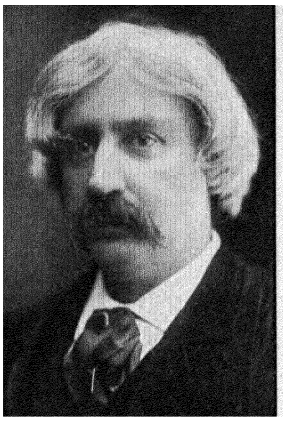
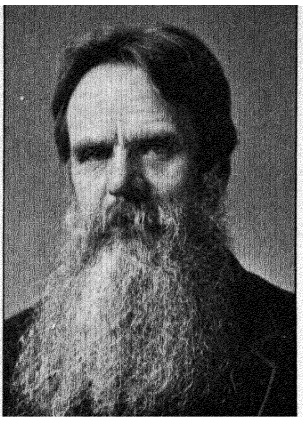
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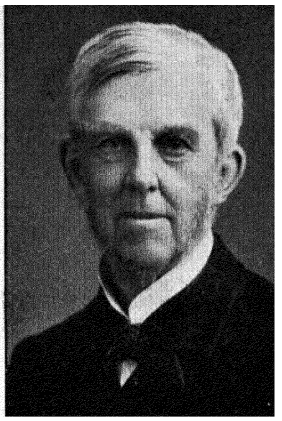
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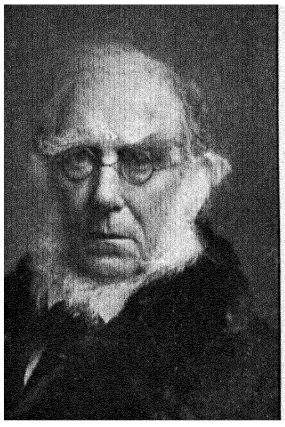
Bret Harte



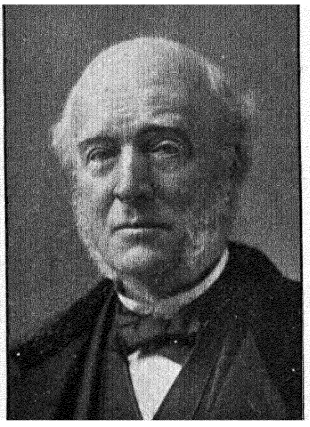
Holman Hunt



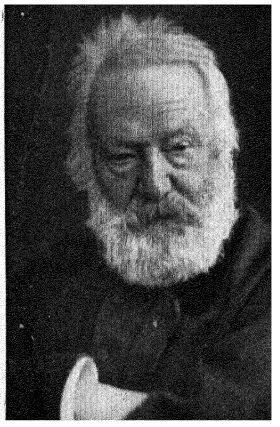
Oliver Wendell Holmes



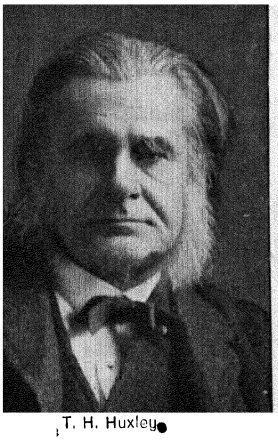
Sir J. D. Hooker



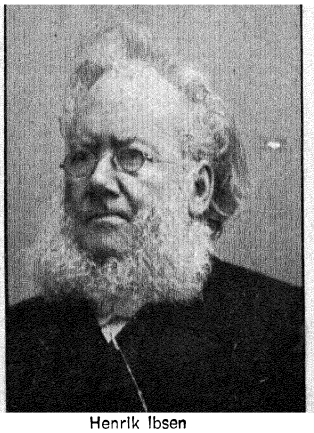
Thomas Hughes



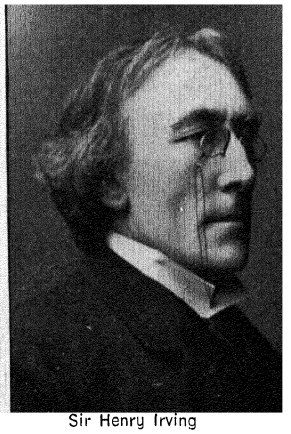
Victor Hugo



T. H. Huxley



Henrik Ibsen



Sir Henry Irving

The portraits are from photographs by Messrs. Elliott & Fry, with the exception of Bret Harte (H. S. Mendelssohn), Victor Hugo (Nadar, Paris), Ibsen (Nyblin, Christiania), and Sir Henry Irving (Window & Grove).

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MANY SPECIALISTS

IN

THE VARIOUS BRANCHES OF HUMAN KNOWLEDGE

Volume VII

THE GRESHAM PUBLISHING COMPANY

LONDON AND GLASGOW

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KEY: ā as in fate or in fare, a as in far (sometimes short, sometimes long), a as in fat, ą as in fall; ē as in me, e as in met, ė as in her; ī as in pine, i as in pin; ō as in note, o as in not, ò as in move; ū as in tube, u as in tub, ų as in bull, ü, the French u (sometimes short, sometimes long); ou as in pound; ch as in chain; *h* as in Scotch loch, German nach; ṅ as in French ton; th as in thin; *th* as in this; w and y always consonants; zh as z in azure or j in French jaune.

H

Harfleur, ärˊflêr
Hargreaves, härˊgrēvz
Haring, hāˊring
Harlri, hä-rēˊrē
Harlaw, härˊlą
Harlebeke, harˊle-bāˊke
Harley, harˊli
Harlingen, härˊling-en
Harmonia, här-mōˊni-a
Harmonica, här-monˊi-ka
Harmotome, härˊmo-tōm
Harpocrates, har-pokˊra-tēz
Harpsichord, harpˊsi-kord
Harrogate, haˊro-gāt
Hartebeest, härˊtē-bāst
Harlepool, härtˊl-pol
Hartmann von Aue, hartˊ-mänˊfon-ouˊė
Harun al Rashid, ha-ronˊ ál rä-shēdˊ
Harwich, haˊrich
Harz, härts
Hasdrubal, hasˊdrų-bal
Haslingden, hazˊling-den
Hastings, hāsˊtingz
Hatzfeld, hatsˊfelt
Hauff, houf
Hauser, houˊzêr
Hautboy, ōˊboi
Hautelisse, ōtˊlis
Hauy, ä-ü-ē
Hauyne, haˊų-in
Havana, ha-vanˊa
Havel, häˊvel
Havelock, havˊlok
Havre, ä-vr
Hawaii, ha-wīˊē
Hawarden, hąrˊden
Hawick, hąˊik
Hawke, hąk
Hawkesworth, hąksˊwėrth
Haydn, hīˊdn
Haynau, hīˊnou
Hayti, hāˊtē
Hazarîbagh, ha-zar-ē-bägˊ
Hazebrouck, āz-bruk
Hearne, hėrn
Hebe, hēˊbē
Heber, hēˊbėr
Hébert, ā-bār
Hebrides, hebˊri-dēz
Hebron, hēˊbron
Hecatæus, hek-a-tēˊus
Hecate, hekˊa-tē
Hecuba, hekˊū-ba
Hedera, hedˊe-ra
Hedysarum, he-disˊa-rum
Heem, hām
Heemskerk, hāmzˊkerk
Heeren, hāˊrėn
Hegel, hāˊgl
Hegira, hejˊi-ra
Heide, hīˊdė
Heidelberg, hīˊdl-bėr*h*
Heidenheim, hīˊdn-hīm
Heilbronn, hilˊbron
Heiligenstadt, hīˊli-gen-stät
Heilsberg, hīlzˊber*h*
Hein, hīn
Heine, hīˊnė
Heinrich, hīnˊri*h*
Hejaz, hej-azˊ
Heldenbuch, helˊden-bu*h*
Helena (personal name), heˊle-na
Helena (Island), he-lēˊna
Helenus, helˊe-nus
Heliacal, he-līˊa-kal
Helicidæ, he-lisˊi-dē
Heliers (St.), helˊyėrz
Heliodorus, hē-li-o-dōˊrus
Heliogabalus, hē-li-o-gabˊa-lus
Heliopolis, hē-li-opˊo-lis
Helios, hēˊli-os
Heliotrope, hēˊli-o-trōp
Helle, helˊle
Hellebore, helˊe-bōr
Hellevoetsluis, helˊvụt-slois
Helmstedt, helmˊstet
Helmund, helˊmund
Heloise, el-o-ēz
Helvellyn, hel-velˊin
Helvetii, hel-vēˊshi-ī
Helvétius, el-vā-si-ùs
Helvoetsluis, helˊvụt-slois
Hemans, hēˊmanz
Hemimetabola, he-mi-me-tabˊo-la
Hemiptera, he-mipˊte-ra
Hemorrhoids, hemˊ-o roidz
Hemsterhuis, hemˊster-hois
Henequen, en-e-kenˊ
Hengist, henˊgist
Hengstenberg, henˊg'sten-ber*h*
Hennebont, en-bo*h*
Hennegau, henˊe-gou
Hennepin, en-pa*h*
Hepaticæ, he-patˊi-sē
Hepatitis, hep-a-tīˊtis
Hephæstion, he-fēsˊti-on
Hephæstus, he-fēsˊtus
Heppenheim, hepˊen-hīm
Heracles, heˊra-klēz
Heracleum, he-ra-klēˊum
Heraclidæ, he-ra-klīˊdē
Heraclitus, he-ra-klīˊtus
Heraclius, he-ra-klīˊus
Herat, he-ratˊ
Hérault, ā-rō
Hérault de Séchelles, ā-rō dė sā-shel
Herbelot, erb-lō
Herculaneum, her-kū-lāˊnē-um
Hercules, herˊkū-lēz
Hereford, heˊre-ford
Heriot, heˊri-ot
Herisau, hāˊrē-zou
Hermandad, er-män-dädˊ
Hermannstadt, herˊman-stat
Hermaphrodite, her-mafˊro-dīt
Hermes, herˊmēz
Hermosillo, her-mō-sēlˊyō
Hernósand, herˊnė-sän
Herod Antipas, heˊrod anˊti-pas
Hérodes atticus, he-rōˊdēz atˊti-kus
Herodian, he-rōˊdi-an
Herodotus, he-rodˊo-tus
Hérold, ā-rold
Herrera, er-rāˊra
Herschel, herˊshel
Hersfeld, hersˊfelt
Herzegovina, hert-se-go-vēˊnä
Herzen, hertˊsen
Herzog, härˊtzō*h*
Hesiod, hēˊzi-od
Hesperides, hes-perˊi-dēz
Hesperus, hesˊpe-rus
Hesse, hes
Hesychasts, hesˊi-kasts
Hesychius, he-sikˊi-us
Hetæra, he-tēˊra
Heuglin, hoigˊlin
Heves, hevˊesh
Hexapla, heksˊa-pla
Hexham, heksˊam
Heyne, hīˊnė
Heyse, hīˊzė
Hickes, hiks
Hidalgo, ē-dälˊgō
Hierapolis, hī-er-apˊo-lis
Hiero, hīˊė-rō
Hieronymus, hī-e-ronˊi-mus
Hilarion, hi-lāˊri-on
Hilary, hilˊa-ri
Hildburghausen, hiltˊbụr*h*-hou-zn
Hildesheim, hilˊdes-hīm
Himalaya, hi-maˊla-ya
Himera, himˊe-ra
Hindley, hīndˊli
Hiogo, hi-ōˊgō
Hipparchus, hīp-pärˊkus
Hipparion, hip-pāˊri-on
Hippocrates, hip-pokˊra-tēz
Hippocrene, hip-po-krēˊnē
Hippodamia, hip-po-da-mīˊa
Hippolytus, hip-polˊi-tus
Hippomane, hip-pomˊan-ē
Hipponax, hip-pōˊnax
Hipponous, hip-ponˊo-us
Hippurites, hip-pū-rīˊtēz
Hirschberg, hirshˊber*h*
Hispaniola, his-pa-ni-ōˊla
Hissar, his-särˊ
Hitopadesa, hit-ō-pa-dāˊsha
Hivaoa, hī-va-ōˊa
Hoadly, hōdˊli
Hobart, hōˊbärt
Hobbema, hobˊbe-ma
Hobbes, hobz
Hoboken, hōˊbo-ken or hō-boˊken
Hoche, ōsh
Hochheim, hō*h*ˊhīm
Hochkirch, hō*h*ˊkir*h*
Hochstadt, hė*h*ˊstet
Hoeven, hoˊvn
Hof, hōf
Hogarth, hogˊarth
Hohenlinden, hō-en-lìnˊden
Hohenlohe, hōˊen-lō-ė
Hohenstaufen, hōˊen-stou-fn
Hohenstein, hōˊen-stīn
Hohenzollern, hō-en-tsolˊėrn
Hokitika, ho-ki-tēˊka
Holbach, holˊbä*h*
Holbein, holˊbīn
Holborn, hōˊborn
Holinshed, holˊin-shed
Holles, holz
Holmes, hōmz
Holoptychius, ho-lop-tikˊi-us
Holstein, holˊstīn
Homœopathy, ho-mē-opˊa-thi
Homburg-vor-der-Hohe, homˊbụr*h*-fōr-dėr-hė-e
Homoousian, hō-mō-ouˊzi-an
Honan, hō-nänˊ
Honawar, ho-na-wärˊ
Honduras, hon-dōˊras
Honfleur, oṅ-flêr
Honiton, honˊi-tun
Hontheim, honˊtīm
Hooch, hō*h*
Hooft, hōft
Hoogeveen, hōˊgė-vān
Hoorn, hörn
Horæ, hōˊrē
Horatii, hō-rāˊshi-ī
Horatius Cocles, hō-rāˊshus kokˊlēz
Horatius Flaccus, hō-rāˊshus flakˊkus
Horde, hėrˊdė
Hordeolum, hor-dēˊo-lum
Horgen, horˊgen
Hornblende, horn'blend
Horsham, hōrˊsam
Horsley, horsˊli
Hosea, hōˊsē-a
Houghton, hōˊtun
Hounslow, houn'slō
Houpe, hōˊpe
Houris, houˊriz, hōˊriz
Houssa, houˊsa
Houston, houˊstun or hōsˊtun
Hoveden, hōvˊden
Howe, hou
Howells, houˊelz
Howrah, houˊrą
Howth, hōth
Hoxter, hėksˊtėr
Hubli, hoˊblē
Huc, uk
Huddersfield, hudˊėrz-fēld
Huelva, ų-elˊvą
Huesca, ų-esˊkä
Huet, u-ā
Hughes, hūz
Hugli, hogˊli
Hugo, ü-gō
Huguenots, hūˊge-nots
Hulsean, hul-sēˊan
Humbert, humˊbert
Humboldt, humˊbolt
Humerus, hūˊme-rus
Hungary, hungˊga-ri
Huningen, hųˊning-en
Hunstanton, hunˊstan-tun
Hurdwar, hurd-wärˊ
Hus, hos
Husch, hosh
Husum, hōˊzụm
Huy, wē
Huygens, hoiˊgens
Huysum, hoiˊsụm
Hyades, hīˊa-dēz
Hydatid, hidˊa-tid
Hyderabad, hī-dėr-ä-bädˊ
Hydrangea, hī-dranˊjē-a
Hydrocele, hīˊdro-sēl
Hydrothorax, hi-drō-thōˊraks
Hydrozoa, hī-dro-zōˊa
Hyères, ē-ār
Hygieia, hī-ji-ēˊya
Hygiene, hīˊji-ēn
Hylæosaurus, hī-lē-o-sąˊrus
Hymettus, hi-metˊus
Hyperbola, hī-pėrˊbo-la
Hyperbole, hi-pėrˊbo-lē
Hyperboreans, hī-pėr-bōˊrē-anz
Hyperides, hī-pėr-īˊdēz
Hyperion, hī-pėrˊī-on or hī-pēˊri-on
Hypersthene, hī-pėrsˊthēn

Hypochondriasis, hip-o-kon-drī'a-sis
Hypothec, hī-poth'ek
Hypsipyle, hip-sip'i-lē
Hyracotherium, hī-ra-kō-thē'ri-um
Hyrcanus, hir-kā'nus
Hythe, hith

I

Iamblichus, ī-am'bli-kus
Ianthina, i-an'thi-na
Ibadan, ib-ä-dän'
Ibague, ē-ba-gä'
Iberis, i-bē'ris
Ibicui, ib'i-kwi
Ibycus, ib'i-kus
Ica, ē'kä
Iceni, ī-sē'nī
Ich Dien, ēh dēn
Ichthyopsida, ik-thi-op'si-da
Ichthyornis, ik-thi-or'nis
Ichthyosis, ik-thi-ō'sis
Ichthys, ik'this
Icica, ī'si-ka
Icolmkill, ī-kōm-kil'
Ictinus, ik-tī'nus
Idaho, ī'da-hō
Iddesleigh, idz'li
Ideler, ē'dē-ler
Idocrase, ī'dō-krās
Idomeneus, ī-dom'en-ūs
Ielsk, yisk,
Iesi, yä'sē
Iglau, ē'glou
Iglo, ig-lō'
Igualada, ē-gwä-lä'dä
Iguana, i-gwä'na
Ihlang-ihlang, ē'lang-ē'lang
Ihre, ē're
Ile-de-France, ēl-dē-fräns
Ilfracombe, il'fra-kom
Ilithyia, ī-li-thī'a
Ilkeston, ilks'tun
Illampu, ēl-yäm-pö'
Illapel, ēl-yä-pel'
Ille-et-Vilaine, ēl-e-vi-lān
Illimani, ēl-yi-mä'nē
Illinois, il'i-noi or -nois
Illuminati, il-lo-mi-nä'ti
Ilmenau, il'men-ou
Ilorin, il-o-rēn'
Imam, i-mäm'
Imaus, i-mā'us
Impetigo, im-pe-tī'gō
Imprimatur, im-pri-mā'tur
Inachus, in'a-kus
Inagua, in-a'gua
Inaja, in-a-jä'
Inchbald, insh'bald
Inchcolm, insh-kōm'
Inchkeith, insh-kēth'
In Cœna Domini, in sē'na dom'i-nī
Incubus, in'kū-bus
Incunabula, in-kū-nab'ū-la
Indictment, in-dīt'ment
Indigirka, in-di-gir'kä
Indre, ańdr
Indre-et-Loire, ańdr-e-lwär
Infante, in-fan'tā
Ingelow, in'je-lō
Ingemann, ing'e-män
Inglis, ing'glz
Ingolstadt, ing'ol-stät
Ingres, ań-gr
Inhambane, in-yäm-bä'ne
Innsbruck, inz'bruk
Inowrazlaw, ē-nov-räts'läv
Insectivora, in-sek-tiv'o-ra
Insessores, in-ses-sō'rēz
Intaglio, in-tal'yō
Intermezzo, in-tėr-met'sō
Invalides, ań-vä-lēd
Inveraray, in-vėr-ā'ri
Invercargill, in-vėr-kär-gil'
Inverkeithing, in-vėr-kē'thing
Iodoform, ī-od'o-form
Iophon, ī'o-fon
Iowa, ī'o-wa
Ipecacuanha, ip-e-kak-ū-an'a
Iphicrates, if-ik'ra-tēz
Iphigenia, if-i-jen-ī'a
Ipsamboul, ip-sam'böl
Ipswich, ip'sich
Iquique, i-kē'kā
Irade, i-rä'de
Irak Ajemi, ir'ak aj'e-mi
Irenæus, ī-re-nē'us
Irene, ī-rē'nē
Iriartea, ir-i-är-tē'a
Iridaceæ, ī-ri-dā'sē-ē
Iridosmine, ī-ri-dos'min
Iritis, ī-rī'tis
Iroquois, i'ro-kwoi
Irrawadi, ir-rä-wä'di
Irvine, ėr'vin
Isæus, ī-sē'us
Isaiah, ī-zā'ya
Isar, ē'zär
Ischia, is'ki-ä
Ischium, is'ki-um
Ischl, ē'shl
Iseo, ē-sā'ō
Isère, ē-sär
Iserlohn, ē'zėr-lōn
Isis, ī'sis
Islam, is-läm'
Islay (Peru), is'lī
Islay (Scotland), ī'lā
Islington, is'ling-tun
Ismailia, is-mā-ē'lē-a
Isochronism, i-sok'ron-izm
Isocrates, ī-sok'ra-tēz
Isomerism, ī-som'ėr-izm
Isonandra, ī-so-nan'dra
Isopoda, ī-sop'o-da
Ispahan, is-pa-han'
Issoire, is-wär
Issoudun, is-ó-dūń
Ithaca, ith'a-ka
Iturræa, it-ū-rē'a
Iturbide, ē-tụr'bē-dā
Itzehoe, it'se-hō
Iviça, ē'vi-sá
Ivrea, iv-rā'á
Ivry-la-Bataille, ēv-rē-lä-bä-tä-yė
Ivry-sur-Seine, ēv-rē-sür-sen
Ixion, ik-si'on
Ixodes, ik-sō'dēz
Iynx, ī'ingks
Izucar, i-zụ-kär'

J

Jabalpur, ja-bal-pör'
Jabiru, jab'i-ro
Jacamar, jak-a-mär'
Jacana, jak'a-na
Jacare, jak'a-rā
Jacitara, ja-si-ta'rä
Jacobabad, ja-kob-ä-bäd'
Jacobean, ja-ko-bē'an or ja-cō'bē-an
Jacobi, yä-kō'bē
Jacobs (German), yäk'ops
Jacquard, zhak-är
Jacquerie, zhäk-rē
Jade, Jahde, yä'dė
Jaen, *hä*-en'
Jagannâtha, jag-an-nät'ha
Jagerndorf, yä'gėrn-dorf
Jaghire, jag'hēr
Jaguar, ja-gwär'
Jaisalmer, jā-sal-mēr'
Jalandhar, jal-an-dhar'
Jalapa, *hä*-la'pa
Jalaun, ja-la'un
Jalesar, ja-lā'sär
Jalisco, *hä*-lis'kō
Jalpaiguri, jal-pī-gụ-rē'
Jamalpur, ja-mal-por'
Jamuna, ja-mu-na'
Janin, zhä-nań
Janina, Joannina, yän'i-nä, yo-än'i-nä

HARE, JULIUS CHARLES, an able writer on subjects connected with theology, was born on Sept. 13, 1795, near Vicenza, Italy, and came to his parents' home at Hurstmonceaux, in Sussex, when four years old. He received his earlier education at Tunbridge School, and after a short stay in Germany he entered the Charterhouse, whence in 1812 he proceeded to Trinity College, Cambridge, where latterly he gained a fellowship. He studied law for a time, and in 1822 he became a classical lecturer at Trinity College. In 1832 he succeeded his uncle as rector of Hurstmonceaux, in 1840 was appointed Archdeacon of Lewes, in 1851 obtained a prebend in Chichester Cathedral, and in 1853 became one of her majesty's chaplains. In 1820 he published a translation of Fouqué's Sintram, and in 1827 he joined with his brother, Augustus William Hare, in publishing the well-known Guesses at Truth by Two Brothers. In concert with Thirlwall he translated Niebuhr's history (1828–32), and in 1829 published a vindication of that work from the charges of the Quarterly Review. His subsequent writings consist chiefly of tracts of a controversial character; charges delivered by him as archdeacon; several volumes of sermons, including those entitled The Victory of Faith (1840), preached before the University of Cambridge; a Memoir of John Sterling (1848), prefixed to a collection of his writings; and a Vindication of Luther against his Recent English Assailants (1855). He died at Hurstmonceaux on 23rd January, 1855. In 1856 his friend and brother-in-law, F. D. Maurice, edited a collection of his charges. — AUGUSTUS WILLIAM HARE, born in 1792, was educated at Winchester, and New College, Oxford, entered the church, held a small living in Wiltshire, and died in 1834. Besides his share in Guesses at Truth, he wrote a number of sermons.—AUGUSTUS JOHN CUTHBERT HARE (born 1834, died 1903), nephew of the brothers, travelled much in Europe, and wrote works on Italy, France, Spain, &c., tourists' handbooks, biographical works, a voluminous autobiography, &c.

HAREBELL, the Scotch BLUEBELL (*Campanula rotundifolia*), a plant common on dry and hilly pastures, &c., in Britain and most districts of Europe, with a beautiful bell-shaped blue (sometimes white) flower. The radical leaves are cordate or reniform, and die off early in the year; the stem leaves are linear, and form the most conspicuous part of the foliage. The stem is slender, from 6 to 14 inches high, and bears sometimes a single flower, but more commonly more than one, arranged in a very loose raceme. The whole plant has a very graceful and delicate appearance, and the flowers are among the finest floral ornaments of the summer months. The juice of the flowers may be used as blue ink, and when mixed with alum as a green one. The roots are edible.

HARELIP, a congenital deformity characterized by a single or double fissure of the upper lip, by which it is divided into two or three parts, and is thus made to resemble the lip of the hare. The fissure is sometimes confined to the lip, but sometimes extends to the gums and palate, producing the deformity known as *cleft-palate*. In its extreme form it presents two fissures traversing the whole length of the palate, the nostrils opening into the cavity of the mouth, a central slip of bone with the incisors in front being left. It produces great difficulty in speech, which is usually marred by a nasal twang, and besides keeping the mouth open and thus suffering the saliva to escape, it is a dreadful deformity in appearance. Simple harelip can be completely remedied by an operation, which should be performed before teething. The operation for cleft-palate is much more difficult, and need not be performed so soon. It should not, however, be delayed till the acquirement of the twang. In more serious cases of the latter deformity, when closure by operation is impossible, the opening may be covered by a special plate.

HAREM (Arabic, 'prohibited'), among Mussulmans, the women's apartments, which are forbidden to every man except the husband and near relations; and the term is also used to designate the women of the family collectively. The ladies of the harem are served by female slaves, and in the larger establishments guarded by black eunuchs. The head of the latter in the harem of the sultan is called *kizlar-aga*. The women of the imperial harem are all slaves, generally Circassians or Georgians. Their number depends solely on the pleasure of the sultan, but is very considerable. Seven of them are wives, and have splendid appointments. All those who bear children take the name of *khassekis*. The one who first presents him with a male heir is styled the *sultana* by way of eminence. If her son ascends the throne she has the title of *sultana valide*. She is the only woman who is allowed to appear without a veil; none of the others, even when sick, are permitted to lay aside the veil in the presence of anyone except the sultan. The life of the ladies of the imperial harem is spent in bathing, dressing, sewing, embroidering, walking in the gardens, witnessing the voluptuous dances performed by their slaves, &c. The women of other Turks enjoy the society of their friends at the baths or each other's houses, appear in public accompanied by slaves and eunuchs, and enjoy a degree of liberty which increases as they descend in rank. Many of the great ladies take the liberty of appearing in public without the attendance of any eunuchs, and under the protection of their veil and a kind of cloak, by which they are fully disguised, are able to carry on intrigues without fear of detection. But

the women of the sultan's harem have none of these privileges. When transferred to the summer residences on the Bosporus they are removed at break of day, passing from the garden to the boats between two screens, while the eunuchs for a considerable distance round warn every one off on pain of death. Each boat has a cabin covered with cloth, and the eunuchs keep the boatmen or *bostandjis* at a distance. It is of course only the richer Moslems who can maintain harems; the poorer classes have generally but one wife.

HARFLEUR, a town, France, in the department of Seine-Inférieure, on the Lézarde, which is here crossed by two bridges, and falls a little below into the estuary of the Seine. It is 6 miles east of Havre. It was long the chief port of the mouth of the Seine, but in consequence of the silting up of the river it is now accessible to barges only, and has lost almost all its trade. Its only building of note is a Gothic church, surmounted by a beautiful spire, and attributed to Henry V. of England. It was once strongly fortified, and well-preserved works dating from the fourteenth century still remain. It was taken by the English in 1415 and 1440, and lost by them in 1433 and 1450. Opposite Harfleur, and due south, lies Honfleur. Pop. (1896), 2265; (1901), 2686.

HARGREAVES, James, an English inventor, author of two important improvements in the art of cotton-spinning, was born at Stanhill, near Blackburn, it is not known at what date. In 1760 he invented a machine consisting of a revolving cylinder with cards or combs set round it as a substitute for the hand-cards formerly in use in combing out cotton. Some years after this he invented the spinning-jenny, by which he was able to spin with several (in the one first constructed eight) spindles at once. He had frequently, before that invention, attempted to spin with more than one spindle, but never succeeded as long as the spindles revolved in a horizontal position, and the improvement which he introduced into the spinning-jenny which enabled him to effect what he aimed at consisted in substituting for the vertical spinning-wheel and horizontally revolving spindles of the old apparatus a horizontal spinning-wheel and vertically revolving spindles. With his new machines he succeeded in turning out a much greater amount of yarn than his neighbours, which excited their jealousy, and caused them to suspect the cause. They accordingly broke into his dwelling, and destroyed his machine. In consequence of the repetition of this kind of persecution Hargreaves removed in 1768 to Nottingham, and in 1770 obtained a patent for his invention. Here, however, he reaped scarcely any more benefit from it than he had done in his native place. After refusing £3000 offered him by a private company for his patent, this was after all declared invalid on the ground that he had sold several of the machines before taking out the patent. For the rest of his life he carried on business as a manufacturer in partnership with Mr. James. He died in April, 1778. The only public recognition which this invention ever obtained was in the form of a bounty of £250 granted by Sir Robert Peel, nearly seventy years after Hargreave's death, to his last surviving daughter.

HARIOT, or Heriot, in law, a due belonging to a lord at the death of his tenant, consisting of the best beast, either horse, ox, or cow, which he had at the time of his death; and in some manors the best goods, piece of plate, &c., are called hariots. See Copyhold.

HARÎRĮ, Abu Mohammed Al Kasim Ibn Ali, Al, a celebrated Arabic scholar and poet, who lived chiefly at Bassorah in the time of the Abbasside caliphs, born in the year of the Hegira 446 (A.D. 1054); died 515 or 510 (1121 or 1116). The surname Al Harîri signifies the silk merchant. He is the author of several valuable works, but he is best known by his Arabic grammar, written in verse, entitled Molhat el Irab, and above all by his Mekâmmât (Sittings), a collection of tales narrated as incidents in the life of the hero Abu Zeid, a clever impostor who adopts every career in life, and succeeds in all to admiration. As a preacher he draws tears from his audiences, as an advocate he dupes the judge, as a halt and blind beggar, a schoolmaster, improvvisatore, physician, in short, in all conceivable characters he manages to charm money out of the pockets of those with whom he has to do. The tales are narrated by one Hareth ben Hemmâm, who is an eye-witness of all the scenes which he describes, and in which Abu Zeid plays the principal part, but only recognizes the old impostor at the end of each adventure. Abu Zeid at last repents of his manner of life, and devotes himself to religious exercises. In carrying out this plan, which is borrowed from a previous Arabic writer, El Hamaclâni, Harîri exhibits the most astonishing mastery of the Arabic language, on which account his work is regarded as an admirable study for those who wish to obtain a thorough knowledge of that tongue. The style is in the highest degree artificial, the work being mostly written in a kind of rhythmical prose, the clauses of which contain numerous rhymes and assonances, and which is full of antitheses, proverbial phrases, and allusions to well-known legends and persons, as well as to passages in the Koran. It is rich also in subtle thoughts and sound maxims. An edition of the Mekâmmât was published at Paris, with a commentary by Silvestre de Sacy, in 1822 (republished in 1853). The first five tales had previously been published in Arabian and Latin by Albert Schultens, at Franeker in 1731, and again at Leyden in 1740. A free translation of the whole work into German has been made by Rückert, and was published at Stuttgart in 1826. There is an English translation, with introduction and notes, by T. Chenery, entitled The Assemblies of Al-Harîri (1867).

HARLAW, Battle of, in Scottish history, an important battle which delivered the Lowlands from a Highland invasion and the fear of Highland supremacy. It was fought on the 24th of July, 1411. The earldom of Ross had descended to an heiress, who retired from the world and took the veil. It was then claimed by Donald, lord of the Isles, who had married an aunt of the heiress; but as this acquisition, added to his other domains, would have rendered him lord of the half of Scotland, his claim was refused by the government. To enforce his claim Donald collected an army of Highlanders, it is said 10,000 in number, and marched across the Grampians to the Hill of Benachie, near the Don, in Aberdeenshire. On the Plain of Harlaw, which extends to the foot of this hill, he was met by a body of Lowlanders, consisting of the gentry and their tenants and the burghers of the cities, who had been hastily gathered together and placed under the command of the Earl of Mar. The battle was stubbornly fought throughout the day, with great fury on the side of the Highlanders and great steadfastness on that of the Lowlanders Donald was at last obliged to retreat. The importance which was attached by the Lowlanders to this victory is shown by the fact that the heirs of those that had fallen in the battle were exempted from the feudal taxes due to their superiors on succession to their estates or during their minority, as was done in the case of those who were slain in the battles with the English. This battle is the subject of a well-known ballad, the title of which is mentioned as early as 1548, in the Complaynt of Scotland and which is

said to have been printed in 1668, although no copy of it is known to exist of a date anterior to Ramsay's Evergreen (1724).

HARLEBEKE, or HARELBEKE, a town in Belgium, in West Flanders, on the Lys and the railway from Ghent to Courtrai, 3 miles north-east of Courtrai. It is said to be the oldest town in Flanders, was once strongly fortified, and has a beautiful parish church, and a pulpit regarded as a master-piece of carving. Pop. (1902), 7440.

HARLEIAN LIBRARY. See HARLEY.

HARLEM. See HAARLEM.

HARLEQUIN, in French *arlequin*, in Italian *arlecchino*, a word of doubtful origin, but probably from old French *Hellequin*, *Herlequin*, the name of a demon figuring in mediæval legends; this again is supposed to be of German origin, its elements corresponding to English *hell* and *kin*. Riccoboni conjectures (History of the Italian Theatre) that the dress of the harlequins is no other than the *centunculus* of the old Roman *mimi* or mimes, who were players in ridiculous pieces or farces of a loose character. In these a sort of pantaloon also played, and was the subject of beating and abuse. To the reasons adduced by Riccoboni we may add the ridiculous sword often carried by the ancient *mimi*, which, for the harlequin, has been converted into a lath. The Roman *sannio*, a kind of buffoon of whom Cicero (De Oratore, ii. 61) gives a description, to some extent also resembled the harlequin. The character of the ancient harlequin was a mixture of extravagant buffoonery with great bodily agility, so that his body seemed almost constantly in the air. He was impudent, droll, satirical, and low, and often indecent in his expressions. But in the middle of the sixteenth century his character was essentially changed. The modern harlequin laid aside the peculiarities of his predecessor. He became a simple, ignorant servant, who tries very hard to be witty, even at the expense of being malicious. He is a parasite, cowardly, yet faithful and active, but easily induced, by fear or interest, to commit all sorts of tricks and knaveries. He is a chameleon, who assumes all colours, and can be made, in the hands of a skilful actor, the principal character on the stage. He must excel in extempore sallies. The modern harlequin plays many droll tricks, which have been handed down from generation to generation for centuries. This account applies more particularly to the Italian harlequin. Italy, in fact, particularly in the *commedia dell'arte*, is his natural scene of action. The gallant, obsequious French harlequin is an entirely national mask. In the Vaudeville theatre he is silent, with a black half-mask, and reminds one throughout the representation of the grace and agility of the cat. The harlequin of Britain, in the Christmas pantomimes, has become a lover and a magician; and in exchange for the gift of language, of which he has been deprived, he has been invested with a wonder-working wand. With this wand he protects his mistress, the columbine, against the clown and pantaloon, who pursue and endeavour to capture her, until the pursuit is brought to a termination by a good fairy. The harlequin wears a tight dress of bright colours, and glittering with spangles. See CLOWN.

HARLEY, ROBERT, Earl of Oxford, and Earl Mortimer, a distinguished minister of state in the reign of Queen Anne. He was born in London in 1661, and was the son of Sir Edward Harley, a Herefordshire gentleman, who had been an active partisan of the Parliament during the civil war. The subject of this article, though of a Presbyterian family, adopted Tory principles in politics, and joined the high church party. In the reign of William III. he acted with the Whigs; but after the accession of Anne he, as well as his more celebrated colleague St. John, afterwards Lord Bolingbroke, deserted the party with which they had acted, and became leaders of the Tories. Harley was chosen speaker of the House of Commons in 1701, and in 1704 was appointed chief secretary of state. He resigned his post in 1708. The cabals of their political opponents having effected the removal of the Duke of Marlborough and his friends from office, Harley was nominated a commissioner of the treasury and chancellor of the exchequer in 1710. On the 8th of March, 1711, the assassination of Harley was attempted at a sitting of the privy-council by a French man, Marquis de Guiscard, who stabbed him two or three times with a pen-knife. This turned out a fortunate accident for Harley, as it produced a strong feeling of sympathy in his favour, which led to his being raised in the same year to the peerage, with the title of Earl of Oxford, and invested with the office of lord high-treasurer. After the Peace of Utrecht, in 1713, the Tory statesmen, having no longer any apprehensions of danger from abroad, began to quarrel among themselves; and the two chiefs, Oxford and Bolingbroke, especially became personal and political foes, actuated by different views and sentiments. The former resigned the treasurership just before the death of the queen in 1714. Whatever projects may have been formed by others of the party, there seems to be no ground for believing that Lord Oxford had engaged in any measures to interrupt the Protestant succession. Early in the reign of George I. he was, however, impeached of high treason by the House of Commons, and was committed to the Tower. He remained in confinement till June, 1717, when, at his own petition, he was brought before the House of Peers, and after a public trial acquitted of the crimes laid to his charge. The rest of his life was spent in adding to his literary stores, in the collection of which he expended a considerable portion of the wealth which his public employments had enabled him to accumulate. He died May 21, 1724. His patronage was extended to Swift, Pope, and other literary men. Pamphlets by Defoe and others have been wrongly attributed to Harley, among them an Essay on Public Credit, and an Essay upon Loans. He was succeeded in his titles by his son Edward, who augmented the collection of printed books and manuscripts formed by his father. On the death of the second Earl of Oxford, in 1741, the library of printed books was sold to Osborne, a bookseller, who published a catalogue of them, compiled by William Oldys and Samuel Johnson (five vols. 8vo, 1743–45). The MSS. are preserved in the British Museum, where they form the Bibliotheca Harleiana.

HARLINGEN, a seaport in Holland, in the province of Friesland, intersected by numerous canals, 16 miles west by south of Leeuwarden. It has an extensive trade with Amsterdam, with which it communicates regularly by steam; with Norway and the Baltic, from which it imports grain, timber, tar, pitch, and hemp; and with Great Britain, to which it exports butter, cheese, flax, bark, and salted hides, in return for coals, chalk, earthenware, and rock-salt. The town of Harlingen is built on the site of a previous town, which was overwhelmed by an inundation in 1134. It suffered greatly by another inundation in 1566, after which a dyke was constructed by the Spanish governor Roblas, to protect it from similar disasters in future. Pop. (1899), 10,267.

HARMATTAN, a wind which blows periodically from the interior parts of Africa towards the Atlantic Ocean. It prevails in December, January, and February, and is generally accompanied with a fog or haze that conceals the sun for whole days together.

Extreme dryness is the characteristic of this wind; no dew falls during its continuance, which is sometimes for a fortnight or more, but more commonly from two to three days. Vegetation withers, and the grass becomes at once like hay. The human body is also affected by it, so that the skin peels off; but it checks infection, and cures cutaneous diseases.

HARMODIUS. See HIPPIAS and ARISTOGEITON.

HARMONIA, in mythology, a daughter of Ares (Mars) and Aphroditē (Venus), the fruit of an amour, in which they were surprised by Hephaistos. She was given in marriage by Zeus to the Phœnician Cadmus, and on the occasion of the marriage was presented with a necklace, which afterwards brought disaster upon all who possessed it. She accompanied Cadmus to Greece, and shared his fate. See CADMUS.

HARMONICA, or ARMONICA, Franklin's name for a musical instrument constructed with glasses of different sizes, revolving by means of mechanism worked by the foot, and played upon by touching the rim of the glasses with the moistened finger.

HARMONICS. We may premise one or two elementary facts which require to be borne in mind in treating of harmonics. Sound is produced by vibrations of the air caused by the resonant body. A musical sound is distinguished from noise by the circumstance of the vibrations which produce it being regular and periodical. All simple sounds are regular, but a non-musical sound consists of a combination of simple sounds, the proportions of whose periods are either so complicated that the ear cannot distinguish them, or so irregular that it dislikes them. There is a class of sounds between the musical and the non-musical, represented by the roll of thunder or the beat of a drum, which will further illustrate this distinction. These sounds are regular but not continuously. At any instant the combination of sound is harmonious; but the harmony changes at each successive instant by insensible gradations and not by harmonic intervals. A single musical tone is distinguished from such a sound by maintaining the same period of vibration throughout; a succession of musical tones is distinguished from it by varying the period of vibration in regular or harmonic intervals. The octave of a simple tone makes 2 vibrations to 1 of the fundamental; the fifth, 3 to 2; the third, 5 to 4. When the first, third, fifth, and eighth are struck in succession, there is thus a change in the rate of vibrations in the ratios of 4, 5, 6, 8, which form a harmonic series. Long after the musical scale was founded on such proportions, it was discovered that no purely simple sound is producible in nature, and that when care is taken to produce sounds comparatively simple, they are characterless and of little musical value. By a simple sound we mean one whose vibrations are all in the same period. The sound of a tuning-fork is simple compared with the note of a pianoforte or violin. When a sound is produced by the vibration of an open string, the whole string vibrates as a unity, and produces a tone which is called the *fundamental*, but this is not the only tone produced by the vibration; the string also divides into various sections, which vibrate separately, more rapidly, and generally much more feebly than the fundamental. These vibrating sections produce sounds different from the fundamental, but bearing certain fixed proportions to it which are called harmonics. By touching a vibrating string lightly, at particular points, the various harmonics may be produced successively at the will of the experimenter. When the string is touched in the middle, it divides into two parts, and produces the octave of the fundamental. If touched at a fourth of its length, it divides into 4, and produces the double octave, and so on. In each case the points of rest between the vibrating sections are called nodes. By whatever vibrating body a musical sound is produced, it is liable to the same tendency to produce harmonics; and although some of the harmonics are always suppressed by modifying circumstances, some are always produced. There is a regular succession of intervals in which the harmonics naturally accompany a fundamental sound, which is represented in the following scale of vibrations, the first being that of the fundamental, the others those of the harmonics in regular succession:—

1 2 3 4 5 6 7 8 9 10, &c.

Now these are the intervals which produce the successive chords in harmony, although the natural harmonics when produced further go beyond the range of harmony which human ears can recognize or musical instruments produce at the will of the performer. 1:2 is the interval of the octave; 2:3 is the fifth; 3:4 is the fourth; 4:5 is the major third; 5:6 the minor third; 6:7 is already beyond the range of production on a keyed instrument, but it is recognized by musicians as the complement of a four-part simple chord, and is represented approximately on the pianoforte, by B flat, for example, for the key of C. The ratio of the three-part chord is 4:5:6; of the four-part, 4:5:6:7. The ratio 7:8 is the complement of 6:7, and is also beyond the range of keyed instruments, as well as of the diatonic scale, the whole intervals of which are founded on the ratios of the first three prime numbers 2, 3, 5, and their compounds.

A musical note, then, is always complex, but the harmony which attends it is not always the same. The different structure of different instruments suppresses now some now others of the succession of harmonics, and a different body of tone is thus produced, distinguishing a note in one instrument from the same note in another. These differences are called in English *quality*, in French *timbre*, in German *klangfarbe*.

