselves been derived from an amphibian stock, and have apparently given rise alike to birds and to mammals. For practical purposes reptiles are vertebrates with a scaly skin, which breathe by lungs and never by gills, which have one occipital condyle, and, owing to the admixture of arterial and venous blood in the aorta, are cold-blooded instead of warm-blooded.

Reptiles are predominantly terrestrial creatures, but they exhibit much diversity of habit. The majority crawl on the surface, but some snakes and lizards burrow underground, many Chelonia and a few snakes have adopted an aquatic life, snakes and lizards frequently adopt an arboreal habit, flying lizards parachute from tree to tree, and the extinct pterodactyls conquered the air. All are dwellers in tropical or temperate regions, but the former is their true home and their numbers dwindle as one recedes from the equator. Like many creatures subjected to extremes of heat, a large proportion of their number pass over the dangerous drought seasons in a state of torpor, known as *æstivation*, a phenomenon very similar to the physiological winter sleep or *hibernation* in which others of their class (tortoises are well-known examples) spend the cold periods of the year.

At the present day rĕptiles, though they number almost 5,000 species, are decadent members of the animal kingdom, for in earlier ages no creatures could compare with them in size, strength, or number. Their earliest fossilized remains have been found in rocks of Permian Age, but in Jurassic and Cretaceous times they reached their greatest development, constituting the predominant inhabitants of air, land, and water. A few of the strange forms then in existence are mentioned below in the note on classification.

Reptiles, though of little use to man, still have much significance for him, for in India alone an annual toll of some 20,000 lives is paid to the bite of poisonous snakes, and crocodiles add to the death-roll. African crocodiles harbour in their bodies a trypanosome which subsequently develops in the tsetse fly, and has been considered to be the cause of the fatal disease sleeping sickness. But this allegation seems to be due to a confusion between some stages of the crocodile parasite, *T. grayi*, and the distinct *T. gambiense*—the true cause of sleeping sickness. Reptiles serve a useful purpose from the human point of view in destroying the multitudes of insects upon which most lizards and many snakes feed, and the latter especially do much to keep down the numbers of ground vermin. Apart from such indirect services, crocodiles furnish a stout ornamental leather, manufactured from portions of their skin, and the horny carapace of tortoises is made into articles of tortoise-shell.

The class Reptilia is divided into eleven orders, sometimes grouped in various sub-classes:

Order I. *Rhynchocephalia*—*e.g.*, *Sphenodon*, sometimes made the solitary occupant of the sub-class *Prosauria*.

Order II. *Lacertilia* or ***Lizards***.

Order III. *Ophidia* or *Snakes*. (Owing to their many resemblances, lizards and snakes are sometimes grouped together in the sub-class *Sauria*.)

Order IV. *Chelonia*, *Tortoises* and *Turtles*.

Order V. *Crocodilia*, *Crocodiles*.

Extinct forms:

Order VI. *Pythonomorpha* (*e.g.*, *Liodon* and *Dolichosaurus*), elongated Cretaceous relatives of *Sphenodon* and the lizards, found in Amer. and European deposits; body snake-like, sometimes 80 ft. long, with two pairs of swimming paddles; marine and carnivorous.

Order VII. *Ichthyosauria* or *Ichthyopterygia* (*e.g.*, *Ichthyosaurus*), extinct reptiles which lived in the Old World from Triassic to Cretaceous times; body whale-like, 30 to 40 ft. long, with two pairs of swimming paddles; marine and carnivorous.

Order VIII. *Plesiosauria* or *Sauropterygia*, inhabitants of Europe, New Zealand, and America in the Chalk period; heavy-bodied and long-necked, related to tortoises and turtles, but without external armour. Some lived on land, but the majority were marine and had paddle-like limbs and tail—*e.g.*, *Plesiosaurus*, 40 ft. long, found fossil in England, and the Amer. *Elasmosaurus*.

Order IX. *Theromorpha* (*e.g.*, *Dicynodon* and *Elginia*), Permian and Triassic reptiles whose remains are found mainly in S.

Africa, though *Elginia* and others are Scot. fossils, and several are Amer. lizard-like land creatures, interesting because they exhibit both reptilian and mammalian characteristics, indicating perhaps the point of origin of the mammals.

Order X. *Dinosauria, Dinosaurs*, mammal-like, with large body bearing four limbs, on all of which, or on the hinder pair only, the creatures moved. Their remains, which show bird and mammal relationships, are widely distributed in deposits ranging from Triassic to Cretaceous Age, especially in America and Belgium. All were terrestrial, but some, such as the gigantic *Diplodocus, Brontosaurus* (50 ft.), and *Iguanodon* (28 ft.), were herbivorous and probably amphibian, while *Lælaps* and *Megalosaurus* were fiercely carnivorous; examples of the former stood 18 ft. high.

Order XI. *Pterosauria, Ornithosauria*, or *Pterodactyls* (*e.g., Pterosaurus* and *Rhamphorhynchus*), highly specialized flying reptiles, the remains of which are found in rocks from Lower Jurassic to Upper Chalk; wing-like flaps of skin extended from an exceedingly long finger to hind limbs and tail. Though distinctly reptilian, in many structures they closely resemble birds, varying 'from the size of a sparrow to that of a condor,' but no traces of such external covering as feathers have been found.

Repton, par. and vil., Derbyshire, England (52° 50′ N., 1° 32′ W.), on Trent; famous school, founded 1557, reorganized 1874; anc. cap. of Mercia; church has Saxon crypt. Area of par. 4,042 ac.; pop. 1,900.

Republic (Lat. *res*, 'business'; *publicus*, 'public'), state in which government is aristocratic or democratic, not monarchical. The city-states of antiquity usually passed through a monarchical to a republican phase, and attained their highest culture in the latter, but the republics of Greece and Rome were oligarchic—a few ruling a large slave class. The anc. cities of Italy retained the Roman ideal. Rome itself made attempts at republican revolution in 12th and 14th centuries, while Venice quickly won freedom from imperial control. Florence became the centre of republican feeling under Renaissance influence; the political institutions of Greece and Rome were studied, but the Florentine republic came to an end (1530), and the greater part of Italy, like the rest of the world, came under absolute government. Calvinism was the parent of modern democracy—the Swiss federation, the Dutch republic, the Eng. Commonwealth, and Amer. colonies (of which republicanism was natural development); and Fr. Revolution, it is agreed, was largely due to admiration of the *philosophes* for Eng. and Amer. ideas. The Fr. Revolution, however, was the child of both Reformation and Renaissance, owing as much to Plutarch as to democratic ideals of reformed countries. U.S. and Switzerland are *federal* republics—*i.e.*, composed of federated states; France and Portugal are unitary republics. As a result of upheaval produced by Great War, Germany, Austria, and Russia

became republics, and some other states which secured autonomy also adopted that form of government. For methods of government in republics, see FRANCE, UNITED STATES, etc.

Requeña, tn., Valencia, Spain (39° 31′ N., 1° 10′ W.); wine and fruits; manufactures taffetas and velvets. Pop. 16,500.

Reserve. See ARMY.

Reservoir, a construction for the storage of water. The present article deals with constructions so large that it would be impracticable to cover them with roofing. Where the source of water supply is the rainfall from a certain catchment area, a reservoir has to be formed of such capacity that sufficient water will be stored to keep the supply up to its required quantity during any drought that is likely to occur. In calculating, it is usual to allow for three consecutive dry years, in which the rainfall only amounts to four-fifths the aver. annual rainfall. With regard to the source of supply, attention must be paid to (*a*) the meteorology of the district—the average and minimum ann. rainfall, how it is distributed throughout the year; and (*b*) the geology and the configuration of the catchment area—whether the rain runs off rapidly or whether much of it sinks down, where the impermeable strata lie, and where faults and dykes occur. For public water supply it is usual in Britain to provide storage for from 150 to 180 days. The amount of compensation water granted to riparian owners of a stream has been virtually fixed at one-third the available flow throughout three consecutive dry years.

The site of a reservoir in some cases is determined by the elevation at which the water must be impounded. A larger catchment area will be included if a position lower down the valley is suitable, and it may be worth while to lose the superior elevation for the sake of gaining the extra water from the increased gathering ground. But the most important item of all is that the reservoir bank must be upon proper geological foundations. A reservoir may be formed either by an embankment blocking up a valley—in which case the catchment area naturally drains into it (as, for example, Edinburgh's reservoirs in the Pentland and Moorfoot Hills, or Birmingham's reservoirs in S. Wales)—or by embankments completely surrounding, or extending for a considerable distance around, a flat or sloping piece of ground, in which case the area naturally draining into it is small, and the water to be stored is brought by an aqueduct from another gathering ground either by pumping or by gravitation. Examples: the Thames valley and Lee valley reservoirs for London's supply.