An illustration of the mode in which these differences are produced will be all that our space will admit of in this article. A vibrating body cannot be set in motion without being struck or agitated by some external force. In producing musical sounds this force is always applied to some particular point of the body. A violin-bow is drawn across the string of a violin, the string of a pianoforte is struck with a hammer. When a string vibrates in sections there are, as we have explained, nodes or points of rest between the sections; and it has been found that these nodes will not establish themselves at the point struck, hence the law laid down by Dr. Young, that when any point of a string is struck the harmony which requires that point as a node vanishes. This is the opposite effect from that produced as above mentioned, by lightly touching the vibrating string. The makers of pianofortes have availed themselves of this law without knowing it to suppress the least agreeable harmonics by making their hammers strike at one-seventh or one-ninth from the end of the string.

HARMONIUM, a musical instrument of modern invention, which produces sounds resembling those of the organ. The invention is ascribed to Alexandre Debain of Paris; but he has at the most merely the credit of perfecting an instrument previously known, called the *orgue expressif*, a kind of organ furnished with an apparatus of free vibrating reeds, intended to increase or diminish the intensity and volume of the sound, by regulating the pressure of the wind, by the aid of which the sounds were produced. The same principle as was followed in the construction of this kind of organ was applied to the harmonium. By the action of two pedals, to which the feet com-

municate a more or less rapid movement, according to the shades of expression which are to be brought out, the air is made to impinge against thin tongues of metal, and to set them vibrating. These metal tongues are fitted into a slit in the top of a small box or sonorous cavity, called a wind-box, and are enabled to vibrate by being fixed only at one end. The improvement of Debain, which constitutes the essential characteristic of the harmonium, depends upon the important discovery which he made, that the quality of the sound produced by the vibration of these tongues of metal varies with the form of the wind-boxes, or sonorous cavities in which they are arranged; so that by modifying the form of these according to certain rules, it was found possible to imitate the sound of the oboe, clarionet, flute, &c. The pitch of the notes depends upon the number of the vibrations which take place in a certain time, and that again upon the length of the tongues or vibrators, which varies from about 3 inches to about ½ inch. The instrument has a key-board like that of a piano, and when one of the keys is pressed down a valve is opened, which allows the wind from the bellows to rush through one of the wind-boxes and act on the vibrator. There are also several stops, like organ stops, by means of which the performer can direct the stream of wind into the wind-boxes, which produce a flute, clarionet, or any other sound, according to the number of stops which the instrument possesses. Such is the harmonium which was patented by Debain in 1840, but since that time various other improvements of more or less value have been made on it. The chief of these are the addition of a knee action, which either serves as an expression stop, or brings all the stops of the instrument into play at once, and what is called the percussion action, the invention of Kaufmann of Dresden, which consists in the application of a small hammer, which strikes the vibrator as soon as the key is pressed down, and thus aids the action of the wind. The better class of harmoniums have now several rows of vibrators. The *American Organ* is a form of harmonium, in which wind suction instead of wind pressure is used.

HARMONY. See MUSIC and COUNTERPOINT.

HARMONY, EVANGELICAL, or HARMONY OF THE GOSPELS, is the title of various books composed to show the uniformity and agreement of the accounts given by the four evangelists. The first work of the kind that is known to have been compiled is that of the heretic Tatian, who lived in the second century, called the Diatessaron, in which the events recorded in the four Gospels were arranged so as to constitute a continuous narrative (whence the name, meaning 'through four'). From this harmony all those passages were omitted which favoured the doctrine of the real humanity of Christ, and hence told against the peculiar doctrines of Tatian on that subject. Ammonius Saccas (died 243 A.D.) was the author of another Diatessaron, executed in a somewhat different way. He took the Gospel of St. Matthew as a standard, and dividing it into sections, arranged in parallel columns the corresponding passages in the other Gospels. But the most complete work of this nature is the harmony called the Ten Canons of Eusebius, prepared probably in the first half of the fourth century. It was based upon the previous work of Ammonius Saccas. It is called the Ten Canons, as consisting of ten tables, the first of which gives in parallel columns all the incidents recorded in all the four Gospels, the second, third, and fourth giving all the passages found in any three of the Gospels, the fifth to the ninth all those found in any two of them, and the tenth all the passages which are found only in one. In modern times numerous works have been prepared with the same object.

HARMONY OF THE SPHERES, an hypothesis of Pythagoras and his school, according to which the motions of the heavenly bodies produced a music imperceptible by the ears of mortals. He supposed these motions to conform to certain fixed laws, which could be expressed in numbers, corresponding to the numbers which give the harmony of sounds. Kepler, in his Harmony of the World, endeavours to apply the Pythagorean ideas on numbers and musical intervals to astronomy.

HARMOTOME, or CROSS STONE, occurs in right rectangular prisms terminated by four rhombic planes corresponding to the solid angles of the prism; but more frequently in twin-crystals formed by the intersection of two flattened prisms at right angles to each other, and in such a manner that a common axis and acumination are formed. The crystals yield to cleavage parallel to the planes and both diagonals of a right rectangular prism, which is their primary form. Its prevailing colour is white, but may be yellow, red, or brown; it is translucent or semi-transparent, with a somewhat pearly lustre, and is hard enough to scratch glass. Specific gravity, 2·392. It consists of silica, 46–48·7; alumina, 15·2–17·6; baryta, 19·1–20·8; water, 13–15·2; with small quantities of ferric oxide, potash, soda, and lime. It occurs in metalliferous veins, as at Andreasberg, in the Hartz; at Strontian, Old Kirkpatrick, and Campsie, in Scotland; at the Giant's Causeway in Ireland, in Norway, and in amygdaloid at Oberstein. It is decomposed by acids, but with difficulty; when heated it fuses to a glass. A variety of harmotome contains lime instead of baryta.

HARNESS. See MAIL.

HAROLD (or HARALD) I., *Haarfager* (Fair-haired), King of Norway, son of Halfdan the Black, one of the greatest monarchs of that country. At the time of his father's death (863) he was in the Dovrefield mountains, and had already evinced great talent and personal prowess in several battles. Love made him a conqueror. He had offered his hand to Gida, the daughter of a neighbouring king; but the proud beauty replied to Harold's ambassadors, that she would only consent to become his wife when he had subjected all Norway. Harold swore he would not cut his hair till he had accomplished Gida's desire, and in less than ten years succeeded in obtaining sole possession of Norway. In the meantime his hair had grown long and beautiful, from which circumstance he derived his surname. While he reduced the lesser kings he left them with the title *jarl*, the administration of their territories, and the third part of their income; but many of them emigrated, and founded Norwegian colonies. Hrolf or Rollo emigrated to Neustria (France). Others, with their followers, established themselves in Iceland, the Shetland Isles, the Faroes, and the Orkneys, some of which were then uninhabited. When Harold found that the emigrants often extended their incursions into his dominions, he embarked with a naval force to subdue them. After a bloody war he conquered the Orkneys, &c., and returned home. He fixed his residence at Throndhjem, and died there in 933, after having raised his country to a prosperous state by wise laws and the encouragement of commerce. Three years previously he had handed over the government to his son Erik Blodöx (that is, Eric of the Bloody Axe).

HAROLD I., surnamed *Harefoot*, King of England, succeeded his father Canute in 1035, notwithstanding a previous agreement that the sovereignty of England should descend to the issue of Canute by his second wife, the Norman princess Emma. His countrymen, the Danes, maintained him upon the throne against the efforts of Earl Godwin in favour of Hardicanute; but Harold gaining over that leader

by the promise of marrying his daughter, they united to effect the murder of Prince Alfred, son to Ethelred II. After a reign of four years, in which nothing memorable occurred, Harold died on March 17, 1040, probably at Oxford. Harthacnut, who was about to invade England at the time of Harold's death, dug up his body and beheaded it. See the first volume of Freeman's Norman Conquest.

HAROLD II., King of England, the second son of Godwin, earl of Kent, was born about 1022. During his father's life he held the earldom of East Anglia, and in 1051, when his family were banished, he went to Ireland to raise forces. Next year he landed in Somerset and plundered the country. He met his father at Portland, and went with him to London, where they became reconciled to the king, and received back their earldoms. On his father's death in 1053 he succeeded him in the earldom of Wessex and his other great offices, and upon the death of Edward the Confessor, Jan. 5, 1066, who had named him his successor, he was chosen king by the nobles, nothwithstanding the claim of Edgar Atheling, or the asserted bequest of Edward in favour of the Duke of Normandy. The latter immediately called upon him to resign the crown, and upon his refusal prepared for invasion. He also instigated Harold's brother, Tostig, to infest the northern coasts of England in conjunction with the King of Norway. The united fleet of these chiefs sailed up the Humber and landed a numerous body of men, who defeated the opposing forces of the Earls of Northumberland and Mercia; but at Stamford Bridge, on the river Derwent, in Yorkshire, they were totally routed by Harold, whose brother Tostig fell in the battle. He had scarcely time to breathe after his victory before he heard of the landing of the Duke of Normandy at Pevensey, in Sussex. Hastening thither with all the troops he could muster, a general engagement ensued at Senlac, near Hastings, October 14, 1066, in which this spirited prince, after exerting every effort of valour and military skill, was slain with an arrow; and the crown of England was the immediate fruit of William's victory. See the second and third volumes of Freeman's Norman Conquest.

HAROLD (or HARALD) III., *Haardrada*, King of Norway, son of Sigurd, chief of Stingarige, a descendant of Harold Haarfager. The date of his birth is unknown. During a great part of his youth and prime he served in the imperial body-guard at Byzantium, and as a member of this corps took part in the war against the African pirates who devastated Sicily, also visited Jerusalem, and under the command of George Maniak defeated the Saracens. In the end he was himself appointed to the command of the imperial body-guard, and during his occupancy of the post he carried the war into Africa, and defeated the Saracens in several battles. About 1042, having learned that his nephew Magnus had succeeded to the Kingdom of Norway, he quitted Byzantium to return to his native country; but on his way visited the Grand-duke Jaroslav of Russia, and married his daughter. On his arrival in Norway, about 1045, he persuaded his nephew Magnus to divide the supreme power with him, in return for a share of his treasures, and two years later (1047) his nephew died, when he himself became sole King of Norway. Subsequently he engaged in a war with Denmark, with the view of dethroning the Danish monarch, but was finally obliged to give up the attempt. In 1066 he joined Tostig, the brother of Harold II. of England, in an invasion of that country (see above article), having been promised half of it in case of success; but he was slain at the battle of Stamford Bridge, Sept. 25, 1066.

HARP, a stringed instrument of great antiquity. In the Bible, Jubal, a descendant of Cain, is mentioned as its inventor. It was in use among the Egyptians, Assyrians, Hebrews, Greeks, Irish, Welsh, and other nations. The modern instrument is nearly triangular, and the strings are extended from the upper part to one of the sides. It stands erect, and is played with both hands, the strings being struck or pulled with both fingers and thumbs. Until the improvements of Erard, which will afterwards be described, this form of harp was tuned in the principal key, and modulations effected by pressure of the thumb, or by turning the tuning-pins of the strings which it was desired to alter. The instrument, even in its best form, was thus very defective. We give from Engel's Music of the most Ancient Nations some particulars of the ancient forms of the instrument. The frame of the Assyrian harp was about 4 feet high. The performer held the instrument before his breast, and played while standing or walking. It must have been light, as women carried it in processions while singing or dancing. The chief difference from the modern harp consists in the absence of the front pillar, which serves to resist the tension of the strings. It was made partly of metal or ivory, so that it may have had strength to resist considerable tension, and may have been less deficient in sound than might be supposed. The upper portion of the frame contained the sounding-board; two sounding-holes, in shape like an hour-glass, are to be seen on one side. The tuning-pegs are arranged in regular order along the edge of the upper part of the frame, which is united at its base with a horizontal bar, on which the strings running from the tuning-pegs are stretched. They are continued below the bar in the form of ornamented tassels, which make the instrument appear longer than it really is. The Egyptian harps are found with four, seven, ten, twenty, or more strings. The frames are curved in various forms, the base being generally more strong and solid than the upper part, and the strings are stretched across the wider part of the curve, the tuning-pins being on the upper part. The front pillars are wanting. The two most remarkable Egyptian harps, in point of elegance of form and decoration, are those described and engraved in vol. i. of Bruce's Travels. The trigonon or triangular harp is of a different and more simple description. It has an angular frame, consisting generally of a horizontal and an upright bar, or of a horizontal sounding-board with an upright bar between which the strings are stretched. In an instrument found at Thebes in 1823 the strings are stretched from the upper part of a curved frame to a horizontal bar resting on the front and passing through the back of the lower part of the frame. It was mounted with twenty catgut strings, which still sounded when made to vibrate. It had no tuning-pegs, and was tuned by winding the strings round the horizontal bar. These instruments are properly related to the lyre kind. The most usual number of strings represented on Egyptian harps is seven, which may be held to indicate that the diatonic scale was not in use. The harps of the Hebrews were probably similar to the Assyrian and Egyptian instruments, but there are no representations of them of undisputed accuracy, and it is uncertain which of the names in the Bible describes this instrument. The trigonon and the lyre are almost the only stringed instruments represented in Greek paintings on pottery and monumental records, with the exception of a representation of Polyhymnia with a harp, depicted on a Greek vase now in the Munich Museum, and which dates from the time of Alexander the Great. It is Assyrian in construction, and has thir-

teen strings. Polyhymnia is touching them with both hands, using the right hand for the treble and the left for the bass. The number of tuning-pegs does not correspond with that of the strings. Considering that the music of some of the Celtic nations possesses peculiarities which remind us of that of Asiatic nations, and that the earliest harps of the Scotch and Irish with which we are acquainted from old monuments bear a greater resemblance to the oriental harp than those of a later date, it appears very probable that the oriental harp preceded the European, and that the latter has been derived from it. In Mr. Conran's book on Irish National Music a monumental figure is represented as playing on a harp resting on his knee, which is in the oriental form without a fore pillar.

The improvements which have rendered the modern harp an efficient musical instrument are due to Sebastian Erard, who in 1794 took out a patent for a harp with seven pedals, and again in 1808 for a double-action harp with the same number of pedals, each of which effects two changes in the pitch of the strings. The harp thus constructed contains forty-three strings tuned according to the diatonic scale, every eighth string being a replicate in another octave of the one counted from. Its range is thus six octaves, being from double E below the bass to E in altissimo. It is tuned in the key of C flat, and by fixing the pedals in one groove it is raised to the key of C, while another change raises them to C sharp. The first of these keys having seven flats, the second seven naturals, and the last seven sharps, a complete succession of semitonic intervals is thus obtained, and the instrument is made capable of rendering the full chromatic scale, and of modulating into all the keys of the tonal system. Each pedal raises or lowers one note of the diatonic scale in all its replicates. Hence, when all the pedals are fixed in the first groove the key of C is produced, as already stated. From this, the normal position in which the harp is set, any pedals may be changed so as to produce the requisite number of sharps or flats. If the key of A is to be played in, for instance, F, C, and G may be sharpened; if E flat is required, B, E, and A may be flattened. The harp being thus set in the principal key required, passing modulations are effected by moving the corresponding pedals with the foot.

HARP, ÆOLIAN. See ÆOLIAN HARP.

HARPER'S FERRY, a village, United States, Jefferson county, West Virginia, on the Potomac, at the junction with the Shenandoah. On the night of the 16th October, 1859, Harper's Ferry was suddenly seized by a band of men headed by a person of the name of John Brown, who had distinguished himself as an abolitionist leader during the civil war which raged in Kansas. Something like a regular conspiracy for the purpose of obtaining an ascendency for abolitionist views by violent means had been formed; but the arrangements were futile, and the conspirators were easily put down. Brown was afterwards tried and executed. Still more recently Harper's Ferry became the scene of many important military operations in the civil war between the Northern and Southern States.

HARPIES (Greek, *Harpuiai*, swift robbers), the goddesses of storms. Their ages, appearance, names and number are so differently given by the poets that it is difficult to say anything definite concerning them. In the Homeric poems they are represented as personified storm-winds. One of them, Podarge, was married to Zephyrus, and gave birth to the two horses of Achilles, Xanthus and Balius. If any one was absent so long from home that it was not known what had become of him, and he was supposed to be dead, it was commonly said, 'The harpies have carried him off'. Hesiod represents them as young virgins of great beauty, fair-locked and winged maidens, the daughters of Thaumas by Electra. Various traditions of their parentage are given by different poets. Sometimes their number is two, sometimes three. The later poets and artists vied with each other in depicting them under the most hideous forms. One has given them the head of a fowl, with wings and a body covered with feathers, human arms with claws, a white breast, and human legs which terminate in the feet of a fowl. Others have given them the face of a young woman with the ears of a bear. Spanheim's work contains three ancient representations of the harpies, from coins and works of art, with the claws and bodies of birds. The first has a coarse female face, the second quite a feminine head and two breasts, the third a visage ornamented with wreaths and a head-dress. There are also other representations of them.

HARPOCRATES, or HORUS, the Egyptian god of the sun, was the youngest son of Osiris. He was supposed to have been born with his finger in his mouth, as indicative of secrecy and mystery. His worship was introduced into Rome, and in Greece he was identified with Apollo.

HARPOON, one of the principal instruments used for the capture of whales. See WHALE-FISHERY.

HARPSICHORD, a stringed instrument formerly in use, in appearance and construction similar to a grand pianoforte. In the front the keys were disposed, the long ones being the naturals, and the short ones the sharps and flats. These keys being pressed by the fingers, their inclosed extremities raised little, upright, oblong slips of wood called *jacks*, furnished with crow-quill plectrums which struck the wires, instead of the hammers of the modern pianoforte. This instrument, called by the Italians *clavicembalo*, by the French *clavecin*, was an improvement upon the clavichord, which was borrowed from the harp. Both are now superseded by the pianoforte.

HARQUEBUSE (French, *arquebuse*; Italian, *archibugio*), an ancient firearm cocked usually with a wheel. They were made at first so heavy that in firing they had to be supported upon a stand, whence the name *arquebuse à croc*. These were fired with a match. The wheel-locks, introduced about 1517, were lighter. The wheel was a small steel one, which, on being turned rapidly by a spring, struck fire on a flint.

HARRINGTON, JAMES, a celebrated political writer, was born at Upton in Northamptonshire in 1611, and was educated at Trinity College, Oxford, under the care of the celebrated Chillingworth. On the death of his father he visited the Netherlands, where he entered Lord Craven's regiment, and being quartered at the Hague, frequented the courts of the Prince of Orange and the Queen of Bohemia. He also accompanied the elector-palatine to Denmark. He subsequently visited Germany, France, and Italy; and on his return to England, siding with the parliamentary party in 1646, he accompanied their commissioners to Charles I. at Newcastle, and on their recommendation was appointed groom of the stole to the king. In this capacity he never disguised his republican sentiments; yet he was desirous of producing an accommodation between Charles and the Parliament, which is supposed to have produced his removal from the king's person. During the protectorate he passed his time in retirement, and occupied his leisure in writing his famous work Oceana, a political romance in imitation of Plato's story of the island Atlantis, which, after some opposition on the part of Cromwell, was published in 1656. In order to propagate his opinions he established a sort of club or

debating society, called the Rota, which was terminated by the Restoration. Being arrested for a supposed plot against the government, of which he was entirely innocent, he was treated with great severity, and his release by habeas corpus was evaded by an arbitrary removal to St. Nicholas Island, near Plymouth. Here, either from distress of mind or improper medical treatment, his faculties became impaired; which, being represented to the king by his relations, led to his release. He partly recovered, and married a lady to whom he had been early attached. He died of paralysis on Sept. 11, 1677, and was buried at St. Margaret's, Westminster. Harrington was a profound thinker. His Oceana, which is a political romance, embodying his ideal of a republic, is a work of genius, and is characterized by an enthusiastic love of liberty. The writings of Harrington were published in one vol. folio by Toland in 1700, and again, with additions, in 1747 and 1771. A cheap edition of the Oceana by Prof. H. Morley was published in 1887.

HARRIS, the southern portion of the island of Lewis (which see).

HARRIS, James, a learned writer on philology and the philosophy of language, was born at Salisbury on July 20, 1709. Having passed through his preliminary studies, he entered at Wadham College, Oxford, in 1726; after which he became a probationer at Lincoln's Inn. The death of his father put him in possession of an independent fortune at the age of twenty-three, on which he retired to his native place to dedicate his time to classical literature. In 1744 he published a volume containing three treatises—on Art, on Music, Painting, and Poetry, and on Happiness. This was followed by his most celebrated production, Hermes, or a Philosophical Inquiry concerning Universal Grammar (1751). This work displays much ingenuity and an extensive acquaintance with Greek literature; but the author's ignorance of the ancient northern dialects caused him to take an imperfect survey of his subject. In 1761 he was chosen member of Parliament for Christchurch, was appointed lord of the admiralty in 1763, and later in the same year a lord of the treasury. In 1774 he became secretary and comptroller to the queen. In 1775 he published Philosophical Arrangements, part of a systematic work which he had projected as an illustration of the logic of Aristotle. His concluding work, Philological Inquiries, was completed in 1780, but was not published till after his death, which took place on December 22, 1780. A collective edition of his works was published by his son, the Earl of Malmesbury (two vols. 4to, 1801).

HARRISBURG, a town of the United States, capital of Pennsylvania, in Dauphin county, 121 miles north of Washington, on the east bank of the Susquehanna, over which there are four long bridges, two of them being for railway purposes. It occupies an elevated site, and has a state-house of brick, surmounted by a dome; various handsome churches; a court-house and prison; many educational institutions, among them Harrisburg Academy, two seminaries, and a training college for teachers; a state lunatic asylum, hospitals, &c. The manufactures are important, and include iron and steel, railway cars, boots and shoes, silks, bricks, &c. There is an active trade, much facilitated by the railways and the Pennsylvania Canal, which passes near the town, and forms a large basin for a harbour. Harrisburg is the see of a Roman Catholic Bishop. Pop. in 1890, 39,385; in 1900, 50,167.

HARRISON, John, a skilful mechanician, celebrated as the inventor of the chronometer for ascertaining the longitude at sea, and also of the gridiron-pendulum. He was born at Foulby, near Pontefract, in Yorkshire, in 1693. He was the son of a carpenter, and became an assistant to his father, who was occasionally employed in repairing clocks. His attention was thus early directed to the study of wheel machinery, in which he took a keen interest. In 1700 he removed with his father to Barrow, in Lincolnshire. In 1726 he constructed two clocks, in which his escapement and gridiron compensation pendulum, depending on the different expansion of various metals, were introduced. An act of Parliament had been passed in 1714 offering rewards of £10,000, £15,000, or £20,000 for a method of ascertaining longitude within 60, 40, or 30 miles. In 1735 Harrison went to London with a new timepiece he had constructed, in order to claim the reward. He received recommendations from Halley and others, and obtained a trial from government in a voyage to Lisbon, the result of which was that he received £500 to perfect his invention. After repeated trials he constructed a time-piece, which in a voyage to Jamaica, under the charge of his son, in 1761, enabled him to claim the highest reward, and after some delay, and the passing of two acts of Parliament, he received it in instalments between 1764 and 1773. He also applied the principle of the different expansibility of metals to watches, and devised a means of winding them up without interrupting their movements. Harrison wrote a tract entitled A Description concerning such Mechanism as will afford a Nice or True Mensuration of Time. This ingenious artist employed the latter part of his life in constructing a fifth improved chronometer on the same principle as his previous ones. This, after a ten weeks' trial, was found to have erred only four and a half seconds. He died in London on March 24, 1776.

HARROGATE, a town of England, in the county of York (West Riding), 20 miles west of York, the principal inland watering-place in England, and noted for its magnesia, sulphur, and chalybeate springs. It is divided into High and Low Harrogate—the former situated on an elevated plain, commanding an extensive prospect, the latter in a valley beneath, but united as one town. There are many handsome buildings, particularly in High Harrogate; the Royal Baths, erected at a cost of £120,000; the Victoria Baths, erected at a cost of £30,000; the new baths, hospital, and convalescent home (1889); market and other halls; several spacious hotels, and a number of excellent lodging-houses for the accommodation of visitors; likewise the usual places of resort and recreation found in fashionable watering-places — promenade-rooms, ball-rooms, billiard-rooms, libraries, and reading-rooms; and extensive pleasure-grounds tastefully laid out. The waters are especially recommended for patients with deranged digestive organs, chronic gout, and some cutaneous diseases. There are over eighty springs, differing greatly in their qualities. The Bog Wells at Low Harrogate alone consist of thirty-two springs, each with distinct properties. The bathing season lasts from April to October, and the number of annual visitors is estimated at 50,000. Pop. in 1891, 15,747, in 1901 (boundaries altered), 28,414.

HARROW. See Agriculture.

HARROW-ON-THE-HILL, a town of England, county of Middlesex, about 10 miles north-west of London, on a hill of peculiar form, which rises out of a fine vale. It is irregularly laid out, and consists chiefly of one street; its church, an ancient structure, with a lofty tower and spire, forms a conspicuous object from great distances around. The grammar-school of Harrow, the rival of Eton, and to which the place owes its celebrity, was founded in 1571 by

John Lyon, a yeoman of the parish, to afford gratuitous instruction to the poor children of Harrow, strangers being permitted to enter on payment of certain fees. The education originally given was exclusively classical, but mathematics, science, English history and literature, modern languages, music, and drawing are now taught. There are also army classes. As the charges are high, most of the scholars necessarily belong to the wealthier classes, Pop. in 1891, 5725; in 1901, 10,220.

HARRY (or HENRY) THE MINSTREL, commonly called Blind Harry, a Scottish poet of the fifteenth century, famous for his narrative of the achievements of Sir William Wallace. Major is the only writer from whom any information regarding Blind Harry is derived. He says that, although by Henry's time minstrels had begun to lose their ancient repute, he was received into the houses of the highest in the land, and recited his poetical tales before them. Major was born in 1469, and, as he says the book of William Wallace was composed in his infancy, the date of its composition may probably be placed between 1470 and 1480. Henry's Wallace professes to be based on lives written in Latin by John Blair and Thomas Gray, but now lost. He seems to have been acquainted with various histories of the period, and his poem, though far from being authentic history, is not without historical value. The best text is that edited by Moir (1885–86). See also Moir's Critical Study of Blind Harry (1888).

HARTFORD, a city of the U. States, the capital of Connecticut, on the west bank of the river Connecticut, 50 miles above its mouth. Pop. (1900), 79,850. It has a pleasant and advantageous situation at the head of sloop navigation, and is surrounded by a fertile and beautiful country. It is built with great regularity, and has among its principal edifices the state-house, post-office and court-house, deaf and dumb and lunatic asylums, large hospital, Trinity College, the head-offices of a number of great insurance companies, various banks, and some handsome churches. Trinity College was founded in 1823, under the direction of the Protestant Episcopal Church. There are also a Congregational theological seminary, and a high school. The Wadsworth Athenæum, a beautiful castellated building in the Gothic style, is devoted to the promotion of literature, science, and the arts. The most important manufactures are fire-arms (including Colt's pistols and Gatling guns), steam engines, boilers, and hardware. Book-publishing is also carried on.

The American asylum for the education and instruction of the deaf and dumb at Hartford was started in 1817 under the management of the Rev. Thomas H. Gallaudet. (See DEAF AND DUMB.) One great object that the asylum has aimed to accomplish is the diffusion of a uniform system of instruction throughout the Union, and to satisfy candid and intelligent minds that experience in teaching the deaf and dumb, as in all other pursuits, mechanical or intellectual, is of primary importance. Its efforts in this respect have met with very great success. Hartford was settled in 1635 by an English colony from Massachusetts.

HARTFORD CONVENTION, an assemblage of delegates from the New England states which met at Hartford on 15th December, 1814. These states were opposed to the war which had been begun with England in 1812. In February, 1814, a committee of the Massachusetts Legislature reported that the constitution of the United States had been violated by the Federal Government, and suggested the appointment of delegates to meet with delegates of other states to devise measures so to amend the constitution as to secure the commercial states from future evils. The recommendation was repeated by another committee in October, the defence of the New England coasts having been neglected by the Federal Government. The report of the last committee was adopted by the Legislature, a committee appointed, and a circular letter addressed to the other New England states. Connecticut, Rhode Island, and separate counties of New Hampshire and Vermont sent delegates to the convention. It sat for twenty days, with closed doors, and embodied the result of its deliberations in a report to the represented states. Its report was moderate in tone, but proposed various administrative changes and modifications in the Federal constitution. It was deprived of its chief political importance by the conclusion soon after its close of peace with Great Britain. Congress satisfied some of its demands by an act for regulating the employment of state troops by the Federal government. The imputation of treasonable designs was long attached to those who took part in the convention.

HARTLEPOOL, a parliamentary borough, England, including the municipal boroughs of Hartlepool and West Hartlepool, is situated in the county of Durham, 17 miles S.E. of the city of that name. The principal buildings of Hartlepool are St. Hilda's parish church, an ancient structure occupying a commanding site; the hospital, Smith high schools, &c. There is now a fine sea-wall and promenade. West Hartlepool, the newer but more important place of the two, has several fine churches and chapels, custom-house, exchange, municipal buildings (opened in 1889), athenæum, a covered market, and has also a beautiful public park. The two places, separated by the harbour, but connected by railway and ferry, may be said practically to form one town. The trade and industries of the towns are much of the same character; they possess iron-foundries, brass-foundries, engine and boiler works, ship-yards for iron ships, saw-mills, breweries, cement-works, &c. Extensive fisheries are also carried on, and the locality is becoming a favourite resort of summer visitors. There are spacious graving and other docks, timber ponds, &c. A large trade is carried on especially with the Baltic and Northern Europe generally, the principal exports being coal, metals and machinery, and cotton, linen, and woollen goods, valued in 1902 at about £1,211,000. The principal imports are timber, cattle, grain, flax, butter, cheese, tallow, and wool, valued in 1902 at £1,742,747. The registered tonnage in 1902 was 284 vessels of 428,923 tons. Hartlepool (municipal bor.) had in 1901 a pop. of 22,737, West Hartlepool 62,614; in 1891 the pop. was 21,521 and 42,492 respectively. The parl. borough, sending one member to Parliament, had a pop. of 64,882 in 1891; 86,310 in 1901.

HARTLEY, DAVID, an English physician, principally celebrated as a writer on metaphysics and morals, was born in 1705. At the age of seventeen he was sent to Jesus College, Cambridge, of which he became a fellow. He engaged in the study of medicine, and practised as a physician in Nottinghamshire, and subsequently in London. He spent the latter part of his life at Bath, and died in 1757. His fame as a philosopher and a man of letters depends on his work entitled Observations on Man (1749, two vols. 8vo). This treatise exhibits the outlines of connected systems of physiology, mental philosophy, and theology. His physiology is founded on the hypothesis of nervous vibrations. The doctrine of association, which he adopted and illustrated, explains many phenomena of intellectual philosophy; and this part of Hartley's work was published by Dr. Priestley in a detached form under the title of The Theory of the Human Mind (London, 1775).

HARTMANN VON AUE, one of the best of the Middle High-German poets, was born about 1170. He was of the knightly order, and was a vassal of Aue, which was probably in Breisgau. He acquired the arts of reading and writing in a cloister school, and had learned French before joining the Crusade, apparently in 1197. He acquired the material for his poetical tales, as he says himself, by his own reading. Among these are Erec, written before 1197 and edited by Haupt (Leipzig, 1871); translated by Fistes, 1851; Iwein, written before 1204 and edited by Benecke and Lachmann (Berlin, 1843) and by Emil Henrici (Halle, 1891), translated by Baudissin (1845). These both belong to the Arthurian cycle of legends, and are both founded on the French poem of Chrétien de Troies. The Gregor (edited by Paul, 1873–82), a Christian legend, was possibly also taken from a French source. Der arme Heinrich, another graceful poem of Hartmann's, is founded on by Longfellow in his Golden Legend. Hartmann is supposed to have died shortly before 1220. There is a collective edition of his works by Bech (new edition, 1870–91).

HART'S-HORN (*Cornu cervi*). To the horn of the common stag and its decomposition products many important virtues used to be ascribed, based on a supposed occult connection or sympathy between the character of the animal and the diseases for which the horns were used as a remedy. The substances derived from the horns were the volatile liquor, salt, and oil, and the ash which remains when the horns are calcined in the air. The last consists chiefly of phosphate of calcium, silica, alkaline sulphates, with smaller quantities of carbonate of calcium, ferric oxide, &c. The fluid portions are got by destructive distillation in a convenient still, and are separated, the salt mechanically, and the others, after washing with water, by repeated rectification either alone or with quicklime, by which the more volatile portions are got free from the tarry matter and heavier oils. The crude oil obtained was sometimes called *empyreumatic animal oil*, or *Dippel's oil* (which see). The salt which is formed in this operation is ammonic carbonate, which in part condenses in the neck of the retort, in part is washed over by the aqueous vapour into the receiver; and when the ammonia is got pure from the distillate and is condensed in water it constitutes the *spirit of hart's-horn*. As for the oil it is a complex mixture of bases, hydrocarbons, and the usual decomposition products of animal substances, modified so far by the fact that the organic matter of horn consists, like hair and feathers, not of gelatin but of keratin. The volatile alkali or spirit of hart's-horn is now no longer obtained from that source, except in special circumstances; the ammonia of commerce is now obtained from gas-liquor, from blast-furnaces, or from other sources. There is, of course, no difference in the ammonia obtained from gas-liquor or hart's-horn liquor; there might be some difference if a portion of the empyreumatic oils were allowed to be present. The horns of the stag are used by cutlers for the handles of knives and cutting instruments of different kinds, but dressed and coloured bone is very frequently substituted for the more expensive horn.

HARTZ. See HARZ.

HARUN AL RASHID, a celebrated caliph of the Saracens, 786–809. (See CALIPH.) The popular fame of this caliph is evinced by the Arabian Nights' Entertainments, in which Harun, his wife Zobeide, his vizier Giaffer, and his chief eunuch Mesrur are frequent and conspicuous characters.

HARUSPICES. See ARUSPICES.

HARVARD COLLEGE. See CAMBRIDGE (U.S.).

HARVEST BUG, the larva of a mite of the genus *Trombidium* or *Tetranychus*. It is of a bright-red colour, and so small as scarcely to be visible, looking on a leaf like a grain of cayenne pepper. It appears in June or July, and is sometimes so numerous in autumn that the leaves are reddened with its numbers. It attacks the skin of domestic animals, as horses, dogs, sheep, &c., under which it burrows, causing a red pustule to arise. Its attacks are also very annoying to human beings, persons with delicate skins being especially liable to them. It attacks the legs, thighs, and lower part of the abdomen, and the wounds it inflicts are intolerably irritating.

HARVEY, WILLIAM, an English physician, the discoverer of the true theory of the circulation of the blood, was born at Folkestone, Kent, in April, 1578. He entered Caius College, Cambridge, in 1593, where he took his Arts degree, and about 1599 proceeded to Padua, then the most celebrated school of medicine in Europe, and attended the lectures of Fabricius ab Acquapendente, Casserius, and others on anatomy, surgery, and other branches of medical science. He took the degree of M.D., and returned to England in 1602. He settled in London, and was admitted Fellow of the College of Physicians, and elected physician of St. Bartholomew's Hospital. In 1615 he was chosen as the Lumleian lecturer on anatomy and surgery, and in this capacity he is believed to have first advanced his views on the circulation of the blood. These were formally given to the world in his great work, Exercitatio anatomica de Motu Cordis et Sanguinis in Animalibus, published at Frankfort in 1628, in which he claims to have expounded and demonstrated them for upwards of nine years. The difficulties Harvey experienced in his investigation appear to have been great. In devoting himself to discover by a great number of vivisections the use of the movements of the heart, he says he thought for a long time with Frascatoro, that the secret was known to God alone. The idea of the circulation of the blood is said, on the authority of Boyle, to have been suggested to him by the obvious use of the valves of the veins. The theories current in the time of Harvey were almost wholly hypothetical, and were, as might be expected, very confused and inconsistent. His great merit consists in not only carefully studying the facts until he had acquired the key to their solution, but in following out his investigation in the same manner until he had completely demonstrated his theory. As a consequence of this thorough and successful investigation, it is said that the theory of the circulation has never to this day been so clearly, concisely, and ably demonstrated as by its first discoverer. His Latin style is praised for perspicuity, fluency, and eloquence. Harvey's theory of the circulation of the blood was attacked by several distinguished foreign physicians, particularly Primirosius, Parisanus, and Riolanus. Harvey is represented as having been greatly disgusted with this opposition; but from the commencement his views were widely received, and able replies were made to his opponents by other pens besides his own. In 1618 Harvey was appointed physician extraordinary to King James I., and performed the duties of ordinary physician. In 1632 he became physician in ordinary to Charles I., and in 1636 he accompanied the Earl of Arundel on an embassy to the emperor. He attended the king after the commencement of the civil war, was present at Edgehill, and afterwards accompanied Charles to Oxford. Here he received the degree of M.D., and was elected Master of Merton College, an office which he lost on the surrender of Oxford to the Parliament. He returned to London in 1646, and spent the remainder of his life in retirement. In 1654 he was elected president of the College of Physicians,

but in consequence of his age and infirmities he declined the office. In 1656 he resigned the Lumleian lectureship, and in taking leave of the College of Physicians, to whose buildings he had made a handsome addition by the erection of a library, he presented it with a small estate in Kent as a provision for an annual oration and other objects. He also presented his library to the college. He died 3rd June, 1657, at Hempstead, Essex, and was buried in the family vault. From this the body was removed in 1883 in its leaden coffin, and was deposited in a marble sarcophagus, provided by the College of Physicians, in Hempstead church. Of Harvey's works, the next in importance to the De Motu is his Exercitationes de Generatione Animalium, published in 1651. The destruction of his museum while he was in the king's service deprived this work of some valuable illustrations, the fruit of his anatomical researches, particularly on the generation of insects. It is, however, a work of considerable originality and importance, although the want of the services of the microscope was a great drawback to accuracy or depth of research in this difficult subject. He contributed to the Philosophical Transactions of 1699 an Anatomical Account of Thomas Parr, whose reputed age was a matter of current speculation. Exercitationes duæ Anatomicæ de Circulatione Sanguinis ad J. Riolanum Fil., is the only reply he has left to the strictures on his principal work. An English translation of his work on the circulation of the blood was published in 1653. A collected edition of his works, with a life by Dr. Lawrence, was published in London by the College of Physicians in 1766; the Sydenham Society published a complete English translation in 1846–47.

HARWICH, a seaport of England, in the county of Essex, on a point of land opposite the confluence of the Orwell and Stour, 66 miles E.N.E. London. It consists of three principal streets, and several smaller; has a handsome modern church, a townhall, custom-house, public hall, a number of daily schools, and several charities. The harbour is spacious, and among the best on the east coast of England, and is the only one between Yarmouth Roads and the mouth of the Thames capable of affording refuge in east winds. It is strongly fortified. Two fixed lights, the one 95 feet above the level of the sea, the other 45 feet, indicate the entrance to the harbour, which, however, is difficult without a pilot. Steamers sail regularly to Antwerp, Rotterdam, &c., in connection with the Great Eastern Railway. In 1900 the vessels that entered were 3759, with a total burden of 898,995 tons. Grain, timber, and tobacco are imported. The harbour has recently been much improved. Ship-building and other employments connected with maritime affairs occupy a great portion of the population. There are fisheries of lobsters, shrimps, &c. Cement stone is found on the foreshore, and Roman cement is manufactured. In the summer season Harwich is much frequented by sea-bathers. The town is of Saxon origin, but is by some thought to have been a Roman station; in 1318 it was incorporated by Edward II., and in 1347 it supplied fourteen ships for the navy. It long sent two members to Parliament, but in 1867–85 only one. It now gives name to one of the eight parl. divs. of Essex. Pop. in 1881, 7842; in 1891, 8202; in 1901, 10,019.

HARZ, the most northerly mountain chain of Germany, forming a somewhat isolated table-land between the Saale and the Leine. It has a length from Hettstedt, in Mansfeld, on the east to Seesen and Langelsheim, in Brunswick, on the north-west of about 61 miles; and its breadth, measured from Blankenburg in the north-east to Walkenried in the south-west, is about 20½ miles. The total area covered by the mass is about 890 square miles, of which fully one-half is in Prussia, nearly a third in Brunswick, and smaller portions in Anhalt and Hanover. It is divided into the Ober and Unter, or Upper and Lower, in a double sense. In the wider sense the Brocken, the loftiest summit of the chain, forms the line of separation. The Upper Harz lies west of the Brocken, and is the most elevated, extensive, and rich in minerals; the Lower Harz lies on the south-east of the Brocken, and is superior in the beauty of its scenery. The same summit is also the dividing point of the rivers; those on the east empty into the Elbe; those on the west into the Weser. The Brocken, the highest summit of the Harz, is 3745 feet above the level of the sea. The other loftiest heights are the Heinrichshöhe, the Königsberg, and the Bruchberg, which all exceed 3000 feet. That part of the Harz which includes the Brocken, with the neighbouring high summits, consists entirely of granite; then come the hills of the second rank, in which the ores are chiefly found. The climate, particularly of the Upper Harz, is cold. The frost continues till the end of May, and appears early in September, accompanied by snow; and even in June night frosts are not uncommon. The Harz is wooded throughout, even to near the top of the Brocken, where there is an open area containing a hotel. Upon the less lofty hills several sorts of deciduous trees are found; the lower slopes are covered with oak, beech, and birch. The hills also abound in wild berries, in truffles and mushrooms, in medicinal plants, Iceland moss, and fine pastures; and in summer immense herds of cattle, sheep, goats, and horses graze here. In the Upper Harz little grain is raised, except oats; in the Lower Harz the productions are more various. The woods furnish a great quantity of game, such as stags, roebucks, and wild boars. But the wealth of the Harz consists in its forests and valuable mines. The latter furnish some gold (from which ducats were formerly coined with the inscription *Ex auro Hercyniæ*); in the Rammels-Berg exist great quantities of silver, iron, lead, copper, zinc, arsenic, manganese, granite, porphyry, slate, marble, alabaster, &c. Among the other industries of the inhabitants is the rearing of songbirds. Agriculture and stock-raising are also practised to some extent by the inhabitants. In addition to the establishments for carrying on the mines, the objects of curiosity in the Harz are the Brocken, with its extensive prospect; the Rosstrappe, a huge precipitous rocky mass in the valley of the Bode, the wildest and most beautiful part of the Harz; the different caves, as those of Baumann, Biel, &c.; the romantic Selkethal, with the Maiden's Leap; the wild Ockerthal, &c. A spot near the Brocken summit is the reputed place of the annual rendezvous of all the witches and demons of Germany, of which Goethe has made such a noble use in his Faust. It is on the Brocken, also, that the wild huntsman of the Harz is supposed to dwell. The spectre of the Brocken is an image of the spectator, of a magnified and distorted shape, reflected from an opposite cloud under particular circumstances.