The latter type of reservoir has an earthen embankment, made water-tight by having a core of puddled clay, which is founded on some impervious stratum, and finishes above the top-water level. So long as clay keeps moist it will remain water-tight, but as it dries it shrinks and cracks. Brit. engineers generally form puddle of the best clay which can be conveniently got,

and out of which the stones are picked. Some fill the trench with concrete, and only have the puddle above ground-level. Dams for valley reservoirs may be formed of earth, as described, or of masonry.

Resht, town, Ghilan, Persia (37° 18′ N., 49° 33′ E.); Enzeli, its port, is 15 m. N.W. on the Caspian Sea; trade in raw silk and cocoons; exports rice, fruit, tobacco, textiles, cotton dyes, sheep, cattle, and wood. Occupied by Bolsheviks (Oct. 1920). Pop. 10,000. See ENZELI.

Resins, compounds of oxygen, carbon, and hydrogen exuded from plants; soluble in alcohol, ether, essential oils, alkalis. Hard resins are solid; they include lac, copal, guaiacum, mastic, jalap. Soft resins contain essential oils (see BALSAMS). They are employed in varnishes, in sizing paper, and in making sealing-wax and soap. Numerous resins are now manufactured synthetically by condensing phenols with formaldehyde—*e.g.*, bakelite. See GUMS; ROSIN.

Resorcin, or RESORCINOL ($C_6H_4(OH)_2$), metadihydroxybenzene, colourless crystals, soluble in water, alcohol, ether; m.p. 118° C.; obtained by heating benzene with sulphuric acid and fusing the result with caustic soda; used to make fluorescein, eosin, azo-dyes; of use also in med. and as a photographic developer.

Respiration, ARTIFICIAL. See DROWNING.

Respiratory System includes the nasal passages, pharynx, larynx, trachea, bronchi, and lungs; the first three are treated under OLFACTORY SYSTEM, PHARYNX, LARYNX, so that the trachea, bronchi, and lungs only fall to be considered here.

The *trachea* is the tube which conveys the air from the larynx to the bronchi, being rather over 4 in. in length, the upper inch being situated in the neck, and the remaining part in the thorax. It is composed of a fibro-elastic membrane, in which are horse-shoe-shaped plates of cartilage which serve to keep the passage permanently open; the posterior aspect, where the cartilages are deficient, being closed by non-striped muscle, which, by contracting, can alter the diameter of the tube.

The *bronchi*, into which the trachea divides, are two in number, the right being rather wider, shorter, and at a less acute angle than the left. The structure of the bronchi resembles that of the trachea, rings of cartilage, deficient behind, similarly keeping the tubes permanently open. The bronchi branch freely on all sides in the substance of the lungs, the smaller branches sending off still smaller branches, and as the air passages become minute the cartilages disappear, and the muscle fibres form a layer all round the passages.

The *lungs* are two in number, and are conical, spongy, vascular organs, situated one on each side of the thorax. Each is invested with a serous membrane, the *pleura*, which is continuous at the root of the lungs with a similar membrane which lines the cavity of the chest, the practically non-existent space between the two membranes, which are only separated by a slight film of serous fluid, being termed the pleural

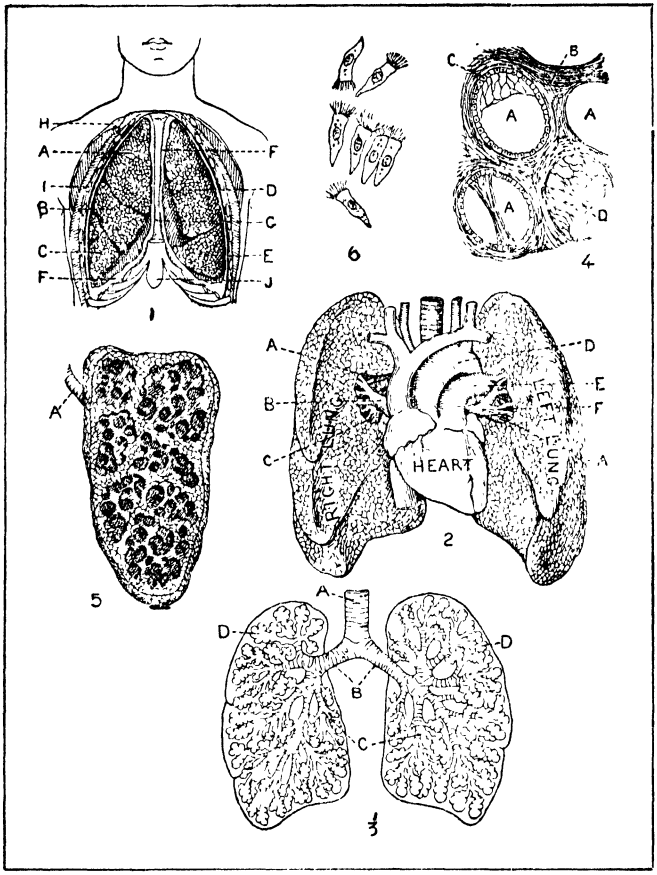
cavity. Each lung has a deep fissure running obliquely downwards and forwards in its substance, and the right lung has also a secondary fissure running horizontally from the middle of the greater fissure to the inner border of the lung. The left lung is thus divided into two, and the right into three lobes. Each lung is attached on its inner aspect to the mediastinal wall of the pleural cavity, at the root, where the blood vessels, bronchi, lymphatics, and nerves enter and leave its substance. The terminal branches of the bronchi end in irregular passages, from the sides of which go off the air-sacs or *alveoli*, which have delicate membranous walls containing a fine network of capillaries. The blood in these capillaries is thus only separated from the air in the alveoli by the slight framework of the walls of the capillaries and the alveoli, being spread by the capillary network over a comparatively large surface, and it is here that the interchange of gases between the air and the blood takes place.

The process of breathing consists in enlarging the chest by raising the ribs to a more horizontal plane and depressing the diaphragm, so as to inspire air into the lungs, the former being the more important factor in women and the latter in men. The movements of the ribs in *inspiration* are produced by muscles attached from the ribs to the skull, vertebral column, and scapulæ. The diaphragm is depressed by the longitudinal curves being straightened through the contraction of the muscular fibres, the central tendon moving but slightly in respiration. In *expiration* the ribs and diaphragm regain their position of rest, and, except the internal intercostal muscles, no special expiratory muscles are called into play in ordinary expiration.

The *chest* acts practically like a bag, which, when it is enlarged, draws in air, and when it is collapsed, drives it out again. The movements of the chest change the air only in the trachea and the larger bronchi, the air-sacs or alveoli not being affected to any extent by the movements, and the air which they contain is renewed by diffusion of gases.

The amount of air which is taken in and passes out at an ordinary respiration is about 20 to 30 cub. in., this being termed the *tidal air;* the *complemental air*, or the amount that can be inspired beyond this by a forced inspiration, is about 100 to 120 cub. in.; the *supplemental air*, or the amount that can be forcibly expelled from the chest after an ordinary expiration, is about 100 cub. in.; while the *residual air* is about 100 to 120 cub. in.

The oxygen is held in the blood in chemical combination with the hæmoglobin of the red corpuscles, and is carried in this way from the lungs to the heart and thence by the arteries and capillaries to the various tissues of the body, where it breaks away from the hæmoglobin and is absorbed. Carbon dioxide, on the other hand, is given off by the tissues and is dissolved in the blood plasma and combined with the sodium carbonate in it, forming sodium bicarbonate; this is conveyed by the veins to the lungs.



The Lungs.

FIG. 1. Human thorax, anterior wall removed, showing lungs in position: right lung—A, superior lobe; B, middle lobe; C, inferior lobe; left lung—D, superior lobe; E, inferior lobe; F, F, pleura, G, mediastinum; H, clavicle; I, ribs, J, sternum. FIG. 2. Lungs, spread out: A, A, bronchi; B, right pulmonary vein; C, right pulmonary artery; D, arch of aorta; E, left pulmonary artery; F, left pulmonary vein. FIG. 3. Diagrammatic scheme of the lungs: A, base of trachea; B, bronchi; C, bronchial tubes; D, air cells (alveoli). FIG. 4. Alveoli: A, A, alveoli; B, elastic trabeculæ; C, epithelium; D, alveolar wall with capillaries. FIG. 5. Lung of reptile (tortoise): A, trachea. FIG. 6. Cells of ciliated epithelium.

The composition of pure atmospheric air is 20·9 per cent. oxygen, 79 per cent. nitrogen, 0·04 per cent. carbon dioxide, and a slight quantity of water vapour; the composition of dried expired air is about 16 per cent. oxygen, 79 per cent. nitrogen, and 4·5 per cent. carbon dioxide, while it contains, in addition, up to 6 per cent. of water vapour.

The respiration is governed by a nerve centre in the medulla oblongata, the lowest part of the brain immediately above the spinal cord, and the nerve by which it is chiefly regulated is the vagus. If the centre in the medulla is injured, respiration stops; if the end of the vagus nearer to the brain is stimulated, respiration is quickened; and if the vagus is cut, respiration is slowed. Stimuli through various other nerves, however, may excite the respiratory centre, and, reflected to the muscles of the chest and the diaphragm, have an effect upon the respiration; for instance, cold water suddenly dashed on the back of the head causes a person to take a deep inspiration and hold it, while in *artificial respiration* pressure is made upon the chest walls, or the chest is enlarged and compressed alternately by moving the arms or body of the affected person. See DROWNING.

Pathology.—The various diseases of the respiratory system will be found described under their different headings—*e.g.*, ASTHMA, BRONCHITIS, EMPHYSEMA, PLEURISY, PNEUMONIA, TUBERCULOSIS. The main general symptoms of diseases of the respiratory system are *pain*, which may be burning, as in bronchitis, or stabbing, as in pleurisy or in pneumonia, the pain in the latter being due to the associated pleurisy; *interference with respiration*, either the respiration being accelerated or difficulty in breathing experienced; *rise of temperature*, to a greater or less extent, a feature common to practically all diseases of the respiratory system; *cough*, generally accompanied by sputum, which may be frothy, as in bronchitis, gelatinous and plum-coloured, later of a rusty tinge, as in pneumonia, in disk-like purulent masses, 'nummular,' as in phthisis. When a blueness of the surface of the body or of certain parts is observed, the term *cyanosis* is applied. It is due to a deoxidized condition of the blood which may be caused by obstruction in the artery or in the lung itself, or to valvular disease of the heart, the last-named condition being frequently congenital.

Certain occupations predispose towards diseases of the respiratory system, stone-masons, coal-miners, knife-grinders, mill-workers, and others working in dusty atmospheres being affected. The particles of stone, coal, or other dust which are inhaled may cause chronic bronchitis, which is followed by emphysema, or they may cause an overgrowth of fibrous tissue in the lung itself, this tissue sometimes becoming softened in parts and breaking down to form cavities, a condition known as stone-mason's or coal-miner's or knife-grinder's phthisis. Glass-blowers are also liable to bronchitis.

Tracheotomy, or the making of an opening into the trachea or windpipe by cutting into it from the front of the neck, may be necessary because of a foreign body in the air-passages, acute laryngitis causing great swelling of the walls of the air-passages, diphtheritic inflammation, or some similar cause, preventing the passage of air into the trachea by the natural passages. A bent silver double tube is introduced as a means of communication between the trachea and the exterior, the inner tube being loosely in the outer so that it can easily be removed by coughing when sputum is coughed into it.

Rest-harrow, the popular Eng. name of a genus of leguminous plants whose flowers have a five-cleft calyx, with stamens all united by their filaments, and with a thread-like style. The common rest-harrow (*Ononis arvensis*) is a perennial plant, most frequently found on sandy ground near the sea. It has hairy stems, almost shrubby in character, and long, tough roots, whence the popular name is derived. It bears rather large, bright red flowers in June and July.

Restigouche, riv., between New Brunswick and Quebec, Canada (47° 40′ N., 67° 30′ W.); flows into the Bay of Chaleur; near mouth is Dalhousie, cap. of Restigouche co., a port of entry, with good wharves, and large trade in timber and preserved salmon; 16 m. to W., also on the Restigouche, is Campbellton, with a similar trade.

Restraint of Trade. A covenant in restraint of trade is one often made by an employee on joining a business, or a trader on selling a business, not to carry on the same trade within a certain area or for a certain term. Such a covenant is void if it is unreasonable—*e.g.,* if it is wider in respect of area than the nature of the trade requires, is against public interest, or is not for valuable consideration. The area depends on the nature of the trade. These rules also apply to Scotland.

Resurrection-men. See under BURIAL.

Resuscitation. See DROWNING.

Reszké, JEAN DE (1852–), Polish operatic singer; *b.* Warsaw; made his début as a baritone at Venice (1874); appeared first as a tenor in 1879, and speedily won recognition as one of the greatest living dramatic tenors; appeared in London (1875); now director of a school of singing in Paris; breeds race-horses.

Retford, EAST, munic. bor., Nottinghamshire, England (53° 18′ N., 0° 54′ W.), on riv. Idle and Chesterfield Canal; iron foundries, paper and corn mills, india-rubber works. Pop. 13,400.

Rethel, tn., Ardennes, France (49° 32′ N., 4° 21′ E.), on riv. Aisne; fine woollen cloth; during Great War was occupied by the Germans (1914–18). Pop. 5,200.

Retina. See EYE.

Retriever. See DOG FAMILY.

Retz, RAIS, or RAIZ, GILLES DE (*c.* 1406–40), Fr. baron; became marshal of France at an early age; executed for sorcery, and for sacrificing children in diabolical rites.

Reuchlin, JOHANN (1455–1522), Ger. scholar; second only to Erasmus; revived study of He-

brew, and engaged in dispute with Johann Pfefferkorn, a converted Jew, who, in the interests of the Church, urged the destruction of all Jewish books except the Bible. Reuchlin, defending the Jewish books, came into conflict with the Inquisition, the treatment he received calling forth the indignant *Epistolæ Obscurorum Virorum*, by Ulrich von Hutten and others; friend of Pico della Mirandola, and follower of his kabbalistic doctrines; greatest work, *De Rudimentis Hebraicis*; though not a Reformer, life and work influenced the Reform movement.

Réunion (formerly BOURBON), Fr. isl. in Mascarene group, Ind. Ocean (21° S., 55° 30′ E.); divided by a chain of volcanic mountains and a plateau into two distinct E. and W. parts; highest point, Piton des Neiges (10,070 ft.); drained by many short streams; towns are St. Denis (cap.) and Pointe-des-Galets (port); leading products are sugar, rum, coffee, manioc, tapioca, vanilla, and spices. The island was discovered by the Portuguese in the early 16th cent., annexed by France (1649), and occupied by the British (1810–14). Area, 965 sq. m.; pop. 174,000.

Reus, tn., Tarragona, Spain (41° 10′ N., 1° E.); silk, calico, soap, and leather; exports fruit and wines. Pop. 27,000.

Reuter, PAUL JULIUS, BARON DE (1818–99), originator of Reuter's News Agency; *b.* Kassel, Germany; became a naturalized Brit. subject (1851), and established offices in London, with correspondents in all parts of the world.

Reutlingen, tn., Würtemberg, Germany (48° 30′ N., 9° 13′ E.); centre of hop, wine, and fruit dist.; leather, woollen and cotton goods, machinery, paper, bricks, and furniture. Pop. 29,800.

Reval, or REVEL, fort. seapt., Esthonia (59° 27′ N., 24° 49′ E.), on Gulf of Finland; cap. of Esthonia; among chief buildings are the castle, cathedral, and churches of St. Olai and St. Nicholas; chief manufactures are cotton, paper, leather, and hosiery; chief exports, grain and flax; has had a varied history, being founded *c.* 1220 as a Dan. town, sold in 1346 to the Teutonic Knights, becoming Swedish in 1561; captured by Peter the Great in 1710. During Great War bombed and raided and occupied by Germans (Feb. 1918). The rebuilding of the port began in Jan. 1919, and in Oct. of the same year a proposal was made to acquire the famous Baltic works in the interests of the German navy.

Revelation, BOOK OF, or THE APOCALYPSE ('uncovering,' 'unveiling'). Early Christian tradition assumed that the author was John the Apostle; much external evidence supports this theory, although there is also evidence in the opposite direction. The internal evidence creates a difficulty, style, contents, and outlook differing extensively from that of the fourth gospel. The authorship cannot be stated with certainty, all that is known being that the author's name was John, that he was a sufferer along with those to whom he was writing, and that he had been banished to Patmos. The book is usually assigned to the reign of Domitian (A.D. 81–96).