HASDRUBAL, the name of several heroes of Carthaginian history, particularly the son of Hamilcar Barca, and brother of the great Hannibal. He was present at the battle in which his father lost his life, and on the departure of Hannibal for Italy, B.C. 218, he was left in command of the army in Spain. Hanno, who had charge of the province north of the Iberus, was defeated and dispossessed by Cn. Scipio before Hasdrubal could come to his aid, and Hasdrubal, in B.C. 217, attempted a movement against Scipio,

but owing to the loss of the fleet, which was destroyed by that of the Romans, he stopped short before crossing the Iberus. Scipio, reinforced by his brother, now crossed the Iberus, and in 216 defeated Hasdrubal near that river, by which he was prevented from following the orders of his brother, who had gained the battle of Cannæ, to march into Italy to his assistance. The Carthaginians now sent a force, intended for the assistance of Hannibal, to the relief of Hasdrubal under the command of his brother Mago. In 215 Hasdrubal and Mago were twice defeated by the two Scipios, according to the Roman accounts. In 213 Hasdrubal was recalled to Africa to subdue the revolted Numidians, which he effected, and afterwards returned to Spain. In 212 Cn. Scipio was defeated and killed by the two Hasdrubals. His brother, Publius, had previously fallen; but though Hasdrubal appears now to have been master of Spain, he did not avail himself of the opportunity to march into Italy, the reason of which is not sufficiently explained by the Roman historians. Publius Scipio, the son of the Publius who had fallen, was sent into Spain in 211, and after seizing New Carthage defeated Hasdrubal in his camp at Baecula in 209. Hasdrubal withdrew to the northern provinces, and determined to proceed to Italy, leaving his colleagues, Hasdrubal, the son of Gisco, and Mago, to make head against Scipio. After recruiting his army he crossed the Pyrenees near their western extremity. He crossed the Alps in 207, accompanied by Gallic allies, and descended into Italy. After losing much time in the siege of Placentia he marched upon Ariminum. He had sent messengers to concert a junction with Hannibal in Umbria, but his despatches fell into the hands of the consul, C. Nero, who, by a cross-march, joined his colleague, M. Livius, at Sena, and offered battle to Hasdrubal. Hasdrubal retreated, but was overtaken by the Romans, and forced to give battle on the right bank of the Metaurus. Being outnumbered, and ill-supported by his Gallic allies, he was defeated, after an obstinate engagement, in which both sides suffered severely. When he saw the battle irretrievably lost, according to the account of Livy, he rushed into the midst of the enemy, and perished fighting sword in hand. Nero hastened back to Apulia, and is said to have announced to Hannibal the defeat of his brother by causing Hasdrubal's head to be thrown into his camp, B.C. 207.

HASHISH, an eastern preparation made from the cultivated hemp plant (*Cannabis sativa*), or more commonly from the Indian variety of it (*Cannabis indica*). This hemp is covered with a soft resin, which is gathered by various processes. It is then kneaded and formed into small balls, which are called *churrus*. Sometimes, particularly in Persia, the plant is pounded and pressed through a coarse cloth; in other cases infusions or decoctions are made from it. It is also smoked or chewed like tobacco after being carefully dried. It is then sold under the name of *bhang*. It is sometimes mixed with narcotic substances, as opium. To all these preparations the resin of the plant gives curious intoxicating powers. Hashish, as prepared from the resin itself, carefully collected and made into balls, has the appearance of a tenacious or viscid mass of a greenish-yellow colour, with an acrid savour and a nauseous smell. It produces an intoxication and somnolence somewhat analogous to the effects of opium, accompanied with ecstasies, hallucinations, distinguished by bursts of gaiety, tears, and other passionate demonstrations, in which a sustained exaltation of ideas is the dominant tendency. The phenomena vary, as in other kinds of intoxication, according to temperament. Hashish is also employed in medicine.

HASLINGDEN, a mun. borough and market town, England, county of Lancaster, 16 miles north of Manchester. It has improved greatly in appearance of late years, many old mean-looking houses having been replaced by substantial new edifices. It has two handsome modern churches, besides various other places of worship; a free school, having a small endowment; a court-house, public hall, and literary institute. The woollen manufacture and that of cotton employ a number of the inhabitants, and there are also engineering and other works. Excellent building-stones, slate, and flags abound in the neighbourhood. Pop. in 1901, 18,543.

HASSEL, Johann Georg Heinrich, a distinguished German geographer and statistical writer, was born in 1770, at Wolfenbüttel, in Brunswick, and died Jan. 18, 1829, at Weimar. He was from 1809 to 1813 director of the Statistical Bureau, &c., in Cassel, then the capital of the Kingdom of Westphalia. After 1816 he lived a private life at Weimar. He wrote many works of much reputation; among others, General Geographico-Statistical Lexicon (two vols. Weimar, 1817 and 1818); Statistical Sketch of all the European States, and the most important of the other Parts of the World (three numbers. Weimar, 1823 and 1824); Genealogico-Statistico-Historical Almanac (annually, from 1824 to 1829, Weimar), a work which contains very extensive statistical information. Hassel was co-editor of the Complete Manual of the latest Geography (Weimar, 1819 to 1829), and in connection with W. Müller edited the second chief division of the Encyclopædia of Ersch and Gruber, from H to O, and contributed largely to Pierer's Encyclopædia Dictionary, from A to K.

HASSELQUIST, Frederick, a Swedish naturalist, was one of the most eminent among the disciples of Linnæus. He was born in the province of Ostrogothia in 1722. The death of his father, who was vicar of a parish, leaving him without the means of support, he exerted his faculties, and obtained friends, by whose assistance he was supplied with the means of instruction. In 1741 he went to the University of Upsala, where his talents and industry drew the attention of Linnæus. In 1747 he published a dissertation De Viribus Plantarum. Soon after he formed the scheme of making researches on the spot into the natural history of Palestine; and the university having furnished him with pecuniary resources, he embarked for Smyrna in August, 1749, and arrived there about the end of November. After exploring the environs of that city he went to Egypt, whence, in March, 1751, he took the route to Palestine by Damietta and Jaffa. He stayed some time at Jerusalem, and afterwards visited other parts of the country. Returning to Smyrna he brought with him a most noble collection of plants, minerals, fishes, reptiles, insects, and other natural curiosities. He died there, Feb. 9, 1752. The Swedish queen, Louisa Ulrica, purchased the whole of Hasselquist's acquisitions, which were deposited in the castle of Drottningholm. Linnæus, from the papers and specimens of natural history collected by his pupil, prepared for the press the Iter Palæstinum, or Travels in Palestine, with Remarks on its Natural History (Stockholm, 1757, 8vo), which has been translated into English and other European languages.

HASSELT, a town, Belgium, capital of the province of Limbourg, on the Demer, 15 miles W.N.W. of Maastricht. It is regularly fortified, tolerably well built, has a court of first resort, and several public offices; four churches, two chapels, a courthouse, two hospitals, an almshouse, a college, and several primary schools; with manufactures of tobacco, madder, soap, oil, candles, chocolate, refined wax, and hats; dyeworks, bleach-fields, salt-works, numerous tanneries,

breweries and distilleries; an important trade in spirits, tobacco, and madder; and two weekly fairs. Pop. (1897), 14,267; (1900), 15,249.

HASTINGS, a parl., mun., and county borough and market town of England, chief of the Cinque Ports, in the county of Sussex, 60 miles S.S.E. of London by rail; pleasantly situated on the sea-coast, with lofty sheltering hills and cliffs towering behind. It may be now said to consist of an old and a new town; the former occupying a hollow between the East and West Hills; the latter stretching inland and westward, this portion being known as St. Leonard's-on-Sea. In front of the town is a splendid esplanade, two magnificent piers with large saloons, and baths, said to contain the largest tepid swimming-bath in the world. It has two ancient churches, respectively restored in 1871 and 1875; several modern churches, and dissenting chapels; a Gothic town-hall (1881); a market-place, with corn exchange over it; a grammar-school; the Brassey Institute, in brick and stone, containing a free library, museum, &c.; a theatre and opera-house; a music-hall; a splendid public park (opened 1882), public gardens, golf-links, cricket and recreation grounds, &c. The charitable institutions include hospitals and a free dispensary. A harbour is in course of construction. Fishing, boat-building, brewing, and other industries are carried on, but the principal support of the town is derived from the numerous visitors who frequent it during the bathing and winter seasons. St. Leonard's also has a fine pier and several fine buildings and gardens. On the edge of the cliff westward of the town are the ruins of a castle erected by William I. in 1067, and of the church and conventual buildings of a free college, supposed to have been founded in the reign of Henry I. Hastings is a town of considerable antiquity. It had a mint in 965, and was one of the Cinque Ports in 1065. William of Normandy defeated Harold near here, 14th October, 1066. Hastings returns one member to parliament. Pop. of mun. borough in 1891, 52,223; parl. borough, 60,878; of county borough in 1901, 65,528; parl. borough, 62,913.

HASTINGS, WARREN, first governor-general of India, was born at Churchill, Oxfordshire, 6th December, 1732. The Hastings family had been for centuries in possession of the manor of Daylesford, Warwickshire, but having been impoverished by the civil war had sold their possession, the last holder presenting his second son to the rectory of the parish. Warren was the grandson of the rector, and was brought up by him in infancy. At eight an uncle in London sent him to a school at Newington Butts, whence he removed him at ten years of age to Westminster School. On the death of his uncle his new guardian procured him an appointment in the East India Company's service, whereupon he left Westminster; and after spending a short time with a private tutor, he set out for Bengal, where he arrived in October, 1750. After passing two years in the secretary's office in Calcutta, he was appointed to the factory at Cossimbazar, where he was engaged for several years. While here he was taken prisoner by Surajah Dowlah when he took and pillaged Cossimbazar (1756). On obtaining his freedom he joined Clive, under whom he served with distinction as a volunteer in his campaign of 1757. He married in 1757, but his wife died in 1759, and his two children both died early. In 1758 he was appointed resident agent of the Company at Moorshedabad, in which capacity he continued to act till 1761. It is recorded to his honour that he did not avail himself of the opportunity of making his fortune in the mode then common among the servants of the Company, by 'presents' (forced) from the native princes. In 1761 he obtained a seat in the Bengal Council, and was the only member of the council who supported Governor Vansittart in protesting against the selfish and corrupt practices of their colleagues. In 1764 he returned to England. He had acquired a moderate fortune by his thirteen years' service; but, tempted by the high rate of interest, he left the bulk of his means in India, and had the misfortune to lose what he had invested there. He was thus compelled again to ask for employment from the Company; and having secured the appointment of second member of the council of Madras, he sailed for India in the spring of 1769. Among the passengers were a German portrait-painter, Baron Imhoff, and his wife. An attachment sprung up between Hastings and the lady, which they openly avowed; and as the husband proved accommodating, an arrangement was made among the parties by which Hastings agreed to purchase the baroness. A divorce was to be procured in Germany, in exchange for which the husband was to receive a sum of money; and Hastings undertook to marry the baroness and adopt her children. Until the divorce was procured the baron retained his wife, and lived with her at Hastings' expense, first at Madras and subsequently at Calcutta. In 1771 the East India Company were contemplating extensive changes in the government of India. The government of Bengal was still carried on in the name of the nabob, although he had become a mere cipher, all his officers being appointed by the Company, who were properly only his collectors of revenue. Famine in Bengal, reports of native oppression, and difficulties at home in regard to their own position, had determined the Company, though at first cautiously and reluctantly, to assume more direct authority, and they cast their eyes upon Warren Hastings as a fitting instrument to carry out their policy. Clive strenuously supported his appointment to the Calcutta council, and he was removed thither, reaching Calcutta 17th February, 1772. He had the second seat in the council, with succession as president of the council and Governor of Bengal. Mr. Cartier resigned on 13th April, when he assumed the governorship. Ten days afterwards he received instructions from the directors to deprive of his offices Mohammed Reza Khan, who had exercised under the Company the complete control of the revenues and administration of Bengal, and to bring him to trial for corruption and abuses of his power. Mohammed bore a high character, and he was accused by Nuncomar, a man of notoriously bad reputation. Shitab Roy, dewan of Behar, was subjected to similar charges. Hastings carried out the wishes of the Company for the prosecution of Mohammed with more zeal than impartiality. He appointed the son of his accuser Nuncomar to the office of dewan or superintendent of the nabob's household, of which Mohammed had just been divested; but after a protracted inquiry both Mohammed and Shitab were, notwithstanding the great anxiety of the council to inculpate them, fully acquitted of all the charges against them. The object of these charges—the reorganization of the judicial and financial administration of the province under the direct control of the Company's officers, had in the meantime been carried out by Hastings to the entire satisfaction of the directors. Another important step taken by Hastings was to enter into a treaty with the Nabob of Oude (Treaty of Benares, 7th Sept., 1773), by which he ceded to him the districts of Cora and Allahabad for fifty lacs of rupees, and engaged to hire out the Company's troops to him for the reduction of the Rohillas, whose territory the nabob coveted. The

acquisition of territorial power by the Company led to the act of 1773, remodelling its powers. (See EAST INDIA COMPANY.) By this act Hastings was appointed Governor-general of India, and a supreme council was named, of whom three members came from England. These formed a majority unfavourable to Hastings, who was supported only by the remaining member of council, Barwell. The whole policy of Hastings' government, both external and internal, now came under question and condemnation by the majority of the council. The natives were encouraged to bring charges against it, and Nuncomar, his old ally, came forward with various charges of bribery. Hastings had received from the begum, whom he had appointed guardian of the nabob, a lac and a half of rupees (£15,000) as entertainment-money. This money he had applied to the public service, but not entered in the accounts. This and similar charges were magnified against him. The majority of the council assumed with indecent haste, on the assertion of Nuncomar, that he had appropriated £34,000, which they demanded that he should refund. While Nuncomar was prosecuting these charges against Hastings with the favour and patronage of the majority of the council, his career was suddenly brought to a close in a way which involved Hastings in a more serious charge. A supreme court of justice had been appointed at the same time with the supreme council of Calcutta. This court held jurisdiction over the natives only in cases of dispute between them and British subjects. The chief-justice, Sir Elijah Impey, its head, was a friend of Hastings. Nuncomar was brought before this court, charged on the accusation of a native Calcutta merchant with forgery, convicted, and executed. This stretch of jurisdiction, which Hastings could easily have prevented, alienated from him public sympathy in England, and made even his friends afraid of the unpopularity of supporting him. The directors of the Company, who had long been favourable to him, had from other causes altered their sentiments, and petitioned the crown on 8th May, 1776, for his removal and that of Barwell from the council. Hastings had deputed Colonel MacLean, who returned to England in 1776 to insist on certain conditions or tender his resignation. MacLean in the circumstances deemed it prudent to tender Hastings' resignation unconditionally. It was accepted, and a successor appointed to take his place in the council, 23d October, 1776, and the consent of the crown obtained to the appointment. Advice of these proceedings reached Calcutta in June, 1777, by which time the death of one of the members had given Hastings by his casting vote a majority in the council, and he was no longer disposed to resign. General Clavering, who had arrived as his successor, now assumed the title of governor-general, which Hastings still insisted on retaining. The supreme court, which was appealed to, decided in favour of Hastings; he then endeavoured to expel Clavering entirely from the council, but the court decided against him. The Baroness Imhoff had now procured her divorce, and the long-deferred union was at length accomplished. Hastings' proceedings were now openly opposed by the directors at home, and he refused compliance with their explicit instructions; but he had still a large amount of support among the proprietors, and although holding office apparently in defiance both of the crown and his direct employers, he was, on the expiry of his term of office, continued in it by act of Parliament (1779) for another year. On the return home of his bitter opponent Francis (Sir Philip) Hastings remained supreme in the council, but his policy involved many doubtful and complicated matters which it is impossible to explain without going into the details of Indian history. To end a dispute between the council and the supreme court of Calcutta, and to bring the chief-justice under the influence of the council, he appointed Sir Elijah Impey superintendent of the native courts with a salary of £8000 a year, an appointment which was regarded by some as equivalent to a bribe. He involved himself in disputes with the Madras government, in which he appears to have overstretched his authority. He made demands for a large war contribution upon the Rajah of Benares, who was a feudatory of the Bengal government, and when the rajah resisted arrested and deposed him. He caused the 'begums of Oude', mother and grandmother of the Nabob of Oude, to give up extensive estates in land and a large amount of treasure, on the ground that these had not been lawfully acquired. The directors, owing to such proceedings, were contemplating his dismissal. The House of Commons had passed a resolution (30th May, 1782) requiring them to pursue all legal and effectual means for his removal. The directors were disposed to comply, but were opposed by the court of proprietors, who twice refused to permit his removal without specific charges being proved against him. While matters were in this state Hastings expressed his willingness to send in his resignation. He then went to Lucknow, and in accordance with instructions from home restored some of their lands to the begums. In November, 1784, he resigned his post, and on 3rd February, 1785, he left India. As soon as he arrived in England Burke intimated in the House of Commons his intention of demanding an investigation into his conduct. In 1786 articles of impeachment were brought in by Burke against him. He was charged with acts of injustice and oppression against native princes and peoples, dependants or allies of the Company, with maladministration, receiving of bribes, conniving at extravagant contracts, &c. The impeachment, after a protracted struggle in the House of Commons, reached the House of Lords in 1788. The preliminary forms were gone through from 13th to 14th February, and Burke opened the charges against him in a speech of three days' duration, begun on the 15th. He was supported by Fox, Sheridan, and Grey. Three sessions were occupied with the case for the prosecution, and in 1791 the Commons intimated their willingness to abandon a part of it, in order to bring the trial to an end. Hastings began his defence on 2d June, 1791, and on 17th April, 1795, he was acquitted by large majorities on all the charges. His acquittal met with general approval. The charges against him had been strained to the utmost, which evoked public sympathy in his favour, and, together with his undoubted services, caused his actual errors to be condoned. The legal expenses of his trial amounted to £76,080. The Company in 1796 settled on him an annuity of £4000 a year for 28½ years, and lent him £50,000 for eighteen years free of interest. He passed the remainder of his life in retirement at Daylesford, which he purchased. In 1813 he received the degree of LL.D. from the University of Oxford, and in 1814 he was created a privy-councillor. He died at Daylesford, 22d August, 1818, having reached the mature age of eighty-five.

HAT (A. Saxon, *hæt*), an outdoor covering for the head. Hats are distinguished from the more ancient forms of head-covering, caps and bonnets; but the line of distinction is not drawn with any great exactitude. For the male sex a hat is the full-dress article of out-door covering, and a dress-hat is a perfectly definable article. It is made of felt or silk plush, with a nap outside, is cylindrical in form, 6 to 8 inches in height, with a brim varying in breadth

with the fashions, both hat and brim being perfectly stiff. The full-dress article of female attire is a bonnet, but hats are also worn, which are generally imitations of some form of male hat. In the male article the popular distinction appears to be that a hat has a brim all round, while the bonnet has no brim, and the cap only a scoop or front brim. Hat may also now be considered as the generic name for a head-covering for the male sex, as bonnet is for the female. The ancient Greeks had various forms of head-covering. Hesiod describes the *pilos* as a suitable head-dress for a farmer in cold weather, covering both ears. It is also said to have been worn as a lining to the helmet. It is supposed to have been made of felt, in various forms, some of them not unlike the felt hats of the present day. The *apex* of the Romans, a similar covering of a conical shape, was worn from the time of Numa. The Greek *petasos* had a brim, and was similar to the round felt now worn. The cap among the Romans was a symbol of liberty, and was worn by slaves on their manumission. This symbolical usage has been revived in a political sense in modern times. The Anglo-Saxons at an early period appear to have worn no hats; in place of a head-covering they wore their hair long and flowing. About the eighth century they wore caps made of the skins of animals, dressed with the hair outside. Felt or woollen hats appear to have been introduced about the ninth century. Beaver is mentioned as a material for hats in the middle of the twelfth century. The earliest English writers mention hats, and they appear in the fourteenth century to have been worn gaily ornamented with plumes. The first mention of hatters as a trade appears to be about the fourteenth century. The hatters of Nürnberg (*Filzkappenmacher*) are mentioned in 1360. Under Louis XII. the velvet skull-caps previously in use in France gave way to what may be considered as the progenitor of the modern hat. It was a round hat with a small brim, very similar to our modern hats, except that it was pointed and ornamented with a feather. Francis I. adopted the Spanish fashion, and made broad-rimmed hats fashionable. Under Louis XIV. broad-bordered hats, gaily ornamented, were fashionable; but when the fashion of wearing perruques came in the hat ceased to be worn on the head, and was reduced to a small three-cornered article carried under the arm. This continued under Louis XV. The ease with which a man carried his hat under his arm was considered the mark of good breeding. These three-cornered hats were still used during the empire, but gradually the present form of hat came to prevail. It now enjoys in most civilized European countries a firm pre-eminence, due to the ascendency of France in dictating fashions to the rest of Europe. It has often been assailed as inconvenient and ungraceful, and rebellions more or less extensive and protracted have been got up against it, but while thrones have toppled before the fervour of democratic enthusiasm, hats have held their sway. They have even extended it to the new world. America prides itself in the excellence of its hat manufacture, and it is said that in London and Paris the citizen of the States is recognized by the superiority of this article of attire.

The hat has become associated in various ways with acts of courtesy. It has long been a privilege of the highest nobility in France, Spain, and sometimes in England and other countries, to wear the hat in presence of royalty. To remove the hat in saluting is a common act of courtesy, especially towards ladies. It is also considered an indispensable mark of respect in entering church, the sitting-room of a private house, &c.

The felting process in the manufacture of hats is described under the article FELTING. Beaver and other skins, which were formerly the most esteemed materials for the manufacture of dress hats, are now superseded by silk plush. The silk hat was invented at Florence about 1760. In 1770 there were already two manufactories of this kind of hat at Paris. The manufacture, however, did not make much progress till 1828, when it began rapidly to expand. The increasing use of felt hats has recently again diminished its importance. A silk hat is composed of a skeleton, to the surface of which the silk plush is glued. The skeleton is usually made of linen cloth, covered with gum-lac, which makes the hat stiff and waterproof. It is made in three parts, the cylindrical part, the crown, and the brim. The cylindrical part is made by gumming together the edges of a piece of cloth of the proper size, shaped on a cylinder. The circular disc forming the crown is gummed to one end of it. The brim is composed of superposed layers of stiffer cloth, and is made with a flat projecting surface round its inner edge, which is gummed to the skeleton. For covering the hat a sort of hood of silk plush is made, which is cut across in an oblique line. This cover is drawn over the skeleton placed on the block, and fitted exactly to it by the application of a hot iron. The heat of the iron melts the gum-lac, which on cooling cements the covering to the skeleton. The edges of the oblique cut are also coated with gum-lac. The hat is finally shaped on the block or form, and the plush damped and polished, while the hat revolves on a turning-lathe.

In the manufacture of straw hats the straw commonly used is that of wheat or barley. The best comes from Italy, and particularly from Tuscany. The straw is exported from Florence in small plaited ribands. From these the hats are made by female workers in millinery establishments, by stitching them together into the required form. In the straw hats called Italian the straw is not sewed but plaited together, being stitched only with a fine thread hidden under the successive plaits. These are made up in Italy, and exported to be dressed or shaped in other countries. Hats are also made of the flat leaves of African and American palms, split lengthways into narrow strips.

HATCHETT, CHARLES, born about 1765, devoted much of his early life to the study of mineralogy and chemistry, and excelled in making careful and delicate analyses. In 1801 he discovered an element which, having been obtained by him from a mineral that came from Massachusetts, he designated columbium. The year following, an element called tantalum was discovered by Ekeberg; but little more was done to the subject until Wollaston in 1809 made an examination of the minerals concerned and asserted the identity of tantalum and columbium. This view was generally accepted till about 1846, when H. Rose re-discovered columbium and gave it the name of niobium, which it still bears. Hatchett died at Chelsea, February 10, 1847.

HATCHING. See INCUBATION.

HATCHMENT. See ACHIEVEMENT.

HATCHWAY, a square or oblong opening in the middle of the deck of a ship, of which there are generally three—main, fore, and aft, affording passages up and down from one deck to another, and also descending into the hold. The coverings over these openings are called hatches.

HATFIELD, or BISHOP'S HATFIELD, a small town of England, in Hertfordshire, about 6 miles to the south-west of the town of Hertford, and 18 miles north of London. It is situated a short distance south of the right bank of the river Lea. The fine church of St. Etheldreda, restored in 1872, is mainly in the Early English and Decorated styles, with some

Norman work, and contains a monument to Robert Cecil, the first Earl of Salisbury. The residence of the bishops of Ely was long at Hatfield, and a gate-house and other remains of the old palace still exist. It came into the possession of Henry VIII. in 1538, and was used as a royal residence till James I. transferred the manor to Robert Cecil, first Earl of Salisbury, who built Hatfield House on its site early in the seventeenth century. Hatfield House, the residence of the Marquis of Salisbury, a fine large edifice of the Jacobean style of architecture, stands in a well-timbered park, and contains many valuable paintings and documents. Pop. (dist., 1901), 7551.

HATTERAS, Cape. See Cape Hatteras.

HATTI-SHERIFF, the Turkish name of an edict signed by the sultan, who subscribes it usually with these words:—'Let my order be executed according to its form and import.' These words are usually edged with gold, or otherwise ornamented. An order given in this way is irrevocable. The firman of 18th February, 1856, called usually *Hatti humayun*, 'exalted writing,' is the constitutional charter of the Turkish Empire. It is a longish document, undivided into articles, and prescribing various reforms administrative and financial, &c., but its chief importance consists in its explicit recognition of the principle of religious liberty, already admitted by the hatti of Gulhana, 3d November, 1839. It says 'all distinctions or appellations tending to render one class of my subjects inferior to another class by reason of worship, language, or race, are for ever effaced from the protocol of administration.'

HATTON, Sir Christopher, Lord-chancellor of England, a favourite of Queen Elizabeth, is said to have been born about 1540, was entered a gentleman commoner of St. Mary Hall, Oxford, but removed, without taking a degree, to the Inner Temple in 1560. He was introduced at court some time previous to the middle of the year 1564, and once at a masque Queen Elizabeth was so much struck with his graceful person and dancing that an introduction to her favour was the result. His inexperience created much prejudice against him as chancellor, but his sound natural capacity supplied his deficiency of information, and his decisions were seldom found defective in judgment or equity. He was elected a member of Parliament in 1571, became captain of the queen's guard in 1572, vice-chamberlain and a privy-councillor in 1577, lord-chancellor in 1587. He was one of the commissioners for the trial of Mary, queen of Scots, in 1586. His artful speech to the unhappy queen, 'If you are innocent you have nothing to fear; but by seeking to avoid a trial you stain your reputation by an everlasting blot,' is supposed to have been mainly influential in inducing her to submit to trial. He died in 1591.

HATZFELD (Hungarian, *Zsombolya*), a town of the Austrian Empire, in Hungary, district of Torontal, 22 miles W.N.W. of Temesvar. Its principal trade is in corn and horses. Pop. (1900), 10,152.

HAUBERK. The coat of mail which preceded the armour composed of plates, either of leather or steel, was called hauberk, from the German *Halsberge*. The small hauberk, a kind of jacket in scales, descending a little below the hips, and with loose sleeves which did not reach the elbow, was in the eighth century worn by all knights, and afterwards became the dress of squires and poorer gentlemen. The large hauberk, in the shape of a frock, and with the *camail*, or hood, at first reached just to the knee, and the sleeves a little below the elbow. Long sleeves, with hose and leggings, in separate pieces, belong to the twelfth century. The most ancient mode of making the hauberk was probably the ringed form, consisting of rings of metal sewed flat, side by side, on coarse leather or padded stuff. The *macled* coat was composed of small lozenge-shaped plates of metal. The trellised coat was made of leathern thongs, plaited in and out over the stuff of which the coat was composed. The *korazin* was an imbricated hauberk, with overlapping scales or plates. The chain-mail hauberk was composed entirely of iron or other metal rings, rivetted piece by piece, without a stuff or leather lining.

HAUSER, Kaspar, the name of a personage whose history is enveloped in mystery. On the 26th of May, 1828, a youth, apparently about sixteen or seventeen years of age, was found at one of the gates of Nürnberg; but he was unable to give any account of himself, nor could it be discovered who brought him there, whence he came, or who he was. He was 4 feet and 9 inches in height; was very pale; had a short delicate beard on his chin and upper lip; his limbs were slender; his feet, which were tender and delicate, bore no marks of having been confined in shoes; he scarcely knew how to use his fingers or hands, and his attempts to walk resembled the first efforts of a child. When spoken to he understood very little that was said to him, and only replied by one or two imperfect phrases to all inquiries. His countenance was expressive of gross stupidity. He held in his hand a letter addressed to the captain of one of the cavalry companies of Nürnberg, dated 'Bavarian Frontiers; place nameless.' Its purport was that the bearer had been left with the writer, who was a poor labourer with ten children, in October, 1812, and who, not knowing his parents, had brought him up in his house without allowing him to stir out of it. A note accompanying the letter contained these words: 'His father was one of the light cavalry; send him, when he is seventeen years old, to Nürnberg, for his father was stationed there. He was born April 30, 1812. I am a poor girl, and cannot support him; his father is dead.' A pen being put into his hands, he wrote in plain letters *Kaspar Hauser*. He appeared to be hungry and thirsty, but manifested great aversion to eating or drinking anything that was offered to him except bread and water.

He fell into the hands of persons who treated him kindly, and taught him the use of language; and he manifested the most amiable and grateful disposition. But he could give no account of himself, except that, as far as he could remember, he had always inhabited a small cell, continually seated on the ground, with his feet naked, and having no covering except a shirt and trousers, and he had never seen the sky. When he awoke from sleep he was accustomed to find near him some bread and a pitcher of water; but he never saw the face of the person who brought them, and it was at Nürnberg that he first learned there were other living creatures besides himself and the man with whom he had always been. In July, 1828, he was put under the care of Professor Daumer, and many curious observations were made as to his progress in education, which, on the whole, was limited. On 17th October, 1829, he was found bleeding from a slight wound, which he represented to have been inflicted by an assassin. Lord Stanhope afterwards took him under his protection, and endeavoured to procure information as to his parentage and early treatment. He sent him to Anspach for education. He was employed in the court of appeal, but showed little capacity for work. He was invited by a stranger to meet him at three o'clock on 14th December, 1833, under pretence of giving him some information about his birth. During the interview he was stabbed on the left side, and died on the 17th of December. See Quarterly Review (1888); Evans, The Story of Kaspar Hauser (1892); and the Duchess of Cleveland's True Story of Kaspar Hauser (1892).

HAUSMANNITE. This is a rare brown or black mineral found in Thüringen, the Harz, Elsass, and in Pennsylvania. It crystallizes in acute octahedra with a square base, the terminal angles being sometimes replaced by a more obtuse pyramid. It is also found in crystalline masses. Its lustre is semi-metallic. It is tolerably hard; dissolves in hydrochloric acid with evolution of chlorine, and when heated before the blowpipe gives the characteristic reactions of manganese (which see). Different views are taken of its composition; it is an oxide of manganese, with traces of other substances; but while some consider it to be a protosesquioxide, and write its formula $MnO\,Mn_2O_3$, others regard it as a compound of the protoxide and binoxide, and assign it the formula $2\,MnO, MnO_2$. According to the former formula, hausmannite is analogous in composition to the magnetic oxide of iron, but the crystalline form of the two is different.

HAUTBOY. See OBOE.

HAUY, RENE JUST, ABBÉ, a distinguished mineralogist, the son of a poor weaver, born 1743, at St. Just, in the department of the Oise, was at first chorister, then studied theology, and during twenty-one years occupied the place of a professor, at first in the College of Navarre, and afterwards in that of the Cardinal Le Moine. He studed botany as a recreation, but his taste for mineralogy was awakened by the lectures of Daubenton. An accident led him to the formation of his system of crystallography. As he was examining the collection of minerals belonging to M. France de Croisset, he dropped a beautiful specimen of calcareous spar crystallized in prisms, which was broken by the fall. Hauy observed with astonishment that the fragments had the smooth, regular form of the rhomboid crystals of Iceland-spar. 'I have found it all!' he exclaimed; for at this moment he conceived the fundamental idea of his new system. He took the fragments home, and discovered the geometrical law of crystallization. He then studied geometry, and invented a method of measuring and describing the forms of crystals. He now, for the first time, ventured to communicate the grand discovery to his instructor Daubenton, who, with Laplace, could with difficulty persuade the modest Hauy to communicate his discovery to the Academy, which in 1783 received him as adjunct in the class of botany. He now devoted himself wholly to his studies, so that he remained a stranger to the revolution with all its horrors, until, having refused to take the oath of obedience to the constitution required of the priests, he was deprived of his place, and was arrested in the midst of his calculations as a recusant priest. He calmly continued his studies in prison. In the meantime one of his pupils, Geoffroi de St. Hilaire, late member of the Academy, exerted himself in favour of Hauy; and the remark of a tradesman, an officer of police in the quarter where Hauy lived, that 'it was better to spare a recusant priest than put to death a quiet man of letters,' saved his life. Geoffroi hastened to him with an order for his release. It was very late, and Hauy, occupied only with his researches, wished to remain in prison until the next day. Hauy continued his studies, and even ventured to write in favour of Lavoisier, who was then in prison, and of Borda and Delambre, who had been removed from their places. After the death of Daubenton the Academy wished to name the modest Hauy his successor; but he recommended Dolomieu, who was imprisoned in Sicily, in violation of the laws of nations; the latter, however, having died soon after his liberation, Hauy received his place from the first consul. The convention had already appointed him keeper of the mineralogical collections of the *école des mines*, and the directory had created him professor in the normal school, and secretary of the commissioners appointed to regulate weights and measures, the result of whose labours was the new decimal system; he was also made a member of the national institute. Bonaparte appointed him professor of mineralogy in the museum of natural history, and afterwards professor in the Academy of Paris. By his influence the study of mineralogy received a new impulse; the collections were increased fourfold, and excellently arranged. He was a most obliging and instructive superintendent of this collection. In 1803, at the command of Napoleon, he wrote his Traité de Physique in six months. Being directed to ask some favour, he asked for a place for the husband of his niece. Napoleon granted his request, besides conferring on the modest *savant* a pension of 6000 francs. The esteem which the emperor had for this distinguished man was the more honourable both to him and to Hauy, as the latter had never stooped to flattery, and had even opposed Bonaparte's elevation to the imperial dignity, by signing *nay*, when the question was proposed for the ratification of the nation. When the emperor, after his return from Elba, visited the museum, he said to Hauy, 'I read your Physics again in Elba with the greatest interest;' he then decorated Hauy with the badges of the Legion of Honour. Hauy was in the habit of amusing himself by conversing with the pupils of the normal school, who often visited at his house, and whom he always received and entertained with kindness. He was gentle, indulgent, and benevolent. Nothing could ruffle his quiet temper but objections to his system. Notwithstanding his feebleness he attained the age of nearly eighty years, and died June 3, 1822. Besides his valuable treatises in different periodicals, and his articles on natural history in the Encyclopédie Méthodique, his Essai sur la Théorie, et la Structure des Cristaux (1784), his Traité de Minéralogie (1801, four vols.), his Traité élémentaire de Physique, which has already been mentioned (1803, two vols.), his Traité des Caractères physiques des Pierres precieuses (1817), his Traité de Cristallographie (1822, two vols., with engravings), his Traité de Minéralogie (second edition, 1822, four vols., with an atlas), are the most distinguished. The charge of editing the manuscripts which he left devolved on his pupil Lafosse. The Duke of Buckingham bought his precious collection of minerals, for which Hauy had refused an offer of 600,000 francs. Cuvier delivered an eulogy on him before the Academy in 1823, and Brogniart, who had been his assistant, became his successor in the museum of natural history. Hauy's mineral system is based primarily upon crystalline form; but he placed considerable stress upon chemical composition, as he supposed that the two characters varied with each other. He did not execute the analyses himself, but intrusted them to his contemporary Vauquelin. After the discovery of isomorphism Hauy's doctrines ceased to be held in all their fulness, so that his writings have now become entirely obsolete.

HAUYNE (named after *Hauy*), or **LATIALITE** (after the ancient *Latium*, where it was first discovered by Abbé Gismondi), is one of a genus of minerals, and includes two or three varieties. The genus comprises Hauyne, Sodalite, Spinellane, or Nosean, and Ittnerite, and these minerals all consist of silicate of aluminium and sodium, with sulphate of calcium or sodium, or chloride of sodium; but there are occasionally present traces of a metallic sulphide, to which the blue colour sometimes exhibited by these bodies is ascribed. They are similar in character to lapis lazuli, but though analogous in composition, the proportions of the constituents are different. The species Hauyne is found in the lava of Monte Somma, Vesu-

vius, at Mont Albano, at Niedermendig, on the Rhine, and at several other localities; but the specimens are different. Hauyne is a blue, or bluish-green, mineral, which occurs massive, in crystalline grains, or in rhombic dodecahedra. It has a vitreous lustre, varies from opaque to translucent, is moderately hard, but brittle. When heated it fuses to a slag, and in this operation may lose its colour entirely. By hydrochloric acid it is decomposed, gelatinous silica separates, and there is sometimes a perceptible odour of sulphuretted hydrogen.

HAVANA, or THE HAVANNAH (Spanish, *La Habana*, 'the haven'), an important maritime city, capital of the Island of Cuba, and one of the greatest commercial marts of the Western World, is situated on a bay on the north-west side of the island. Its harbour, formed by the bay, which nowhere exceeds 1½ mile in width, is one of the best in the world. It is entered by a channel, which is about 1500 yards long, and not more than 350 yards wide; and the entrance is defended by two strong castles—the Punta on the west side, and the Morro on the east. Other four forts, some of which are very strong, defend the harbour and town. The bay within forms a capacious basin, in which 1000 vessels of the largest class might ride safely at anchor. The town consists of the town proper and the suburbs, the former occupying a sort of peninsula on the west side of the bay. When viewed from the sea it has a very picturesque and imposing appearance; and it has fine parks and promenades; but its interior is by no means attractive. The streets, though regular, and intersecting each other at right angles, are narrow, badly-paved, and lined with massy structures of stone closely crowded together, and generally provided with ponderous folding-doors and barred windows, which give the whole place a heavy and even gloomy appearance; but considerable improvement in the character of the streets has been of late years effected; and the town, though still unhealthy in summer, is less so than formerly. The suburbs, standing partly on the other side of the bay, are more pleasingly built, and even in extent are superior to the town proper. Among the principal buildings the first place is due to the cathedral (built in 1724), which long contained the bones of Columbus, brought hither from San Domingo in 1796; but they were removed to Spain on the occupation of the island by the United States. After the cathedral, the principal churches are those of San Juan de Dios and San Felipe. The other buildings or public establishments deserving of notice are—the governor's house; the admiralty; the episcopal palace; the university, dating from 1670, and including a medical and law school, with chairs for the natural sciences, botanical garden, academy of art, &c.; the exchange; the opera-house, and other theatres—one of them, the Teatro Tacon, said to be larger than the Scala of Milan; the Cuna or foundling hospital; the Casa Real de Beneficencia, an extensive and well-endowed institution, combining an orphan hospital, a lunatic asylum, and an infirmary; San Lazaro, an hospital for persons affected with leprosy; and the prison, a large quadrangular building, well arranged, and placed so as to secure a free circulation of the sea-breeze. Tramways have been laid in the town and suburbs, electricity being now the means of propulsion. The staple manufacture of Havana is that of cigars, which have long obtained an almost universal celebrity. The other manufactures, such as chocolate, straw hats, &c., are not of much consequence. There are numerous printing-offices; and several daily papers are issued. The trade is extensive and important. The total value of the exports in 1899 was £5,126,678, of which the United States took £4,245,763, the British Empire coming second with £421,763. The imports were valued at £9,791,021, of which £4,140,549 came from the United States, £1,874,534 from Spain, and £1,402,757 from the British Empire. The most important articles of export are sugar and tobacco, the latter both unmanufactured and in the form of cigars and cigarettes. The other principal exports are molasses, wax, honey, rum. The principal imports are manufactured goods of all kinds, preserved meat, rice, flour, lard, dried cod-fish, wine, olive-oil, coal, timber. The British direct trade is now very small, however, but British vessels are largely employed in the trade with the United States. Havana is connected by railway with Matanzas, Cardenas, Cienfuegos, and other seaport and inland towns, some of the lines being used chiefly for goods. The port of Havana was discovered by Sebastian Ocampo in 1508. The town was founded by Diego Velazquez in 1511, but was only fairly begun in 1519. In 1536 it was surprised and burned by a French privateer. During this and the beginning of the following century it rapidly increased; great numbers of the inhabitants of Cuba flocking to its vicinity, to avoid the depredations of the buccaneers. The English failed in an assault upon it in 1655, but succeeded in capturing it in 1762. In the following year, by the peace of 1763, it was restored to Spain. On the defeat of the Spaniards by the United States in the war of 1898 it passed into the occupancy of the United States. For a long time Spain derived the chief part of her fleet from the building-yards of Havana, which, from 1724 to 1796, furnished her with 51 ships of the line and 22 frigates, besides smaller craft. Pop. (1899), 235,981, of whom about two-thirds are whites, the rest being negroes or coloured.

HAVEL, a river of Germany, which rises in a lake situated 8 miles north-west of New Strelitz, enters Prussia near Fürstenberg, and flows circuitously S.S.W. past Spandau, where it receives the Spree; past Potsdam to Brandenburg, where, after expanding into a series of lakes, it turns N.N.W., passes Rathenau and Havelberg, and 5 miles below the latter town joins the Elbe, after a course of about 160 miles, of which more than 100 miles are navigable. Its navigable importance is much increased by several canals.

HAVELOCK, SIR HENRY, K.C.B., major-general in the British army, was son of a ship-builder, and was born at Bishop-Wearmouth, near Sunderland, on 5th April, 1795. He was educated at the Charterhouse, London, and proved a diligent and successful student. He entered the Middle Temple in 1813, with a view to study for the bar; but through his elder brother, William, who had served in the Peninsular war, he obtained a commission in July, 1815, as second lieutenant in the 95th Regiment. In 1822 he exchanged into the 13th Light Infantry, with which he sailed for Bengal in January of next year. Lord Amherst, the governor-general, having declared war against Burmah (24th February, 1824), Havelock, who was appointed deputy assistant adjutant-general, took part in the war, and on 24th February, 1826, he was one of the commissioners who negotiated the peace. He wrote an excellent account of this war. In 1827 he was appointed adjutant to the military depôt at Chinsurah. In 1829 he married Hannah, daughter of Dr. Marshman, the celebrated Baptist missionary at Serampore, having already become a member of the Baptist communion. His religious opinions were shared by many men in his regiment, and he was accustomed to hold meetings in his quarters for religious worship. This was made the ground of a charge against him, which was investigated by the authorities, but did

not interfere with his promotion. On the breaking up of the Chinsurah depôt Havelock, after passing an examination in the native languages, was appointed adjutant of his regiment. In 1838 he attained the rank of captain, and took part in the Afghan war, being present at the storming of Guznee and the capture of Cabul, accompanying Sir Robert Sale in his march to Jelalabad, including the forcing of the Khoord Cabul Pass, and assisting in the defence of Jelalabad, and in the victory gained over Mohammed Akbar on 7th April, 1843. In the interval between the two campaigns he went to the Punjab with a detachment, and was placed as Persian interpreter on the staff of Major-general Elphinstone. He published an account of the first campaign in a Narrative of the War in Afghanistan in 1838–39 (London, 1840). For his services in these campaigns, which were of the most distinguished kind, he received a Companionship of the Bath and a brevet-majority. He accompanied General Pollock as Persian ambassador in the return march on Cabul in August and September, 1842. In 1843 he was appointed Persian interpreter on the staff of General Sir Hugh Gough, and fought at Maharajpur, in the Mahratta war, 29th December, 1843. In 1844 he was made lieutenant-colonel by brevet. The first Sikh war broke out in 1845, and in it he took a prominent part, being present at the battle of Mudki (18th December), Ferozeshah (21st–22d December), and Sobraon (10th February, 1846). He escaped unwounded, although he had three horses killed under him. On the termination of the war he was appointed deputy adjutant-general of the queen's troops at Bombay. In 1849 he left for England on two years' leave of absence, and on his return was made first quarter-master-general, and afterwards adjutant-general, of the queen's troops in India. In the Persian war he commanded a division under Sir James Outram. In returning to Calcutta he was wrecked in the *Erin* steamer off Ceylon, on 5th June, 1857. His return had been hastened by the progress of the great mutiny which had broken out among the sepoys at the beginning of the year, and on reaching Calcutta he was immediately despatched to Allahabad with instructions to quell the disturbances there, and lose no time in supporting Sir Henry Lawrence at Lucknow and Sir Hugh Wheeler at Cawnpore. He set out from Calcutta on 25th June, and leaving Allahabad on the 8th of July, with a small number of Sikh and British troops, he encountered the enemy at Fattihpur on the 12th, and gained a complete victory. He then pursued his march to Cawnpore, and after defeating the rebels again at Aong and the bridge over the Pandunadi he reached Maharajpur, near which Nana Sahib had posted himself with a large force. A fiercely contested battle was fought on the 16th, in which Havelock was again victorious. On the 17th he entered Cawnpore, after a march of 126 miles effected in eight days, besides fighting four battles against overwhelming odds, the whole force under his command being about 2000 men. He was not in time, however, to prevent the barbarous massacre by Nana Sahib of his prisoners, chiefly women and children. The difficulties of the British commander were now extreme. Besides losses from the enemy, his men were being daily diminished by cholera, and General Neill, from whom reinforcements were expected, entered Cawnpore on 20th July with only 227 men. Havelock, notwithstanding, pursued his march to Lucknow; but although victorious in every encounter with the enemy, he was compelled by paucity of numbers, when almost in sight of Lucknow, to fall back on Cawnpore. On the 16th of August he defeated the rebels at Bithoor. Sir James Outram, who brought him reinforcements, having gallantly waived his rank in his favour, Havelock at the head of the united column set out again for Lucknow, defeated the enemy at Alumbagh on the 23d, and stormed Lucknow, with the loss of General Neill, on the 25th. The small British force, now under the command of Sir James Outram, was eventually shut up in Lucknow till the arrival of Sir Colin Campbell, by whom it was relieved on 17th November. While superintending the arrangements for the homeward march Havelock was stricken with dysentery, and expired at Dilkusha on 24th November, 1857. In September, 1857, he was created a major-general in the British army, made a baronet and created a Knight Commander of the Bath, while a pension of £1000 a year for life was voted him by Parliament; but before the patent of baronetcy was sealed (26th November, 1857) he had expired. It was conferred on his son.