Apocalyptical writings had their rise in the centuries immediately preceding and following Christ; they sprang up in difficult times, and brought a message to suffering people that help would arrive, and counselled them to abide in patience and hope. The Book of Revelation was the most outstanding of these, and is the only one which has been accepted in the canon of the Bible. The period to which the Revelation belongs was one of special hardship and trial: the Christians were suffering persecution on every hand; the cult of Cæsar was everywhere in vogue; there was open antagonism between Christianity and Cæsar-worship, and the Christians were in danger of giving way to weariness and depression. In seeking to strengthen and encourage them, which was the writer's object, he assumes that God will come to the rescue of His people, that a day of judgment will follow, and a kingdom of saints be set up, and the future showed that his promise of Divine help to the persecuted Church was not in vain. Several different modes of interpreting the book have been adopted. The 'futurists' believe that the end of the world is dealt with, and that the events named are connected with this in the dim and distant future; the historical view is that a symbolical narrative of the Church's history is set forth from its early days till the end of the world; the 'preterist' school hold that the writer was dealing only with his own times, and seeking a means of escape from immediate difficulties by fixing his belief on Divine intervention; they therefore maintain that the promises have already been nearly or entirely fulfilled.

C. A. Scott, in *Century Bible;* A. Ramsay, in *Westminster New Testament;* Charles, *Revelation of St. John* (1920).

Revelstoke, tn., Brit. Columbia, Canada (50° 58′ N., 118° 12′ W.), on C.P.R.; mining industries, railway workshops. Pop. 2,700.

Reventlow, CHRISTIAN DITLEV FREDERICK, COUNT (1748–1827), Dan. statesman; president of *Rentekammeret* (1784), and carried out agrarian reforms; obtained appointment of royal commission (1786) to inquire into condition of peasantry; result—abolition of feudal services; introduced free trade measures; fell in 1813.

Reventlow, ERNST ZU, COUNT (1869–), Ger. publicist, of Dan. extraction; entered Ger. navy, but became naval expert on staff of *Berliner Tageblatt* and other newspapers, and a prominent advocate of Pan-Germanism; during Great War was frenzied in demands for frightfulness on sea and land, and the utter extinction of England.

Reverberatory Furnace. See FURNACES.

Revere, tn., Massachusetts, U.S. (42° 25′ N., 71° W.), popular summer resort and wat.-pl. Pop. 18,200.

Reversing Layer. See SUN.

Reversion. See HEREDITY; REMAINDER.

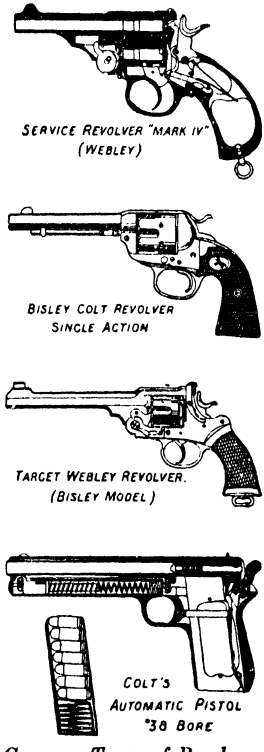
Reviews. See PERIODICALS.

Revigny, tn., Meuse, France (48° 50′ N., 4° 58′ E.); phosphates; clock-making, printing; 15th cent. church; town hall partly Renaissance; in the Great

War was occupied by the Germans in their invasion of France (Aug. 1914), and lost by them in the first battle of the Marne (Sept. 1914); important railway centre; several times bombed by Ger. aircraft. Pop. 2,000.

Revival of Learning. See RENAISSANCE.

Revolver, a small firearm to be held and fired with one hand, and designed for use at close quarters; invented about 1570. Earliest form was a double-barrelled weapon, but about a century later we find pistols with three barrels which were unscrewed to load. When more than three barrels came to be used, they were grouped round a solid core. Eventually, however, the barrels were made to revolve so as to come successively opposite to the hammer. The first really serviceable revolver, as these came to be called, was that made by Samuel Colt, a native of Hartford, Connecticut, U.S., some time after 1835. The original Colt had muzzle-loading chambers, and the introduction of the breech-loading chamber, which came shortly thereafter, was an important step in advance. Various improved types of revolver have since been introduced by other inventors. The Brit. service revolver is the Webley pistol, of ·450 calibre. If an easily portable weapon is required, a short barrel is essential, but this will only give good results at a very short distance; for ordinary purposes a barrel of from 4 to 6½ in. is considered necessary. The extreme range of the average 'service' revolver is about 1,550 yds., but it is only accurate at short distances (it is sighted to 50 yds.), and the chief competitions in revolver shooting, of which the National Rifle Association is the chief patron, and



Common Types of Revolvers.

which are held at Bisley, are fired at distances of 20 yds. The latest type of pistol to be used is the 'automatic,' which relieves the firer of all manipulation, ex-

cept the replenishing of the magazine, taking aim, and pressing the trigger, but its special dangers are that the recoil is apt to cause another shot to be fired unintentionally, and that when the catch which holds the hammer gets worn, the whole contents of the magazine may be discharged automatically. Automatics have also the defect that the small bullet used has not always sufficient 'stopping power'—an important disadvantage in close-quarter fighting.

Rewa. (1) Feudatory state, Baghelkhand, Central India; well watered and very fertile, producing rice, wheat, millet, and timber; rich in minerals, of which coal and iron are mined. Area, 13,000 sq. m.; pop. 1,514,800. (2) Chief tn. of above state (24° 32′ N., 81° 18′ E.). Pop. 25,000.

Rewa Kantha, political agency, Bombay, India (21° 23′–23° 33′ N., 73° 3′–74° 20′ E.); comprises about sixty separate states. Area, 4,956 sq. m.; pop. 480,000.

Rewari, tn., Gurgaon dist., Punjab, India (28° 12′ N., 70° 40′ E.); manufactures brass ware, and exports grain and sugar. Pop. 28,000.

Reykjavik, or REIKJAVIK, tn., cap. of Iceland (64° 8′ N., 21° 52′ W.); contains cathedral and government buildings; chief exports are salt cod and other fish, butter, wool, and skins. Pop. 15,300.

Reynolds, SIR JOSHUA (1723–92), Eng. portrait painter; first president Royal Academy (1768); knighted (1769); painter to King George III. (1784); brilliant career both artistically and socially; founded Literary Club (1764); figures much in Boswell's *Johnson*; excelled in painting children; chief works: *Mrs. Siddons as the Tragic Muse* (sold for £54,600 in 1919), *Duchess of Devonshire and her Baby, The Age of Innocence,* and portraits of Johnson, Sterne, Burke, Goldsmith, Fox, Garrick, etc.; renowned also for literary quality of his *Discourses* (Presidential Addresses); buried in St. Paul's.

R.F.A., ROYAL FIELD ARTILLERY.

R.G.A., ROYAL GARRISON ARTILLERY.

R.H., ROYAL HIGHLANDERS (Black Watch).

R.H.A., ROYAL HORSE ARTILLERY; Royal Hibernian Academy.

Rhabdomancy, divination by a rod or wand. See under DIVINING ROD.

Rhadamanthus (Gr. myth.), son of Zeus and Europa; because of his justice he was made a judge of the dead in Hades.

Rhætian Alps, central chain of Middle Alps (46° 20′ N., 10° E.), between the Inn, the Adda, and the Upper Adige, and comprising the Rhætian chain and the Silvretta, Albula, and Bernina groups. Highest peaks: Piz Bernina (13,300 ft.), Piz Roseg (12,936 ft.), and Orteler Spitze (12,800 ft.). Chief pass is the Splügen (6,945 ft.).

Rhamnaceæ, natural order of trees and shrubs; two genera: *Rhamnus* (buckthorn), used in dyeing as an astringent; and *Zizyphus,* the lotus of antiquity.

Rhatany, name of two plants of genus *Krameria* (natural order Polygaleæ): Peruvian rhatany (*K. triandra*), Savanilla rhatany (*K. ixina*); roots are used as strong astringent.

Rhayader, tn., Radnorshire, England (52° 18′ N., 3° 28′ W.), on Wye; centre of agricultural dist.; tanyards. Pop. 1,200.

Rhé, Ile de. See Ré.

Rhea. See Ramie.

Rhea (ostrich). See under Running Birds.

Rheims. See Reims.

Rheine, tn., Westphalia, Prussia (52° 16′ N., 7° 25′ E.); manufactures cottons, jute, tobacco, flour, and machinery. Pop. 14,400.

Rhenish Prussia. See under Rhineland.