HAVERFORDWEST, a parl. and municipal borough of Wales, county town of Pembroke, and a county in itself, on the West Cleddau, 10 miles N.N.W. of Pembroke. Picturesquely situated on the slopes and at the foot of a hill, it is irregularly but neatly and substantially built. It contains three interesting parish churches, a Roman Catholic church and several dissenting places of worship, a handsome shire hall, masonic hall, markets, grammar-school, with fine new buildings, high school for girls, and an infirmary. The castle, a considerable portion of which still stands, is believed to date from the twelfth century. Near the town are the ruins of an Augustinian priory. Haverfordwest is a favourite residential town. It has a lord-lieutenant of its own, and forms one of the Pembroke district of parliamentary boroughs. A colony of Flemings is said to have been settled here about the year 1105. Pop. (1891), 6179; (1901), 6007.

HAVERHILL, a market town of England, in the south-west corner of Suffolk. Among the chief buildings are a Gothic town-hall, a court-house, a corn exchange, and the parish church and other places of worship. Clothing, horse-hair cloth, silk, boots and shoes, &c., are manufactured. Pop. (1901), 4862.

HAVRE, Le (formerly *Le Havre-de-Grâce;* Latin, *Portus-Gratiæ*), a seaport town of France, in the department of Seine-Inférieure, on the north side of the estuary of the Seine, 108 miles north-west of Paris, with which it is connected by railway. The town, which, with exception of a number of old wooden houses of wretched appearance, is of comparatively modern date, is built of brick or stone, with great regularity, in straight, wide, and well-cleaned streets, which intersect each other at right angles. The public buildings are not numerous, and possess little interest. They include the Church of Notre-Dame, in a kind of bastard architecture, partly Gothic; the town-house, formerly the governor's palace; the round tower of Francis I., the only relic of the fortifications of that monarch; the theatre, arsenal, exchange, library, and barracks. The manufactures consist of sulphuric acid, earthen and stone ware, paper, starch, lace, oil, refined sugar, cables, and other marine cordage. There are also breweries, and numerous brick and tile works. A government tobacco factory employs 300 workmen; and from the building-yards a great number, both of sailing vessels and steamers, celebrated for the beauty of their make and their sailing properties, are annually fitted out. But the great dependence of Havre is on its commerce, for which it possesses great advantages, both in its harbour and in its position. Its harbour is entered by a narrow channel, formed by two long jetties stretching from east to west, and kept clear by constant dredging. This channel leads to the outer harbour (*avant port*), an irregular expanse of no great

extent, which is left dry at ebb-tide, and is occupied by great numbers of coasters and other small vessels. Within the *avant port* are capacious wet-docks, lined with fine quays and extensive warehouses. Havre commands the greater part of the import and export trade of Paris, and of the more important towns in the north of France; importing vast quantities of colonial and other produce, among which cotton holds a most important place; and exporting numerous articles of French manufacture. It is the second port in France, being exceeded only by Marseilles. The average tonnage arriving from foreign ports in recent years was about 2,260,000, the number of vessels being about 2200. Of these a large proportion are British vessels. The earliest notice of Havre is in the fifteenth century, when it became of importance to form a new harbour in consequence of the silting up of that of Harfleur. The project was conceived, and some progress made in it, by Louis XII.; but Havre continued little more than a fishing village till the time of Francis I., who erected numerous works, and at immense expense gained the greater part of the present site of the town from the sea. A citadel was afterwards built; and Havre, being now regarded as a place of strength, became the object of repeated contests between French and English. Pop. (1896), 117,009; (1901), 129,044.

HAWAII, the largest of the Sandwich Islands (which see), which gives its name to the whole group and to the United States territory constituted by the archipelago.

HAWICK, a parliamentary burgh of Scotland, in the county of Roxburgh, on the Teviot, 50 miles south-west from Edinburgh, on the main line to London. It consists of one long and numerous diverging streets, several of the houses in the newer streets having an attractive and imposing appearance. It has handsome municipal buildings; a public library and reading-room (new buildings for which have now been provided); an excellent museum; the Buccleuch memorial hall, with a science and art institute, a good exchange, a new post-office (1892), a cottage hospital; several religious, friendly, and benevolent societies, a secondary school, and several public and private schools. There are extensive public parks, a golf course, cricket and football fields, &c. At the upper extremity of the town is an artificial mound of earth, called the Moat, supposed to have been used as a court for the administration of justice. The Tower Inn is composed in part of an ancient border peel, and was the residence, in former times, of the barons of Drumlanrig; it is now the property of the Buccleuch family. The staple industries of the town are the manufacture of hosiery and that of tweeds, but skin-dressing, dyeing, and iron-founding are also carried on to some extent. Its markets for Cheviot sheep are very important. Hawick, with Galashiels and Selkirk, sends one member to Parliament. Pop. in 1881, 16,184; in 1891, 19,204; in 1901, 17,303.

HAWK, a name often applied in a general way to all the diurnal birds of prey except the eagles, vultures, and owls. It thus includes the falcons as well as the hawks proper, the latter being distinguished from the former chiefly by their shorter wings, which do not reach the extremity of the tail, and have the fourth quill longest and the first short; their beaks are also less robust and want the tooth-like notch of the former. Of the hawks proper the chief British species are the goshawk and the sparrow-hawk (which see; and see also FALCON).

HAWKE, EDWARD, LORD, a celebrated naval commander, was born in London in 1705. His father, a member of the English bar, died in 1718, and early in 1720 Hawke entered the navy. After going through the usual gradations he was appointed in 1733 to the command of the *Wolf*, and a year later he became captain of the *Flamborough*. Being promoted to the command of a squadron in 1747, he fell in with the French fleet off Belleisle, 14th October, and totally defeated it, taking six large ships of the line. For this service he was made a knight of the Bath, and promoted to be vice-admiral of the blue. In 1759, being then vice-admiral of the white, he was sent in pursuit of the Brest fleet, which he came up with in Quiberon Bay, and signally defeated. He now received a pension of £2000, and in 1768 he became admiral of Great Britain and commander-in-chief of the fleet. From 1766 to 1771 he was first lord of the admiralty. In 1776 he was advanced to a seat in the House of Lords by the style of Baron Hawke of Towton. He died at Sunbury-on-Thames on Oct. 17, 1781. See the Life by Burrows (1883).

HAWKERS. See PEDLARS and HAWKERS.

HAWKE'S BAY, a provincial district of New Zealand, on the east coast of North Island, bounded north by Auckland, and west and south by the district of Wellington, having a length of about 100 miles, a breadth of about 60, and an area of 2,822,300 acres. It includes a fine tract of country irrigated by the Nuhaka, Wairoa, Mohaka, Tutaekuri, and other rivers, and containing much fertile soil, well adapted for agricultural and pastoral purposes. The capital is Napier, with a fair harbour. From the capital a railway intersects the province, and has been continued to meet the line from Wellington. Pop. in 1901, 35,441.

HAWKESWORTH, JOHN, English writer, the son of a watchmaker of Bromley in Kent, where he was born in 1715 or 1719. His father apprenticed him at an early age to his own trade. His dislike to the business, however, soon proved insuperable, and he became clerk to a writing stationer. Some essays in the Gentleman's Magazine introduced him to the acquaintance of Cave, the proprietor of that work, who, on the secession of Johnson in 1744, placed him in his situation as compiler of the debates in both houses of Parliament. In 1752 he started the Adventurer on the model of the Rambler, and to this he contributed a series of essays, through that and the two following years, other contributors being his friend Joseph Warton, Johnson, &c. These were collected and repeatedly printed. In 1755 he published an edition of Swift's works, with a life prefixed, which met with great favour, and was afterwards extended by the addition of other volumes, and in the following year he received the degree of LL.D. After writing tales, an oratorio, and miscellaneous literary matter, in 1771 he undertook a commission from government to arrange and digest the narrative of the voyage of Captain Cook, just returned from his first expedition, with notices of the prior voyages of Byron, Wallis, and Carteret. This task, for which the liberal sum of £6000 was paid him by the publishers, he completed, not altogether to the satisfaction of the public, in 1773, when the work appeared in three volumes 4to. He died at Bromley on November 16, 1773. He closely imitated Johnson's style, but from his want of depth and range of thought the imitation looked too often like a caricature.

HAWKING. See FALCONRY.

HAWKINS, SIR JOHN, a renowned sea commander, was born in 1532 at Plymouth, and was the son of Captain Hawkins, a naval officer. He made several voyages in his youth, thus acquiring much maritime experience. In 1562 he projected an expedition, mainly designed to procure negroes on the

coast of Africa, and convey them for sale to the West Indies. In this plan he was successful; and he is branded on the page of history as the first Englishman, after the discovery of America, who made a merchandise of the human species. He made two subsequent voyages for the purpose, one of which proved very profitable; and he was rewarded for the supposed benefit conferred on his country by the addition of a crest to his coat of arms, consisting of 'a demi-Moor, proper, bound with a cord.' The third expedition, in 1567, was unfortunate; for having endeavoured to carry on a contraband trade with the Spaniards, his small fleet was attacked by an overpowering force and only one of his ships and a bark escaped being taken or destroyed; and after undergoing great hardships he reached home in January, 1568. He afterwards filled the office of treasurer of the navy; and he appears to have been much consulted on maritime affairs. In 1588 he was appointed vice-admiral of the squadron sent out against the Spanish armada, and he received the honour of knighthood for his conduct on that occasion. His last service was in 1595, when he was sent with Sir Francis Drake against the West Indian settlements of the Spaniards. The two commanders differed in opinion; and their consequent want of success occasioned so much chagrin to Sir John Hawkins, that it is supposed to have hastened his death, which took place at sea, November 21, 1595, in his seventy-fifth year.

HAWKINS, Sir John, a lawyer and miscellaneous writer of the eighteenth century, born in London in 1719. He practised as a solicitor, with reputation, for some years, writing also for the periodical press. In 1749 he was chosen a member of the Thursday-Evening Club in Ivy Lane established by Dr. Johnson, with whom he formed an acquaintance which lasted during their joint lives. He contributed some notes for Johnson and Steevens' edition of Shakspere, and for some years he was engaged in preparing for the press a General History of the Science and Practice of Music, which he published in 1776 (in five vols. 4to). Although this, his principal work, is now looked upon as a useful book of reference, and is found in all musical libraries, the critics of the time (with some justice) condemned it as being extremely tedious and ill written, and it fell nearly dead from the press. Sir John Hawkins, having accepted the office of executor to Dr. Johnson, was employed by the booksellers to draw up a memoir of that celebrated writer to accompany a posthumous edition of his works. Neither as editor nor biographer does he appear to advantage. Some pieces not written by Johnson are printed among his works; and the Life seems to have served the writer as a receptacle for the contents of his common-place book. His death took place May 21, 1789.

HAWK-MOTH. See Sphinx-moth.

HAWKWOOD, Sir John, called by contemporary historians *Agudo della Guglia*, &c., and styled by Hallam the first distinguished commander who had appeared in Europe since the destruction of the Roman Empire, a military adventurer of the fourteenth century. He entered, in the capacity of a private soldier, the English army, then preparing for the invasion of France, with Edward III. and the Black Prince at its head. His courage and military abilities soon procured him the honour of knighthood. In 1360, on the conclusion of the Peace of Bretigny, Sir John joined himself with some other soldiers of fortune whose revenues were unequal to the support of their rank in times of tranquillity. These associates, under the name of *Les tard-venus*, continued, notwithstanding the cessation of national hostilities, to harass and plunder their old enemies the French, and even extended their depredations to Italy. After leading a marauding life of this description for nearly four years he once more took regular military service under the Republic of Pisa, and displayed his accustomed bravery. Having carried arms under this banner for three-and-twenty years, he in 1387 exchanged the Pisan service for that of the Florentines. He died at Florence, March 17, 1394, at a great age, and was honoured with a public funeral in the Duomo or cathedral.

HAWORTH, a parish and village (forming an urban district) of England, in the West Riding of York, about 8 miles north-west of Bradford. The Rev. Patrick Brontë, father of the famous sisters Brontë, was long incumbent, and the graves of Charlotte and Emily are here. Pop. (1901), 7492.

HAWSE, in nautical matters, is that part of a vessel's bow where holes are cut for her cables to pass. If a vessel drives at her anchors into the hawse of another she is said to foul the hawse of the vessel riding there, hence the threat of a man-of-war's man, 'If you foul my hawse I'll cut your cable,' no merchant vessel being allowed to approach a man-of-war within certain limits, and never to make fast to the government buoys.—*Hawse-holes* are the cylindrical holes cut through the bows on each side of the stem through which the cables pass in order to be drawn into or let out of the vessel.

HAWSER, a large rope which holds the middle degree between the cable and bow line, being a size smaller than the former and as much larger than the latter.

HAWTHORN, or White Thorn (*Cratægus oxyacantha*), a small spiny European tree, rising sometimes to the height of 20 to 25 feet, much admired for the beauty of its foliage. The leaves are smooth, shining, more or less deeply lobed, and of a beautiful green colour; the flowers are white, sometimes with a reddish tinge, disposed in corymbs, and possess an agreeable perfume; the fruit, when mature, is of a bright red colour. The species of *Cratægus* are about fifty in number, all shrubs or small trees, spiny, with alternate simple or lobed leaves, and bearing fruit resembling in miniature that of the apple, from which plant they are distinguished chiefly by their osseous seeds, and are arranged with it under the same natural family Rosaceæ. Eight species with several varieties belong to the United States. When young the hawthorn springs up rapidly, a shoot of a single year being sufficient for a walking stick. It thus, if well pruned and kept down, quickly grows into a thick and intricately woven hedge. When it arrives at the height of a tree, however, it makes wood very slowly and lives to a great age. The timber of the hawthorn is extremely hard and durable, and fit for many purposes of utility. The double flower kind is one of the most ornamental for shrubberies. The fruit of the sweet-scented (*odoratissima*) is reckoned very agreeable, and that of the azarole (*Azarolis*) is much esteemed in the south of Europe; in this country it rarely arrives at perfection.

HAWTHORNE, Nathaniel, American author, was born at Salem, Massachusetts, July 4, 1804. His father was a shipmaster—the hereditary profession of the family. He studied at Bowdoin College, where he took his degree in 1825, along with George B. Cheever and the poet Longfellow. For a number of years after this he led a retired and studious life in Salem, writing tales, many of which he burned, while others appeared in newspapers and magazines. In 1832 he published an anonymous romance which he never claimed, and in 1837 his Twice-told Tales, a collection of stories which he had contributed to various American periodicals. This book was reviewed by Mr. Longfellow, and pronounced to be the

work of a man of genius and a poet. In 1839 he received an appointment in the Boston custom-house, but lost it in 1841 on a change of government. On quitting this appointment he joined an association for agriculture and education at Brook Farm, founded upon principles similar to those inculcated by Fourier, but in less than a year the establishment broke down. In 1843 he married and settled in the charming village of Concord, occupying the old parsonage in which Emerson had previously lived, and hence the title of his next work, Mosses from an Old Manse (1846). In 1846 he was appointed surveyor of the port of Salem, and held this post three years. In 1850 was published The Scarlet Letter, a romance of early New England life, which was received with the warmest admiration both in America and Europe; and this was followed in 1851 by the no less popular House of the Seven Gables. The Blithedale Romance came out in 1852. In 1853 he was appointed American consul at Liverpool by his college friend Franklin Pierce, then president of the United States, a life of whom he had published in 1852. This office he held till 1857, when he went to travel on the Continent. He died suddenly at Plymouth, New Hampshire, May 19, 1864. Other works of his are the romance of Transformation (1860), by many critics considered the best of his works, Our Old Home (sketches of England and the English), and The Snow Image. His writings display poetic feeling and great descriptive power, a deep knowledge of the human heart, a pensive melancholy combined with a delicate humour, and a style singularly chaste, elegant, and flowing. The best edition of his works is the Riverside (Boston, 12 vols., 1883). See Nathaniel Hawthorne and his Wife by his son (2 vols., 1885); Lathrop's Study of Hawthorne (1876); James's Life (1880); and Bridge's Personal Recollections of N. Hawthorne (1893).

HAY, the stems and leaves of grasses and other plants cut for fodder and dried in the sun. In haymaking the object of the farmer is to preserve the hay for winter use in the condition most nearly resembling the grass in its natural state, and to accomplish this it is first of all necessary to know when the grass has reached that state that we may thus fix upon the proper time for mowing. Of the various ingredients which compose grass, those portions which are immediately soluble in water are the most fitted for the purposes of nutrition; and therefore the mowing should be done when the plants contain the largest amount of sugar and other soluble matter. It has been shown that when the grass first springs above the surface of the earth the chief constituent of its early blades is water, the amount of solid matter being comparatively trifling; as its growth advances, the deposition of a more indurated form of carbon gradually becomes more considerable, the sugar and soluble matter at first increasing, then gradually diminishing, to give way to the deposition of woody substance, the saccharine juices being in the greatest abundance when the grass is in full flower, but before the seed is formed. During all the latter part of the process of fructification, the formation of the seed, &c., the sugar rapidly decreases in quantity, and when the seeds have arrived at maturity the stem and leaves begin to decay; so that if the grass is not cut when in flower, a great amount of nutriment will be wasted. For the operation of mowing, dry weather, and, if possible, that in which sunshine prevails, is chosen. In making meadow grass into hay on the old plan, where the scythe, fork, and rake are the implements used, it generally takes three or four days, under ordinary weather, to get ready for stacking. The first day the grass mown before noon is *tedded*, that is, shaken abroad evenly over the ground with forks; it is then turned over once or twice with rakes, and left in narrow windrows, and finally put into small grass *cocks* or heaps for the night. The second day, if the weather is favourable, the whole must be again thrown out, so as to secure the greatest possible benefit from the sun's rays and the drying wind. It is turned once or twice during the day, and in the evening put up into cocks of about twice the size of those of the preceding night. On the third day these *bastard-cocks*, as they are called, are shaken out into narrow *staddles*, which are afterwards turned, and, if the weather is fine, the newly-made hay will be ready by afternoon for gathering into large windrows for carrying and stacking; but otherwise it will have to be put up into larger cocks, and the carrying deferred until the next day. It is not desirable that grass should be too rapidly made into hay under a burning sun, as it is liable to scorch and lose its nutritive value. Great care must also be taken to preserve the hay from dew and rain, as water washes away the soluble salts and other matters, and when in the stack will cause fermentation, which, if excessive, destroys some of the most valuable properties of the hay; the cocks formed in the evening must never be opened in the morning until the dew has gone off. The stacking is rather a nice operation. The great object should be to preserve the green colour and natural juices of the herbage, and to induce a slight degree of fermentation, which has the effect of rendering the fibres of the plants more sweet and tender. The skill of the farmer must determine the proper degree of moisture, and even when this is done successfully only a certain quantity of hay must be put upon the stack daily, so as to let the steam out. Some farmers salt their hay in stacking; others do not. Salt is generally commended. A good plan, when the hay harvest has been accompanied by wet weather, is to place a few layers of straw in the stack at intervals to absorb the moisture from the heating hay. On large farms the tedding, or spreading out of the hay after it is cut down is performed by a tedding or haymaking machine drawn by a horse, which will do the work of twelve or fifteen haymakers, and distribute the grass more thinly and evenly as it crosses the field. A double-action machine, with rows of rakes, has been known to repay its cost in a single season. It is only for the haymaking of the true grasses, however, that it is adapted, as clover must not be shaken so violently. To be transported to markets at a distance, hay is now frequently compactly pressed into bales by presses worked by hand or power.

HAYDN, Joseph, celebrated musical composer, was born on March 31, 1732, in the village of Rohrau, on the borders of Hungary and Lower Austria, his father, Matthias Haydn, being a poor wheelwright. His musical talents early attracted attention, and his parents being advised to give their son a musical education, young Haydn was sent to school at the neighbouring town of Haimburg at the age of six, where he learned reading, writing, singing by note, and to play on such instruments as his childish strength would admit of his handling. His voice proved to be one of remarkable sweetness, compass, and power, and attracted the notice of the parish priest, who recommended him as a choir-boy to Reuter, chapel-master of St. Stephen's in Vienna. At the age of eight Haydn was received into the choir, a position which, from the liberal provision of the emperor, should have secured him comfortable maintenance and the best teachers. With the exception of some Latin and much practical music, however, Joseph seems to have been taught nothing; in the theory

and science of the art he received but two lessons from his master in eight years. His physical wants were as ill supplied as those of his mind. Hunger during these years was a constant spur to him in the study of singing, he having early learned that his beautiful voice could be made to procure him food. Even in those years he was an industrious composer, and was once surprised by Reutter in attempting a complicated Salve Regina. 'I thought at that time,' said Haydn long afterwards, 'that the blacker the paper the finer the music. Reutter laughed at the immature production, at passages which no voice nor instrument could perform, and scolded me for undertaking sixteen parts before I could manage two.' At last, in his sixteenth year, his voice began to break, and he lost his place, being turned out into the streets by his harsh master, with a threadbare coat and three bad shirts. He found that his parents could not aid him, and he took up his abode in an attic of a six-story house in the Austrian capital, intending to live by his art. How he contrived to keep soul and body together for the first few months is not known. He attempted often to still the craving of hunger by practising on his violin and his worm-eaten harpsichord. At that time the first six sonatas of Emmanuel Bach fell into his hands. 'I could not leave my instrument,' he said in his old age, 'until I had played them through; and any one who knows me must perceive how much I owe to Emmanuel Bach, that I studied him carefully, and comprehended him.' After a time he became acquainted with Metastasio, the greatest operatic librettist of the time, who was living in the same house. The poet had charge of the education of a Signora Martinez, and Haydn was employed to give her elementary instructions in music. This afforded him an opportunity for mastering Italian, and what was of more immediate importance, procured him board and lodging. Metastasio introduced the struggling young artist to Porpora, a celebrated Italian musician, then in Vienna, who engaged him to play accompaniments during singing lessons. As Porpora's accompanist he attracted the attention of Gluck and other masters, and his prospects from this time onwards grew steadily brighter. He was often engaged to play at the musical entertainments given by the Austrian nobles, was appointed organist of two churches, sang tenor parts in the choir of another, and pupils became rapidly more numerous, and willingly paid the successful young teacher higher fees. He wrote a short comic opera, Der hinkende Teufel (The Limping Devil), for which he received the sum of twenty-four ducats, at that time a very fair remuneration. The piece was given three nights with applause, but owing to the satirical character of the libretto it was forbidden by the police. Having now the means, Haydn determined to master the science of music, and purchased and studied the theoretical works of Emmanuel Bach, Mattheson, and Fux. His own pen was seldom idle; besides the exercises in harmony and counterpoint written for his own improvement, he wrote numerous pieces for his pupils, which fell into the hands of publishers, and brought him some fame, if no pecuniary profit. In 1759 Count Morzin engaged him as music composer and director at a salary of 200 florins, with free lodgings and table with his secretaries and other officials. He now resolved to marry, but unfortunately chose the younger sister of a lady to whom he had formerly been much attached, but who was destined for the convent. Of his wife he seldom spoke, but on one occasion he complained that she cared little whether her husband was a cobbler or an artist; and he might have become rich but for her propensity to squander his earnings. In 1761 he was appointed 'chapel-master' or musical director to Prince Nicholas Esterhazy, in whose service he remained for thirty years. Anything like a catalogue of his compositions during this time is impossible; much was destroyed on three separate occasions when his house was burned down, and much was scattered; but we know of 163 pieces for the baryton, an obsolete instrument in size between the viola and the violoncello; about 120 symphonies for full orchestra; more than 100 works of chamber music of the higher forms; twelve Italian operas performed in his patron's private theatre. During the building of the new chatean at Esterhaz, the accommodation was so scanty that the prince took but a few of his orchestra with him, and they were obliged to leave their wives and families at Eisenstadt. Six months passed, and the artists got impatient to return, and were further cruelly disappointed when the prince told them he intended to stay two months longer. The young men consulted Haydn as to how the prince could be made to alter his determination. Haydn composed a symphony in which one instrument stops after another, and each musician, as soon as his part is finished, puts out his light, rolls up his music, and retires. The prince understood the hint, and gave the musicians liberty to rejoin their families on the following day. This is the story of the origin of the sestette known as Haydn's Departure as related by Haydn himself, which has been related with many changes and additions. On the death of Esterhazy, in 1790, Haydn was induced to visit London, where the musical world received him with the greatest enthusiasm, and where he stayed eighteen months. Here he produced an opera, the Orfeo, nine symphonies, six quartettes, eleven sonatas, several songs and canzonets, and the accompaniments to more than 100 Scotch songs. He visited the English metropolis a second time in 1794, his stay lasting a like period, and being equally favourable as to his fame and fortune. On his return to Vienna he set about composing the music of an oratorio, the Creation, the words adapted by Linley from Milton's Paradise Lost. Haydn thought the text too long, and being not thoroughly acquainted with English, had it translated and curtailed by Baron von Swieten. It was produced 19th March, 1799, when its author was in his sixty-sixth year. It obtained a great success, and he was induced to undertake the music of another text prepared from Thomson's 'Seasons.' This work wants the freshness and vigour of the previous work; which may have resulted in some measure from the barren unpoetical text. He may be said to have taken his public farewell of the world on 27th March, 1808, when his Creation was performed by the Dilettanti Society of Vienna, to conclude their series of concerts. Haydn was invited, and received an ovation from the nobility and gentry of the brilliant capital. He died on the 31st May, 1809. Haydn thought it unfortunate that circumstances had led him so preponderantly into the field of instrumental music, rather than into that of operatic writing. But in this no one, who knows his works extensively, can doubt he was in error.

HAYDOCK, an urban district or town of England in Lancashire, about 7 miles north-east of Warrington. The places of worship include a recently-rebuilt parish church. Coal-mines employ a number of hands. Pop. (1901), 8575.

HAYDON, Benjamin Robert, an eminent painter, was born in Plymouth in 1786, and early showed a turn for art; but his father, a bookseller in the town, was dissatisfied with this tendency in his son, and it was with great difficulty that he at last consented to his going up to London, in 1804, to study the profession of an artist. He entered the schools of the Royal Academy, and soon gained the friendship of Fuseli, to whom he had been introduced. His first

picture, The Repose in Egypt, was exhibited in 1807, followed by his Dentatus in 1809, which afterwards gained the prize of 100 guineas at the British Institution, and is a wonderful composition, both from its intrinsic merits as a bold and vigorous production, and the youth of the artist, who had not yet attained his twenty-third year. The hanging of it, however, caused a rupture between him and the directors of the Academy, which proved the commencement of an endless war, Haydon maintaining and publishing that the former were afraid of his success as the founder of a new school of historical art, and therefore endeavoured to retard it by every means in their power. Throughout the whole of his career this extraordinary man was ever complaining of the injustice of patrons, and the apathy of the world in general, though, as usually happens in such cases, much of this apparent neglect was fairly attributable to himself. He was obstinate and opinionative in his views, upholding them defiantly in the face of all remonstrance, one point on which he was specially persistent being the size of his pictures, which he extended to such dimensions as to render them quite unfit for suspending on the walls of any ordinary room. One of his best pictures, The Judgment of Solomon, was exhibited, in 1814, in the gallery of the Water Colour Society, and purchased for 600 guineas. The same year he made a trip to Paris with Wilkie. In 1815 he established a school in opposition to that of the Academy, and had among his first pupils the Landseers, Eastlake, and others, who afterwards distinguished themselves. The school was, however, a pecuniary failure, and in 1823 he got so involved in debt that he became an inmate of the King's Bench Prison, where he remained two months. Of his subsequent pictures, the principal are—Christ's Entry into Jerusalem, exhibited in 1820; the Raising of Lazarus; the Mock Election; Chairing the Member; Pharaoh Dismissing Moses; the Burning of Rome; the Banishment of Aristides; and Quintus Curtius Leaping into the Gulf. His lectures on painting and design show him to have possessed literary talents of no mean order; and his autobiography, edited by Mr. Tom Taylor from his journals, forms a singularly interesting and instructive record. The embarrassments in which he was involved, and his disappointment at not being included among the painters appointed to decorate the new houses of Parliament, at length overturned his reason; and on 22d June, 1846, he perished by his own hand, after making this last entry in his journal, 'Stretch me no longer on this rough world.' A post-mortem examination discovered a long-seated disease of the brain, which may account for much of his eccentricity. No man alienated more friends, yet his conduct as a husband and a father was unexceptionable.

HAYESINE, Tiza, or Ulexite, is a borate of calcium with ten molecules of water; but it generally contains beside a certain amount of borate of sodium, with traces of chlorine and sulphuric acid. It generally occurs in rounded mammillated masses, which are covered with powder, and appear amorphous; but when these are broken they are seen to consist of a mass of delicate pure white crystals, which are interlaced so as to have a silky appearance. It fuses before the blowpipe, dissolves slowly in water, readily in acids. It is found in the gypseous deposits of Nova Scotia, at Iquique in Peru, and in the lagoons of Tuscany. It has been mined in considerable quantity as a source of boracic acid, and for glass and pottery manufacture, and cargoes of it have been brought to British ports.

HAY-FEVER, or Hay-asthma, a troublesome complaint, caused by the odours of certain flowering grasses; it is also caused by the odour of a stable, or of certain drugs, such as ipecacuanha, the merest whiff of the powder of which causes some susceptible persons to be immediately seized with painful paroxysms of sneezing. The disease varies extremely in its severity, presenting in one person the symptoms of an aggravated common cold, and in another, in addition to these, the disagreeable and alarming accompaniment of spasmodic asthma. The patient is tormented with headaches, his eyes are suffused, he sneezes violently, and there is an acrid discharge from the nose, with harassing cough. There is nothing for it in such cases but to remove from the cause of the disorder, otherwise it may run on for a month or more. A change to the seaside is often attended with beneficial results. During a paroxysm perhaps the most simple and efficacious remedy is the smoking of tobacco, which generally gives relief if continued until slight nausea comes on. The inhalation of the vapour of creasote, and the use of antispasmodics generally, as ether, lobelia, with the compound tincture of camphor, is recommended. While free from attack the constitution of the patient should be strengthened by a liberal use of tonics, especially iron, strychnine, arsenic, and quinine, either alone or in combination.

HAYLEY, William, an English poet of the 18th century, was born at Chichester in 1745, and studied at Trinity College, Cambridge. After quitting the university he settled at Eartham, in Sussex, where he possessed landed property, devoting his time principally to literature. His Poetical Epistle to an Eminent Painter (G. Romney), 1778, was followed by two other small poems. In 1780 appeared his Essay on History, in three (poetical) Epistles to Edward Gibbon (4to), and in 1781 his Triumphs of Temper. He next published an Essay on Epic Poetry (1782), Essay on Painting, Triumphs of Music, and Essay on Sculpture. His most popular work, next to the Triumphs of Temper, was a prose Essay on Old Maids (three vols. 12mo), illustrated by a series of fictitious narratives, chiefly satirical. In 1803 he published the life and correspondence of the poet Cowper (two vols. 4to), to which he added a supplement in 1806. He died Nov. 12, 1820. His Memoirs were published in 1823.

HAYMARKET THEATRE, one of the principal theatres of London, so called from the Haymarket, where it is situated. It was built in 1720, made a theatre royal, and rebuilt in 1767, when it was under the management of Foote. In 1821 this building was demolished to make way for the larger and more commodious and elegant structure now standing.

HAYNAU, Julius Jakob, an Austrian general, and younger son of the Elector William I. of Hesse and the Countess von Lindenthal, was born at Cassel in 1786. In 1801 he entered the Austrian service, and in 1805 was severely wounded and taken prisoner. In 1809 he was again wounded at the battle of Wagram. When in 1813 Austria declared war against Napoleon, he was employed in organizing a light battalion, with which he afterwards performed distinguished service in the campaigns of 1813–15. In 1848, when war broke out in Italy, he took an active part in the events of July and August. While the main army marched to give battle to the enemy at Custozza, he commanded at Verona. By the happy idea of sending a brigade to Sommacampagna, on the night of the 24th and 25th of July, he contributed essentially to the subsequent victories of the imperial army. A successful action at Lonato, and the bombardment of the fortress of Peschiera, contributed to his fame, and on the armistice he was honoured with the military order of Maria Theresa. With an iron hand he maintained quiet in Bergamo

and Brescia, and punished Ferrara for insurrectionary movements against the Austrian soldiers. Meanwhile Sardinia renewed the war in 1849. A formidable insurrection now took place in Brescia, and Haynau pushed forward from Padua, and hemmed in the city. After a fearful bombardment and murderous street fighting it was taken by storm. According to a statement in one of Haynau's own despatches, he commanded that no prisoners should be taken, that every man found with weapons in his hand should be put to death on the spot, and that every house from which shots were fired should be set on fire. He was afterwards carrying on the siege of Venice, when a letter from the emperor called him to Hungary, where he held the chief command in 1849. The storming of Raab, the advance southwards in the face of almost insurmountable difficulties, caused both by the nature of the country and the weather, the siege of Szegedin, the battle on the Theiss, followed by the capture of Temesvar, were all effected by Haynau, though Görgei appears disposed to give much of the credit to the Russians. After obtaining new honours for these services, he incurred loud censure for the cruel and bloody measures with which he followed up his victories, and more especially by the numerous executions at Pesth and Arad, which were ascribed to his influence and instigation. After the war his conduct in Hungary was almost that of a military dictator. His arbitrary proceedings brought him into collision with the ministry, and in 1850 he was suddenly deprived of his powers. On this he retired into private life, and took up his residence at Gratz. His name came again prominently before the public, when, in 1850, on a visit to the brewery of Barclay, Perkins, & Co., at London, he was attacked and maltreated by the persons in their employment. In Brussels, which he visited in 1852, he was the object of a similar demonstration. In military circles Haynau was distinguished for his familiarity with the soldiers, his incessant care for their welfare, and willing share in all their hardships. He died on 14th March, 1853.

HAYTI, Haiti, or San Domingo, Island of (Spanish, *San Domingo*, originally *Española*; Latin, *Hispaniola*), an independent island of the West Indies, and, after Cuba, the largest and one of the richest and most beautiful of the Antilles. It lies south-east from Cuba, and is separated from it by the Windward Passage, 50 miles broad. It extends from Cape Engaño, lat. 18° 35′ N.; lon. 68° 20′ W., to Cape Tiburon, lat. 18° 22′ N.; lon. 74° 28′ W.; and from Point Beata, lat. 17° 36′ 42″ N.; lon. 71° 32′ W., to Cape Isabella, lat. 19° 59′ N.; lon. 71° 1′ W.; and is about 400 miles long, east to west, and 150 miles broad at its broadest part. Area, including the islands of Tortuga, Gonaive, &c., about 28,250 square miles, or nearly as large as Scotland. The eastern part of the island is occupied by the Republic of San Domingo, and the western part by the Republic of Hayti.

The island of Hayti is of irregular form, being deeply indented by bays and inlets, and having corresponding projections; the greatest of the latter being its south-west portion, which forms a headland about 150 miles long, and 18 to 40 miles broad. It is intersected west to east by three chains of mountains, all mutually connected by offsets; between are extensive plains and savannahs. The principal central chain, which contains the culminating peaks, of which Loma Tina, 10,200 feet, is the loftiest, commences west at Cape Nicolas, takes an E.S.E. direction, and terminates at Cape Engaño. Nearly parallel with this chain another, commencing west near Monte Christi, nearly skirts the north coast, till it terminates east abruptly on approaching the so-called Peninsula of Samana; it is followed by low marshy grounds, interlaced by estuaries and channels, which separate Samana from the mainland, and afford communication from the bight of that name to the sea on the north shore of the island; the heights, however, reappear on the opposite side of the low grounds, and terminate in Cape Samana. Between these two mountain ranges extends the pastoral district of La Vega Real, or the Royal Valley, 130 miles long, watered by the Yacki and Yuma. The third and south mountain range commences west at Cape Tiburon, extends east along the whole of the south headland, and terminates at the river Neiva, about 80 miles west of the town of San Domingo. Besides La Vega Real there are other extensive plains and valleys; more particularly, on the coast east of San Domingo, *los llanos*, or the flats, 80 miles long, a rich pasture district. All the streams of Hayti of any importance originate in the great central mountain-chain; and, as may be inferred from the general direction of the mountains, have either an east, west, or south course, no stream of any consequence flowing north. The principal are: Artibonite, flowing west, and Monte Christi or North Yacki, north-west; the Yuma, flowing south-east; and the Neiva or South Yacki, the Nisao, and the Ozama, flowing south. They are all encumbered at their mouth with sand-bars, and hence few of them are navigable. The Ozama, however, admits vessels drawing 12 feet or 12½ feet. There are several lakes, mostly in the south-west of the island. The chief are the salt lakes of Enriquillo and Azuey; the former in the valley of the Neiva, about 20 miles long by 8 miles broad, and abounding in caymans; the latter, 10 miles west of Lake Enriquillo, about 10 miles long by 6 miles broad. South of these lies the fresh Lake of Icotea or Limon, about the size of Lake Azuey. Mineral springs exist in various parts. The most noted in the east portion of the island are those of Banica—temperature, 112° to 125°—Biahama, Yaya, and Pargatal; and in the west portion those of St. Rose, containing iron, vitriol, and alum; the saline waters of Jean Rabel, and those of Dalmarie, containing sulphur, potash, &c. The mineral products are various and rich, including gold, platinum, silver, quicksilver, copper, iron, similar to that of Dannemora in Sweden—magnetic iron, tin, sulphur, manganese, antimony, rock-salt, bitumen, jasper, marble, opal, lazulite, chalcedony, &c. The gold mines are abandoned, and gold-washing is only carried on by the poorer classes in some of the rivers. Indeed all of the minerals are neglected from want of capital.

Hayti as a whole is one of the healthiest of the West Indian Islands, and this may more especially be said of its north provinces and more elevated localities. The Vega Real is famed for its salubrity. The seasons are, a wet, during which heavy rains are frequent, 3, and even 5 inches at times, falling in twenty-four hours; and a dry, during which little or no rain falls, and in some localities years have passed over without a single heavy shower. At San Domingo the mean temperature is 78° 5′ and the extremes 60° and 95°; while at Port-au-Prince the range is from 63° 5′ to 104°. The minimum occurs in December, and the maximum in August and September. Land-breezes moderate the summer heats. Hurricanes occur seldomer than in the Windward or Caribbean Islands. Earthquakes, though not frequent, have been very disastrous; the most notable recorded are those of 1564, 1684, 1751, 1770, 1842, and 1887. By that of 1751 Port-au-Prince was destroyed, and 60 miles of coast submerged; and by that of 1842 towns were overturned, and thousands of lives were lost. Nowhere is tropical vegetation seen to greater advantage than in Hayti. Majestic pines, noble mahogany-

trees, fustic, satin-wood, and lignumvitæ clothe the mountains, and form the principal exports of the south provinces. The roble or oak (*Catalpa longissima*), which yields hard, durable wood; the wax-palm, divi-divi (*Caesalpinia coriaria*), numerous fine cabinet-woods, and the richest flowering plants abound; and the usual tropical vegetables—plantains, bananas, yams, batatas; and fruits—oranges, pine-apples, cherimoyas, sapodillas, with melons and grapes, yield a plentiful return. The staple cultivated products are: coffee, sugar, indigo, cotton, tobacco, and cacao. The west or former French section has always been the best cultivated. The native quadrupeds of Hayti are small, the largest not bigger than a rabbit; but the animals introduced from Europe, and now in a wild state, have thriven prodigiously, large numbers of cattle, pigs, and dogs now roaming freely in the savannahs and in the mountain forests. Birds are neither numerous in species nor beautiful in appearance; still great numbers of pigeons (*Columba leucocephala*) are annually taken, and used as food; and ducks in large quantities, and other swimmers and waders, frequent the marshy places. Insects, many of them venomous or annoying, abound. The lakes and rivers contain numbers of caymans and alligators, and in the surrounding seas whales are common in spring; and green and hawksbill turtles, lobsters, and crabs abound on the coasts.

Among the principal towns in Hayti are Port-au-Prince in the west; San Domingo and Jacmel on the south coast; and Cape Haytien and Monte Christi on the north.

Hayti was discovered by Columbus in 1492; and here, at Isabella, on the north shore of the island, the discoverer founded the first Spanish colony in the new world. The aborigines were described as being a happy docile race, subject to five hereditary chiefs, named caciques, who reigned over as many districts. So ruthlessly did the Spaniards deal with this race, that, estimated at 900,000 (probably too high) on the landing of the Europeans, in 1507 they were reduced to 60,000, and in 1537 there remained only 500. Having exterminated the aborigines, the Spaniards introduced African slaves to cultivate the sugar-cane, &c. Numerous colonists emigrating to South America after the conquest of Peru, the inhabitants were all withdrawn to the interior to prevent their escape; and the west end of the island thus left free to the French colonists, who, driven from St. Christopher's, settled there in 1630. Joining arms with freebooters, who, in 1632, settled in Tortuga, they became marauders by sea and land; and their successes rendered the name Buccaneer, by which they were known, terrible over all the West Indian seas. Ultimately the island of Tortuga and part of the mainland were claimed by the French settlers for their king. The first governor was appointed in 1664, and by treaty with Spain in 1773, the west part of the island was guaranteed to France. The Spanish part declined, while the French part prospered, and in 1789 it was in its most flourishing state. In 1790 the population of the island was estimated at 550,000; consisting of whites, who were Europeans, and their descendants; negroes, nearly all slaves; and people of colour, the offspring of the intercourse of the two former races. Many of the latter were free-born, or had obtained their liberty, and likewise had enjoyed a liberal education; still they were carefully excluded from political privileges, and were not eligible to situations of authority or trust. On the breaking out of the great French revolution a contest ensued between the coloured people and the whites, the former demanding equal privileges with the latter. A petty but sanguinary war ensued, until the slave population, also rising, joined the coloured people, and completely subdued the whites. The whole island, including the Spanish portion, ultimately fell under the power of the negro chief Toussaint L'Ouverture, first president of the Haytian Republic. He was afterwards betrayed into the hands of the French, who had despatched an army to Hayti with the view of regaining the position they had lost in the island; but after some partial successes they were permanently expelled, and in 1803 the island was declared independent, and its Spanish name of San Domingo replaced by its indigenous one of Hayti, meaning the mountainous country. Contentions succeeded between the leaders of the young republic (see CHRISTOPHE); unheard-of atrocities were committed, and much blood spilt, limited, however, chiefly to the French portion of the island. In 1821 the Spanish portion declared itself independent of the mother country, and assumed the name of Spanish Hayti; but it was soon subjugated by Boyer, the president of the Haytian Republic, or French Hayti, and the whole island was thus brought under one government. In 1842 a revolution broke out, and President Boyer was compelled to flee to Jamaica; and in 1844 the inhabitants of the Spanish portion rose, overpowered their Haytian oppressors, and formed themselves into a republic under the name of San Domingo (Republica Dominica), which was proclaimed November 24, 1844. The independence of the Dominican Republic was virtually recognized by Great Britain, by the appointment of a consul to it in 1849, and it was formally recognized by a treaty of amity and commerce, ratified September 10, 1850. Soulouque, the president, and afterwards emperor of the French division of the island, under the title of Faustin I., endeavoured to subjugate the new republic, but was successfully resisted. Upon his downfal in 1859 the Dominican government concluded a truce for five years with his successor. But the state was distracted by political factions, chiefly led by Santana and Baez, the first presidents. At length in 1861 Santana negotiated a reunion of the state with Spain, which took place. But insurrections broke out against the Spanish authority, and after the loss of 15,000 men and £6,000,000 Spain evacuated the island in 1865. Fresh dissensions immediately arose, headed by Baez on the one side, and Cabral on the other. At last in December, 1867, Baez made a successful attack upon his rival, and Cabral had to flee; Baez was afterwards proclaimed president of San Domingo, and held the office for some years, though his tenure of it was disturbed by the attempts of Cabral and his party. Notwithstanding recurring subsequent political disturbances, the country seems to be in a fairly prosperous condition. The Republic of San Domingo has an area of 18,045 square miles, with an estimated population in 1888 of 610,000, largely composed of mulattoes and other half-breeds, negroes, and whites, the whites being comparatively numerous. Owing to the influence of the Spaniards and their blood, Spanish is the prevailing language, and the R. Catholic is the state religion. The capital is San Domingo, founded in 1494. The commerce of the republic is small, and is mainly carried on with Britain, the West India Islands, and the United States. Exports and imports are each about £500,000.

—The Republic of Hayti occupies the west end of the island, and includes the adjacent islands of Tortuga, Gonaive, &c. The east boundary, towards the Dominican Republic, is formed by an irregular line drawn south to north, from the river Anses-à-Pitre or Pedernales, on the south coast, about lon. 71° 50′, to the mouth of the River Massacre, which flows into the Bay of Mazanilla, about 10 miles south-west of Cape Haytien. Area, 10,204 square miles. A census of the population does not exist;

but the inhabitants, nine-tenths of whom are negroes and the rest French-speaking mulattoes, with very few of European descent, are calculated by some authorities to number about 572,000, but are also estimated at over 1,000,000. The capital of the republic is Port-au-Prince. By the constitution of 1867 the legislative power rests in a National Assembly of two chambers, the Senate and the House of Representatives, the latter elected by manhood suffrage, while the members of the Senate are nominated by the House of Representatives. There is a president, elected for seven years, which term is generally cut short by insurrections. Society is represented as being in a deplorable state, such heathenism as prevails in Africa, and even cannibalism in some of its most repulsive forms, being prevalent, while justice is bought and sold, and political corruption and peculation rampant. The chief exports are coffee, mahogany, and dye-woods. The commerce is principally with the United States and Great Britain. The exports and imports of the republic of Hayti are each valued at over £2,000,000.

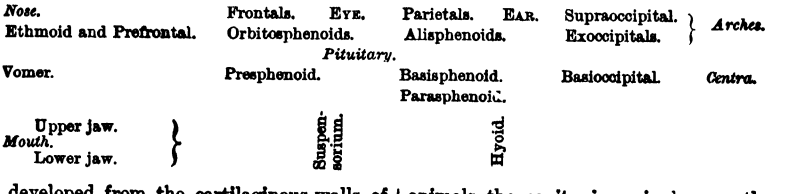
HAZEBROUCK, a town of France, department du Nord, 24 miles W.N.W. of Lille. It is tolerably well built, has a spacious and richly-ornamented parish church, erected between 1490 and 1520, with an open spire 240 feet high; a fine town-house, a subprefecture (both modern); communal college, public hospital, and an old convent of Augustins, now occupied by the large linen-market; a small public library, manufactures of linen, thread, starch, soap, leather, and salt; breweries, tanneries, dye-works, oil-mills, and lime-kilns. An important linen-market is held every Saturday. Pop. (1896), 7736.

HAZEL (*Corylus*), a genus of plants of the natural order Cupuliferæ, confined to the northern hemisphere. They are shrubs or small trees, with simple alternate leaves. The male flowers are in long cylindrical aments or catkins; and the fruit, consisting of a nut, marked at base with a large cicatrix, is enveloped in the persistent calyx, which is irregularly toothed on the margin. The European hazel (*C. avellana*), from cultivation, has produced several varieties, differing in the size, shape, and flavour of the nuts, which are commonly known under the name of *filberts*. It grows in all situations, and is easily cultivated, but a light and tolerably dry soil is the most suitable. This plant at one time gained celebrity from its twigs being believed by the common people capable of pointing to hidden treasures when in the hands of certain persons. (See RHABDOMANCY.) The American hazel (*C. Americana*) very much resembles the European, but is lower in stature. The flavour of the kernel is by many preferred to the filbert, though we know of no attempts to improve it by cultivation. It is common in most parts of the United States of America. Both the hazel and filbert are much esteemed, but particularly the latter, the flavour of its kernels being very delicious. They are, however, difficult of digestion. The oil which is obtained from hazel-nuts by pressure is little inferior in flavour to that of almonds, and under the name of *nut-oil* is often preferred by painters, on account of its drying more readily than any other of the same quality. Chemists employ it as the basis of fragrant oils artificially prepared, because it easily combines with and retains odours. In many parts of England hazels are planted in coppices and hedge-rows for several useful purposes, but particularly to be cut down periodically for charcoal, poles, fishing-rods, &c. Being extremely tough and flexible, the branches are used for making hurdles, crates, and springles to fasten down thatch. They are formed into spars, handles for implements of husbandry, and when split are bent into hoops for casks. Charcoal made from hazel is much in request for forges, and when prepared in a particular manner is used by painters and engravers to draw their outlines. The roots are used by cabinet-makers for veneering; and in Italy the chips of hazel are sometimes put into turbid wine for the purpose of fining it.

HAZLITT, WILLIAM, a distinguished modern critic and essayist, was born 10th April, 1778, at Maidstone in Kent. His father, a Unitarian minister, who came originally from the north of Ireland, went to America when Hazlitt was about five years old, but returned in two years. In 1793 young Hazlitt became a student in the Unitarian College at Hackney. He devoted more time, however, to literature and art than to the study of theology, and upon leaving college resolved to become a painter. He painted portraits with tolerable success; yet finding he was not likely to reach the high standard he had fixed for himself, he renounced the art, and in 1805 opened his literary career with an essay On the Principles of Human Action, in which much metaphysical acumen was displayed. In 1808 he married, and after a three years' retired country life he settled in London, deriving his principal support from his contributions of political articles and theatrical and art criticisms to the newspapers, and his occasional lectures and publications. In 1813 he delivered at the Russell Institution a course of lectures on English Philosophy, and subsequently at the Surrey Institution delivered courses of lectures on the English poets generally, the comic poets, and the Elizabethan poets. He was employed for a short time as reporter to the Morning Chronicle, and wrote occasionally for the Examiner. Later in life he contributed to the Edinburgh Review and some smaller magazines. In 1822 he was divorced, and married a second time two years afterwards. The latter years of his life he resided in a house in Westminster once occupied by Milton. He died in 1830. Many of his lectures and essays were retouched and published by him, and six years after his death a further collection was brought out by his son under the title of Literary Remains, containing a biography and thoughts on his genius by Lord Lytton and Serjeant Talfourd. Among the best known works of Hazlitt are: Characters of Shakspere's Plays (1817); A View of the English Stage (1818); Lectures on the English Poets (1818); Lectures on the English Comic Writers (1819); Table Talk (two vols. 1821); Lectures on the Elizabethan Age (1821); Life of Napoleon Bonaparte (four vols. 1828), which he intended to be his chief work, and which was dictated by enthusiastic admiration of his subject. The Essays, written in conjunction with Leigh Hunt, to the Examiner, were published under the title of the Round Table in 1817. He was a good art-critic, but his tendency to prejudice and paradox, and his almost contemptuous regard for the productions of contemporary genius, render him a less safe authority than his knowledge and talents would lead us to expect. See Memoirs by W. C. Hazlitt (2 vols., 1867).

HEAD. When the anterior part of the body of an animal is marked off by a difference in size, or by a constriction (neck), it is called head. The presence or absence of a head was formerly much used as a character in classification. Thus Latreille divided animals into the headless, *Acephala*, and those provided with a head: and these again formed two groups, the *Vertebral* animals, with heads properly so called, and *Cephalidia*, with small, indistinct heads. But this classification would separate the oyster and all other lamellibranch molluscs from the snail, cuttle-fish, &c.; it is, in fact, an artificial character. The mouth and principal nervous organs are the guides to the anterior end of the

body, where the head, when recognizable, is situated. In the Protozoa, Infusoria, and Cœlenterates, such as the Hydra and Corals, there is no nervous ganglion, and the mouth is not surrounded by special structures. In the inferior Vermes the anterior end becomes marked by the presence of ganglia, though the mouth may be at some distance from it. The so-called head of parasitic animals, such as the tape-worms, is only the end of attachment, the globular hook-bearing mass being head-like on a long neck, but neither mouth nor ganglia exist in it. In the Polyzoa, lampshells, ascidians, and lamellibranch molluscs mouth and ganglia exist, but they are not surrounded by special structures. But in the worms proper, the articulated animals (crustaceans, myriapods, spiders, and insects), the land and fresh-water gasteropods (snails and whelks), and the cuttle-fishes a head proper is found. That is, the mouth with the anterior nervous ganglia, and some at least of the sense organs, are placed in a segment of the body which, either by structure or by structure and appearance, is different from the rest. Thus in the worms and articulated animals some of the rings or articles of which the body is made up are fused together, the appendages being not walking limbs, but modified into jaws or jaw-like organs. Thus the common shore-worms possess a structural head, though it is not apparent. The head is best defined in the insects, as in the house-fly, where it is separated by a slender neck from the thorax. The snail's head has its cavity shut off by a diaphragm from the rest of the body cavity, and contains the denticulate lingual ribbon or tongue, with the muscles which work it, while the antennæ and eyes appear on the surface. The cuttle-fishes have, in addition, a remarkable cartilaginous box, which, like a skull, protects the ganglia and gives support to the muscles. The head of the vertebrated animals presents a regular series of increasing complexity from the lancelet (Amphioxus) upwards. In that fish the most anterior part of the nervous cord is lodged in a canal scarcely distinct from that which contains the rest of it. Ascending in the series, it becomes evident that as the anterior nervous mass enlarges, and its ganglia increase in complexity, the anterior vertebræ change their character; as the brain becomes specialized, so does the brain-case or skull. In man the brain attains its highest development and the head its greatest complexity, the difference between skull and face being now most pronounced. The vertebrate theory of the skull, first propounded by Goethe, is now accepted to this extent, that the skull or cranium consists of three vertebræ, which are recognizable in the fish, and that the facial bones are not vertebræ, but developed from cartilage which did not form an original part of the vertebral column. A vertebra consists of a body or centre, from which two processes arch upwards and close in the spinal canal with its contents, the spinal cord: while lateral processes give attachment to ribs, and indirectly to limbs. The posterior cranial vertebra is the occipital, consisting of a centre, the basioccipital bone, two lateral pieces, exoccipitals, and a superior supraoccipital; the next is the parietal, of which the basisphenoid is the centre, and the great wings of the sphenoid and the parietals the lateral arches; the most anterior is the frontal, with its centre, the presphenoid, and its arch, formed by the orbital plates of the sphenoid and the frontals. The centres of the spinal vertebræ are ossifications around a fibro-cartilaginous rod, the *chorda dorsalis*, which ends in the basisphenoid. So far spinal column and skull have a common base; but the spinal vertebræ were preceded by, and are in fact modifications of primitive vertebræ, and no representatives of these appear in the development of the skull. It is therefore open to question whether the three divisions just mentioned are really vertebræ, or should not rather be called cranial segments. There is the more reason for this that in fishes the basisphenoid and presphenoid are represented by a single bone, the parasphenoid, which underlies the skull, but disappears in the higher vertebrates, and that the presphenoid is not properly connected with the chorda dorsalis, but rather belongs to the series of facial bones. The pituitary body which projects from the lower surface of the brain lies in front of the end of the chorda dorsalis: from this latter rod and its surroundings a plate of cartilage passes forward on either side of the pituitary body, and these (the *trabeculæ*) meeting in front of that body, form the cartilaginous axis around which the vomer, ethmoid, and other facial bones are developed, while the presphenoid is an ossification in this axis just where the two portions meet in front of the pituitary. The sense organs, the ear and the eye, are, so to speak, lodged in capsules of bone which are inserted, the ear between the occipital and parietal, the eye between the parietal and frontal segments. They are accidental, not essential parts of the cranium. The hyoid apparatus and the lower and upper



jaws are developed from the cartilaginous walls of the embryonic skull, and the jaws come in a secondary manner to take part in the composition of the face. (See Respiratory Organs.) The increasingly globular form of skull in the vertebrates is due to the greater increase of the cerebral hemispheres relatively to that of the base of the brain and axis of the skull: hence the brain comes in man to overhang the face. Of course it is to be remembered that while in the vertebrated animals the head is divided by its axis (commencing at the middle line of the upper jaw, and passing backwards through the basisphenoid to the vertebral centres) into an upper chamber, lodging the brain, and a lower, lodging the first part of the alimentary canal; in the lower animals the cavity is a single one, the œsophagus piercing the nervous system so as to reach the surface of the body, and thus coming to be surrounded by a pair of ganglia above and a pair below, with the filaments connecting these ganglia. In the vertebrate the head is curved downwards, the basisphenoid being the pivot point, so that the mouth is pushed to the lower surface; in the lower animals the under surface of the body curves upwards, so as to carry a part of the nervous system past the mouth towards the upper surface. The eyes and feelers of a crab are in fact modified limbs which are thus carried upwards; the jaws and sense organs of a vertebrate are entirely distinct from the limbs and other appendages of the trunk.

HEAD, Sir George, a writer of travels, &c., was the son of J. R. Head of the Hermitage, Kent, and was born there in 1782. An ancestor of his was a Jewish physician, who came from Portugal to England in the reign of Charles II., and was afterwards physician to the king. He was educated at the Charterhouse School, and in 1808 received a captain's commission in the West Kent militia. The following year he proceeded to Portugal, accepted the situation of a commissariat clerk, and joined Wellington's army at Badajoz. He was afterwards appointed to the charge of the commissariat of a brigade; and after the battle of Fuentes d'Onoro was nominated deputy-assistant commissary-general. He was present at most of the great battles in the Peninsula, and also in the concluding campaign in the south of France. In the autumn of 1814 he proceeded to Canada to superintend the commissariat of a naval establishment intended to be formed on the Canadian lakes; but the American war having shortly afterwards terminated, he returned after an absence of ten months to England. An account of his expedition was published by him under the title of Forest Scenes and Incidents in the Wilds of North America, which obtained considerable success. In 1831 he was made a knight, and in 1836 appeared his Home Tour through the Manufacturing Districts of England in the Summer of 1835, followed next year by A Home Tour through Various Parts of the United Kingdom. These contain a large amount of useful and reliable information. In 1849 he published Rome, a Tour of Many Days. Sir George Head contributed also several articles to the Quarterly Review, and translated from the Italian the Historical Memoirs of Cardinal Pacca, and from the Latin the Metamorphoses of Apuleius. He died in London, unmarried, on 2d May, 1855.

HEADACHE is one of the most frequent ailments, the result of a variety of causes. It may arise from overfulness of blood, from deficiency of blood or debility, from excited or inflammatory action, from the nerves, &c. If a person who suffers from headache is of full habit generally; if he is sleepy, dull, the vessels of his face full; if the uncomfortable sensation in the head is aggravated by stooping, by an abundant meal, by stimulants or by sleep, overfulness is the probable cause, and reduction of the diet, purging with calomel and colocynth, with occasional doses of saline medicine, exercise, bathing the head with cold water, and if the symptom is very severe, the application of a few leeches to the temples will be beneficial. If the urine is deficient, cream of tartar in some form may be taken with advantage. The above species of headache may also be occasioned by whatever impedes the circulation, such as affection of the heart or liver; when the latter is the case the pain is frequently most severe at the back of the head. When, on the other hand, headache occurs in a person of weak constitution; when it is produced or aggravated by mental over-exertion; when there is listlessness both of mind and body rather than oppression—the face pale, the pulse weak—debility is the probable cause, although at the same time there may be overfulness of the blood in the interior of the head itself; very frequently, however, in this kind of headache the head is hot without there being any particular flushing of the countenance. This form of headache is often accompanied with indigestion, and is common in students and anxious men of business. Anything like abstraction of blood will certainly prove injurious. Exercise, attention to the state of the bowels without purging, care in diet, rest, and change of scene and air, will be most useful. Headache from excitement or inflammatory causes is such as occurs in the first stages of inflammation of the brain and in some forms of fevers, or it follows violence to the head. Of all kinds of headache that arising from some disorder of the stomach or some part of the alimentary canal is, however, the most common. The presence of indigestible food in the stomach almost certainly causes dull pain in the forehead; and too acid a condition of the contents of the organ produces the same effect. The various symptoms of indigestion will generally point to the cause. In the first an emetic or some aperient, such as the compound rhubarb pill, or a saline draught, will probably remove the disorder. When acid eructations, heartburn, &c., indicate the presence of superabundant acid, a dose of soda, potash, or magnesia will correct the cause and remove the effect. There is a peculiar form of headache which consists in throbbing and pain of one particular part, or sometimes over one side of the head; it lasts an hour or two, and then goes off, returning at stated intervals. This is called *hemicrania* (the *migraine* of French and the *megrim* of old English writers), and is often of a distinctly intermittent character. For its permanent cure quinine is in common use; a mustard poultice on the nape of the neck is also of service; and antipyrin, a recent remedy, has proved of the greatest value in affording speedy relief.

HEAD-BOROUGH, in England, an old name for the head of a borough, town, or tithing, a sort of high-constable. The office of head-borough was united with that of petty constable when the latter office was instituted in the reign of Edward III.

HEALDS, or Heddles. See Weaving.

HEALTH is that condition of the living body in which all the functions are harmoniously performed without difficulty or pain, so that the whole body is maintained in activity and vigour. Ideally this implies perfection of structure, so that we might say health was harmonious co-operation of perfect structures. But practically perfection of structure is not essential. Now what does this harmonious discharge of bodily functions, necessary to a state of health, mean? Given a healthy body, work is done by it, in the various forms of physical, nervous, and intellectual activity. This implies waste of tissue, and a continuance of the healthy state demands repair of the waste and removal of the waste products. The repair of waste is effected by materials supplied as food and drink, which must be of a kind fitted by its quality to yield the elements needful for the upbuilding and renewal of the wasted tissues, and by its quantity sufficient to afford the amount for complete renewal. This food must be elaborated into the form which the tissues can make use of. This elaboration is performed primarily by the digestive organs, and secondarily by glandular organs, so that while the first condition of health is a sufficient supply of food of a proper quality, the second is the due performance of the digestive function, followed by proper activity of the absorptive process by which the nutritive elements are removed from the food. The nutritive material having been duly prepared by the digestive system, absorbed, and elaborated by glands, must be distributed, as the blood, to the various tissues and organs in proportion to their needs. This is achieved by the system of blood-vessels, the motive power being supplied by the heart. The part the circulatory system plays in the healthy organism is apparent. But besides nutritive material the tissues require oxygen, without which tissue change, on which the liberation of energy depends, cannot occur. Besides the oxygen introduced in food, free oxygen enters the blood by the lungs, any interruption to which process would, it is clear, imply an immediate departure from health. Suppose, then, the body to be efficiently supplied with food,

water, and oxygen, and these to be properly distributed to the tissues, the means for the repair of waste are complete. The removal of waste requires the activity of the bowels, skin, kidneys, and lungs, by all of which channels solid, liquid, and gaseous waste products are expelled. The *harmonious* co-operation of all these functions requires the regulating action of the nervous system. These are the *internal* conditions of health. Among the external conditions are, besides an efficient and wholesome food supply, a pure water supply, pure atmosphere, removal of waste expelled from the body from its neighbourhood, and so on. Finally, there is for health required the means by which the bodily organism is related to the outside world, by the senses and the higher nerve centres, which are the substrata of perception, intelligence, and so forth. See PUBLIC HEALTH.

HEALTH, BILL OF, a certificate signed by consuls, or other proper authorities, delivered to the masters of ships at the time of their clearing out from ports or places suspected of being particularly subject to infectious diseases, certifying the state of health at the time the ship sailed. A *clean* bill imports that at the time the ship sailed no infectious disease was known to exist; a *suspected*, commonly called a *touched* bill, imports that there were rumours of an infectious disease, but that it had not actually appeared; a *foul* bill, or absence of a clean bill, imports that the place was infected when the vessel left.

HEARING. See EAR and ACOUSTICS.

HEARSAY EVIDENCE. See EVIDENCE.

HEART, a hollow muscular organ, the function of which is to maintain the circulation of the blood. The organs of circulation are the heart, the arteries, the veins (see BLOOD-VESSELS), and the capillary vessels. The blood is either arterial or venous, according to the relative proportions of oxygen and carbonic acid gas it contains. The venous blood which has returned to the right side of the heart from the body is propelled along the pulmonary artery by the contraction of the heart into the lungs, where by the absorption of oxygen and the giving off of carbonic acid gas it becomes arterial blood, which then is conveyed along the pulmonary veins to the left side of the heart, and is thence distributed throughout the body to nourish it and repair its losses. The heart is composed of four cavities, two auricles and two ventricles. It is enveloped in a membrane called the *pericardium*, situated toward the left of the cavity of the chest, between the lungs, and resting on the diaphragm. Its form is that of a cone flattened on its inferior and superior faces. The right auricle communicates with the right ventricle, besides which there are in it three openings, that of the *vena cava inferior*, that of the *vena cava superior*, and that of the *coronary vein*. The communication between this auricle and ventricle is closed by a valve of three flaps when the ventricle contracts. The right or pulmonary ventricle communicates with the pulmonary artery, which also is provided with a valve of three flaps. When these flaps are brought together they interrupt the communication between the ventricle and the artery. The left auricle communicates with the left ventricle, and contains also the orifices of the four pulmonary veins. The left ventricle, besides the communication with the left auricle, which is guarded by a valve of two flaps, contains the orifice of the aorta, guarded also by a valve similar to that of the pulmonary artery. The ventricles are divided from each other by a fleshy wall, called the *septum cordis*. The valves at the openings of the arteries are called *semilunar*, that at the orifice of the right auricle *tricuspid*, that at the orifice of the left auricle *mitral*, and that at the orifice of the vena cava inferior the *Eustachian* valve. The heart is formed of a firm thick muscular tissue, composed of fibres interlacing with each other, so as to form a figure of eight. It also contains nerves and vessels. The coronary arteries arise from the aorta, and are distributed on the heart. The coronary veins return the blood of the heart into the right auricle. The arteries (from the Greek *aĕr*, air, and *tērein*, to preserve, because they were thought to contain air) are the vessels which serve to carry the blood from the heart to all parts of the body. They terminate in the capillary vessels, a series of extremely minute vessels which pass over into the veins. The veins are the channels by which the blood passes back from the body into the auricles of the heart. The blood which is returned from the veins is dark, and is called *venous;* that which leaves the heart is bright scarlet, and is called *arterial*. The venous blood having parted with carbonic acid and acquired oxygen in the capillary system of the lungs, flows into the pulmonary veins, thence is received into the left cavities of the heart, from which it passes into the aorta. From the aorta it is distributed by branches —arteries—to every tissue and organ of the body, with few exceptions, the arteries dividing and subdividing till exceedingly minute vessels—arterioles—are reached. The arterioles finally pass into exceedingly thin-walled vessels, the capillaries, which pervade every part of the tissue or organ. Through the thin walls of the capillaries fluid—plasma—of the blood passes to bathe the tissues. But the bloodstream, thus brought into contact with the tissues, not only gives up to them oxygen and nutritive material, but receives waste products, among them carbonic acid gas, which are removed from the tissues in its current. The capillaries are not only the terminations of the arteries, but also the commencement of the veins. Gradually they unite to form larger vessels, minute veins, which again uniting form larger veins, and so on, by which the blood is returned from the tissues, till the large trunks, vena cava inferior and superior, are formed, which enter the right auricle. In the tissues the blood has lost oxygen and gained carbonic acid gas, becoming venous, the reverse process to that which takes place in the lungs.

We will now explain the mechanism of the sanguineous system. The blood contained in the two venæ cavæ is poured into the right auricle, which contracts, and thus forces the fluid to escape; but the vena cava superior opposes to its passage the column of blood which it contains, the other veins are closed by valves, and it must therefore pass into the right ventricle. The ventricle then contracts, and as the tricuspid valve closes the passage through which the liquid entered, the blood is forced forward into the pulmonary artery, which recoils by its elasticity, and, its orifice being closed by the semilunar valve, propels the blood still forward into the capillary system of the lungs, whence it passes into the pulmonary veins, which pour it into the left auricle by their four orifices. The contraction of the auricle impels it into the left ventricle, by which it is in the same manner driven forward into the aorta (the mitral valve preventing its return into the auricle), and thence into the general circulation as above described. The mitral and tricuspid valves have tendinous cords—*cordæ tendineæ*—connected with the edges of the flaps, and these cords are attached to muscular projections (*musculi papillares*) of the inner wall of the heart, by means of which the valves are prevented from being forced upwards too far. The two auricles contract and relax simultaneously with each other; as do also the two ventricles. The relaxation is called *diastole;* the contraction *systole*. It is difficult to determine what quantity of blood

the heart projects at each systole. It is generally estimated at six ounces. The systole of the ventricles is the cause of the motion of the blood in the arteries, which also dilate with each wave driven into them by the motion of the heart and thereafter recoil by their elasticity, causing the pulse.

The heart is not the 'centre of the circulation'; it is the central contractile organ. The blood is developed in the embryo before the heart is formed. In the lower animals the circulation of a nutrient fluid precedes the formation of a heart. In Protozoa, Infusoria, and those parasites which have no digestive canal, the soft tissues of the body are at once digestive and circulatory organs, the fluids being driven to and fro by the movements of the body. In Cœlenterates, Echinoderms, the lower Vermes, and some Articulates there is no true blood circulation; but water vessels discharge functions which are more comparable to those of respiration. In such cases the general cavity of the body contains a fluid which has passed by osmosis through the intestinal walls, and represents the products of digestion, its movements being determined by those of the body. The imperfect heart of the Ascidians or Sea-Squirts presents the rare phenomenon of alternate movement in opposite directions. In Molluscs, as a rule, a ventricle and two auricles are present among the bivalves, two ventricles occurring in a few; in the Gasteropods an auricle and ventricle; in the Cephalopods the system is symmetrical. Among the Annelids and Articulates a dorsal vessel represents the central propulsive organ; the blood, however, on leaving this vessel, passes into the interstices of the tissues, not being contained in definite vessels. In some forms, as the crab, where the body is shortened, the heart is also shortened, so as to give a resemblance to the compact heart of vertebrates. In fishes an auricle, a ventricle, and a muscular arterial bulb maintain the circulation, which is simple. In the amphibians and reptiles a three-chambered heart allows that mixture of venous and arterial blood which constitutes 'cold blood'.

HEART'S-EASE. See VIOLET.

HEAT, the name given to a peculiar sensation, and also to the agent by which that sensation is produced. The effects of heat on various kinds of matter are very remarkable, and will be described immediately: with respect to the sensation of heat, it may be observed that our sensations give us no indication whatever as to the absolute hotness or coldness of bodies, except when the temperature is so extreme as to cause pain, and that in that case the sensation of heat or cold is lost, intense heat or intense cold producing the same kind of pain. What our sensations do give us is, in the first place, a comparison between the temperature of the body which we touch and the temperature of the hand that touches it, a comparison which we get by noticing whether the hand is heated or cooled by contact with the foreign body; and in the second place, a means of comparing together the temperatures of two bodies by touching first one and then the other, and noticing to which of them we lose heat, or from which of them we gain heat the faster.

We now proceed to consider the effects of heat on the various properties of matter, and to indicate where, according to the plan of this work, detailed information on points which can only receive a general mention here may be found.

1. One of the most important and obvious effects of heat is to alter the temperature of bodies. In almost all cases when heat is supplied to a body the temperature of the body rises, and when heat is removed the temperature of the body falls. Temperature is, in fact, the tendency that a body has to impart heat to other bodies; and when heat is supplied or removed from a body, that tendency is increased or diminished. Temperature is measured by *thermometers* of various kinds, of which a description will be found under that name. We have not yet considered how quantities of heat are measured. We may, however, say, without going into that question, which is taken up below, that different bodies require very different amounts of heat in order to raise their temperature through the same number of degrees. In the first place, it requires twice as much heat to raise the temperature of 2 lbs. of iron from 0° C. to 1° C. as it does to raise 1 lb. of iron from 0° to 1°: and again, equal quantities of different materials require different amounts of heat to raise their temperature through any given number of degrees. Thus, it requires about thirty times as much heat to raise the temperature of 1 lb. of water 1° as to raise the temperature of 1 lb. of mercury by the same amount. The terms *capacity for heat* and *specific heat* are used in relation to the property of bodies now under consideration. The capacity for heat of a body or piece of apparatus is defined to be the quantity of heat required to raise the temperature of the body or piece of apparatus 1° from some fixed point, for instance, 1° from 0° C., or from 32° Fah. The specific heat of a substance is the ratio between the quantity of heat required to raise the temperature of the substance 1° from some fixed point and the quantity of heat required to raise the temperature of an equal mass of distilled water 1° from 0° C. See SPECIFIC HEAT.

2. Heat also alters the dimensions of bodies. Increase of volume almost always results from addition of heat. There are only, in fact, three or four exceptions to this law. One of these is the well-known phenomenon presented by water between the temperatures of 0° C. and 4° C. Between these temperatures the volume of water *decreases* as the temperature rises. Above 4° C., however, its volume increases as the temperature rises. Thus, at 4° C. the volume of the water is a minimum, and this point of temperature is called the *point of maximum density* for water. There are one or two other bodies which increase in volume on solidifying from their melted condition. Iron is one of these, and bismuth another; and it is this property that makes these bodies capable of affording *sharp* castings. There are also some crystals not belonging to the regular form, whose minor axes contract while their major axes expand. These are rare cases, however, and the almost universal rule is, that bodies expand with a rise of temperature. Taking the common scale of temperature, which practically makes the expansion of *common air* (and other gases) the measure of changes of temperature (see THERMOMETER), it is found that between moderate limits bodies expand nearly regularly with the temperature; that is to say, that for a rise of two degrees they expand twice as much as for a rise of one degree. But if we take wider limits, 100° of temperature or more, changes in expansibility are noticeable by delicate experiments for every substance. (Under EXPANSION some further information on this subject will be found.) Change of temperature also alters the elasticity of figure of solid bodies, an increase of temperature diminishing it in almost every case; and the elasticity of volume, that is, resistance to compression, is also altered, being increased as the temperature rises.

3. Addition of heat liquefies solid bodies, and converts liquids into gases. This, we have good reason to believe, is an absolutely general rule, although we have not yet succeeded in liquefying all solids, or in liquefying and solidifying all gases, which is the reverse process. During the conversion of a solid into a liquid, or a liquid into a gas, a considerable quantity of heat

is absorbed, and in the reverse process heat is given out; but this is one of the cases in which, though heat is taken in or given out, the temperature is not altered. Hence the heat is said to be made *latent*, and under the term LATENT HEAT particulars on this subject will be found.

4. Heat also alters the power of bodies for conducting electricity. In solids the conductivity is diminished to a great extent by an increase of a few degrees in the temperature. In liquids, on the other hand, increase of temperature increases the conductivity. The magnetic properties of bodies are also changed by heat. For example, an iron bar that has been magnetized suddenly loses the whole of its magnetism at a particular temperature, a temperature at which, it appears from recent observations, there is also a sudden alteration of volume. The *magnetic susceptibility* of iron is also altered by temperature to some extent. The optical properties of transparent bodies vary with the temperature; in liquids, at any rate, the refraction seems to decrease uniformly with the temperature, and so does the dispersion.

5. Lastly, we refer to the effects of heat in altering chemical properties of bodies. In some cases a very high temperature breaks up chemical compounds. In a strong solution of nitric acid, the nitric acid is decomposed by heat. On the other hand, increase of temperature, as a rule, favours chemical combination, as is seen when a spark is applied to a mixture of oxygen and hydrogen, where it causes their instantaneous combination.

We may now consider the measurement of quantities of heat. Almost any one of the various effects of heat might be made the basis of a system of measurement. For example, the unit quantity of heat might be chosen as that quantity which is required to melt a gramme or a pound of some known substance, ice for instance. Indeed, this is sometimes used as a temporary unit: and Black, the discoverer of latent heat and of specific heat, did use it constantly, in consequence of his method of calorimetry. Our present science has, however, made our measurement of *temperature* so much more exact than any other measurements of the kind that we can make, that the unit quantity of heat is now defined by universal consent as the quantity of heat required to raise the temperature of a known body by a definite amount. For many reasons that will readily suggest themselves water is chosen as the substance for reference: and the unit quantity of heat is, therefore, defined (the Centigrade thermometer and metrical system being employed) as the quantity of heat which will raise the temperature of 1 gramme of distilled water from 0° C. to 1° C. The unit quantity of heat may be otherwise defined: for example, 1 lb. of water may be used instead of 1 gramme, and one degree Fahrenheit instead of one degree Centigrade. The reduction from one system to the other is, however, very simple. The definition given above is that which is now sanctioned by the best writers, and by committees of the scientific societies that have considered the question. *Calorimetry* is the technical name given to the part of the subject that deals with the practical measurement of quantities of heat. The methods adopted in various cases depend on the nature of the problem, and on the way in which the heat presents itself for measurement. See SPECIFIC HEAT.

The nature of heat was long a subject of active controversy. After the times of the alchemists and of those who held the phlogiston theory, the material theory of heat long held sway. Heat was considered to be a subtle imponderable fluid, permeating all matter, and was known under the name *caloric*. It was supposed that this fluid combining with the molecules of gross matter gave rise to the effects and phenomena observed; for instance, that a certain quantity of it entering into combination with the particles of a solid turned the solid into a liquid, or combining with the particles of the liquid converted it into a gas.

Doubtless the material theory was the more firmly held because the Chemists were the cultivators of the science of heat, as of electricity; and it was natural to them to explain, if possible, the changes that they saw produced by heat as changes of the same nature with the chemical composition and decomposition that they were so familiar with. The great names of Black and of Lavoisier, too, gave popularity to the doctrine that they held; and the two grand discoveries of Black, of specific heat and latent heat, were so simply explained by the material hypothesis that the truth of the hypothesis seemed almost beyond question. The holders of the material hypothesis met, however, with one great difficulty in the fact of the production of heat by mechanical means, for example, by the friction of two solid substances. To explain it they were forced to resort to the supposition that the effect of the friction was to alter the *capacity* for heat of one or both of the substances. Black, indeed, brought forward a striking experiment in support of this supposition, showing that a piece of soft iron that has once been heated to redness by hammering, cannot again be heated in that way to the same extent without being previously exposed to a red heat in the furnace and allowed to cool. An experiment like this was, in fact, strongly in the favour of the *calorists*, as those who held the material theory were subsequently called, for, in this case, the heat seemed actually to be squeezed from the iron as from a sponge, and the iron to be so altered during the process as to be incapable of containing its original quantity of heat.

To Rumford and Davy, at the end of the 18th and the beginning of the 19th century, is due the credit of the two experiments that to their minds did overthrow, and to all other minds ought to have overthrown, the calorist hypothesis. Rumford, remarking on the vast quantity of heat given out during the boring of brass cannon at the arsenal at Munich, and especially being struck with it on comparing it with the small quantity of the cuttings and powder removed from the mass, considered that it was scarcely conceivable that an alteration in the capacity for heat of so small a quantity of the brass should cause the evolution of so large a quantity of heat. He argued from the fact that the supply of heat producible by mechanical work is apparently unlimited, and from experiments showing that the specific heat of the brass cuttings was precisely the same as that of the massive metal, that heat cannot be a fluid; and he brought forward what was all but a convincing proof that it can be nothing but a form of motion. Among the contributions of Davy to the science was his beautiful and celebrated experiment of rubbing together two pieces of ice, while surrounded by an ice-cold atmosphere, until they melted away completely. Now the specific heat of water is nearly double that of ice, and the circumstances absolutely prevented any heat being acquired from the surrounding objects. Thus he showed the very large quantity of heat required for the liquefaction of the ice produced under circumstances where none of the calorist explanations could hold. He concluded that 'the immediate cause of the phenomenon of heat is motion, and the laws of its communication are precisely the same as the laws of the communication of motion.' This statement was given by Davy in his Chemical Philosophy (1812): the date of Rumford's paper in the Philosophical Transactions is 1798; but it was not till thirty years after that the conclusions of Rumford and Davy were adopted. We cannot enter here into a complete history of the development of the dynamical

theory of heat. We must pass directly to Joule, who between 1840 and 1843 conclusively established the truth of the dynamical hypothesis, by measuring the amount of energy required to produce a definite heating effect, and by showing that the quantity of heat obtained by expending a definite amount of energy in friction is the same whatever is the nature of the body in which the friction takes place. The conclusions arrived at by him are thus given:—

1st. *The quantity of heat produced by the friction of bodies, whether solid or liquid, is always proportional to the quantity of work expended.*

2d. *The quantity of heat capable of increasing the temperature of* 1 *lb. of water by* 1° *Fah. requires for its evolution the expenditure of mechanical energy represented by the fall of* 772 *lbs. through* 1 *foot.*

Thus work equal to 772 foot-pounds is called the *dynamical equivalent of heat:* meaning thereby the dynamical equivalent of a pound-Fahrenheit unit of heat.

That heat is a form of energy is now considered by all to be beyond question. Every substance, whether solid, liquid, or gaseous, is considered to have some kind of molecular structure. What the nature of the molecular structure is is a question of great difficulty, nay, a question that, at present, no one pretends to be able to answer; but whatever is the nature of the molecular structure, it is certain that heat consists of relative motions of the particles. The greater the energy of the motion the higher the temperature of the body, so long as it maintains its original state, solid, liquid, or gaseous; and an alteration in the nature of the motion probably, we may even say certainly, constitutes the change from one of the states of matter to another. The reader may consult our article GAS for some farther information as to the most recent speculations on the relations between temperature and pressure in the case of gases. The kinetic theory of gases has not yet been completely extended to the liquid and solid states of matter; but, of the applicability of a corresponding theory, and of the necessity of it, there can be no doubt.

It is perhaps scarcely to be regretted that the discoveries of Rumford and Davy lay unheeded for nearly half a century, for it is impossible to say how their adoption would have affected the efforts of two great investigators in the mathematical theory of heat, Fourier and Carnot. To the former we owe a complete investigation of the theory of Conduction and Radiation of Heat; and not that alone, but likewise a method of mathematical analysis of extraordinary power, the effects of which have been felt in every branch of physical science. To the latter we owe his *Reflexions sur la Puissance Motrice du Feu*, in which he endeavours to determine *how* it is that mechanical effect is produced from heat; and although he assumes, in his investigation, the materiality of heat, yet his principles and laws, modified so as to correspond with now received notions, are at present the basis of *Thermodynamics.* His work is devoted to the consideration of the conversion of heat into work, the converse of the problem of Joule.

From the investigations of Joule, and the discovery of the equivalence of a definite quantity of mechanical energy to a definite quantity of heat, sprang the grand principle of *conservation of energy;* and perhaps we may say that from an extension of some of Carnot's investigations with respect to heat engines sprang Kelvin's great principle of *dissipation of energy.* The first law extends the principle of equivalence to other forms of energy. It asserts that the whole amount of energy in the universe, or in any limited system which does not receive energy from without, or part with it to external matter, is invariable. If energy of any form seems to disappear in such a case, it reappears in some other form. Thus, mechanical energy may be converted into heat. Heat again may be converted into the energy of electricity in motion, or into the potential energy of chemical separation. And electrical energy, whether potential or kinetic, and the energy of chemical separation, are also convertible into heat. The second principle states that no known natural process is *exactly* reversible, and that if we transform mechanical energy into heat, for example, we never can pass back and obtain from the heat produced precisely the amount of mechanical energy with which we commenced. Whatever attempt is made to transform and retransform energy by an imperfect process, and no known process is perfect, *part of the energy is necessarily transformed into heat,* and is *dissipated* so as to be incapable of further useful transformation. It therefore follows, that as energy is in a constant state of transformation, there is a constant process of *degradation* of energy going on, a process by which energy constantly approaches the unavailable form of uniformly diffused heat; and *this will go on till the whole of the energy of the universe has taken this final form.*

For a more extended development of these principles we refer our readers to our article PRINCIPLE OF CONSERVATION OF ENERGY, also to Tait's Thermodynamics, to Kelvin's original papers, and to Preston's Theory of Heat (1894).