Rhetoric, the art of public speaking. It was first taught in Sicily by Corax and Tisias, about 460 B.C. Gorgias devoted his attention to the formal side of rhetoric, and elaborated a very artificial style. Other sophists wrote and taught on the subject, but it was Aristotle who first raised the study to the dignity of a science. His *Rhetoric* survives, and consists of three books containing copious illustrations from Gr. rhetoricians and writers. The first two books are mainly devoted to *proofs*, but the third, which treats style, is the most interesting. Of the Attic orators, Antiphon, Lysias, and Isocrates are famous, but Demosthenes is on a plane by himself. Among the Romans the art was cultivated assiduously, being in harmony with Roman ideals and temperaments.

The *Rhetoric* of Quintilian is an exhaustive manual dealing with rhetoric on the broad basis defined by Cicero. In modern times rhetoric has not received the close attention which it received in classical times.

Saintsbury, *History of Criticism.*

Rheumatism, term popularly applied to a number of conditions characterized by pain, more accurately differentiated as acute, chronic, and muscular.

Acute Rheumatism or *Rheumatic Fever* is an acute fever due to a toxic condition of the blood caused by a micro-organism, the chief symptom in *adults* being the affection of the joints, which become swollen, reddened, hot, and tender, first one of the larger joints (knee, ankle, shoulder) being affected, then some of the others, often in symmetrical order. At the same time the temperature rises, accompanied by other symptoms, and the heart may become affected, but the latter is not so usual as in children. In *children* the affection of the joints is slight, the other symptoms are not so marked, and the patient does not seem very ill. There is, however, a particular liability to affection of the heart and pericardium, and the heart must be frequently examined by a physician. The presence of fibrous nodules under the skin is also often a characteristic of the disease in children. The *treatment* is to put the patient to bed between blankets, give a dose of calomel, and keep the affected joints at rest, wrapped in cotton wool. Salicylate of soda has a remarkable effect in relieving pain, reducing the temperature, and shortening the course of an attack. Alkaline drinks in liberal quantities are also of benefit. Aspirin is a valuable substitute for salicylates.

Chronic Rheumatism may follow one or more acute attacks,

or it may be chronic from the beginning, sometimes several joints being affected, sometimes only one. The capsule, tendon sheaths, and ligaments are thickened, and there is a tendency towards adhesions and fibrous thickenings in the joint, which may be somewhat distorted. There is no tendency to heart or kidney affections. The treatment is to give potassium iodide, quinine, cod-liver oil internally; massage, and the use of iodine and other liniments. Alcohol of any kind and sugar should be avoided in the diet, while Turk. baths, hot-air or hot-sand baths are of benefit.

Muscular Rheumatism usually comes on suddenly with pain in certain groups of muscles, with little or no swelling, often accompanied by digestive disturbances, the chief varieties being *lumbago* (affecting lower part of the back), *intercostal rheumatism* (affecting the muscles between the ribs), and *torticollis* (affecting one side of the neck), gouty or rheumatic persons being generally affected. The treatment is to administer calomel and saline purges, while sodium salicylate, quinine, and potassium iodide are of benefit. Counter-irritants (*e.g.*, iodine or mustard leaves) should be applied locally, and rest is necessary. Massage, electricity, and mineral baths have been found valuable; diet should be kept simple, alcohol and sugars being avoided.

Rheumatoid Arthritis, OSTEO-ARTHRITIS, or ARTHRITIS DEFORMANS, is a disease characterized usually by a chronic course and destructive changes in the joints, the cause of which is believed to be either a micro-organism or toxæmia due to absorption of toxins from the alimentary canal. It may assume one of several types: in the most common form the tissues around the joint and the synovial membrane of the joint are involved, the joints are swollen, painful, and tender, and there is often fever. Later, there may be a certain amount of muscular atrophy, the skin is glossy and pigmented, and the joint may become deformed. In the *atrophic* type, which is rarer and more serious, there is atrophy of bone and of cartilage in the joint, which becomes disorganized and usually ankylosed. In the *hypertrophic* type new bone is formed, projecting around the joint and sometimes leading to ankylosis, while there are also changes in the cartilage. In a type which usually affects children (*Still's disease*) there is usually fever in the acute stages, and, in addition to the swelling of joints, swelling of the lymph glands and the spleen, accompanied by anæmia, muscular wasting, and limitation of movement.

The *treatment* is, in the acute stages, rest and an abundant nourishing diet. Passive hyperæmia has been induced with benefit by applying an elastic bandage above the joint for a few hours each day. Douches, massage, hot-air and mineral baths afford relief, and the treatment as carried out at such spas as Bath, Buxton, and Aix-les-Bains is valuable.

Rheydt, tn., Rhineland, Prussia (51° 11′ N., 6° 28′ E.); textiles, machinery, shoes, soap, and tobacco. Pop. 44,000.

Rhine (Ger. *Rhein*), riv., Germany (50° 12′ N., 7° 34′ E.), rises in the Swiss canton of Graubünden (Grisons); after passing through the Lake of Constance forms falls at Schaffhausen; between Basel and Mainz known as the Upper Rhine, from Bingen to Cologne as the Middle Rhine, and from Cologne to the North Sea as the Lower Rhine; forms boundary between Switzerland and Germany. Chief tributaries are Aar, Ill, Neckar, Main, Lahn, Moselle, Ruhr, Lippe; total length, 760 m., of which over 500 are navigable, beginning at Basel; connected by canals with the Danube, Rhone, and Marne; the most picturesque part is between Bingen and Koblenz, where many anc. castles crown several of the rugged eminences which dot the banks of the river, the most famous being Ehrenbreitstein, 'the Gibraltar of the Rhine,' immediately opposite the confluence of the Moselle; from Cologne to its mouth passes through flat country, and on its way through Holland divides into several arms; the left or S. arm, which falls into the North Sea at the Hook of Holland, is known alternately as the Waal or the Maas; the right or N. arm splits up into the Yssel and the Rijn. The Rhine has always played an important part in history, romance, literature, and commerce. By Treaty of Versailles (1919) river was placed under control of International Rhine Commission.

Rhineland, RHINE PROVINCE, or RHENISH PRUSSIA, most westerly prov. in Prussia (*c.* 49° 12′–51° 54′ N., 6°–7° 45′ E.); between Belgium and Luxemburg on the W., and Hesse-Nassau and Westphalia on the E.; drained by the Rhine and its tributaries; wine extensively produced in the valleys of the Rhine, Moselle, and Saar; sugar, hops, and flax are grown, and fruit abundant; most important occupations are mining and manufacturing; chief minerals are coal and iron; manufactures include iron, brass, and steel goods, cutlery, textiles, chemicals; chief towns are Koblenz (cap.), Essen, Duisburg, Düsseldorf, Cologne, Elberfeld-Barmen, Crefeld; mineral springs at Aachen, Kreuznach, etc. Area, 10,420 sq. m.; pop. 7,120,500.

Rhinoceros (Rhinocerotidæ), a genus and family of large odd-toed or perissodactyle ungulate mammals, with five species found only in Africa, N.E. India, Burma, Malay, Sumatra, Borneo, and Java. They are shy nocturnal creatures, with thick skins and one or two upright horns on or behind the snout. They live on foliage and the young shoots of trees, and are often found wallowing in muddy pools or in rivers.

Rhizopoda (Gr. *rhiza*, 'a root'; and *podos*, 'a foot'), a sub-class of the simplest class (Sarcodina) of the PROTOZOA. Its members are distinguished by the possession of pseudopodia, which are mobile, branched, and root-like (hence the name), in contradistinction to the unbranched, ray-like pseudopodia of the Actinopoda. The structure is of the simplest nature, consisting essentially of a single cell without definite bounding walls, and containing a nucleus, and vacuoles utilized in digestion and respiration.

Rhizopoda are found all the world over. The majority are aquatic, living in fresh water or in the sea. Some live in damp earth, while many are parasitic in the bodies of animals and of man, and to such are due amœbic dysentery and abscesses in the liver and other organs.

Rhizopoda are divided, according to Minchin (1912), into four orders, distinguished as follows (1) *Amœbœa*, simple indefinite individuals, with naked protoplasm or a simple shell; (2) *Foraminifera*, marine, with complex shells of carbonate of lime or cemented sand particles and fine net-like pseudopodia; (3) *Xenophyophora*, marine, with skeleton of hollow tubes, containing the protoplasmic body; (4) *Mycetozoa*, terrestrial forms, without skeleton, and with complex spore reproduction.