HEAT, RADIATION OF. Radiation of heat consists in the propagation of heat from a hotter body to a colder one through an intervening medium which is not heated during the process. If we compare the case of heat conducted from particle to particle along an iron bar, one end of which is exposed to a high temperature, with that of heat transmitted to us from the sun, it is evident that the two processes of propagation are very different. It is certain that it is not by the heating of the intervening region between the sun and the earth that heat is transmitted in the latter case. Radiant heat is transmitted by the same medium that transmits light from a luminous body. Radiant heat and light are, in fact, the same thing, namely, vibrations of an elastic medium, only they are perceived by us in different ways. Radiant heat and light obey the same laws of reflection, refraction, interference, and polarization. In fact, being both of them vibrations of the same nature, they both obey all the general laws of wave motion, and the particular laws of the particular kind of wave motion that they belong to. They also obey similar laws with respect to transmission through various substances, and with respect to absorption. Let us now explain briefly the nature of the vibrations that constitute radiant heat. Any intensely heated body, a ball of quicklime, for example, that has been heated to whiteness, has the power of exciting vibrations in a certain highly elastic medium, commonly called the *luminiferous ether.* Of this medium we know very little at present, except that it probably pervades all space; that it certainly pervades, without apparent alteration in quantity or quality, the best vacuum that we can obtain; and that while it has scarcely any retarding effect on the motions of the planets and comets, yet it possesses elasticity of the nature of rigidity, which gives it the power of transmitting the minute vibrations of light, and which is greater in proportion to the density of the medium than that of any known solid. The vibrations of light and heat are such that the direction of the disturbance is perpendicular to the direction of propagation of the wave. Thus the undulations that constitute light and heat resemble rather waves in water, or waves running along a stretched string, than the waves of sound. Now such a heated body as we

have considered excites in the medium waves of a great many different wave-lengths, and consequently different times of vibration, which are propagated outward from the white-hot body in all directions. Of these some are capable of affecting the eye as light, and others are not. Those waves which, falling on the eye, give the sensation of light have wave-lengths between about 800 millionths of a millimetre and 350 millionths of a millimetre, and though undulations proceed from the white-hot body whose wave-lengths are both greater than and less than those just specified, yet they are not perceived by the eye as light. Those that have a wave-length greater than 800 millionths are, however, perceived by the thermometer. It is only vibrations of this kind that are radiated from a body which has been heated in the fire to less than dull red-heat, and having no light-giving power, such rays are usually called rays of *dark heat*. Those that have a wave-length less than about 350 millionths are not sensible to the eye as light, nor are they sensible to the thermometer as heat, but they have powerful *chemical* effects. They are called *actinic rays*, and may be examined photographically. For further information on this subject our readers may refer to SPECTRUM, SPECTRUM ANALYSIS, and UNDULATORY THEORY. The properties of the rays, as far as luminous and heating effects are concerned, leaving polarization (which see) out of the question for the present, depend solely on the wave-length and the amplitude of the vibration. It is the wave-length that determines the character of the ray. In light it determines the colour, and in both heat and light it determines the refraction of the ray. The amplitude of vibration determines the intensity of the ray. Rays of light of low refrangibility, the red rays and the yellow rays, for instance, possess considerable heating power. Falling on a non-translucent substance they are absorbed, and the substance becomes warmed. In fact the energy of vibration of the luminiferous ether is converted into energy of motion of the particles of the substance on which the light falls, and (see article HEAT above) the temperature of the substance rises. The same is the case with the invisible or dark-heat rays; but it is difficult to obtain any considerable heating effects from rays of less wave-length than about 500 millionths of a millimetre, which corresponds to green light. Radiant heat consists, then, of motion of a certain elastic fluid. This motion is of the same character precisely as the motion that constitutes light; but, only observable as heat when it possesses sufficient energy to be able to raise the temperature of any body on which it falls and which absorbs it. Farther, the thermometer proves to us the existence of *dark-heat*, that is, undulations not perceptible to the eye; and the prism, aided by the thermometer, shows us that dark-heat exists in the complete system of vibrations transmitted from the sun and other intensely heated bodies.

We have considered the nature of radiant heat at considerable length, on account of the want of clearness as to the relations between heat and light prevalent in almost all popular writing on this subject. It must be distinctly understood that the vibrations that we are here concerned with have certain properties, of which, for the present purpose, those that are important are the wave-length and the amplitude of the vibration, that is, the greatest extent of the disturbance. Whether the vibration falling on the eye gives light or not depends solely on the wave-length, and it is the wave-length that defines the colour of the light. This may be stated otherwise if we consider that the velocity of propagation in a homogeneous medium is the same for all wave-lengths, and that therefore the time of vibration is inversely proportional to the wave-length. We may then say that whether the vibrations give the sensation of light or not depends on the frequency of the vibrations, and the colour of the light depends upon the same thing. The heating effect of the vibrations depends upon the energy of the vibrations; and that again depends on the time of vibration and on the amplitude and extent of the disturbance. The *intensity* of the light, when the vibrations cause the sensation of light, and the heating effect go together. Hence to speak as if light were one thing and heat another is not only misleading, but actually false.

Having explained the nature of heat rays, let us next briefly consider the laws of radiation. The general effect of radiation is to equalize the temperature of any system of bodies so placed as to be capable of radiating one to the other. Every body of the system, according to Prevost's Theory of Heat Exchanges, is constantly sending forth heat-rays in all directions, and receiving the heat radiated from the other bodies. But the hotter bodies emit more than they receive, while the colder bodies receive more than they send forth, and the temperature of the system is thus gradually equalized. This simple law is the result of long and difficult inquiry. It is known under the name just given, and the principle, extended and worked out in detail by the experiments of Balfour Stewart and other investigators, is the most important in the general theory of radiation. Our readers may find full details regarding it in Balfour Stewart's work on Heat.

A heated body exposed in a space colder than itself loses heat to the surrounding objects by radiation, and the amount of heat lost in a given time depends, all other things being given, on the difference between the temperature of the body and the temperature of its surroundings. The simplest case is when a small heated body is suspended in the middle of a chamber, the walls of which are of uniform structure, or rather surface, and of uniform temperature. Under these circumstances, if, when the temperature of the heated body is 20° higher than that of the walls, one degree of temperature is lost in one minute, then it would lose 2° in a minute were the excess of its temperature above that of the walls 40°, and only half a degree were the excess of temperature only 10°. The loss in any given interval of time is, in fact, proportional to the excess of temperature of the heated body above the temperature of the surroundings. It follows from this that the cooling of a body, under such circumstances, goes on according to the well-known 'compound interest law.' Thus if the body loses 5 per cent. its excess of temperature in the first minute, it loses 5 per cent. of what is left in the next minute, in the third minute 5 per cent. of the second remainder. The law that has just been stated is known as Newton's law of cooling. It may be applied to circumstances much more varied and complicated than those just referred to. In such a case, however, it is necessary to take the effect of the circumstances carefully into account. Serious errors have been introduced even into the calculations of competent mathematicians by applying the law unmodified to cases that it was never intended to include. Our readers will find in the work referred to above a full account of the experiments of Dulong and Petit on this subject. Fourier's great work, *Theorie de Chaleur*, deals with the mathematical theory of the diffusion of heat by radiation.

On comparing together the radiation from various bodies under the same circumstances, it is found that the radiation from some bodies is much greater than from others. Some lose their heat far more rapidly than others. It is necessary in making such a comparison to consider bodies that are, properly speak-

ing, comparable. For example, in comparing the rate of cooling of two balls of different metals, both polished, let us suppose, the balls must be of dimensions so small that differences in conductivity which may exist do not interfere with the genuineness of the experiment. Particulars such as these being attended to, it may be stated that the radiation depends on the nature of the surface of the body, and that the power of a body to radiate heat is intimately connected with its power of absorbing heat radiated to it, and with its power of reflecting heat. Surfaces that are good radiators are good absorbers, and surfaces that absorb heat readily reflect it badly. Take, as a very familiar case, two kettles of the same dimensions and of the same material, one of them brightly polished, the other covered with soot, and having generally a dull surface. First let both be filled with hot water, and let them be hung up in the same room, and examined from time to time with the thermometer. It will be found that the dull sooted kettle loses its heat far more rapidly than the brightly-polished kettle does. Again, if the experiment—which, however, would not be very easy in this form—were tried of exposing the two kettles, each with cold water, in a space whose walls are kept heated and are radiating out heat, it would be found that the sooted kettle gains heat far quicker than the other. Experiments on this subject were made in great variety by Leslie, who examined emission, absorption, and reflection of a great variety of surfaces, both for dark-heat and for the heat of luminous rays. The best absorber of all is a surface covered with a thin coating of lamp-black. Such a surface absorbs almost every ray of every kind that falls upon it. Brightly-polished metals are the worst absorbers among bodies that are not transparent to radiant heat.

Lastly, we must consider very briefly the transmission of radiant heat through various substances—a subject of great importance. Here we meet with great variety, just as we do in the case of light. We know but one body almost perfectly transparent to heat,—almost perfectly *diathermanous*, as it is called, the names *diathermanous* and *athermanous* being used in radiant heat to correspond to transparent and opaque, which are applied to light. That substance is rock-salt. Rock-salt transmits nearly the whole of the heat that falls upon it, and the heat is transmitted independently of the nature of it, that is independently of whether the heat is of great or of small wave-length. All other bodies behave towards heat as coloured glasses behave towards light. For example, white glass transmits light unaltered; blue glass transmits blue light, that is, light of high refrangibility; red glass transmits red light, that is, light of low refrangibility. With respect to heat, while clear rock-salt transmits heat of all wavelengths, common white glass transmits rays of high refrangibility, stopping those of low refrangibility. Hence its use as a fire-screen. For the greater part of the heat of a common fire is of the dark kind, and nearly all of this is stopped by the glass; but glass does not screen from the heat of the sun, a great part of which consists of heat of high refrangibility. On the other hand, smoked rock-salt transmits very little of the heat of high-refrangibility, though it is nearly perfectly diathermanous to dark-heat rays; and solution of iodine in bisulphide of carbon is perfectly opaque to light, and perfectly athermanous to heat of high refrangibility, but yet it transmits dark-heat with great freedom. The property of *selective* absorption is of extreme importance. It is the possession of it to a high degree in gases that gives rise to the dark lines seen in the solar spectrum. We must, however refer our readers to our article SPECTRUM for information on this subject, and to the Treatises on Heat of Clerk Maxwell, Balfour Stewart, and Preston (1894) for information on many points that the limits of this article render it impossible for us even to touch on.

HEAT-ENGINE. See THERMO-DYNAMIC ENGINE.

HEATH (*Erica*, a genus of the natural order Ericaceæ). The leaves of the heaths are simple and entire; their flowers oval, cylindrical, or even swelled at the base, resembling those of *Vaccinium* and *Andromeda*, to which genera they are allied; the corolla is four-cleft; the stamens eight, terminated by anthers which are usually notched or bi-aristate at the summit. From 400 to 500 species are known, twelve or fifteen of which inhabit Europe, and have small flowers, whilst all the remainder are natives of South Africa, many of them bearing brilliantly coloured flowers, and forming one of the most characteristic genera of that singular region. Their range northward seems to be, however, rather limited, the whole tribe totally disappearing on approaching the tropic from the Cape. It was observed by Humboldt that only one species of *Erica* has been discovered across the whole extent of the New World, from Pennsylvania and Labrador to Nootka Sound and Alaska. In addition to the two species common in Britain, *E. Tetralix* and *E. cinerea*, there are other two, *E. Mediterranea* and *E. Mackayi*, found at Connemara in Ireland; while *E. ciliaris* and *E. vagans* occur both in England and Ireland. The common heath of Europe (*E. vulgaris*, called by some *Calluna vulgaris*, *Calluna* having been made a separate genus from *Erica*), a low shrub, often covers exclusively extensive tracts of barren land, and is used in domestic economy: mixed with oak-bark, it is employed in tanning; and also when tender, for fodder. Notwithstanding the depth to which the roots penetrate, and the difficulty of exterminating it, such has been the progress of agriculture in Great Britain, that a considerable portion of these tracts have been reclaimed.

HEATHFIELD, GEORGE AUGUSTUS ELIOTT, LORD, a distinguished British general, was born in Roxburghshire in 1717, of an ancient family. He was educated at home by a private tutor, and afterward sent to the University of Leyden. He studied military science at the French military school at La Fère, and served in the Prussian army as a volunteer. In 1735 he joined the engineer corps at Woolwich, where he continued till he was made adjutant of the second corps of horse grenadiers. He accompanied George II. to Germany in May, 1743, was wounded in the battle of Dettingen, and rose to the rank of lieutenant-colonel. In the Seven Years' war he fought from 1757 as commander-in-chief of a regiment of light cavalry which he had himself raised. He was called from the Continent to be made second in command at Havana. In 1775 he was made commander-in-chief of the forces in Ireland, and in the same year received the governorship of Gibraltar. Spain, in connection with France, took part, in 1779, in the war between Britain and America, and even before the declaration of war laid siege to Gibraltar by sea and by land. In the course of three years all the preparations had been made for a siege which is one of the most extraordinary in history. In June, 1782, the Duke of Crillon, commander-in-chief of the Spanish army, arrived at Gibraltar with a reinforcement. All the French princes royal were in the camp. An army of 30,000 Frenchmen and Spaniards were at the foot of the hill. Floating batteries were constructed to attack the fortifications, with two roofs, so carefully and strongly built, that neither balls nor bombs could injure them. There were ten of them, which together had 397 cannons, each cannon being served by thirty-six men. Septem-

ber 13, 1782, they commenced the attack. Eliott assailed the batteries with red-hot shot, more than 4000 of which were showered upon them. The same afternoon smoke was seen to rise from the principal battery and two others. The enemy in vain attempted to subdue the flames and close the holes; at one o'clock at night three of the batteries were completely in flames, and some of the others were beginning to burn. The crews in vain made signals to the Spanish fleet of their condition; they could do nothing for the batteries, and only attempted to rescue the crews; but twelve gunboats, which left the fortress, commanded by Captain (afterwards Sir Roger) Curtis, prevented the boats of the besiegers from approaching, and, at the same time, continued to fire on the floating fortresses. At break of day the crews were seen on the burning batteries crying for help. The besieged now hastened to assist them, dangerous as it was on account of the balls from the heated cannons and the pieces of wood from the bursting structures which flew against them. Curtis saved thirteen officers and 344 soldiers. An attack by land was also frustrated by Eliott, and at the same time a tempest greatly injuring the Spanish fleet, the siege, from the middle of November, 1782, was changed into a close blockade, to which the peace put an end on the 2nd February, 1783. The king sent Eliott the order of the Bath, and shortly afterwards he returned to England, being created Lord Heathfield in 1787. In 1790 he was obliged to visit the baths of Aix-la-Chapelle for his health. At Kalkofen, a place near that city, and his favourite residence, he died of apoplexy, July 6, the same year. His corpse was carried to England, and the king himself prepared the plan of a monument erected in honour of him at Gibraltar.

HEAT OF CHEMICAL COMBINATION. Chemical combination is accompanied by the evolution of heat. Such is always the case; and even where, at first sight, the opposite seems to be true, as is the case of freezing-mixtures, this is due to the overpowering of the heat evolved in chemical combination by the cold given out in the change from the solid to the liquid condition. Ordinary combustion is the commonest case of evolution of heat during chemical combination. There, coal or wood is burned in the oxygen of the air, and the heat given out is due to the combination of the carbon and hydrogen of the combustibles with the oxygen. Animal heat is another familiar example: the materials of the food having been properly prepared during the digestive processes, are thrown into the blood, and during the passage through the lungs, and probably also through other parts of the body, are combined with oxygen taken in from the air. A third case is found in what was called by Liebig *eremacausis* (*ērema*, slowly, *kausis*, a burning). This takes place when damp hay, fallen leaves, or other organic matter slowly decays, becoming oxidized and getting hot in the process. Heat is also given out during the solution of a metal by an acid, or the combination of an acid with a base.

The determination of the heat of chemical combination in various cases is a very difficult problem. It is not very difficult to determine the heat given out during the combination of a given weight of one substance with an equivalent quantity of another, but that is not nearly all that requires to be done. For during the combination many of the properties of each of the substances alter, and the effect of such alterations must be taken into account. For example, one of the bodies may be a solid and the other a liquid, and let us suppose that the resulting compound is a liquid. Here we must take into account the heat made latent during the conversion of the solid constituent into the liquid form. Again, the alteration in the specific heats of each of the constituents must be considered, and it is very difficult to estimate the effect of each of these changes on the heat observed to be given out during combination. The problem was first taken up by Lavoisier, and subsequently by many other investigators; but the question has been perhaps most carefully examined by Andrews and by Favre and Silbermann. The experiments of Andrews were described in the Philosophical Magazine, 1848, those of Favre and Silbermann in the Ann. de Chemie, III. xxxiv. xxxvi. xxxvii. Readers will find full information on the subject in Miller's Elements of Chemistry.

HEAT SPECTRUM, the part of the spectrum from an incandescent body that contains invisible heat rays; that is, rays of so great a wave-length that they are non-luminous. To produce the heat spectrum properly lenses and prisms of rock-salt must be employed. Prisms of glass absorb a great part of the dark-heat rays, and are therefore unfitted for this purpose. When the spectrum from the sun is examined, it is found that the place of maximum heat intensity is not in the luminous spectrum but in the dark-heat spectrum at a considerable distance from the place where light ceases to be perceptible. Tyndall examined with great care the heat spectrum from the electric light.

HEAVEN, in a physical sense, is the azure vault which spreads above us like a hollow hemisphere, and appears to rest on the limits of the horizon. Modern astronomy has taught us that this blue vault is, in fact, the immeasurable space in which our earth, the sun, and all the planets, with the countless host of fixed stars, revolve. The blue colour of the heavens was formerly attributed to light reflected by the earth to the air, and thence again to the earth. Saussure derived the blue colour from reflected light, but attributed the reflection not to the air, but to the vapours which it contains. Modern authorities, however, assert that the blueness is due to reflection of the blue rays of the solar spectrum. 'The blue sky,' as Dr. Mann explains, 'which reveals itself as the hemispherical vault of the firmament in the absence of clouds, is the far depths of the air sending back to the observer some part of the solar illumination which they receive. The light thus returned to the eye is blue, simply because the particles of the air are of such exceedingly diminutive size that they can effectively deal with only the smallest of the luminous vibrations—that is, with the blue vibrations. There are some faint and subordinate interminglings of the other coloured rays in the blue of the sky, but they are in such trifling quantity compared with the blue that they are practically swallowed up and lost in its superior abundance.' The gorgeous colours of clouds are owing to the fact that their larger particles reflect the red and yellow rays.

Heaven, in ancient astronomy, denoted a sphere or circular region of the ethereal heaven. The ancient astronomers assumed as many different heavens as they observed different celestial motions. These they supposed to be all solid, thinking they could not otherwise sustain the bodies fixed in them; and spherical, that being the most proper form for motion. Thus they had seven heavens for the seven planets: the Moon, Mercury, Venus, the Sun, Mars, Jupiter, and Saturn. The eighth was that of the fixed stars, which was particularly denominated the *firmament*. Ptolemy adds a ninth heaven, which he calls the *primum mobile*. After him, two crystalline heavens were added by Alphonso, king of Castile, to account

for some irregularities in the motions of the other heavens; and lastly, an empyrean heaven was drawn over the whole for the residence of the Deity; which made, in all, twelve heavens. But others admitted many more heavens, according as their different views and hypotheses required: Eudoxus supposed twenty-three; Regiomontanus, thirty-three; and Fracastoro no less than seventy.

In theology, this word denotes the upper and nobler region of God's universe, in contrast with the earth, the lower part assigned to men for their habitation. Of the belief in the existence of some special scene of the presence of Deity, the majority of the known religions of the world bear ample evidence. According to Aristotle all men, whether Greeks or barbarians, had a conception of God; and all united in placing the residence of the gods in the most elevated regions of the universe. This idea runs through the Persian, Egyptian, German, Scandinavian, and indeed of all the ancient religions in which the belief in a supreme being assumes any other form than the pantheistic; and even though the pantheistic philosophers may have denied that any peculiar locality could be regarded as the peculiar habitation of the Deity, we find that the popular belief and worship of the sect is evidently grounded upon a contrary opinion. In addition, however, to its being the special seat of the Deity, heaven also denotes the place, or the state or condition of blessed spirits, and of the souls of just men either immediately after physical death or at some certain period subsequent to it. All the religious systems which include the immortality of the soul involve, at least in substance, the idea of a future state of happiness as a reward for a virtuous life. The delights of the heavens of the various creeds differ greatly in kind. The pleasures of the classical Elysian fields were to a great extent pleasures of sense; the German warrior believed he would be transferred to a region where he would be able to pursue his old fierce enjoyments, and the American Indian cherishes the notion that he quits this world for a happier hunting-ground. Among Christians the general opinion is that heaven is the residence of the Most High, the holy angels, and the spirits of just men made perfect, that this abode is eternal, its joys entirely spiritual; it is believed also by many that the just who are free from sin are admitted into heaven immediately after death; also that the souls of the patriarchs, prophets, and in general the good, were detained, before the new dispensation, in a temporary abode till the coming of the Redeemer.

HEAVY SPAR. See BARYTA.

HEBE, the goddess of youth, and the cup-bearer on Olympus until replaced by Ganymede; a daughter of Zeus and Hera, who gave her as a wife to Heracles, in reward of his achievements. At Rome she was worshipped under the corresponding name of Juventas, and had a chapel on the Capitol before the temple of Jupiter was erected there. She is described by some authorities as being a divinity who had it in her power to make old persons young again. In the arts she is represented with the cup in which she presents the nectar, under the figure of a charming young girl, her dress adorned with roses, and wearing a wreath of flowers. An eagle often stands beside her (as at the side of Ganymede), which she is caressing.

HEBER, REGINALD, D.D., Bishop of Calcutta, was born April 21, 1783, at Malpas, in Cheshire, and in 1800 was sent to Brasenose College, Oxford. In 1802 he obtained a university prize for a copy of Latin hexameters; and the following year he greatly distinguished himself by another prize poem—Palestine—in English. He was elected to a fellowship in All Souls' College, and soon after travelled in Germany, Russia, and the Crimea, and made observations, from which many curious extracts were published in the travels of Dr. E. D. Clarke. Having returned home, he published an English poem entitled Europe, Lines on the Present War (1809). About the same time he was presented to the family living of Hodnet, and he married Amelia, daughter of the Rev. W. Shipley, dean of St. Asaph. For several years subsequently he devoted himself, with great assiduity, to his duties as a parochial priest. In 1815 he was appointed Bampton lecturer, and two years after received a stall in St. Asaph's Cathedral. In 1822 appeared his life of Jeremy Taylor, with a review of his writings. In the same year he was elected preacher of Lincoln's Inn. On the death of Bishop Middleton he was offered the see of Calcutta, which he accepted, and June 16, 1823, embarked for the East Indies. On Ascension Day, 1824, Bishop Heber held his first visitation in the cathedral of Calcutta; and he subsequently made progresses through various parts of his very extensive diocese, consecrating churches, and taking the appropriate steps for extending the knowledge of Christianity among the Hindus. Having taken a journey in the discharge of his episcopal duty, he arrived at Trichinopoli, April 1, 1826; and on the next day, while bathing, he was seized with an apoplectic fit, which terminated his existence. He published a volume of hymns in 1812, and after his death was published a Narrative of a Journey through the Upper Provinces of India, from his MSS. His widow also published his biography (two vols. 4to, London, 1830).

HÉBERT, JACQUES RÉNÉ, notorious during the French revolution, was born at Alençon, in the department of the Orne, in 1757. When yet very young he went to Paris, where he supported himself by very dishonourable methods. Employed as a check-taker at the Théâtre des Variétés, he was dismissed for dishonesty, after which he lived with a physician, whom he ungratefully robbed. It is but fair to state, however, that these accusations were brought against him by his political opponents, and do not seem to be founded on the most trustworthy evidence. At the beginning of the French revolution Lemaire published a journal supporting constitutional principles under the title Père Duchesne, which was distributed in the streets. The Jacobins soon established another paper, also called Père Duchesne, and Hébert became editor. It owed its success to the warmth and virulence with which he advocated the popular cause, and abused the court and the monarchy. August 10, 1792, he became one of the members of the municipality of Paris, which contributed to the massacre in the prisons in the following September. Hébert was soon after nominated attorney-general of the commune, and employed all his influence in forwarding a project to establish the authority of the commune on the ruins of the national representation. The Hébertists rejected the advances of the Orleans party, and separated from the Cordeliers, of whom they had hitherto formed a part. The Girondists, who were at that period contending against the Mountain, had credit enough to procure the arrest of Hébert, May 24, 1793. He was defended by Marat in the convention; the deputies of all the sections spoke in his favour at the bar on the 25th; and on the 27th, after a tempestuous sitting, he was again restored to liberty. Prompted by revenge, as well as other motives, he assisted with all his power and influence in the proscription of the Brissotins. Their downfall hastened his own. He established the Feast of Reason, and afterwards accused Danton of having violated the nature of liberty and the rights

of mankind. This terrified both Danton and Robespierre; they suspended their mutual jealousies to accomplish his destruction; and Hébert, with the greater part of his associates, was arrested, and condemned to death, March 14, 1794. None of the numberless victims died in a more cowardly manner. Besides his journal, he was the author of some other political pieces of a similar description. Among the crimes of this man were the calumnies with which he assailed the character of the Queen of France. His wife, a former nun, was executed a few days after him.

HEBREWS. The appellation of *Hebrew* (from the Hebrew word *Ibri*, from the other side, that is, of the Euphrates), so far as we can learn from history, was first given to Abraham by the people of Canaan, among whom he dwelt (Gen. xiv. 13). It seems to have been applied to him on account of his emigration (about 2000 B.C.) from Mesopotamia, beyond the Euphrates, into the land of Canaan (Palestine). Some, however, consider it as a patronymic derived from Heber, great-grandson of Shem, from whom Abraham was descended. Whatever meaning was attached to the term *Hebrews* before the time of Jacob (Israel), it appears afterwards to have been limited to his posterity, and to have been synonymous with *Israelites*. This latter term was used by the Jews of themselves among themselves, the former was the name by which they were known to foreigners. The word Hebrew is used either where foreigners are introduced as speaking (Gen. xxxix. 14, 17; xli. 12; Ex. i. 16; 1 Sam. iv. 6, 9), or where they are opposed to foreign nations (Gen. xliii. 32; 1 Sam. xiii. 3, 7). So in Greek and Roman writers we find the name Hebrews or Jews, but never Israelites. For a continuous sketch of their history from the time of Abraham down to our own see the article JEWS.

Hebrew Language and Literature.—The Hebrew language (Hebrew, *ibrith*, or *lashon ibrith*, also *leshon hakkodesh*, sacred tongue in post-biblical Jewish works, *jehudith*, Jewish, in the biblical history of the period following the Babylonish captivity) forms a branch of that extensive family of languages called Semitic, from the real or supposed descent of those who speak these languages from Shem, the son of Noah. The Semitic languages may be divided into three branches —the Arabic, to which the Ethiopic is closely allied, the Aramaic, consisting of two dialects, the Babylonic or East Aramaic (sometimes called Chaldee), and the Syriac or West Aramaic, and the Hebrew. Once identical with the Phœnician, Hebrew was adopted by Abraham and his family in Palestine. The peculiar religious and moral notions of the Hebrews could not but impress upon it by degrees a distinct character, and thus Hebrew became a distinct dialect. In the antiquity of its extant literary remnants it far surpasses all other Semitic idioms, and in richness and development is only inferior to the Arabic. It is deficient in grammatical technicalities, especially in moods and tenses of the verb, and consequently, also, somewhat in precision; but in simplicity, brevity, and power of poetic expression it is hardly excelled by any tongue. The alphabet is composed of twenty-two letters, which, according to Buxtorf and his school, are all consonants, the vowels being expressed by marks above or below the letters. The system of vowel points was introduced so late as the sixth or seventh century of our era by the rabbis of the school of Tiberias when the Masora, a collection of critical, exegetical, and grammatical remarks on the sacred texts, was first committed to writing. There are no capital letters. The accents and marks of punctuation amount to about forty. The writing is from right to left. There are three kinds of Hebrew alphabet now in use—the square or Assyrian (properly called the Babylonian), which is generally supposed to have been introduced by Ezra, the most common in print; the rabbinical, or mediæval, used chiefly in commentaries and notes; and the cursive, in writing.

The extant classical Hebrew writings embrace a period of more than 1000 years from the era of Moses to the date of the composition of the books of Chronicles, which stand last in the Hebrew Bible. We naturally expect that the language of the earliest books should differ considerably from that of the later, and that we would even be able to trace a gradual change in the form of the language, becoming more and more decided as century followed century, and new influences were brought to bear upon it. This expectation is not, however, realized. There is indeed to be observed a very decided difference in style and language between the earliest and the very latest Hebrew writings; but this difference was the result, not of a very gradual process of change extending over centuries, but of a very sudden and rapid revolution. Hence the extant Hebrew writings, when classified with respect to language, have usually been arranged into two great divisions—those of a date earlier than the Babylonish captivity, and those of a subsequent date. In passing from the book of Genesis to the books of Samuel we do not recognize any very striking difference in the language. Doubtless there is a difference; but not such a difference as we might expect to find in writings separated from one another in date by so considerable a period; not so much a difference as we actually find when we take up an English author of the seventeenth century, or even later, and compare his language with the English of the present day. The explanation of this remarkable phenomenon is not to be found in the rejection of the traditional belief as to the age and authorship of the Pentateuch. Even some critics who bring down the Pentateuch as a whole to a comparatively late era admit that a portion at least of its contents is to be assigned to the Mosaic age (Ewald, Lehrbuch, sect. ii. c.); and thus, unless it can be shown that this most ancient portion bears in its language and style the stamp of high antiquity, and is distinguished in a very marked manner from the other portions of the Pentateuch (which has not been shown), the phenomenon still remains unexplained. But indeed the phenomenon is by no means unexplained. It does not stand alone. The Chinese language displays the same tenacity and aversion to change still more decidedly, and it is well known that the written Arabic of our own day does not differ greatly from that of the first centuries after Mohammed. It is probable that the language was, as it were, stereotyped by becoming the language of books held in highest esteem, diligently studied by the learned, frequently committed to memory, and adopted as a model by succeeding writers. In further explanation of this phenomenon appeal has also been made to the permanence of eastern customs, and to the simple structure of the language, which rendered it less liable to change than other more largely developed tongues. Some of the peculiarities of the early writing may be concealed by the uniformity of the system of punctuation adopted and applied to the Scriptures by the Hebrew grammarians. The writings which belong to the second age—that subsequent to the Babylonish captivity—differ very considerably from those which belong to the first; the influence of the so-called Chaldee language, acquired by the Jews in the land of their captivity, having greatly corrupted the national tongue. The historical books belonging to this age are the books of Chronicles, Ezra, Nehemiah, and Esther. In the prophets who

prophesied during and after the captivity, with the exception of Daniel, the Chaldee impress is by no means so strong as we might anticipate, they having evidently formed their style on that of the older prophets. It is important, however, to observe that the presence of what appears to be a Chaldeism is not always the indication of a later age. Chaldee words and forms occasionally appear even in the most ancient Hebrew compositions, especially the poetical, the poet delighting in archaic and rare words, and substituting these for the more commonplace. But between the Chaldaic archaisms and the Chaldeisms of the later Scriptures there is this marked distinction, that the former are only occasional, and lie scattered on the surface, the latter are frequent, and give a peculiar colour and character to the whole language. At what time the Chaldee became the dominant element in the national language it is impossible to determine. All political influences favoured its ascendency; and with these concurred the influence of that large portion of the nation still resident in the East, and maintaining constant intercourse with a Chaldee-speaking people. To these influences we cannot wonder that the Hebrew, notwithstanding the sacred associations connected with it, gradually succumbed. On the coins of the Maccabees indeed the ancient language still appears; but we cannot conclude from this circumstance that it maintained its position as a living language down to the Maccabean period. The fragments of the popular language which we find in the New Testament are all Aramaic; and ever since the Hebrew has been preserved and cultivated as the language of the learned and of books and not of common life.

Since the return from the captivity, the Jewish, or as it is often called, Rabbinical literature, has been extensively cultivated. Under the guidance of Ezra the Scriptures were collected, authenticated, and arranged into a canon. The Pentateuch was publicly read, taught in schools, explained, hermeneutically expounded and translated into Aramaic or Chaldee. The legal or religious traditions explanatory or complementary to the law of Moses were traced back through the prophets and elders to that law-giver, and systematically established as the oral law. These labours resulted in the Midrash, divided into the Halacha and the Haggada: the former considered the improvement of the law with a view to practical results; the latter the essence of the religious and historical. Later on we reach the Maccabean era, to which belongs the whole of the Apocrypha, various Greek versions of the Bible, and several collections of prayers, poems, and proverbs. To the succeeding epoch belong the earlier Christian writers, Hillel the elder, Shammai, his rival, Gamaliel, and others; while the age following the destruction of Jerusalem (A.D. 70) witnessed the completion of the New Testament and the historical works of Josephus, written, however, in the Greek language. On being driven from their capital by the Romans, numerous schools were established by the Jews in which their language and literature were taught. Of these schools the most celebrated were those of Babylon and Tiberias. The Mishna, which contains the traditions of the Jews and interpretations of the Scriptures, is supposed to have been compiled in the latter part of the second or in the earlier part of the third century by Jehudah Hanassi. From this period the Mishna was considered one of the principal works of Hebrew literature, and the rabbis of Tiberias and Babylon wrote numerous commentaries on it. These commentaries were at length collected into two separate works, and entitled the Jerusalem and the Babylonian Talmuds. The Jerusalem Talmud seems to have been completed about the end of the fourth century, and the Babylonian Talmud about a century later, under the care of Rabbi Ashe. The most brilliant epoch of modern Jewish literature is incontestably that of the domination of the Moors in Spain. Treated by these conquerors with a mildness which contrasts strongly with the cruelty with which the Christian kings of that country used them, the Jews applied themselves enthusiastically to the culture of science and literature. The proscribed nation soon found itself at the head of the civilized world, without excepting even the Arabs, whose intellectual culture is a subject of admiration among all historians of that time. No science remained unstudied by the Israelites; astronomy, geography, philology, medicine, history, poetry, music, the Spanish rabbis knew well and taught well. The Jewish school of Toledo was the most renowned of all the schools in the Peninsula. This is the era of the great Moses ben Maimon (Maimonides), the illustrious disciple of Averroes; of the poet and philologist Aben-Ezra; of David Kimchi, of Isaac Pen-Sid, &c. The age of persecution of the Jews in Spain had set in several years before it reached Portugal, and the celebrated Academy of Lisbon flourished up to the end of the fifteenth century. But at last the unfortunate people were driven from that country, and took up their scattered residences in France, Germany, Italy, and, in fact, in most of the countries of Europe where they could find the least toleration. At Leghorn they founded those printing establishments from which issue at the present day a great number of the works published in Hebrew. The seventeenth century was more fatal to Judaism than even the centuries of persecution, for there sprang up within itself a more terrible plague than persecution—incredulity. It is the age of Spinoza, the pantheist, whom the orthodox Jews even of our days regard with horror. But even before his day the Hebrew language had been falling rapidly into disuse among the learned, who, with the exception of a few enthusiastic rabbis, employed in their works the language of the country in which they had settled. In Germany many of the writers of the eighteenth and nineteenth centuries are Jews, or of Jewish extraction, and are among the brightest names in her literature. We need only mention those of Moses Mendelssohn, the celebrated philosopher; Neander, Heinrich Heine, Berthold Auerbach, Herz, Borne, &c.

HEBREWS, EPISTLE TO THE, one of the longest and most didactic compositions of its class in the New Testament, and in these respects most resembling the Epistle to the Romans. The absence of the initiatory formula usual in the apostolic epistles has led to some doubt as to its canonicity and authorship. The immediate successors of the apostles (Clement of Rome, Justin Martyr, &c.) seem to have considered it as of canonical authority, while the Gnostic heretics Basilides and Marcion are spoken of as distinctly rejecting it. No disbelief of its authority was expressed by the orthodox church, however, until about the middle of the second century, and for two centuries afterwards it was generally rejected by the fathers of the Roman and North African churches. Towards the end of the fourth century Jerome reviewed the conflicting opinions as to the canonicity of this epistle. He considered that the prevailing, though not universal view of the Latin churches was of less weight than the view not only of the ancient writers, but also of all the Greek and Eastern churches by whom the epistle was received as canonical, and he pronounced in its favour. Ambrose of Milan, Hilary of Poitiers, and Augustine all held a similar opinion; and in 416 a decretal of Pope Innocent III. placed its authority beyond dispute. As to the authorship there is no reason to doubt that at first,

everywhere but in North Africa, Paul was recognized as the writer. Clement of Alexandria states that it was written by Paul in Hebrew for the benefit of the Hebrews, and translated by Luke for the benefit of the Greeks. Origen believed the thoughts to be Paul's and the language and composition Luke's or Clement's of Rome. The opinion that it was originally written in Hebrew is strongly advocated by Michaelis; while the opposite one, that Greek is the original language, is supported by Rosenmüller and others. Tertullian mentions Barnabas as the reputed author, according to the North African tradition. The Roman Church, down to the middle of the fourth century, denied its Pauline origin. Cardinal Cajetan, the opponent of Luther, rejected its authority and its Pauline authorship. Luther conjectured that Apollos was the author. It is inferred from internal evidence that it was written some time before the destruction of Jerusalem. Some critics have maintained that this epistle was addressed directly to the Jewish believers everywhere, others have restricted it to those dwelling in Asia and Greece, and others again hold it as written merely for the faithful in Jerusalem.

HEBRIDES, New, an archipelago or island group of the South Pacific Ocean, north-east of New Caledonia, between lat. 13° 15′ and 20° 3′ S., and lon. 166° 30′ and 170° E. It consists of about twenty larger and a much greater number of smaller islands and rocks. The most important are Espiritu Santo, with an area of 1875 square miles; Mallicolo, area 876 square miles, with a good harbour, called Port Sandwich; Erromango, area 401 square miles; Sandwich, 23 square miles, the most fruitful and beautiful of the archipelago, with two harbours; Tanna; Aneitium, with good harbour, &c. They are mostly of volcanic origin, and there are active volcanoes in Tanna and some other islands. Most of the islands rise into lofty hills, and some of them into mountains of considerable elevation; and all of them are well wooded, abound with water, and present a most luxuriant vegetation. Copra is the chief product of the islands, but the sugar-cane, coffee, sago, and other food plants are also grown in some quantity. Sandal-wood was formerly found on Erromango, but is now exhausted. The fauna is not well known, but seems to be poor. The natives are in some parts of Papuan race, with a mixture of Malay blood, but other types prevail in other islands. Cannibalism and other savage practices prevail in some of the islands, while others, especially Aneitium, have been Christianized. The climate is not on the whole very healthy, owing to the prevalence of malaria. Area estimated at 5106 square miles. Pop. 70,000. —In 1606 Quiros and Torres discovered the more northerly islands, Espiritu Santo, &c.; and in 1774 they were visited by Cook, who discovered Mallicolo and others, and gave the group its present name. Both Britain and France advance claims to the New Hebrides.

HEBRIDES, The, or Western Islands (the *Heboudai* of Ptolemy, and *Hebudes* of Pliny), a series of islands and islets off the west coast of Scotland, extending from lat. 55° 35′ to 58° 32′ N.; the most southern being the island of Islay, and the most northern the island of Lewis. They are usually divided into the Outer Hebrides, popularly called the Long Island, of which the principal are Lewis and Harris (forming a single island), North Uist, Benbecula, South Uist, and Barra; and the Inner Hebrides — Skye, Mull, Islay, Jura, Coll, Rum, Tiree, Colonsay, &c. The islands within the Firth of Clyde (Arran, Bute, the Cumbraes, &c.) are not now considered as part of the Hebrides. The Outer are separated from the Inner, and from the mainland, by a strait or channel called the Minch, which at its narrowest part, between Harris and Skye, is about 12 miles broad. The Outer Hebrides consist of a continuous series of islands and islets, running south-west and north-east through a space of 130 miles, having Barra Head, lat. 56° 47′ 6″ N.; lon. 7° 39′ 15″ W., at the south extremity; and the Butt of Lewis, lat. 58° 31′ N.; lon. 6° 14′ W., at the north extremity. The Inner Hebrides are more widely scattered and more irregularly disposed, many of them being from 10 to 30 miles asunder. The group is politically divided between the shires of Ross and Cromarty, Inverness, and Argyle, very nearly in the line of their coincidence with the coasts of the respective counties. They number about 400 in all, but many are inconsiderable islets and rocks, and only about 90 are inhabited; area, about 2800 square miles; pop. (1901), 79,159. The Outer Hebrides are almost wholly formed of gneiss, with poor soil; the more northern of the Inner Hebrides, Skye, Rum, Eigg, Canna, Mull, Ulva, Staffa, &c., belong to the trap series of rocks, with a more fertile soil than the former. Islay, Jura, Gigha, Colonsay, &c., belong to the slate formation. Most of the islands are rugged and mountainous, and contain large proportions of moss and moor. The climate is mild and salubrious, but variable, tempestuous, and humid. Snow and frost are almost unknown in the smaller islands, and are but little felt in the larger. There is comparatively little wood in the Hebrides, and on many of the islands none at all, although some centuries ago most of them were thickly covered with wood. In Lewis, Skye, Islay, Mull, and several of the other islands, however, both forest and fruit trees have been planted in recent times to a considerable extent, with great success. The rivers of the Hebrides are necessarily small. There are many, however, in which salmon abound, particularly in the larger islands. Lakes are numerous, but few of them of any great depth. In some of the larger islands, as Lewis, Mull, Islay, great improvements in agriculture have taken place of late years; but in the most it is still in a very backward state. Oats and barley are almost the only cereal crops raised. Potatoes are extensively cultivated. Cattle constitute the staple product, and might be considerably increased in numbers. The native breed are small but handsome. Cheese and butter of good quality are produced. The native breed of sheep is very small, but Cheviots have been introduced with success. The breed of horses is also small, but hardy and docile. Whisky is manufactured in Skye, Islay, and Mull.

The productive land is partly occupied as sheep-farms (some of very large area), or as farms on which both sheep and cattle are reared, and to which may belong also a certain portion of arable land; but much of it is held by 'crofters', who occupy holdings usually of a very few acres, sometimes with a right of pasturage in common attached, and pay a rent of not more than £30. There are also 'cottars' who occupy houses, with or without a patch of ground, on the land of the crofter, the farmer, or the landlord, and who are often mere squatters paying no rent. Grouse-moors and deer-forests cover a considerable area. Owing to the minute division of the arable land among the crofters there is in many places an excess of population. The condition of the crofters and cottars (though the Crofters Act of 1886 has been of service to the former), especially in the Outer Hebrides and Skye, is very depressed; their dwellings miserable, and their living poor, consisting chiefly of potatoes, milk, and oat or barley bread; and in bad harvests often insufficient in quantity. The fisheries are not developed to the extent they might be. Gaelic is the universal language

of the Hebrides, which in remote times were subject to the kings of Norway, but in 1264 were annexed to the crown of Scotland. They were now held by various native chieftains, in vassalage to the Scottish monarch; but subsequently all fell into the hands of one powerful chief, who thereupon (1346) assumed the title of 'Lord of the Isles,' and began to affect an entire independence of his sovereign. The abolition of hereditary jurisdictions in 1748 secured to these islands for the first time the peace and safety afforded by a just and powerful government. For a long time little was known about the Hebrides, but the publication of Johnson's Journey to the Western Islands of Scotland (1775), and more recently of Scott's Lord of the Isles, invested them with a popular interest which is being yearly increased by the facilities afforded to tourists by the steamers of the Clyde.

HEBRON (originally *Kirjath-arba*, now *El-Khalîl*), a town of Asiatic Turkey, in Southern Palestine, 18 miles south by west of Jerusalem, 2830 feet above sea-level. It lies in the narrow valley of Mamre, with olive-trees towards the west, vineyards north, and bare mountains rising above. It has narrow streets, seldom more than 2 or 3 yards in width, and excessively dirty; high well-built stone houses with flat roofs, many surmounted with small domes, rather extensive covered bazaars, with well-furnished shops, exhibiting in profusion glass manufactures, consisting of lamps, coloured rings, &c., for which the place has long been celebrated, and in which it carries on a considerable trade. The chief of the mosques is that in the enclosure said to have been built round the Cave of Machpelah, from which Christians are rigorously excluded, it being esteemed by Mohammedans one of their holiest places. But in the spring of 1862 the Prince of Wales and his suite were allowed to enter this mosque, of which a description is given in Dean Stanley's Lectures on the Jewish Church. It is surrounded by a lofty wall, built of large stones, and of great antiquity. Hebron is one of the oldest existing towns, having been built seven years before Zoan (Num. xiii. 22), and it is mentioned prior to Damascus (Gen. xiii. 18). Abraham resided here, and acquired the Cave of Machpelah as a sepulchre for Sarah and his family. It was David's royal city for seven years. There is a German Protestant mission here. Pop. about 19,000.

HECATÆUS, one of the most distinguished Greek historians and geographers, was a native of Miletus, and the son of Hegesander, a member of an ancient and illustrious family. He was born probably about 550 B.C.; and died about 476 B.C. Like many eminent contemporaries he travelled into distant countries, visiting Egypt, the provinces of the Persian Empire, Thrace, Greece, and the coasts of the Euxine, Italy, Spain, and Africa. Of his public life the only event of which we have any definite knowledge was the part he took in the insurrection of the Ionians against the Persians. Being well acquainted with the resources of Persia, he attempted to dissuade Aristagoras, the planner of the revolt, from his rash undertaking, but in vain. He next exhorted his countrymen to provide themselves with a naval force; but this advice was also disregarded. When Aristagoras, not brave enough to endure the calamities of which he was the author, meditated a flight to Sardinia, Hecatæus counselled him to fortify himself in the island of Leros, and there watch the issue of events. Again his counsel was rejected, to the public loss. Still he did not desert his countrymen, but went as ambassador to Artaphernes, and prevailed on the satrap to win the confidence of the Ionians by lenient treatment. Whatever we know of him redounds to his credit. His two great works were his Tour of the World and his Genealogies or Histories. He was the first historical writer who applied a sound and discriminating criticism to the matters which he had to record, rejecting what appeared to be fabulous, and endeavouring to extract historical truth from the chaos of myth and tradition. He improved the map of the world made by Anaximander; and his writings were so highly esteemed by Herodotus that he even raised him to the rank of a rival. The fragments of his works were published by R. H. Klausen (at Berlin, 1831, 8vo), and by C. and Th. Müller (at Paris, 1841).

HECATE, an ancient Greek goddess, whose parentage is variously given. Homer does not mention her. She appears to have been an ancient Thracian goddess, and a Titan who ruled in heaven, on the earth, and in the sea. She could bestow or withhold at pleasure the blessings of wealth, victory, and wisdom to mortals; of good luck to sailors and hunters; and of prosperity to youth and to the flocks. She was the only Titan who retained power under the rule of Zeus. She was subsequently confounded with several other divinities, and at length became a mystic goddess having all the magic powers of nature at her command. She was identified with Demeter and Artemis, and was regarded as the mystic Persephone. Magicians and witches prayed particularly for her aid. Sacrifices used to be offered to her at places where three ways met, and these consisted of dogs, honey, and black female lambs. Her mysterious festivals were celebrated annually at Ægina. Her appearance was frightful. She had three bodies or three heads, and serpents hung hissing around her neck and shoulders. Various figures of her are found on gems.

HECATOMB (from the Greek *hecaton*, a hundred, and *bous*, an ox), signifying literally a sacrifice of a hundred oxen, but applied generally to the sacrifice of any large number of victims. Homer speaks of a hecatomb of lambs; but the hecatomb proper was supposed to consist of a hundred bulls. In Athens the hecatomb was a popular form of sacrifice, though not so with the thrifty Spartans. In the Greek as in the Hebrew sacrifices it was required that the victim should be without blemish. Only part was burned, the rest furnishing the festive meal at the close of the sacrifice.

HECKLES, or HACKLES, and GILLS, are used in preparing animal and vegetable fibres for spinning. They are of the nature of combs, the teeth of which are usually of iron, and vary in length according to the nature of the substance on which they have to operate. In heckles for flax the teeth are from 1 to 2 inches in length; but in those for hemp, jute, and other large and coarse fibres they are about 8 inches long, and made of steel wire ¼ inch in diameter. They are very sharp at the points, which are sometimes four-sided instead of round, for the better separation of the fibres. Through these the material is drawn, so that the fibres may be combed out straight. The material is divided into two parts—the short fibre or *tow*, and the long fibre or *line*. Much care is required in the manufacture of heckles and gills, as any imperfection damages the fibre as it passes through them. To reduce friction to a minimum, the teeth are finely polished. The teeth of gills are much finer than those of heckles, and are fewer in number. The manufacture of these articles is a special trade. There are various recent improvements in heckling machines, among others that of a *double-cylinder machine*, which dresses both sides of the fibre at once, and thus double the quantity of work is obtained.

HECKMONDWIKE, a considerable and thriving town of England, county of York (West Riding),

9 miles south-west of Leeds. It has a neat church in the early English style, with a tower surmounted by a handsome spire; nine Dissenting chapels, several board schools; mechanics' institute and library; extensive blanket, carpet, woollen cloth, and woollen yarn manufactories. Population (1871), 8300; (1881), 9326; (1891), 9709; (1901), 9459.

HECLA, or HEKLA, a volcano, Iceland, about 20 miles from its south coast; lat. 64° N.; lon. 19° 42′ W. It is of a conical shape, and stands completely isolated, having a circumference at the base of about 12 miles. It terminates in three peaks, the central and loftiest of which, Heklufjall, has a height of 5110 feet. It is composed chiefly of basalt, much of which is columnar, and of lava, but is mostly covered by stones, scoriæ, ashes, and other loose volcanic matters. The lava occurs chiefly at the bottom, and forms a rugged and vitrified wall around the base. The craters, which are numerous, occur on the sides of the peaks; and deep ravines form channels for the torrents fed by the melting of the snow, with which the mountain is at all times more or less covered. The eruptions on record, commencing with the tenth century, are forty-three. One of the most tremendous occurred in 1783, when a very great extent of country was laid waste, and an immense volume of lava produced. As if the volcano had then exhausted its force, it remained quiescent till September 2, 1845, a period of sixty-two years, when it again became active, and continued with little intermission till November, 1846, to discharge itself from three craters; throwing out ashes, some of which descended in small dust on the Orkney Isles, a distance of 400 miles, projecting masses of pumice-stone, weighing ½ ton, to the distance of 1½ league, and pouring out a torrent of lava which, at 2 miles from the crater, was 1 mile wide, and from 40 to 50 feet deep. The last outbreak was in 1878.

HECTOR, the son of Priam and Hecuba, the bravest of the Trojans, whose forces he commanded. His wife was Andromache, the daughter of Aetion, king of Cilicia, by whom he had Astyanax, or Scamander, and, according to some, Laodamas and Amphinous. His exploits are celebrated in the Iliad. He encountered the Grecian heroes in battle, and often gained advantages over them. His words and example animated the Trojans with new courage whenever their strength failed. In council he recommended perseverance, unity, and contempt of danger; and though he had a presentiment of the fall of his country, he persevered in his heroic resistance. By his presence Troy was invincible; but when he had slain Patroclus, the friend of Achilles, the latter, forgetting his dispute with Agamemnon, resumed his arms to avenge the death of his beloved companion. Pierced by the spear of Achilles, the body of Hector was dragged at the chariot wheels of the conqueror; but afterwards, at the command of Zeus, it was delivered to Priam for a ransom, who gave it a solemn burial. Hector is, indisputably, the finest hero in the Iliad. Inferior to no one in valour, he fell by the hand of Achilles not from want of courage, but because he had entered the contest wearied with a protracted battle, and faint with wounds, and trusting to the aid of Deiphobus, under whose form Minerva deceived him. In humanity Hector stood alone. One of the finest episodes in the Iliad is the relation of his parting from Andromache, where he expresses the best feelings of a prince, a husband, and a father.

HECUBA, a daughter of Dymas, king of Thrace; according to some of Cisseus, or of the river Sangarius and Metope. She was the second wife of Priam, king of Troy, to whom she bore Hector and Paris. While pregnant with the latter she dreamed that she brought a torch into the world, which consumed all Troy. The explanation of this dream, given by the soothsayers, was that her son should occasion the ruin of the kingdom. He was consequently exposed, but miraculously rescued from death. Hecuba afterwards became the mother of Creusa, Laodice, Polixena, Cassandra, Deiphobus, Polydorus, Troilus. After the conquest of Troy the unhappy princess was made a slave by the Greeks, and, according to one form of the legend, in despair leaped into the Hellespont. Other accounts have it that she exasperated the Greeks by her invectives to such a degree that she was put to death by them. The old tragedians represent her on the stage as a tender mother, a noble princess, and a virtuous wife, subjected to the most cruel destiny.

HEDGE, a fence formed of living trees or shrubs. Hedges are generally composed of one or more of the following species:—Hawthorn, crab, blackthorn, holly, privet, beech, hornbeam, maple, barberry, furze, broom, alder, poplar, willow, yew, box, arbor-vitæ, sweet-briar, &c. When there are so many different species to select from plants may be found suitable for almost all kinds of soil—such as wet or boggy, and dry or sandy; for all situations, whether sheltered or exposed; and for all purposes, such as fences against cattle, or simply as ornaments for garden and pleasure grounds. Hedges are common in Britain and Italy, but rare in France and Germany. As a shelter against winds, and as affording pleasure to the eye, they are to be preferred to dry stone walls; though they take up so much room, and exhaust the soil to such an extent on each side, that they ought to be kept under by frequent trimming. Where used for agricultural purposes it has been calculated that judicious trimming would increase the cultivated land in England and Wales 490,000 acres, an effect similar to the addition of a new county nearly equal in extent to Nottinghamshire, and somewhat larger than Berkshire. An enlargement of the fields is also desirable, for one-third of the present fences in England are not needed for the purpose of agriculture, and might be dispensed with. The average quantity of land occupied by fences appears to be 5 per cent. Removing one-third of the existing fences effects a gain of 1 acre in 60; and by further reducing the remaining two-thirds to one-half their present size there would be on the whole a gross gain in England and Wales of 1,000,000 acres. However, the space occupied by fences is in a great measure determined by the geological character of the country. By the ancient Romans hedges were used to inclose vineyards and gardens. They were not very common in England till the close of the seventeenth century, and Cromwell's officers are supposed to have introduced the planting of them into Scotland and Ireland.

HEDGEHOG (*Erinaceus*, Linn.) These quadrupeds are distinguished by having the body covered with spines instead of hair. The skin of the back is provided with a great orbicular muscle, which enables the animal to roll itself up in the form of a ball. The tail is very short. There are several species known —some authorities enumerate fourteen—and these animals (which belong to the order Insectivora) inhabit Europe and great part of Asia and Africa. The best known is the common hedgehog (*E. Europæus*), a native of most of the temperate parts of Europe and Asia. This species has a long nose, the nostrils bordered on each side by a loose flap; the hind feet have five toes; the ears are short, rounded, naked, and dusky; the upper part of the face, sides, and rump covered with strong, coarse, hair, of a yellowish ash colour, the back with sharp, strong spines, of a whitish tint, with a bar of black through their middle.

They are usually about 10 inches long, the tail about one. Their usual residence is in small thickets, and they feed on fallen fruits, roots, and insects; they are also fond of flesh, either raw or roasted. Pallas remarks that they can eat hundreds of cantharides without suffering from them, whilst a single one of these acrid insects will cause the most horrible torments in dogs or cats. It has been asserted that they mount fruit-trees, and come down with apples, pears, &c., stuck upon their bristles. This is equally false with the fable that they suck cows. That accurate observer Gilbert White observes that the manner in which they eat the roots of the plaintain is very curious. With their upper mandible, which is much longer than the lower, they bore under the plant, and gnaw off the root upwards, leaving the tuft of leaves untouched. The hedgehog defends himself from the attacks of other animals by rolling himself up, and thus exposing no part of his body that is not furnished with a defence of spines. It may be rendered domestic to a certain degree, and has been employed in Europe to destroy cockroaches, which it pursues with avidity. In the winter the hedgehog wraps itself in a warm nest, composed of moss, dried hay and leaves, and remains torpid till the return of spring. The female produces four or five young at a birth, which soon become covered with prickles. These animals are sometimes used as food, and are said to be very delicate. The skin was formerly used for the purpose of napping cloths. The long-eared hedgehog (*E. auritus*) is smaller than the common, and is distinguished by the great size of its ears and shortness of tail; in its manners it is said to be similar to that species. The female produces twice each year, having six or seven young at a birth. This species inhabits from the northern part of the Caspian Sea to Egypt. The species found in bone caves (*E. fossilis*, Schmerl.) is scarcely to be distinguished from the common living species. The Miocene species (*E. priscus*, Pomel) found in Auvergne is larger than the living. The Senegal species (*E. Pruneri*, Wagner) differs from the European in having four toes on the hind feet.

HEDGE-WARBLER, or HEDGE-SPARROW (*Accentor modularis*), sometimes called the Hedge-accentor, belongs to the family of the Sylviadæ, and is generally diffused over the British Islands, though no notice occurs of its having visited Orkney or Shetland. It resides in Britain throughout the year, though it is found in Sweden only in summer. It inhabits all the temperate parts of Europe, but goes southward in autumn. It feeds on insects, worms, and seeds, but not on fruit; and its nest, built of green moss, roots, and wool, and lined with hair, being generally finished early in March, too often becomes the booty of the prying school-boy. The eggs, four or five in number, are of a delicate and spotless bluish green colour, and the first brood of birds is hatched in April, and a second brood further on in the season. The cuckoo often deposits her egg in the hedge-warbler's nest. Though the species is subject to varieties in colour, the plumage is generally of a reddish brown, streaked with dark brown. The song of the male is short and plaintive, and his voice, though sweet in tone, is deficient in variety and power. The whole length of the bird is rather more than 5½ inches.

HEDJAZ. See HEJAZ.

HEDJRAH. See HEJRA.

HEDWIG, St., born in 1174, was daughter of Duke Berthold von Meran, margrave of Baden, and was married in her twelfth year to Duke Henry of Silesia, where, by the number of Germans she took with her, or induced to settle, she contributed greatly to the progress of civilization. After she had born six children she and her husband took the vow of chastity. He, allowing his beard to grow so as to obtain the surname of Bearded, laid aside all distinction of dress, and devoted himself entirely to spiritual functions. At her request he founded the Cistercian nunnery of Trebnitz, which she richly endowed. Here she shut herself up after the death of her husband, and died in 1243. She was admitted into the Roman calendar in 1268 by Clement IV. Her bones, which rest in the church of the nunnery, were the objects of numerous pilgrimages.

HEDYSARUM. See FRENCH HONEYSUCKLE.

HEEM, JAN DAVIDSZ DE, the greatest Dutch painter of fruit and still life, born at Utrecht in 1600, studied under his father, and soon obtained large sums for his fruit-pieces. Towards the end of his life he quitted Utrecht for Antwerp, and died there in 1683 or 1684. His paintings consist chiefly of magnificent vases filled with fruit, or of articles of vertu, &c., placed on marble tables; the background is formed by a rich green drapery. He was also accustomed to depict rich garlands of fruits and flowers as the border of a central figure, as a Madonna, &c., in the style of Daniel Seghers. A certain Jan Vander Meer refused 2000 guilders for a garland of flowers painted by Heem. He afterwards gave it to William of Orange, who brought it with him to England. His colouring and chiaroscuro are almost perfect, and the peculiarities of each object, as the smoothness or roughness of its surface, the down of fruit, the tissue of the drapery, &c., are given with admirable skill. In spite of the confined nature of his subjects he is always interesting and graceful, and furnishes the ornaments of many galleries. His son Cornelius was also excellent in the same style.

HEEMSKERK, MARTIN VAN, surnamed the *Dutch Raphael*, born in 1498, at the village of Heemskerk, near Haarlem, from which he derived his name, was the son of a mason, of the name of Van Veen, who at first placed him with a painter at Haarlem, but afterwards took him home to learn his own trade. The young Martin returned to his father's house unwillingly, and seized the first opportunity of leaving it again. He then went to John Lucas, a painter of some celebrity at Delft; but finding that his master did nothing for him, he placed himself under the direction of J. Shoreel, a celebrated artist who had brought from Rome and Venice many valuable studies. He imitated his style so carefully, that it was almost impossible to distinguish between the works of the pupil and the master; and his master, fearing to be eclipsed by him, sent him away. He then executed his picture of St. Luke painting the Blessed Virgin and the Child Jesus, and presented it to the Corporation of Painters at Haarlem. This picture had great success. In 1532 Heemskerk visited Italy, remained there about three years, forming his taste on ancient models, and enjoyed the instructions of the celebrated Michael Angelo, who, at that time, was enriching the capital of the Christian world with the works of his pencil. When he returned to Holland some of his admirers lamented that they no longer found in his pictures the charms which had delighted them; but connoisseurs knew how to appreciate the progress which he had made in the art of drawing, and his improvement in taste. His apartments were soon filled with scholars, and in a short time he became rich. A great part of the now rare works of this diligent and prolific artist were lost in 1572, at the capture of Haarlem by the Spaniards, when his own house was likewise destroyed. Heemskerk's drawing is firm and accurate, but his outlines are without elegance or grace; his drapery is stiff, and overloaded with folds, and his heads want dignity. He is chiefly indebted for his fame to his

knowledge of anatomy, in which he endeavoured to imitate Michael Angelo. He died at Haarlem, 1574.

HEEREN, Arnold Hermann Ludwig, an eminent German historian, was born at Arbergen, near Bremen, 25th October, 1760. He was at first educated by his father, a clergyman of extensive knowledge; but in 1776 he entered the gymnasium of Bremen, to prepare himself for the university. In 1779 he went to the University of Göttingen, and mainly by the influence of Heyne he abandoned the study of theology, and devoted himself to philological pursuits. But he soon found that philology proper was not his vocation, and thereafter he applied himself chiefly to historical investigation. In 1784 he took his degree of Doctor in Philosophy, and in 1785 he published an edition of Menander, and formed the plan for a new edition of Stobæus. That he might collate the various manuscripts of Stobæus he visited Italy, and travelled also in Germany and France, forming friendships with many eminent men, in his intercourse with whom his mind became expanded and enriched with new ideas. On his return in 1787 he was appointed professor extraordinary in the philosophical faculty, and in 1789 he was elected a member of the Academy of Sciences. In 1796 he married a daughter of Heyne, and in 1801 was appointed to the professorship of history. He died at Göttingen, March 6, 1842. He was a member of the Academies of St. Petersburg, Berlin, Munich, Stockholm, Dublin, and Copenhagen, and of the Asiatic Societies of London and Calcutta. He was among the first of historians who removed the study of antiquity from the domain of dry details, and invested it with a living interest. An edition of his historical works in fifteen vols. 8vo, was published at Göttingen, 1821–26. Vols. i.–iii. contain his Kleine historische Schriften. Vols. iv. v.: Geschichte der classischen Liter. im Mittelalter. Vol. vi.: Biographische und liter. Denkschriften, &c. Vol. vii.: Handbuch der Geschichte der Staaten des Alterthums. Vols. viii. ix.: Handbuch der Geschichte des Europ. Staatensystems and seiner Colonien. Vols. x.–xv.: Ideen über die Politik, den Verkehr und den Handel der vornehmsten Völker der alten Welt.

HEGEL, George William Frederick, a celebrated German metaphysician, born at Stuttgart, on the 27th of August, 1770. After attending the gymnasium of his native city he entered the theological institute at Tübingen, where he remained from 1788–93 diligently devoted to the study of theology and philosophy. On leaving the institute he was employed for six years as a private tutor, first at Berne, and then at Frankfort-on-the-Main; but on the death of his father, who left him some property, he took up his residence at Jena, where, through an intimate friendship with Schelling, the strong love which he had always felt for metaphysics was more fully developed. When the battle of Jena, in 1806, had laid Prussia prostrate at the feet of Napoleon, he removed to Bamberg, and was employed on a newspaper till 1808, when he became rector of the gymnasium at Nürnberg. This situation he held for eight years, and then was appointed professor of philosophy first at Heidelberg in 1816, and next at Berlin, where in 1818 he succeeded to Fichte's chair. He had here gathered around him a large number of admirers, and was in the zenith of his fame, when he was suddenly cut off by cholera, on the 14th of November, 1831. He was buried beside Fichte. Among his numerous works, the most important, taking them in the order of their publication, are his Phänomenologie des Geistes, which appeared in 1807 as the first part of a system of sciences; Wissenschaft der Logik (three vols. Nürnberg, 1812–16); Encyclopädie der philosophischen Wissenschaften (Heidelberg, 1817); and Grundlinien der Philosophie des Rechts oder Naturrecht und Staatswissenschaft (Berlin, 1821). The philosophy of Hegel, starting from the same position as that of Schelling, soon departed from it. As there are, according to him, three stages in the process of thought and existence, his system has necessarily a threefold division: first, logic; second, the philosophy of nature; and third, mental philosophy. Hegelianism has exercised a powerful influence on modern thought. But for an exposition of his system such works must be consulted as: J. Hutchison Stirling's The Secret of Hegel, Edward Caird's Hegel (in Philosophical Classics), John Caird's Philosophy of Religion, Prof. Wallace's Logic of Hegel, Erdmann's History of Philosophy, &c.

HEGIRA. See Hejra.

HEIDE, a town of Prussia, in Schleswig, 27 miles W.S.W. Rendsburg. It was the capital of the peasant republic of the Ditmarshes from 1447 to 1559, when the last battle of the Ditmarshers for their freedom took place here. Pop. (1895), 7936; (1900), 8112.

HEIDELBERG, an old university town of Germany, in Baden, on the left bank of the Neckar, here crossed by two bridges, one of them finished in 1877, in one of the loveliest districts of Germany, 11 m. E.S.E. Mannheim. It stands on a narrow strip between the river and the rock on which the castle is built, and chiefly consists of one long main street and less important cross and parallel streets. The most remarkable edifice is the castle, on a height above the town, an immense ivy-clad ruin begun in the 13th century, and exhibiting elaborate examples of early and late renaissance architecture. In the town itself the principal buildings are: the Gothic church of St. Peter, the Gothic church of the Holy Ghost, the Roman Catholic church, the university, founded in 1386, and possessed of a library of 500,000 volumes, not remarkable as an edifice, but distinguished as a seat of learning, and attended by over 1200 students; the town-house, the post-office, gymnasium, real-school, and other schools. The university is the oldest in the German empire. It was founded after the model of that of Paris, and was an early seat of the Reformation doctrines, coming especially under the influence of Melanchthon. It attracts many foreign students: and many other foreigners also visit Heidelberg. The manufactures, not of much importance, include cement, tobacco, cigars, fire-extinguishing apparatus, shoddy, mathematical and surgical instruments, leather, &c., and there are also several breweries. One of the greatest curiosities of the place is the well-known Heidelberg tun, kept in a cellar under the castle; and, though far less than several of the London porter vats, it is the largest wine cask in the world, being 36 feet in length, 26 feet in diameter, and capable of holding 800 hogsheads. Heidelberg is rich in public walks. The gardens around the castle are well laid out, and at every turn present the finest views of the Neckar, and the fertile and richly wooded valley through which it winds to join the Rhine. Still higher up, behind the town and castle, a carriage-road leads by easy ascent to the top of the Königstuhl, the loftiest hill of the district, from which an extensive view is obtained of surpassing beauty. In 1622 the ferocious Tilly, after bombarding Heidelberg for a month, took it by storm, and gave it up to three days' pillage. In 1688 a French general, Melac, on the orders of Louis XIV., took the town, and burned it, outrivalling even Tilly in cruelty and brutality. In 1693 another French force perpetrated similar atrocities. Pop. (1895), 35,190; (1900), 40,119.

HEIDENHEIM, a town of Wurtemberg, circle Jaxt, in the Brenz valley, 46 miles E.S.E. Stuttgart. It is an old but well-built place; has manufactures of

woollen and linen cloth, flannel, paper, and earthenware; bleachfields, dye-works, several mills, and a trade in corn. Pop. (1895), 9063; (1900), 10,510.

HEIGHTS, MEASUREMENT OF. A most important geodetical measurement is that of the relative heights of various points on the earth's surface; and the knowledge of the relative heights is absolutely necessary to the civil and to the military engineer, to the topographer, and to the geologist, and is at the same time an important element in physical geography. The difference of heights between any two places may always be determined by means of proper trigonometrical measurements, and it is in that way that the most accurate information is obtained on the subject. In all cases where very great exactness is required, for example, in laying out a railway, or planning an aqueduct, or even in laying down a road, it is by trigonometrical surveying that the relative heights are determined. There are many cases, however, where minute accuracy is unnecessary, and where rapidity and ease of application, portability of instruments, and so on, are of more consequence; and, indeed, it is not every traveller, geologist, or physical geographer who possesses the knowledge and the skill required in trigonometrical land-surveying. Hence, the invention of another method, by means of the barometer, has proved of great importance, and it is so easy and convenient of application that, except where the trigonometrical method is necessary, it is universally employed. We shall not enter here into the trigonometrical method. We must refer our readers to works on trigonometry and land-surveying for information about it.

Pascal's celebrated *experimentum crucis* with respect to the invention of the mercurial barometer by Torricelli was the first step towards the barometric method. There, the mercurial barometer was carried up to the top of the Puy-de-Dome at Clermont in order to verify that the barometric column is supported by the pressure of the atmosphere. For, as Pascal pointed out, if that were the case, then, on climbing the mountain and thus ascending in the air, the barometric column ought to fall, because the superincumbent atmosphere has been diminished in amount to an extent corresponding to the height through which the observer has ascended. This is the principle of the method that we are considering. When, by ascending in the air, we diminish the column above that gives the atmospheric pressure, the barometric column is correspondingly diminished in height; or, again, if the barometer is carried down the shaft of a mine, the height of the superincumbent atmospheric column is increased; the atmospheric pressure is consequently increased also, and therefore the barometric column increases in height. Were the atmosphere uniform in density throughout, nothing could be simpler than the measurement of heights by the barometer. Then the diminution in the length of the barometric column would be in simple proportion to the height through which the barometer has been carried. That, however, we know is not the case. Gases are very compressible, and the lower strata of the atmosphere are denser than the upper strata, being exposed to greater pressure. Thus a column of air 100 feet high, and of unit area, has far greater weight at the sea-level than a similar column at the top of a mountain 4000 feet high; and the effect on the barometric column of rising 100 feet from sea-level is correspondingly greater than the effect of rising 100 feet from a height of 4000 feet above the level of the sea.

The first attempts to find a formula for calculating heights by barometric observations were not very successful. They were made experimentally by carrying the barometer up to known heights, making observations with it, and comparing together the heights and the effects on the barometer. Deluc (1754) first gave precision to the method. One of the great difficulties was the effect of temperature. Increase of temperature affects the density of the mercury of the barometer, and also the density of the air, but the latter far more than the former; and the effect of temperature on the air must be taken into account in any but the very roughest estimates of heights. As the temperature of the air increases the density is diminished rapidly; and thus the weight of a column 100 feet high is less, and its effect on the barometric height is correspondingly less, when the temperature of the air is high than when it is low. Deluc first showed how to take into account the effect of temperature; but it was Laplace who gave a complete investigation of the problem, and established the barometric formula. To subsequent investigators is due the experimental determination of certain numerical data, the ratio of the density of mercury to air under given conditions, for example, with greater accuracy than that with which they were possessed by Laplace. A barometric formula convenient for calculation is given below. For the mathematical proof of it we must refer our readers to works on natural philosophy or on engineering. Professor Maxwell furnishes a demonstration of it in his book on the Theory of Heat.

Barometrical observations may attain great accuracy when they are made with good instruments and by practised observers under favourable circumstances. Portable mercurial barometers are constructed for the purpose. For the greatest accuracy in determining the difference of levels between two stations, two barometers and four thermometers are required. Two of the thermometers are used for determining the temperature of the air at the stations, and two, which are attached to the barometers, are used for determining the temperature of the mercury. The observations are made simultaneously. Very good observations may, however, be made in favourable weather, when there is little or no wind, and when the barometer is not varying rapidly or at all, with a single barometer and two thermometers, by first reading the instruments at the lower station, then carrying them to the upper station and reading, and finally bringing them back to the lower station and getting fresh readings. If the barometric height or the temperature of the air has varied during the course of the experiment, the second readings at the lower station will indicate the variations, and they may then be allowed for.

The invention of the aneroid barometer has made the measurement of heights extremely easy. Although the mercurial barometer is still commonly supposed to be the more trustworthy instrument, yet, considering the accuracy and the sensitiveness of the aneroids now constructed, even that may be questioned; and in portability and convenience of application these instruments leave nothing to be desired. The difficulty of suspending a mercurial barometer exactly vertical is considerable; and with an aneroid properly compensated for temperature, the use of two of the thermometers mentioned above for determining the temperature of the mercury in the mercurial barometer is avoided. The aneroid barometers are now universally employed by travellers and others to whom it is an object to carry instruments in the most portable form possible. Very good determinations of the height of a mountain may be made by a single observer with a single aneroid barometer and a single thermometer. Care must be taken to obtain the true temperature of the air, and this, it must be remembered, is no easy matter with a portable, particularly with a pocket thermometer. The thermometer should be removed from its case, and carried in the

hand with the bulb freely exposed to the air, but not to the sun, for some time before the reading is taken. Then two or three readings should be taken at short intervals, in order to make sure, by observing whether the thermometer is stationary or not, that the true temperature of the air has been attained; and during the whole time of observation care must be taken to keep the thermometer in such a position that it is not affected by the heat of the hand or of the body of the observer. A very good way, when it happens to be practicable, of getting the temperature of the air rapidly and with great certainty is first to warm the thermometer to a temperature slightly above that of the atmosphere, and allow the instrument to cool till it appears stationary; then to cool it slightly below the atmospheric temperature, and allow it to become warmed by exposure to the air till it again seems stationary. If the temperatures indicated after the warming and after the cooling agree, we may be sure that we have obtained the true atmospheric temperature, provided, of course, that no improper influence is brought to bear on the thermometer.

The following formula serves to calculate the difference of levels between two stations. Let B and B′ be the observed barometric heights in inches, at the lower and upper stations, corrected[1] if necessary for the temperature of the mercury if a mercurial barometer is used. Let t be the temperature of the air in degrees Fahrenheit, which may be taken as the arithmetic mean (*i. e.* half the sum) of the observed temperatures at the lower and upper stations, unless there is some way of obtaining a more exact estimate of it. Then if h is the difference of levels in feet,

$$h = (\log. B - \log. B') \times [60360 + (t - 32)\ 122{\cdot}68].$$

Thus the difference of the common logarithms of the numbers B and B′ are to be taken and multiplied by the number found by adding to 60360 the product of $(t - 32) \times 122{\cdot}68$. For rough purposes the following rule may be used:—Multiply the difference of the logarithms of the barometric heights by 10,000, and the difference of the levels in fathoms (6 feet) will be obtained.

From the formula just given tables may be constructed for calculating the difference of levels of two stations without the use of logarithms; and they are often supplied by instrument makers along with aneroid barometers. Such tables must be constructed assuming some mean barometric height for that of sea level. The following table, assuming ordinary barometric height at sea-level to be 30 inches, and taking 50° Fah. as the mean temperature of the air, will enable the observer to calculate a difference of levels with considerable accuracy. Let $d = B - B'$, and let s be the number found in the table corresponding with the sum of B and B′, and let t and t' be the readings of the thermometers at the lower and upper stations respectively, then, h being the difference of levels in feet,

$$h = 10 \times d \left\{ s + \frac{s}{1000} \times 1{\cdot}07\ (t + t' - 100) \right\};$$

or approximately,

$$h = 10 \times d\ [s + 0{\cdot}1\ (t + t' - 100)].$$

	0	1	2	3	4	5	6	7	8	9
54	100·94	100·76	100·57	100·39	100·20	100·02	99·83	99·65	99·47	99·29
55	99·11	98·93	98·75	98·57	98·39	98·21	98·04	97·86	97·69	97·51
56	97·34	97·16	96·99	96·82	96·65	96·48	96·31	96·14	95·97	95·80
57	95·63	95·46	95·30	95·13	94·97	94·80	94·64	94·47	94·31	94·15
58	93·98	93·82	93·66	93·50	93·34	93·18	93·02	92·86	92·71	92·55
59	92·39	92·24	92·08	91·92	91·77	91·62	91·46	91·31	91·16	91·00
60	90·85	90·70	90·55	90·40	90·25	90·10	89·95	89·80	89·65	89·51
61	89·36	89·21	89·07	88·92	88·78	88·63	88·49	88·34	88·20	88·06

Example.—By observation, B = 29·9, B′ = 28·2, $t = 58°$, and $t' = 56°$. Here $d = B - B' = 1{\cdot}7$, and $B + B' = 58{\cdot}1$ From the table we find for s the value 93·82, and $t + t' - 100$, being equal to 14, we get on calculation the value of $h = 1618$ feet.

HEILBRONN, a town of Würtemberg, beautifully situated on the Neckar, 26 miles north of Stuttgart. The older portion of the town, on the right bank of the river, has still quite a mediæval aspect, with its narrow streets, lofty gabled houses, and pointed towers; outside it are elegant suburbs, partly on the left bank of the Neckar, over which are several bridges. The principal church is St. Kilian's, mostly a late Gothic building of the fifteenth century, with a beautiful tower 220 feet high, a beautiful choir, fine carvings, painted glass, and curious monuments. Other buildings are St. Joseph's R. Catholic Church, a fine Jewish synagogue, an ancient town-house, an ancient tower, the Thief's Tower or Götz-tower; and the House of the Teutonic Knights, now a barrack. The manufactures consist of silver plate, especially table utensils, paper, machinery, manures, salt, beet-sugar, cutlery, pianos, soap, cement, woollen goods, artificial coffee of chicory and figs, leather, beer, &c.; and the trade is important. Gypsum and sandstone are quarried in the vicinity. Heilbronn is built upon the site of a Roman station, and was long an imperial free town. Pop. (1895), 33,461; (1900), 37,891.

[1] The nature of this correction we need not enter into here. All books on natural philosophy explain it.

HEILSBERG, a town, Prussia, in the government and 40 miles south of Königsberg, on the left bank of the Alle. It has a castle (now an orphan asylum), a Protestant and two R. Catholic churches, court-house, &c.; manufactures of leather and starch, and a trade in grain and cattle. Pop. (1900), 5514.

HEIN, Peter Petersen, a man of obscure origin, who, by his bravery, rose to the dignity of High-admiral of Holland. He was born at Delftshaven in 1570, rose gradually to the rank of vice-admiral of the East Indian fleet, and three years afterwards received the chief command. He attacked the Portuguese in 1626 on the coast of Brazil, took several ships, and carried home a rich booty. Two years later he captured the Spanish Plate fleet, and obtained an immense booty. In 1629 he was appointed high-admiral in reward for his services, and was soon after killed in an engagement off the coast of Flanders with a fleet from Dunkirk, of which he had already captured three ships.

HEINE, Heinrich, a German poet and author, was born of Jewish parents at Düsseldorf on 12th December, 1799, though at least two other dates have been assigned; studied law at Bonn, Berlin,

and Göttingen, and took the degree of Doctor at the last-mentioned place. In 1825 he became professedly a convert to Christianity, and was baptized in the Lutheran church of Heiligenstadt. His conversion seems to have been a purely secular matter, having no connection with religious convictions, and it was professed mainly in order that he might be free to practise law now that he had obtained his doctor's degree. Nevertheless he showed no desire to become a practical lawyer, and soon all his energies were devoted to literature. At Bonn A. W. Schlegel had influenced him greatly, and later in Berlin his powers had been stimulated by the brilliant society which frequented the house of Madame Rahel, a Jewess, the wife of Varnhagen von Ense. He engaged in political journalism in Munich and elsewhere, and the revolutionary opinions expressed by him soon made his imprisonment very probable. The fear of such a result helped to strengthen the joy with which he welcomed the Parisian revolution of 1830. In that year he took up his residence in the French capital, and there he lived almost uninterruptedly till his death, which took place on February 17, 1856. From 1836 till the revolution of 1848 he received a pension from the French government. During the last years of his life he suffered much from disease of the spine, but his sufferings could not permanently cloud his spirit, and, so far from impairing his creative power, they seem rather to have stimulated him to the production of some of his finest works. He began his literary career with a volume of poems (Gedichte) published in 1822, and in the following year he printed two dramas entitled Almansor and Radcliff. Some years later (1826–27) the publication of the first two volumes of his Reisebilder (Pictures of Travel) made him famous, and his fame was enormously increased by the appearance of his Buch der Lieder (Book of Songs) in 1827. The third and fourth volumes of the Reisebilder were published in 1830-31, and among the prose writings of his French period, many of them of the *feuilleton* kind, are: Zur Geschichte der neuern Schönen Litteratur in Deutschland (2 vols., 1833); Französische Zustande (1833), a collection of papers on French affairs; Der Salon (4 vols., 1835–40), including an account of German literature and philosophy; Die Romantische Schule (1836); Shakespeares Mädchen und Frauen (1839); and his bitter pamphlet Über Börne (1840). His witty and cynical Neue Gedichte appeared at Hamburg in 1844, and in Deutschland, Ein Wintermärchen he gives a characteristically satirical account of his last visit to his native country. Other poetical works are: Atta Troll (1847); Romanzero (1851); and Der Doktor Faust (1851). The three volumes of Vermischte Schriften published in 1854 contained his Geständnisse (Confessions) and Lutetia. His Letzte Gedichte und Gedanken were published posthumously. Among complete editions of Heine's works we may mention that published at Hamburg in twenty-two vols. in 1861–66 (new edn., 12 vols., 1887), and those of Born (12 vols., Stuttgart, 1887), Karpeles (9 vols., 2nd edn. 1893), and Elster (critical, 7 vols., Leipzig, 1887–90). As a poet, more especially in his earlier productions, Heine is remarkable for the simplicity and pathos of many of his lyric pieces. His powers of wit and raillery were also great, but in the use of these he has often transgressed all the bounds of propriety and decorum. Scepticism and over-sensuousness are prominent characteristics of this writer. In private life he displayed many good qualities, showing himself generous and self-sacrificing, and ever ready to sympathize with and relieve distress. Heine has found many English translators. There is a complete translation of all his works by C. G. Leland (12 vols., 1891, onwards); and among translations of parts we may mention: The Prose Writings of Heine, by Havelock Ellis (1887); Travel Pictures, by F. Storr (1887); Poems and Ballads of Heine, by Sir Theodore Martin (1878). There are Lives in English by W. Stigand (1876) and W. Sharp (1888). See also Erinnerungen an Heinrich Heine und seine Familie (1868), by his brother Max; Heines Familienleben (1892; Eng. trans. by Leland, 1893), by Baron von Embden; and Karpeles, Heinrich Heine: Autobiographie (1888; Eng. trans. by Dexter, 1894).

HEINECCIUS, JOHANN GOTTLIEB, a German author who wrote on logic, jurisprudence, and ethics. He was born at Eisenberg, 11th September, 1681, and studied at Halle, where he afterwards obtained a professor's chair in the sciences of philosophy and law. In 1724 he quitted Halle for Francker, and remained there till 1727, when he accepted an invitation given him by the King of Prussia, to settle at Frankfort-on-the-Oder. Here he resided upwards of six years, when he returned to Halle, where he died 31st August, 1741. His works were collected and published at Geneva in 1744–71, with the title Operaad Universam Jurisprudentiam, Philosophiam, et Litteras Humaniores Pertinentia.

HEINSIUS, ANTHONY, Dutch statesman, was born at Delft in 1641 and died at the Hague in 1720. He studied law at Leyden, and in 1688 became grand pensionary of Holland. He was the friend and confidential agent of William of Orange who became William III. of England, and was a determined opponent of Louis XIV. in the war of the Spanish Succession.

HEINSIUS, DANIEL, a celebrated Dutch philologist, poet, and critic, born at Ghent in 1580. At fourteen he was sent to the University of Francker to study the civil law, but he applied himself chiefly to Greek literature. Removing to Leyden in 1594 he continued his studies under Joseph Scaliger. He was chosen professor of history and politics in the University of Leyden in 1605, and librarian and secretary in 1607. He died at Leyden, February 25, 1655. His Latin poems consist of elegies, satires, and two tragedies, besides other pieces. He also wrote Greek poems, which were much esteemed, and verses in the Dutch language. His editions of the principal Greek and Roman classics secured for him a high reputation over Europe.—His son NIKOLAUS (1620–1681) was Dutch resident at Stockholm and also a distinguished classical scholar.

HEIR. See DESCENT.

HEIR-APPARENT, the name given to a person who necessarily succeeds to the ancestor if he survives him, as the eldest son in England: opposed to *heir-presumptive* (which see).

HEIRLOOMS, in English law, means personal chattels which go by the special custom of a particular place to the heir-at-law, together with the inheritance. An heirloom cannot be devised away from the heir by will. The term is often, though not quite accurately, applied to the case where certain chattels, such as pictures, plate, or furniture, are directed by will to follow the limitations of some family mansion or estate. *Heirship movables*, the analogous term in Scotch law, are those things to which the heir in heritage is entitled, that he may not succeed to a house and land completely dismantled. They consist of the best of everything that belonged to the heir's predecessor, such as furniture, horses, cows, oxen, farming utensils, &c.

HEIR-PRESUMPTIVE is one who, if the ancestor should die immediately, would, under existing circumstances, be his heir, but whose right of inheritance may be defeated by some nearer heir being

born, as an only daughter, who is displaced by the birth of a son. See HEIR-APPARENT.

HEJAZ, or HIJAZ, a division of Arabia, extending along the north half of the east coast of the Red Sea, bounded north by the Syrian Desert and the Gulf of Akaba, east by Nejd, south by Yemen, and west by the Red Sea, comprehending a lowland (Tehâma el Hejáz) and a tract of highland or Nejd, east of a range of mountains which attain in some places an elevation of perhaps 8000 feet. There are no rivers in the Tehâma el Hejáz, where the wadies or beds of occasional torrents are but rarely filled; indeed the lower part of the Tehâma does not enjoy the refreshing influence of ten days' rain in the year, and whatever fertility it possesses is due to little streams led to it from the mountains. On these the rain falls more copiously, and the well-watered valleys among the hills, with their corn-fields, their variety of exquisite fruits, and their shady groves of date-palms, contrast strongly with the sun-burned plains below. The coast of Hejáz is said to be unhealthy, owing to the foulness of the water, which produces fever. The water in the interior, if collected from the surface of the ground, is brackish; or, if fresh, it is impregnated with sulphur, and otherwise unwholesome. The productive and irrigated valleys of the interior also are rendered insalubrious by the combined effects of humidity and rank vegetation. In the Tehâma the wild plants are few and uninteresting, and offer little for the support of animal life. On the mountains near the Gulf of Akaba may be found two species of wild goat. A few hares and gazelles, with jerboas and lizards, possess the plains. The hyænas and foxes, more numerous, subsist chiefly on fish, which they find on the coral reefs along shore. The falcons, feeding on fish, are also relatively the most numerous of the feathered tribe. In some localities the fish are extremely plentiful; and certain tribes of Bedouins not only subsist on them, but also carry great quantities of salt-fish to the market of Mecca. Three species of dolphin, besides a manati (the dugong), are taken on the coast of Hejáz. Tortoise-shell and mother-of-pearl add largely to the fisherman's gains. Mecca, Medina, Jiddah, and Yambo are the chief towns. Mecca, the birth-place of Mohammed, and Medina, the place of his sepulture, are regarded by his followers as holy, and are annually resorted to by vast numbers of pilgrims. Hejáz forms a part of the Turkish dominions.