Rhode Island, one of the thirteen original states of the U.S. (41° 18′–42° 3′ N., and 71° 8′–71° 53′ W.), bounded on the N. and E. by Massachusetts, on S. by Atlantic Ocean, on W. by Connecticut. Surface generally rough and hilly (highest point, Pine Hill, 760 ft.); divided into two unequal portions by Narragansett Bay, with islands including Aquidneck or Rhode I. (summer resort). Is dotted by numerous lakes; watered by Blackstone, Pawtuxet, and Pawcatuck rivers. Climate fairly equable, but extremes greater inland. Mean ann. rainfall is 45 to 50 in. Composed mainly of Archæan (granites and gneisses) and Palæozoic rocks; eastern part carboniferous. Mineral deposits are comparatively small; fisheries (oysters) very important. Chief crops: hay and forage; corn, potatoes, oats, vegetables, and fruits (apples) are largely grown. Pre-eminently a manufacturing state, the following are the chief industries: woollen, worsted, and felt goods, cotton goods, jewellery, foundry and machine-shop products, electrical machinery, silverware and plated goods, gold and silver reducing and refining. Railway mileage, 212; electric railway, 372. Education is obligatory. PROVIDENCE is the largest and most important city. Pawtucket, Woonsocket, and Warwick specialize in textiles. Legislature consists of senate of 38 members besides the governor and lieut.-governor, and a house of representatives of 100 members (elected annually). Permanently colonized by Roger Williams and other settlers from Massachusetts (1636); incorporated as Brit. colony (1663); took active part in War of Independence and temporarily occupied by British (1776–9); admitted to Union as original state (1790). Area, 1,248 sq. m. (smallest state in the Union); pop. 542,600; density of pop., 508·5 per sq. m. of land surface, exceeds that of any other state.

Rhodes, CECIL JOHN (1853–1902), Brit. colonial statesman; *b.* Bishop-Stortford, Herts; son of clergyman; sent to Natal for health (1871); with brother Herbert made fortune in Kimberley diamond fields; founded De Beers Mining Co. (1880); early formed plan of making S. Africa British and linking it with Brit. protectorate of Egypt; entered

Cape politics (1881); negotiated (1882) surrender of territories in Bechuanaland; secured establishment of Brit. protectorate of Bechuanaland, and considerable increase of territory across Zulu border (1884); established British S. Africa Co. with Rothschild; secured for Britain pre-emption of Matabeleland (1888); obtained charter for S. Africa Co. ('Chartered Co.') (1889), and built up what is now known as RHODESIA.

Rhodes became prime minister at Cape (1890); advocated policy of 'Equal rights for all civilized men south of the Zambezi,' regardless of colour; strove to conciliate the Dutch; Jameson Raid (1895) forced him to resign (1896); quelled Matabele revolt (1896); censured by parl. inquiry for not preventing Jameson Raid (1897); chief promoter of Cape to Cairo Ry. and trans-African telegraph line; present in siege of Kimberley (1899–1900), when his health broke down. He was buried in the Matoppo Hills, Rhodesia. Public-spirited, energetic, autocratic, Rhodes was a great 'empire-maker,' and for nearly quarter of a century was the dominating personality on the imperial side in S. African politics. By his will he left practically his whole fortune (*c.* £6,000,000) to the public service, including 175 Rhodes Scholarships (for Brit. Colonial, and Amer. students) at Oxford.

Life, by 'Vindex' (1900), Mitchell (2 vols. 1910), Jourdan (1910), Fuller (1910), Colvin (1912).

Rhodesia, terr. of British S. Africa Co. in South-Central Africa (3°–22° S., 22°–33° E.), named after founder, CECIL RHODES; bounded N. by Belgian Congo and Tanganyika Terr., E. by Nyasaland and Port. E. Africa, S. by Transvaal and Bechuanaland, W. by S.W. Africa Protectorate and Angola; length, *c.* 980 m.; breadth, 600 m.; area, *c.* 445,000 sq. m. Terr. is divided into (1) *Southern Rhodesia*, containing the provinces of Matabeleland and Mashonaland; area, 149,000 sq. m.; pop.: Europeans *c.* 37,000, natives 770,000; and (2) *Northern Rhodesia*, until 1911 divided into N.E. and N.W. Rhodesia or Barotseland; area, *c.* 296,000 sq. m.; pop.: Europeans 2,400, natives 890,000. The Zambezi separates N. and S. Rhodesia. Surface consists mainly of an elevated plateau from 3,000 to 5,000 ft. above sea-level; Inyana plateau in S. Rhodesia *c.* 5,000 ft.; Tanganyika and Matoka plateaus highest elevations of N. Rhodesia. Chief rivers are Zambezi, Luangwa, Kafue; large lakes are Bangweolo and part of Tanganyika and Mweru; many swamps; climate is sub-tropical; tableland healthy, river valleys and low-lying country unhealthy, malaria being very prevalent; sleeping sickness in some districts owing to tsetse fly; rainy season between Oct. and April. Fauna is that of tropical Africa; affords splendid big-game shooting; includes eland, kudu, giraffe, zebra, baboon, elephant, hippopotamus, rhinoceros, lion; numerous reptiles, butterflies, and birds; white ants and locusts abound and are very destructive. Vegetation generally is sub-tropical; extensive forests; immense tracts of grass and large

stretches of country suitable for pasturage and agriculture.

Of utmost importance for development are railways. Cape-to-Cairo railway traverses terr. Rhodesian and Mashona railways begin at Vryburg (Bechuanaland), pass Bulawayo, Victoria Falls, Wankie coalfields, and cross Congo border. Another important line runs from Bulawayo via Salisbury and Umtali to E. coast at Beira (Port.); small branches link main lines with mining districts; line projected from Salisbury across Lomagunda goldfield to w. line at Semalembue; total railway mileage, 2,463. Chief products are wheat, maize, cotton, coffee, rice, rubber, tobacco, timber, ivory; cattle raising is important in S. Rhodesia; rich in minerals, which are already extensively worked: gold, silver, copper, coal, lead, chrome iron, diamonds, asbestos; the country is being rapidly developed and is of great promise. Brit. S. Africa Co. has made free grant of 500,000 ac. for ex-service men with a minimum capital of £1,000.

Rhodesia is under the administration of Brit. S. Africa Co.; S. Rhodesia is governed by administrator and executive council (not less than three members) appointed with secretary of state's approval, and legislative council of administrator and six members appointed by the company with secretary of state's approval and twelve members elected by registered voters; N. Rhodesia is administered by resident commissioner appointed by N. Rhodesian Order in Council, and administrator appointed by Brit. S. Africa Co. with secretary of state's approval; feeling in Rhodesia is as yet adverse to the suggested incorporation in the Union of S. Africa. Principal towns are Salisbury (cap. of S. Rhodesia), Bulawayo, Victoria, Umtali, Gwelo; Livingstone (cap. of N. Rhodesia), Fort Jameson, Abercorn, and Fife.

History.—Numerous anc. ruins show Rhodesian gold mines were worked in very early times—some say in Solomon's days; Rhodesia probably old Empire of Monomotapa; Portuguese entered Mashonaland (16th cent.); Matabele overwhelmed pastoral tribes (1836 onwards); region explored by Livingstone; Brit. S. Africa Co. obtained charter (1889); Mashonaland administered under Rhodes, Matabele rebellion (1893); Shangani R. disaster (1893); King Lobengula died in 1894; name Rhodesia officially adopted (1895); Jameson Raid (1895); Matabele again revolt (1896); Protectorate proclaimed over N.W. Rhodesia (1900). Rhodesia contributed men during the S. African War (1899–1902); during the Great War Rhodesian police occupied the Caprivi Concession (Sept. 1914); shared in defence of Saisi (June 1915), and in campaigns of S.W. and E. Africa; of total males of all ages (15,580) 4,250 served outside the terr.

Hensman, *History of Rhodesia* (1900); Hone, *Southern Rhodesia* (1909); Johnson, *The Mineral Industry of Rhodesia* (1911); Gouldsbury and Sheane, *Great Plateau of N. Rhodesia* (1911).

Rhodium (Rh, 102·9), **rare metal of platinum group, named**

from red colour of salts; occurs with platinum and gold; white, sp. gr. 12·1, difficult to fuse, melting at about 1,700° C.; it tarnishes when fused, and is easily attacked by chlorine; it is employed for crucibles, etc.; its salts correspond to the oxide Rh_2O_3.

Rhododendron (Gr., 'rose-tree'), an evergreen shrub with tough glossy leaves; natural order Ericaceæ; a handsome flower, slightly zygomorphic; of high decorative value.

Rhodope Mountains (Turk. *Dospad Dagh;* Bulg. *Despoto Dagh*), part of the Balkans (41° 50′ N., 24° E.), dividing Macedonia from Thrace. Muss Alla (9,615 ft.), culminating point in W. portion.

Rhondda, parl. div., Glamorganshire, Wales (51° 40′ N., 3° 32′ W.), watered by Rhondda R., trib. of Taff; valley densely populated and rich in minerals. Pop. 152,800.

Rhondda (David Alfred Thomas), 1st Viscount (1856–1918), senior partner in the firm of Thomas and Davey, coal sale agents; was M.P. (1888–1916), in latter year cr. 1st Baron; president Local Government Board (1916–17); subsequently food controller; managing director of the Cambrian Combine and other colliery companies in S. Wales; created 1st Viscount (1918); succeeded in the title and directorships by his daughter, Margaret Haig Mackworth (1883–).

Rhône, dep., S.E. France (45° 40′ N., 4° 35′ E.), on r. bk. of Middle Rhone and Lower Saône, and embracing old provinces of Lyonnais and Beaujolais; cap. Lyons; silk and textile industries; wines, copper, coal, manganese, iron-smelting, glass, etc. Area, 1,104 sq. m.; pop. 915,600.

Rhone, riv., France, swiftest and second longest, rises on W. slopes of Mt. St. Gothard, Swiss Alps (46° 33′ N., 8° 25′ E.), flows into and through Lake Geneva, westward to Lyons, where it is joined by the Saône, then S. to Mediterranean, discharging by La Camargue delta into Gulf of Lions; chief tributaries, Ain, Saône, Arve, Isère, Drôme, Durance; fierce current prevents navigation above Lyons; canals connect Rhone with Loire, Seine, and Rhine; length, 500 m., of which 45 are in Lake Geneva.

Rhopalocera. See under Lepidoptera.

Rhubarb, any one of several plants of the genus *Rheum*, the *R. rhaponticum* and *R. undulatum* being grown extensively in Britain, U.S., and other temperate countries; their leaf-stalks, boiled with sugar, being a favourite article of food. The *R. officinale* and *R. palmatum* are grown chiefly in N. China, but also to a small extent in Europe, their roots being dried and employed as a drug, used, in small doses, from ½ to 2 grs., as an astringent tonic, and in larger doses, 15 to 30 grs., as a purgative. *Gregory's powder*, composed of rhubarb, magnesia, and ginger (dose, 20 to 60 grs.), is a popular and valuable means of administering the drug.

Rhyl, wat.-pl., Flintshire, Wales (53° 19′ N., 3° 29′ W.), near mouth of Clwyd; remains of submerged forest at Prestatyn, 3 m. E. Pop. 9,000.

Rhyme, the recurrence of similar sounds at intervals not too great to be perceived by the ear. Rhyme as a poetical device was not used by the ancients. Only when the quantitative system had grown corrupt in mediæval times did rhyme come into prominence. Rhyme usually denotes a correspondence in the final syllables of words at the ends of lines, and in English the vowel sounds and following consonantal sounds of a perfect rhyme must be the same, but the preceding consonantal sound must be different—*e.g.*, love, dove; bare, fair. For *false rhyme*, see ASSONANCE. See also POETRY.

Rhymney, tn., Monmouthshire, England (51° 44′ N., 3° 16′ W.); ironworks, collieries. Pop. 11,500.

Rhynchoflagellata. See under CYSTOFLAGELLATA.

Rhynchophorous Beetles (Rhynchophora), a sub-order of beetles with head prolonged into a snout or rostrum. Those most familiar are the weevils (Curculionidæ), the 20,000 species of which occur all over the world. Both larvæ and adults are vegetarian, but many are exceedingly destructive to plants. The ambrosia and elm beetles (Scolytidæ) are wood- and bark-borers, the former living gregariously in a burrow and feeding on fungi growing therein.

Rhynchops, skimmer. See under GULL FAMILY.

Rhyolite, LIPARITE, or QUARTZ-TRACHYTE, group of volcanic rocks, widely distributed and resembling granite in chemical composition; highly acidic; occurs mostly in lava flows, especially in Lipari Islands (whence name *Liparite*); with exception of dacites, the only lavas containing free primary quartz. They contain orthoclase, plagioclase, felspar, and biotite.

Rhys, SIR JOHN (1840–1915), Welsh philologist; first prof. of Celtic in Oxford Univ. (1877); from 1895 till his death he was principal of Jesus Coll., Oxford; knighted (1907); P.C. (1911). His works include *Lectures on Welsh Philology* (1877), *Celtic Britain* (3rd ed. 1904), *Studies in the Arthurian Legend* (1891), *Celtic Folk-lore, Welsh and Manx* (1901), *Celtic Inscriptions of France and Italy* (1906 and 1911).

Rhythm, a combination of movements or sounds halting and recurring at intervals on a more or less settled plan, producing that balance which is one of the main constituents of harmony. It applies to the world of motion and of sound that peculiar quality of harmonious order which in the visual world is called symmetry. Its three chief spheres are music, literature, and dancing. In all three it is notable that the modern tendency is to favour an irregular and apparently unsettled system of cadence rather than the staid and well-ordered rhythm of class. times.

Rhythm is fully as important an element in prose as it is in verse; it is more obvious in verse because it is aided by outward manifestations, but it is perhaps of even greater importance in prose, where, owing to the absence of formal restrictions, the danger of inharmonious lack of balance is all the greater. There is without doubt an unconscious use of rhythm as the vehicle of emotion,

especially in the impassioned prose of oratory.

Thomson, *The Basis of English Rhythm* (1904); Saintsbury, *History of Prose Rhythms* (1912).

Rhytina, Steller's sea-cow. See under SIRENIA.

Riazan. See RYAZAN.

Riazanoff, FEDOR, a Russian revolutionary; was early expelled from Petrograd Univ. and from Russia; knew Karl Marx in Germany, and is one of his greatest followers; shared Lenin's exile for some years, and on his rise to power became supreme head of the All-Russia Trade Unions. When Kameneff was requested to leave England (Sept. 1920) he became his successor as head of the Soviet trade delegation to this country.

R.I.B.A., Royal Institute of British Architects.

Ribble, riv., England; rises in Pennine chain, W. Yorkshire; flows S. past Settle and Gisburn to Lancashire; traces border 6 m., past Clitheroe; then S.W. past Preston (53° 46′ N., 2° 42′ W.), into Irish Sea; estuary 5½ m. wide between Southport and Lytham; length, 75 m.

Ribblesdale, THOMAS LISTER, 4TH BARON (1854–), former lord in waiting, and master of the buckhounds; married a sister of Mrs. Asquith (*d.* 1911); succeeded to peerage (1876); has written *The Queen's Hounds and Stag-hunting Recollections*, and has edited the letters of his son, Charles Lister (1917), killed in the Great War; married Mrs. J. J. Astor (1919). See *Autobiography of Margot Asquith* (1920).

Ribbon Fishes and **Oar Fishes** (Trachypteridæ), long, laterally compressed, fragile, bony fishes, with thin light bones and silvery skin. The oar fish or 'king of the herrings,' many specimens of which have been stranded on Brit. coasts, may be over 20 ft. long. They live in the open sea, but are seldom captured alive, and are supposed to be the original of the sea-serpent myth.

Ribchester, par. and small town, Lancashire, England (53° 49′ N., 2° 32′ W.), on the Ribble; Roman station. Pop. of par. 1,300.

Ribécourt, vil., Nord, France (49° 31′ N., 2° 56′ E.), on the Oise, 7 m. S.W. of Cambrai. Stormed in Byng's attack on Cambrai (Nov. 1917); lost during great Ger. offensive of March 1918; recovered by 3rd Division (Sept. 27, 1918).

Ribeira, tn., prov. Corunna, Spain (42° 52′ N., 8° 19′ W.), 64 m. S.S.W. of Corunna; its port is Santa Eugenia de Ribeira. Pop. 12,500.

Ribes. See CURRANTS.

Ribot, ALEXANDRE FÉLIX JOSEPH (1842–), Fr. statesman; admitted to bar (1864); elected member of Chamber of Deputies (1878); minister for foreign affairs in the Freycinet cabinet of 1890; concluded alliance between France and Russia; premier (1892, 1895, 1898, and again 1917); minister of finance (1914–17); strongly opposed policy of retaliation against religious orders, and acted as chairman of committee on secondary education; member of Fr. Academy. Has written *Réforme de l'Enseignement secondaire* (1900), *Discours Politiques* (1905).

Ribs. See SKELETON.

R.I.C., ROYAL IRISH CONSTABULARY.

Ricardo, DAVID (1772–1823), Eng. political economist, of Jewish origin; obtained practical knowledge of economics from early life as stockbroker, when he amassed large fortune; pub. *High Price of Bullion a Proof of the Depreciation of Banknotes*, first scientific treatise on currency (1810). He also published *Principles of Political Economy and Taxation* (1817), universally praised, though now to a large extent antiquated; most important feature, doctrine of nature of RENT; M.P. (1818–23).

Riccarton, par. and vil., Ayrshire, Scotland (55° 36′ N., 4° 29′ W.), containing greater part of Hurlford; vil. adjoins Kilmarnock; coal mining. Pop. 7,600.

Rice (*Oryza sativa*), the staple Asiatic cereal; grown in hot, damp plains, well irrigated; unhusked rice is known as *paddy*, and the areas under cultivation as 'paddy fields'; flower differs from that of most grasses in possessing six stamens. Principal rice-producing countries are India (78¾ million ac. under rice), China, Japan, Siam, Natal, Madagascar, Ceylon, U.S.

Rice, ALICE HEGAN (1870–), Amer. author; helped to organize the Cabbage Patch Settlement in the factory dist. of Louisville, Kentucky. Her writings include *Mrs. Wiggs of the Cabbage Patch*, *Lovey Mary*, *The Romance of Billygoat Hill*, and *Mr. Opp.* Several of her books have been trans. into German, French, Danish, Swedish, and Japanese, and some have been dramatized.

Rice Bunting. See BOBOLINK.

Richard I., CŒUR-DE-LION (1157–99), King of England; third son of Henry II.; Duke of Aquitaine (1168); succeeded to Eng. throne (1189); raised money for Crusade; prominent in capture of Acre (1191); defeated Saladin at Arsuf (1191); on way home, captured and imprisoned by Leopold of Austria; handed over to Emperor Henry VI., who released him for ransom; on return to England (1194) crushed brother John's intrigues against him; subsequently returned to Fr. dominions; killed during siege of castle of Châlus.

Archer, *Crusade of Richard I.*

Richard II. (1367–1400), King of England; son of Black Prince; succeeded 1377; met rebels under Wat Tyler at Mile End and Smithfield (1381) and ended their insurrection; deprived of absolute power by Lords Appellant (1388); concluded peace with France (1396); revenged himself on Lords Appellant (1397–98), sentencing them to death or exile; captured and deposed by cousin, Henry of Bolingbroke (afterwards Henry IV.) (1399); subsequently imprisoned in Pontefract Castle, where he is supposed to have been murdered.

Richard III. (1452–85), King of England; son of Richard, Duke of York; distinguished at battles of Barnet and Tewkesbury; crowned in 1483; shortly afterwards his nephews, Edward V. and his brother, were murdered in Tower by his orders; suppressed Buckingham's insurrection which ensued; defeated and killed at Bosworth by Henry of Richmond (afterwards Henry VII.) (1485).

Richardson, SAMUEL (1689–1761), Eng. novelist; *b.* Derbyshire; son of a joiner; after apprenticeship as printer, entered into business, became printer of House of Commons Journals, and King's Printer; was made master of the Stationers' Company. Richardson began to write novels when advanced in years; was approached with a view to publishing a 'model' letter-writer; this suggestion was the origin of his first novel, *Pamela,* which was pub. in 1740. It was intended as a 'moral' novel, and therefore met with much ridicule, but was original and full of life. *Pamela* was followed by *Clarissa Harlowe,* a somewhat tedious seven-vol. novel, written in 1747–8, and *Sir Charles Grandison* (1753).

Richardson's chief importance lies in his introduction of the analysis of human emotion into novel-writing; he had great influence on the Continent, being the inspirer of Diderot and Rousseau among others; and more important, but for his *Pamela* Fielding might never have been induced to become a novel writer.

Richborough, port, Sandwich, Kent, England (51° 17′ N., 1° 22′ E.); erected (1916) during Great War as base for cross-Channel barge service to Calais and Dunkirk; area, 2,200 acres. From Dec. 1916 to Nov. 1918, 9,654 barges were loaded and 1,257,545 tons war material carried to France for the British army. After Armistice depot was chiefly concerned with salvage operations. Government was severely criticized for enormous expenditure in connection with erection of this port. It was offered for sale (1920).

Richebourg-l'Avoué, vil., Pas-de-Calais, France (50° 34′ N., 2° 40′ E.), 7½ m. N.E. of Béthune; Indians advanced from this vil. during battle of FESTUBERT. Adjoining is Richebourg-St. Vaast.

Richelieu, ARMAND JEAN DU PLESSIS DE (1585–1642), Fr. statesman; Bishop of Luçon (1607); representative of clergy in States-General (1614); secretary of war and foreign affairs (1616); assisted Marie de' Medici in recovery of power (1620); cardinal (1622); minister of state (1624–42). Richelieu laid foundations of France's pre-eminence; won permanent power over king on 'Day of Dupes' (1630); overrode opposition of Gaston d'Orléans, brother of Louis XIII., and secured supersession and exile of Marie de' Medici; made government strong by suppression of feudal nobility; captured Rochelle (1628) and destroyed political power of Huguenots, but granted them certain amount of religious toleration; initiated policy of opposition to Austria in Thirty Years' War, and so destroyed power of France's great rival; opposed Habsburgs in Netherlands and Piedmont, and aided revolt of Catalonia against Spain; outside the sphere of his foreign policy, which was successful but immensely expensive, it may be doubted if his rule was beneficial to France. Founded Fr. Academy. Lodge, *Life of Richelieu;* Hanotaux, *Histoire du Cardinal de Richelieu.*

Richepin, JEAN (1849–), Fr. poet, romancer, conférencier, dramatist; member of Fr. Acad-

emy; has produced literary work of remarkable brilliance and unconventionality, with a tendency towards morbidity in his earlier writings—*e.g.*, *La Chanson des Gueux* (1876), which led to his imprisonment for 'outrage aux mœurs.' Other works include *Les Caresses* (1877), *Les Blasphèmes* (1884), and such novels as *Les Morts Bizarres* (1876), *La Glu* (1881), and *Le Pavé* (1883). Some of his novels are distinguished for psychological analysis, *e.g.*, *Sophie Monnier* (1884), *Césarine* (1888), *L'Aimé* (1893), *Les Grandes Amoureuses* (1896). *Miarka* (1883), *Braves Gens* (1884), *Le Cadet* (1890), *Truandailles* (1890), *La Miseloque* (1892), and *Flamboche* (1895), are realistic transcripts from life. His best work is contained in his plays: *La Glu* (1883), *Nana Sahib* (1883), *Le Chien de Garde* (1889), *Monsieur Scapin* (1886), *Le Flibustier* (1888), *Par le Glaive* (1893), *Le Chemineau* (1897), *Les Truands* (1899), *La Belle-au-bois-dormant* (1907), *La Route d'Emeraude* (1908), *Le Tango* (1913), *Macbeth* (1914). In 1920 he pub. *L'Ame américaine à travers quelques-uns de ses interprètes.*

Richmond, tn., Yorkshire, England (54° 24′ N., 1° 45′ W.), on the Swale; ruined castle (1071); agricultural produce; gives title to Lennox family; was centre of great military camp (Catterick) during Great War. Pop. 3,900.

Richmond. (1) Cap., Virginia, U.S. (37° 32′ N., 77° 26′ W.), on James R., with falls; connected by bridge with Manchester, and in direct steamer communication with New York, Philadelphia, etc.; public buildings include city hall, state library, St. Paul's Church, Bell House and the Capitol in splendid Capitol Square, which has statues of Washington, Jefferson Davis, and many others; Jefferson Davis's house also shown; Richmond Coll., a woman's coll., and a negro univ., among its educational institutions; R.C. cathedral; leading industry tobacco production; other items, lumber and planing mill goods, foundry and machine shop products, packing-boxes, carriages, and wagons. Captain John Smith's settlements, 'None Such' (1609) and Fort Charles (1645), both near site of present city; made cap. in 1779; in war of revolution taken by British (1781); cap. of Confederacy in Civil War, evacuated in 1865. Pop. 127,600. (2) Cap. Wayne co., Indiana, U.S. (39° 49′ N., 84° 52′ W.); 'Quaker City of the West'; agricultural machinery, etc. Pop. 22,300.

Richmond, Sir William Blake (1842–), Brit. painter; R.A. (1895); succeeded Ruskin as Slade prof. at Oxford (1878); president of Soc. of Miniature Painters (1899); entrusted with interior decoration of St. Paul's; wages incessant war against the smoke nuisance; wrote novel, *The Silver Chain* (1917).

Richter, Hans (1843–1916), Hungarian musical conductor; became Wagner's chief assistant (1866); conducted at Munich, Budapest, and Vienna; from 1879 up to the Great War held annual series of orchestral concerts in London; in 1900 conducted Hallé concerts in Manchester; his prodigious memory enabled him to conduct largest