HEJRA, HEJIRA, or HEGIRA, an Arabic word signifying emigration. The Mohammedans designate by this word the flight of Mohammed their prophet from Mecca to Yatreb (Medina), which latter place was in consequence called *Medina al Nabi*, that is, the City of the Prophet. From this flight, which happened on the 13th of September, 622 A.D., but which they fix on the 16th of July of the same year, they begin their computation of time. For the reduction of the years of the Hejra to the corresponding period in the Christian computation, see EPOCH.

HELDENBUCH (German, *Book of Heroes*), a celebrated collection of old German poems, drawn from national traditions of events which happened in the time of Attila and the irruption of the German nations into the Roman Empire. It contains the exploits and adventures of the Emperor Otnit and the dwarf Elberich, of Hugdietrich, Wolfdietrich, King Giebich of Worms, Dietrich of Berne, of King Laurin, the history of the famous garden of roses at Worms, of Hornensiegfried, of the court of Attila, &c. These poems excite the imagination by their lively tales of war and of love. They were written at different times by various poets. The oldest are of the Suabian period, and in their form and style resemble the Nibelungenlied. A critical edition has been published at Berlin (5 volumes, 1866-73), under the title Deutsches Heldenbuch.

HELDER, THE (Dutch, *Den Helder*), a market town, military port, and strongly-fortified seaport, Holland, in the most northern part of the province of North Holland, opposite the Island of Texel, its forts commanding the Marsdiep, the entrance to the Zuider Zee. Its harbour, known as the Nieuwe Diep, is the northern terminus of the North Holland canal, completed in 1824, which connects the town with Amsterdam. The Helder is one of the strongest places in Holland, requiring 7000 to 9000 men for its defence, and being capable of receiving 30,000. Being much exposed to the fury of the ocean the port and coasts are protected by gigantic dykes, one of which is 6 miles long and 40 feet broad, with an excellent road on the top of it. It is built entirely of Norwegian granite, and presents to the sea a sloping side of 200 feet, inclined at an angle of 40°. The Marsdiep has a strong current, which always keeps it clear for the passage of vessels. The British, under Sir Ralph Abercromby and the Duke of York, took possession of the Helder in 1799, but were compelled to re-embark a few weeks thereafter, having fruitlessly endeavoured to excite the Dutch to throw off the French yoke. Pop. (1899), 25,159.

HELENA (commonly called *Helen* in English), in ancient Greek legend, the most beautiful woman of her age, sprung from one of the eggs which Leda, the wife of King Tyndareus, brought forth after her amour with Zeus, metamorphosed into a swan. (See LEDA.) Her beauty was so universally admired, even in her infancy, that Theseus, with his friend Pirithous, carried her away before she had attained her tenth year, but her brothers, Castor and Pollux, recovered her by force of arms, and she returned safe and unpolluted to Sparta, her native country. Her hand was afterwards eagerly solicited by princely suitors from all parts of Greece. At the proposal of Ulysses, who was likewise one of them, Tyndareus bound all the suitors by solemn oath to approve of the choice which Helena should make, and engage to unite together to defend her person and character if ever any attempts were made to ravish her from the arms of her husband. Helena chose Menelaus, and Hermione was the early fruit of this union, which continued for three years with mutual happiness. Being subsequently seduced and carried off to Troy by Paris, son of Priam, Menelaus assembled the Grecian princes, and reminded them of their solemn promises. Hence arose the Trojan war. When Paris was killed, in the ninth year of the war, she voluntarily married Deiphobus, one of Priam's sons; and when Troy was taken she made no scruple to betray him, and to introduce the Greeks into his chamber to ingratiate herself with Menelaus. She returned to Sparta with Menelaus, but after his death was driven from the country, and retiring to Rhodes was murdered by the queen of the island to avenge the death of her husband, who had fallen at Troy. Helena, according to some, was carried into the Island of Leuce, after death, where she married Achilles, who had been once one of her warmest admirers.

HELENA, mother of the Emperor Constantine the Great, appears to have been of humble origin, and was probably the daughter of an innkeeper. By some accounts she was a native of Bithynia, others make her the daughter of a British or Caledonian king; but this is a monkish legend destitute of foundation. She captivated Constantius Chlorus, and became his wife; but when Diocletian elevated him to the dignity of Cæsar, in A.D. 292, he was compelled to repudiate her. The succession of her son,

and the influence which she had exercised in educating him as a Christian, compensated her for previous humiliations. Her piety and zeal for the propagation of Christianity have made her a saint in the Roman Catholic calendar. She is said to have discovered the cross used in crucifying our Saviour, which then must have been nearly 300 years old. This event is known as the 'invention of the cross', and is commemorated by an annual festival of the Roman Catholic Church. (See CROSS.) In honour of the discovery the empress founded the celebrated Church of the Holy Sepulchre at Jerusalem, and died shortly afterwards at the age of eighty.

HELENA, ST., an island in the South Atlantic Ocean, belonging to the British Empire; lat. (Diana's Peak) 15° 57′ S.; lon. 5° 42′ W.; about 850 miles south-east of the Island of Ascension, 1150 miles west from the west coast of South Africa, and 2000 miles from the east coast of Brazil; greatest length, from Barn Point, in the north-east, to West Point, 10½ miles; greatest breadth, from Sugar Loaf Point, in the north, to the Barn, in the south, 7 miles; area, about 47 square miles. Its comparatively small size, and its immense distance from the continents both of the Old and the New World, might seem to have doomed it to be one of the most solitary and least frequented portions of the earth's surface; but its position, in the direct line of the great ocean thoroughfare from Europe to the East, long made it a most important halting station for vessels performing that lengthened voyage, while it has acquired much additional celebrity from being the place of Napoleon's banishment, and where he resided from 1816 till his death, May 5, 1821. When seen from a distance it has the appearance of a lofty pyramidal mass, of a dark grey colour, rising abruptly from the surface of the ocean, and presenting no signs of vegetation; but when more nearly approached, though its precipitous and almost inaccessible coasts become still more striking, and on all sides, but particularly on the north, enormous beetling cliffs are seen almost perpendicular, and varying in height from 600 to 1200 feet, a number of openings are discovered, forming the mouths of narrow valleys or ravines, leading gradually up to a central plateau. On the shore, at all of these openings where a landing might be effected, small forts and other military works have been formed, chiefly for the purpose of making it a secure prison-house while the peace of Europe depended on the safe custody of its prisoner. The island is beautiful, healthy, and tolerably fertile. The greater number of the inhabitants reside in James' Town, which has a fine natural harbour, is defended by strong batteries, contains the official residences, and has a handsome church. The island, which is of volcanic formation, derives its name from having been discovered by the Portuguese navigator Juan de Nova Castilla, on May 22d, St. Helena's day. It was afterwards possessed by the Dutch, and finally was ceded to the English about 1651, in whose possession it has, with a short interval, ever since remained. Previous to the opening of the Suez Canal (1869), and before sailing vessels were so largely supplanted by steamers, St. Helena did a large trade with the vessels that called, and was in a flourishing condition, but now its prosperity has departed, though it still supplies potatoes and other fresh vegetables to vessels calling or stopping to trade as they pass. Potatoes form the chief crop. The annual revenue is about £9000. Several thousands of Boers taken prisoners in the South African war of 1899–1902 were kept here for some time. Pop. (1901), 5195.

HELENIN (C_6H_8O), a crystalline substance got from elecampane root. The root, distilled with water, gives an oil, part of which passes over, part concretes in the neck of the retort. A better way of getting it is to exhaust the root with strong spirit, mix with three or four volumes of water, and allow to stand, when crystals of helenin deposit. They are colourless, have no taste or odour, are insoluble in water, but dissolve readily in spirit. Helenin, by the action of various reagents, yields different products—such as a yellow oily hydrocarbon called *helenene*, chlorine-, nitro-, and other substitution products.

HELENIUM, a genus of plants belonging to the natural order Compositæ, and to the tribe of Heleniæ of Lindley. The genus is characterized by a radiate head or capitulum, with stamens and no pistils in the florets of the ray, and both stamens and pistils in those of the disk; florets of the ray three-cleft; a convex or globular naked receptacle; an involucre consisting of one leaf many-parted; flowers yellow. The species are all natives of America. *Helenium autumnale* is a herbaceous plant, very vivacious, and capable of flourishing in any soil and any exposure. It grows to the height of 6 feet, and bears lanceolate leaves. Its flowers bloom in autumn.

HELENSBURGH, a coast town and police burgh of Scotland, Dumbartonshire, prettily situated on the north shore of the Firth of Clyde, opposite Greenock, from which it it is distant about 4 miles. The town is about a mile and a half in length and a mile in breadth. It stretches along the shore, and consists of six or seven long parallel streets intersected by several shorter. These being spacious, and the houses generally wide apart with gardens attached, the whole place has an airy and cheerful appearance. It has a handsome pier and a long esplanade fronting the firth, two large public parks, commodious halls, numerous churches, and schools. It is a fashionable place of residence, and depends a good deal on summer visitors. It takes its name from Helen, wife of Sir James Colquhoun, by whom it was founded in 1777. Pop. in 1881, 7693; in 1901, 8554.

HELENUS, son of Priam and Hecuba, and twin-brother of Cassandra, endowed with the gift of prophecy. Respecting his desertion of his countrymen and his joining the Greeks there are conflicting accounts, which it would be futile to attempt to reconcile. After the death of Paris he disputed with Deiphobus about the possession of Helena, and being vanquished fled to Mount Ida, where he was taken prisoner by the Greeks. After the death of Pyrrhus, son of Achilles, he married Andromache, his brother Hector's widow, and reigned over a part of Epirus. He received Æneas on his voyage to Italy, and foretold to him the future events of his life.

HELIACAL, as applied to the rising of a star, planet, &c., denotes its emerging out of the sun's rays, in which it was before hid. When applied to the setting of a star it denotes the entering or immerging into the sun's rays, and thus becoming lost in the lustre of his beams. A star rises heliacally when, after it has been in conjunction with the sun, and on that account invisible, it gets at such a distance from the sun as to be seen in the morning before the rising of that luminary.

HELIADS, the seven sons of Helios (Sol), the god of the sun, who were born when the warm beams of Helios dried up all the moisture of the Island of Rhodes. Their names are Cercaphus, Actis, Macareus, Tanages, Triopas, Phaëton, and Ochimus. Their only sister, Electrione, died a virgin, and received divine honours from the Rhodians. The brothers distinguished themselves by their knowledge of the sciences, particularly of astronomy; they improved ship-building, and divided the day into hours. Tanages excelled all his brothers in intellect,

on which account they put him to death. When the act became known they all fled from the island except two, whose hands were not stained with the blood of Tanages.

HELIANTHUS. See SUNFLOWER.

HELICON (now *Sagara*), a celebrated mountain, or rather mountain range, of Greece, in the western part of Bœotia, which may be regarded as a continuation of the range of Parnassus. It was anciently famous as the favourite residence of the Muses, who, together with Apollo, had temples and statues here. In this mountain also were Aganippe and Hippocrene, the fountains of the muses, and the fountain in which the unhappy Narcissus saw his own image. The region around was extremely fertile, and so healthy that even the serpents were fabled to be harmless. The range attains a height of 5735 feet.

HELIER, ST., the capital of the island of Jersey, on the south coast, on the east side of St. Aubin's Bay, at the base of an amphitheatre of low hills. It is protected by two fortresses, namely, Elizabeth Castle, on a rock in the bay, opposite the town; and Fort Regent, which overlooks the inner harbour. The town is composed of several spacious and a number of narrow, irregular streets. The houses are generally of stone, most of them indifferently built. There are some pretty villas in the suburbs. The educational institutions include Victoria College and a ladies' college, and there is a public library dating from 1736. The church, which has recently been restored, dates from about the middle of the fourteenth century. The only other building worth noticing is the House of Assembly, but it has little architectural merit. There are manufactories of soap and candles, and several foundries and breweries. Ship-building is carried on to a small extent. The harbour, docks, and quays are spacious and commodious, and a considerable shipping trade is done. The mildness of the climate and the cheapness of living have induced many persons to fix their residence here. It is the seat of the states, or representative parliament of Jersey, and the terminus of the two small railways. Pop. (1891), 29,133.

HELIGOLAND (Ger. *Helgoland*, 'holy land'), a small island in the North Sea, belonging to Germany, and situated about 40 miles north-west of the mouth of the Elbe, about a mile long and one-third of a mile broad. The area is about one-quarter of a square mile. It consists of two parts, the *Oberland*, a flat-topped rock affording a little soil for pasture and the growth of potatoes, &c., and the *Unterland*, a small stretch of shore at its foot. Most of the houses stand on the Oberland. The Unterland gives partial shelter to the shipping. There is a royal Prussian biological station for the study of the fauna and flora of the North Sea. The bathing facilities, which attract so many visitors, are found in a dune or sand-bank separated from the main island by a channel about a mile wide. This Sandy Island, as it is called, is slowly being reduced in size by the inroads of the sea. There is a lighthouse on the main island. The inhabitants are chiefly employed in fishing, and speak a Frisian dialect. The island is well fortified, and has cable communication with Cuxhaven and Wilhelmshaven. Christianity was first preached here by St. Willibrod in the seventh century, and the island from that time received the name of 'Holy Land'. Taken from the Danes in 1807, it was ceded to Great Britain in 1814, but was transferred to Germany in 1890. Steamboats ply between the island and Hamburg. Pop. (1900), 2307; in the bathing season increased by several thousand visitors.

HELIOCENTRIC PLACE OF A PLANET, that place in the ecliptic in which the planet would appear if seen from the centre of the sun. See GEOCENTRIC.

HELIODORUS, the earliest and best of the Greek romance writers. He was a native of Emesa, in Syria, and lived near the end of the fourth century. Though he was of the family of priests of the Syrian god of the Sun, he became a believer in the Christian religion, and Bishop of Tricca in Thessaly. His youthful work, Æthiopica (that is, Æthiopic Affairs), or the Loves of Theagenes and Charicleia, is a tale written in poetical prose, and with an almost epic tone. It is distinguished by its strict morality from the other Greek romances, and interests the reader by the wonderful adventures it recounts. One of the best editions is that of Hirschig in the Erotici Scriptores (Paris, 1856). An English translation by the Rev. R. Smith appeared in 1855.

HELIOGABALUS, or ELAGABALUS, a Roman emperor, son of Sextus Varius Marcellus. He was born at Emesa about A.D. 205, and was originally called *Varius Avitus Bassianus*. He received his new name from having been, while still almost a child, priest of Elagabalus, the Syro-Phœnician Sun-god. After the death of Macrinus, who had become obnoxious to the soldiers from the severity of his discipline, he was invested with the imperial purple, and the senate, however unwilling to submit to a youth only fourteen years of age, approved of his election, and bestowed upon him the title of *Augustus*. Rome now displayed a scene of cruelty and debauchery; the imperial palace was full of prostitution, and the most infamous of the populace became the favourites of the prince. His excesses soon roused the populace, and Heliogabalus, unable to appease the seditions of the soldiers whom his rapacity and debaucheries had irritated, was slain in an insurrection of the prætorians, A.D. 222, in the eighteenth year of his age, after a reign of three years, nine months, and four days.

HELIOGRAPH. See HELIOSTAT.

HELIOGRAVURE, or PHOTOGRAVURE, is a photo-mechanical printing process. A photograph of any object is taken, and from the negative a positive print is made on gelatinized paper. This print is transferred to a highly-polished copper-plate, and a solution of perchloride of iron is poured upon it. This penetrates through the gelatine, and etches the picture upon the copper. The final result is the production of a photo-etched copper-plate, which yields a large number of impressions.

HELIOMETER (called also *Astrometer*), an instrument for measuring small distances on the sky, particularly the apparent diameters of the sun and of the moon. There are different ways of constructing it. The heliometer of Bouguer is an astronomical telescope provided with two object-glasses, one of which is movable, and which form two distinct images of the same object, visible through the same eye-glass. A single object-glass cut into two parts, which are relatively movable by a screw, is often employed now. If, in contemplating a celestial body, the object-glasses are placed so as to bring the images to touch each other, the distance of the centres of the glasses gives the diameter of the image. In this manner the instrument gives, for instance, the difference of the diameter of the sun in perigee and apogee.

HELIOPOLIS, in Cœlosyria. See BALBEC.

HELIOPOLIS (City of the Sun), the On of the Hebrew Scriptures, was situated a little to the north of Memphis, and was one of the most ancient and extensive cities of Egypt during the reign of the Pharaohs, and so adorned by monuments as to be

esteemed among the first sacred cities of the kingdom. The temple dedicated to Ra was a magnificent building, having in front an avenue of sphinxes and adorned by several obelisks, raised by order of Sethosis Rameses 1900 years B.C. By means of lakes and canals the town, though built upon an artificial eminence, communicated with the Nile, and during the flourishing ages of the Egyptian monarchy the priests and scholars acquired and taught all the learning of the Egyptians within the precincts of its temples. It may be regarded as having been the university of the land of Misraim, and at the time of Strabo, who visited this town soon after the death of our Saviour, the apartments were still shown in which, four centuries before, Eudoxus and Plato had laboured to learn the philosophy of Egypt. Solon and Thales were also reputed to have visited its schools. Here Joseph and Mary are said to have rested with the infant Saviour. There is now a village here called *Matarieh*. Near the village stands the Pillar of On, a famous obelisk, supposed to be the oldest monument of the kind existing in Egypt. Its height is 67½ feet, and its breadth at the base 6 feet. It is one entire mass of reddish granite. Hieroglyphical characters are sculptured upon it, but are partly illegible. A bloody battle was fought here, March 20, 1800, between the French under Kleber and the Turks, when the latter were defeated.

HELIOS, the god of the sun (Latin, *Sol*) in the Greek mythology; son of Hyperion and Theia, and brother of Eos (Aurora, the dawn) and Selēnē (Luna, the moon). He is frequently called by the name of his father. He dwells with Eos in the ocean behind Colchis. From the portals of the morning he rides through the air in an oblique curve to the gates of evening, and after having cooled his horses in the ocean, he drives his chariot into a self-moving golden vessel, made by Hephæstus (Vulcan), which with wonderful rapidity bears him during the night along the northern shore of the ocean back to Colchis, where he bathes his horses in the lake of the Sun, and rests till the dawn of the morning. Other accounts represent him as making this nightly passage while slumbering in a golden bed; but both Homer and Hesiod are silent as to the manner in which he makes his nocturnal voyage from the western into the eastern ocean. Later authors assign him a palace in the west, where he refreshes himself and his horses with ambrosial food. His horses and chariot are first mentioned in the Homeric hymn on Helios. Among events in the history of Helios the poets relate his contest with Poseidōn for the Isthmus of Corinth, his revealing the secret amours of Arcs and Aphroditē, and his disclosure to Demeter of Pluto as the ravisher of her daughter. This idea of his omniscience seems to have been the cause why he has been confounded and identified with Apollo, though they were originally quite distinct. In Sicily he had a herd of cattle dedicated to him, with the sight of which he was delighted as he rode through the sky. His vengeance fell heavily upon the companions of Ulysses, who slaughtered some of them. He threatened to descend into Orcus, and to give light to the dead, if Zeus did not punish the criminals. The lightning dashed their vessel to pieces, and sunk them in the waves. As he was descended from the race of the Titans he is often called *Titan*. His worship was very extensively diffused, and he had many temples and statues; for instance, in Corinth, Argos, Trœzene, Elis, but particularly in Rhodes, where a team of four horses was annually sacrificed to him, by being precipitated into the sea. The famous Colossus of Rhodes was a representation of Helios. White rams, boars, bulls, goats, lambs, and especially white horses, were sacrificed to him. Horses, wolves, eagles, and especially cocks, were sacred to him. He is represented as a youth with most of his body covered with clothing, and having his head surrounded with rays. Sometimes he rides upon a chariot drawn by four horses. For the connection of Helios with Apollo, see APOLLO.

HELIOSCOPE is a telescope behind which the image of the sun is received upon a plane surface. An astronomical telescope is drawn out a little further than is necessary for common use, and directed towards the sun, and the image which is formed is received in a dark place. For this purpose a dark chamber is employed, or the telescope is placed in a dark funnel-shaped inclosure, the bottom of which is covered with oiled paper or closed with ground glass, on which the sun's image is formed. Upon the paper or glass a circle is described equal to the image, and it may be divided by concentric circles into rings. With this instrument the spots on the sun, eclipses, &c., may be observed without injuring the eyes, and may be seen by a number of persons at the same time.

HELIOSTAT, an instrument used in optical experiments with sunlight for keeping a beam always falling in the same direction in spite of the motion of the sun. It consists of a mirror mounted equatorially, and carried round by clock-work in such a way as to neutralize the apparent motion of a beam of sunlight reflected from it. This instrument has been employed among other purposes as a means of signalling. A beam of light being directed to the point to which it is intended to convey the signals, the dot-and-dash alphabet is made use of by the device of exhibiting and obstructing the light for longer or shorter periods. A short flash represents one letter, a long flash another, a short quickly followed by a long a third, and so on. (See TELEGRAPH.) Heliostats have been used in this way in war, and in particular in the operations carried on in South Africa. As adapted to this purpose the heliostat has received the name of *heliograph*.

HELIOTROPE (*Heliotropium*), a genus of plants belonging to the natural order Boraginaceæ, many of whose species have vanilla-scented blossoms. The species most in repute is the *H. peruvianum*, which emits a fine fragrance, and has small flowers growing compactly together in the spikes. Cuttings taken from the young branches grow readily, and come soon into blossom. The *H. europæum*, or common heliotrope, is indigenous in the south and west of Europe. The heliotropes form a sub-order, Heliotropeæ, of the Boraginaceæ. They are natives partly of temperate and partly of warm climates; there are sixty-seven known genera, and nearly 900 species. They have a terminal style, an entire or two-lobed ovary, a dry fruit separating into four nutlets, and exalbuminous seeds. The name heliotrope (Greek *hēlios*, the sun, and *trepō*, I turn) was applied by the ancients to flowers that follow the sun in his course, by bending gradually from the east to the west as the day advances. The heliotropium alluded to by Ovid cannot be the heliotrope of the moderns, as it is described as resembling the violet.

HELIOTROPE, the bloodstone, is a variety of quartz partaking of the character of jasper or of chalcedony. It is of a deep-green colour, and is covered with red spots like drops of blood. It is hard, and is much used for making burnishers, while the finely-marked specimens are much prized for seals, signet-rings, and similar articles. It is found in Tartary, Persia, Siberia; in the island of Rum, Scotland, and many other places. It received the

name heliotrope, or as some of the older writers give it, elitropia, because it was said that if the mineral be put into water contained in a basin rubbed with the juice of the plant heliotrope, and be exposed to the sun, the water will appear red and the sun blood-like, as if it was eclipsed. Other virtues were ascribed to it; if the stone were rubbed with the juice of the plant it rendered its wearer invisible. These ideas are part of the doctrine of sympathy and signatures.

HELIOTYPE (Greek, *helios*, the sun, and *typos*, an impression). The heliotype process is an attempt to obtain a cheap and easy method of combining photography and printing. The pictures it produces are photographs printed in lithographic ink, and may be obtained as rapidly as any other printers' work, having at the same time the advantage of being as permanent as engravings. The process is used for illustrating books, for scientific and technical designs, and for making copies of maps and drawings, whether of the size of the original, enlarged, or reduced. The principle of the process is the sensitiveness to light of bichromate of potash or ammonia when mixed with some organic substance, such as gelatine, albumen, or any organic colloid substance. If a sheet of ordinary paper, covered with a thin film of gelatine, be brushed over with an orange solution of bichromate in water, the surface becomes sensitive to light. If any object, such as a fern-leaf, be now placed upon the paper, the part exposed to the sun will become brown, while the film of the part covered by the leaf will remain in its original state. If the surface be next washed in hot water the bichromate will be dissolved on the portion that was sheltered, while that on the portion rendered brown by exposure to the sun has become insoluble. Hence a faithful image of the outline of the leaf will be secured. By applying the gelatine and bichromate in one solution, or first one, and, when dried, the other, adding to the gelatine a carbon or mineral pigment insoluble in water, and colouring the liquid of the tint desired, after printing and washing as before, there will be produced a picture which is perfectly permanent. To render the film sufficiently hard to bear the pressure of printing without destroying the absorbent nature of the gelatine, a small quantity of a spirituous solution of resinous gums, or a dilute solution of chrome alum, must be added to the gelatine. When the film is thoroughly dry it may be exposed to the action of light under a glass negative. When the print is washed over we have an image in *slight* bass-relief, from the absorption of water by some parts and its non-absorption by others. If an ink-roller is passed over the surface, the greasy ink is repelled where water has been absorbed and attracted where the gelatine is dry and insoluble, its insolubility having been secured by the addition of alum. As lines extend to different depths in the printing surface of the gelatine film it can become charged with a graduated load of ink, reproducing the lights and shadows of the picture in relative proportion. Several shades and consistencies of inks may be rolled on to the plate one after the other. The gelatine is rendered so hard by the application of chrome-alum, that thousands of impressions may be taken from the same film. Two great advantages of the process are that the negative is not destroyed, and that any subject can be reduced or enlarged at pleasure to suit books of different sizes or editions. Hence its value in magazine illustration. The film of gelatine is prepared on a glass plate, from which it is stripped when dry, and prepared in the ordinary manner under the negative. The plate is ground on one side, which is coated with a solution of white wax dissolved in ether, and then it presents a polished appearance. The sensitized gelatine mixture is applied to this surface, and the plate is laid aside to dry. The film is then removed, and the surface which was in contact with the glass is placed in contact with a reversed negative in a printing-frame. A transfer-plate of smooth metal is next prepared, and coated with a solution of india-rubber in benzole, which is allowed to dry. The skin and the prepared plate are immersed in water, leaving a layer of water between them. The superfluous water is removed, the two surfaces brought close together, and the edges brushed round with india-rubber solution, to prevent water from again penetrating. The plate is again immersed in water, the bichromate washed out, the surface of the skin wiped dry, and it is then ready for printing. The process of lithography is now applied, the ink used being of the consistency of soft wax. The inked roller is evenly and smoothly applied to the plate, when the portions acted on by light receive the ink, and all the others reject it. The paper is now laid on, and a proof pulled in the usual manner. The rollers are made of a solution of gelatine, to which glycerine and castor-oil are added; but india-rubber rollers may also be used. The prototype of the heliotype, as now described, is what is known in Munich as the *albertype*, in which the film is hardened by the introduction of chrome-alum. Much care is necessary in the preparation of the printing-plates for this process. Thin glass should be chosen rather than thick, and the greatest care should be taken to insure the perfect cleanliness of the plates. Nitric acid may be used for this purpose, and all the subsequent operations should be performed in a place illuminated only by yellow light, or ruby-red, and perfectly free from every particle of dust. The plates after being covered with the solution should be dried in a room of about 135° Fahr. The side that has been covered with the solution should be covered over with a black cloth, and the other side then exposed for about thirty minutes to the diffused sunlight. The chromate salt still remaining must be dissolved, and the plate rendered both colourless and transparent. The succeeding processes are not dissimilar to those already described as to the heliotype. After the plate has been sufficiently illuminated the picture will appear brown on a yellow ground. After all the bichromate of potash has been removed from the layer the printing process may be proceeded with. The superiority of the heliotype over the albertype are: 1. In the ease and certainty of removing the skin from the glass plates. 2. In the heliotype the plate is pewter, and not of glass; hence it is not only cheaper, but is not liable to break by the introduction of dust beneath it. (The above account is mainly from The Lithographer.)

HELL (A. Saxon, *hel*, from *helan*, to cover), signifies originally the covered or invisible place. In the English Bible the word is used to translate the Hebrew *sheol* (grave or pit), and *Gehenna* (properly the valley of *Hinnom*), as well as the Greek *Hades* (the unseen). In the Revised Version of the New Testament, however, hell is used only to translate *Gehenna*, *Hades* being left where it stands in the Greek. In common usage hell signifies the place of punishment of the wicked after death, its earlier meaning being lost. The distinctive Scripture term for the place of future punishment of the wicked is *Gehenna*, and our Lord adopting on this point the current language of the time gave the sanction of his authority to the leading ideas involved in it. Gehenna, or hell, is with him the place of final torment. The belief in a state of punishment after death for the finally impenitent is held by almost all sects of Christians, as an analogous belief in the future punishment of unexpiated guilt is a tenet of nearly all religions

ancient or modern. The nature of the punishment of hell, its locality, and its duration, have given rise to interminable and useless controversies among Christian writers, who seem to dispute with greater pertinacity in proportion as less can be definitely known. The early Christian writers sometimes apply the word hell to a place of temporary purgation, in which the soul is freed from the stains of guilt contracted on earth preparatory to its enjoying the pure bliss of heaven. In this sense it corresponds in some degree with the Roman Catholic purgatory, and with the pagan idea of purification, as illustrated by Virgil in the sixth Æneid. Sometimes it is applied to the place of waiting of the just under the old law, till the coming of Christ should secure for them the completion of their reward; sometimes to the place where unbaptized children are detained because of unremitted original sin; and more frequently to the place of final and everlasting punishment for impenitent sinners. Many, however, reject the dogma of everlasting punishment as irreconcilable with our ideas of the benevolence of God, while others maintain it, as the same terms are applied to the duration of the penalty of the wicked as to the felicity of the just. As to the locality of the scene of final punishment none but the profoundly ignorant ever at the present day make a formal declaration. The terms *above* and *beneath*, as applied to heaven and hell, are merely relative, and though conventionally accepted convey no information. The Eastern and Western churches are not fully agreed as to the nature of hell-punishment. They are at one as to its being partly 'a pain of loss,' that is, the consciousness of their being debarred from the presence of God, and partly a 'pain of sense,' that is, real physical suffering; but they diverge on the question whether this be caused by material fire, a point which was left undecided at the Council of Florence. The prevailing idea among modern theologians is that the 'fire' and the 'worm' are significant emblems to give us the most correct and living conceptions of the reality that we can possibly attain in our present circumstances They are fit emblems of anguish, and as such had laid hold of the Jewish imagination in connection with the word *gehenna*, the term used by our Lord in Mat. v. 22, 29, 30; Luke xii. 5. *Gehenna*, unlike *Sheol* and *Hades*, has never any intermediate signification, but is invariably applied to the place of punishment of the wicked after death. See HADES.

HELL, MAXIMILIAN, a learned astronomer, was born 13th May, 1720, at Chemnitz in Hungary, and first educated at Neusohl. Having in 1738 entered the society of the Jesuits, he was sent to the college at Vienna, where he exhibited a genius for mechanics. He then applied to mathematics with great diligence, and in 1745 became assistant at the observatory belonging to his order. In 1750 he published Adjumentum Memoriæ Manuale Chronologico-Genealogico-Historicum, which has been translated into various languages. In 1751 he took holy orders, and in 1752 he became professor of mathematics at Clausenburg, a position which he retained for four years. From 1757 to 1786 he published annually the Ephemerides, which is much esteemed by astronomers. In 1756 he was recalled to Vienna, to be astronomer and director at the new observatory. In 1768, at the desire of the King of Denmark, he went to Vardöehuus in Lapland, to observe the transit of Venus, in which he succeeded perfectly. In 1770 an account of his observations was published under the title, De transitu Veneris ante discum Solis die 3 Jun, 1769. He died 14th April, 1792. Hell is to be ranked among those who have rendered essential services to astronomy.

HELLAS, HELLENES. See GREECE.

HELLE, in classical mythology, a daughter of Athamas and Nephele, sister to Phryxus. When Phryxus was to be sacrificed his mother rescued him and his sister Helle, who were carried through the air on a golden ram, which Nephele had received from Hermes; but in the passage Helle became giddy, and between Sigeium and the Chersonesus fell from her seat into that part of the sea which from her received the name of *Hellespont*.

HELLEBORE (*Helleborus*), a genus of the Ranunculaceæ, consisting of perennial low-growing plants, with leathery leaves, and yellowish, greenish, or white flowers. *H. niger*, the Christmas-rose (which see), is the source of the black hellebore of modern pharmacopœias, but the ancient black hellebore, a famous remedy for insanity, was probably obtained from other species. *H. viridis* and *H. fœtidus* are British species with greenish flowers, and emetic and purgative properties. *White hellebore* is *Veratrum album*, order Melanthaceæ, an acrid plant, used in the form of powder to destroy caterpillars.

HELLENISTS, EGYPTIAN, the Jewish colonists who settled in Egypt after the destruction of the Kingdom of Judah, about 600 B.C. Their number was increased by the many colonists of Jews planted by Alexander the Great (336 B.C.), and later by Ptolemy Lagus. Under the reign of the Emperor Augustus they amounted to nearly 1,000,000. They laid the foundation of a new epoch of Græco-Jewish literature, which, from its prevailing character, received the name of the *Hellenistic*. The Alexandrian Jews were the most influential in developing Hellenizing tendencies, and to them chiefly is to be referred the formation of the peculiar dialect termed the *Hellenistic*. In their literature the systems of Pythagoras and Plato were strangely combined with those oriental phantasies which had been reduced to a system in Egypt, and with which the mystical doctrines of the Gnostics were imbued. The most noted of the Jewish Hellenistic philosophers was Philo of Alexandria, and the chief of the learned labours of the Alexandrian Jews was the Greek translation of the Old Testament. See SEPTUAGINT.

HELLESPONT. See DARDANELLES.

HELLEVOETSLUIS, a strongly-fortified seaport of Holland, in the province of South Holland, 18 miles south-west of Rotterdam, on the south side of the island of Voorne, and on the Haringvliet, the largest mouth of the Rhine. It has a large and excellent harbour, one of the stations of the Dutch navy. Vessels bound for Rotterdam may take the ship-canal from Hellevoetsluis across the island of Voorne; and by this route Indiamen reach the sea in a single day. But larger vessels require to take the New Channel cut through the Hook of Holland. There are here two docks, arsenal, ship-building yards, a naval school, and other establishments met with in a naval port; also three churches, a synagogue, a school, poor-house, and town-house. William III. embarked here for England, November 11, 1688. Pop. in 1899, 4293.

HELM, the contrivance by which a vessel is steered, usually composed of three parts, viz. the rudder, the tiller, and the wheel, except in small vessels, where the wheel is unnecessary. The rudder (also itself called the helm), is a long and flat piece or frame suspended edgewise down the hind part of a ship's stern-post, where it turns upon a kind of hinges to the right or left, serving to direct the course of a vessel, as the tail of a fish guides the body. The rudder is somewhat in the form of a long rectangle with a stem at top. The part of it which joins the stern-post is thinned off throughout its whole length, so that it may be more easily turned from one side to the other. The length and thickness of the rudder

are nearly equal to that of the stern-post. The tiller is a bar of timber or iron, fixed horizontally in the upper end of the rudder, and projecting within the vessel. The movements of the tiller to the right and left direct the efforts of the rudder to the government of the ship's course as she advances, which is called *steering*. The movements of the tiller are effected in small vessels by hand, often assisted by a sort of tackle, communicating with the ship's side, called the *tiller-rope*. In all large vessels there are, properly speaking, two ropes, or chains, which being wound about the axis of a wheel, act upon the tiller with the powers of a windlass. The ropes or chains are fastened at the after ends to the deck on either side, then pass respectively through a block attached to either side of the tiller at its fore end, and again through a pair of fixed blocks on either side, whence they are carried to the barrel of the wheel. The latter is fixed upon a horizontal axis, often on the quarter-deck almost perpendicularly over the fore end of the tiller, but this position may be varied according to circumstances, and the wheel may be placed in an elevated position amidships, as is often the case in river steamers. In some of these also there is no tiller, the rudder being moved directly by chains or wire ropes attached to its outer edge. The spokes of the wheel generally reach about 8 inches beyond the rim or circumference, serving as handles to the person who steers the vessel. As the effect of a lever increases in proportion to the length of its arm, it is evident that the power of the helmsman to turn the wheel will be increased according to the length to which the spokes extend beyond the circumference of the barrel. When the helm, instead of lying in a right line with the keel, is turned to one side, it receives an immediate shock from the water, which glides along the ship's bottom in running aft, on the side towards which the helm is turned, and pushes it towards the opposite side whilst it is retained in this position, so that the stern, to which the rudder is confined, receives the same impression, and accordingly turns in one direction whilst the head of the ship moves in the opposite. The more the velocity of a ship increases the more powerful will be the effect of the rudder, because the water will act against it with a force which increases as the square of the swiftness of the fluid, whether the ship advances or retreats. The direction given in the two cases will, of course, be contrary. The application of steam-power to steering has led to the introduction of much complicated machinery for controlling the rudder. To *ease the helm* is to let the helm come more amidships; and to *port the helm* is to place the tiller so as to carry the rudder to starboard.

HELMET, a defensive covering for the head. Helmets were originally made of leather or the skins of various animals, sometimes adorned by metallic additions; but, later, metal helmets came into use. The *galea* of the Romans was a helmet of the former type, whilst the *cassis* was a metal one, but the two terms were sometimes confounded. Various ornamental and protective external additions were commonly attached to ancient helmets. The crest, frequently of horse-hair, was supported on a metal ridge known as a *phalos*, and some helmets had also cheek-pieces (*buccula*) and a nose-piece, or even a vizor. A simple form of galea was used as a cap in hunting. During the middle ages the helmet as a piece of defensive armour underwent great developments. The vizor and the beaver, which were movable coverings for the upper and lower parts of the face respectively, formed during several centuries an almost essential part of the helmet; and consequently during this period the whole head was encased in metal armour. One of the earliest forms was the *heaume*, a closed head-piece which gradually became so heavy that it was replaced in general use by lighter forms such as the *bassinet* or *basnet*. When these lighter head-pieces were in use the heaume was worn over them by warriors actually engaged in battle. This combination was superseded by the *sallet* or *salade*, which covered only the top and sides of the head, leaving the neck and throat to be protected by other pieces of armour. The latter part of the fifteenth century saw the invention of the *armet*, a helmet lighter than either the heaume or the bassinet, and more useful for protection than the salade. It was provided with a neck-piece, vizors, and a mouth-piece (or *aventaile*), and had openings to enable the warrior to see and breathe. The parts were connected by hinges, hooks, and other contrivances, in such a way that the whole when closed was perfectly rigid. The armet was superseded by the *morion*, a sort of steel hat provided with a brim, which was introduced from Spain in the sixteenth century. Soon afterwards the helmet disappeared almost entirely, but the name is still applied to the head-gear of some classes of soldiers, the metal hats of firemen, and the hats of many policemen. For helmet in heraldry see HERALDRY.

HELMONT, JOHN BAPTIST VAN, born in 1577 at Brussels, studied natural philosophy, natural history, and medicine, in which he made such rapid proficiency, that in his seventeenth year he gave public lectures on surgery at Louvain. Abandoning medicine, he left his country and for ten years wandered about the world; when, having become acquainted with an empirical chemist, he entered eagerly upon the study of chemistry. After the example of Paracelsus, he employed himself in seeking a universal remedy by means of that study. His former passion for medicine now revived, but it was a novel kind of medicine, of his own creation. He now married, and retired to the little city of Vilvorde, near Brussels. Here he occupied himself till his death with medical labours, boasted of having found the means of prolonging life, and propounded visionary theories on the spiritual and physical formation of man, and on the causes and treatment of diseases. He was the first to introduce the term *gas* into scientific nomenclature, and he was also the first to observe the strongly acid reaction of the gastric juice. According to him, life is ruled by a principal power and by other subordinate powers. The system of Van Helmont resembles that of Paracelsus, but it is more clear and scientific. The emperors Rodolph II., Matthias, and Ferdinand II. invited him to Vienna, with promises of wealth and dignities; but he preferred the independence of his laboratory. He died December 30, 1644. His works appeared in one vol. fol., Leyden, 1656, entitled Ortus Medicinæ (Beginnings or Elements of Medicine).

HELMSTEDT, a town of Northern Germany, in Brunswick, 20 miles E.S.E. of Brunswick. It is an old place, and was once famous for its university, which was founded in 1576, but suppressed by Jerome Bonaparte at the commencement of the nineteenth century, and a part of its library transferred to Göttingen. The building, a handsome Renaissance structure, now contains the gymnasium and library. The principal church is that of St. Stephen, dating from the fourteenth century. Near Helmstedt is a chalybeate spring, with a bathing establishment; and both lignite and common coal are worked. The manufactures comprise machinery, boots and shoes, earthenware, soap, sugar, &c. Pop. (1895), 12,891; (1900), 14,259.

HELMUND, a large river in Afghanistan, which traverses diagonally north-east to south-west, and ultimately falls into the extensive Lake Hamoon, after a course of about 550 miles. Its source is 11,500 feet above sea-level, and its course, in consequence, so extremely rapid that navigation upwards is impracticable; 70 miles west of Candahar it is, in spring, 1000 yards broad, with a depth of 10 or 12 feet, and a powerful and rapid current. In the dry season it is two-thirds less. The immediate banks are in some places very fertile, but at a short distance from the river the country on each side is an arid, barren desert, nearly uninhabited. It has few affluents of any considerable size; the principal are the Shahbund, the Turnuk and its tributaries, and the Khaush; the first flowing from the north-west, the second from the north-east, and the third from the north.

HELOISE, ELOISE, or LOUISA, celebrated for her beauty and wit, but still more on account of her love for Abelard, was born in Paris in 1101. After the cruel and ignominious mutilation of her illustrious lover she was persuaded by him to take the veil at Argenteuil, and ultimately became prioress of the convent there; but she attended more to study than to the monastic discipline of those under her charge, who finally were dispersed in 1129 on account of their licentiousness. She then accepted the invitation of Abelard and entered, with some of her nuns, the oratory of the Paraclete, built by Abelard at Nogent-on-the-Seine, where she lived in exemplary piety. The bishops loved her as a daughter, the abbots as a sister, and the laity as a mother. Abelard, at her request, wrote the rules for her convent, which were confirmed by Pope Innocent II. She died in 1164. Contemporary writers speak in high terms of the genius of Heloise. She understood Latin, Greek, Hebrew, was familiar with the ancients, and had penetrated the depths of philosophy and theology. Among Abelard's letters we find three which are ascribed to her, full of fire, genius, and imagination. The two first of her letters, which paint the conflict between her present duties and former feelings, and vividly contrast the inward storm of the passions with the repose of the cell, furnished Pope with some of the finest passages of one of his best productions. See ABELARD.

HELOTS, slaves in Sparta. The name is generally derived from the town of Helos, the inhabitants of which were carried off and reduced to slavery by the Heraclidæ about 1000 B.C., though a more probable derivation is the Greek *helein*, to take, making the name signify captives. They were the property of the state, which alone had the disposal of their life and freedom. The state assigned them to certain citizens, by whom they were employed in private labours, though not exclusively, as the state still exacted certain services from them; and they were attached to the soil—that is, each citizen received the number that belonged to his allotment, without any power to sell or free them. Agriculture and all mechanical arts at Sparta were in the hands of the Helots, since the laws of Lycurgus prohibited the Spartans from all lucrative occupations. But the Helots were also obliged to bear arms for the state, in case of necessity. Their dress, by which they were contemptuously distinguished from the free Spartans, consisted of sheep's skin and a leather cap of a peculiar shape. They were sometimes liberated for their services or for a sum of money; but they were not admitted to the full dignity of citizenship, and constituted a separate class under the name of *Neodamodes*. If their numbers increased too much the young Spartans, it is said, were sent out to assassinate them. In 424 B.C. 2000 of the Helots, who had conducted themselves with distinguished bravery in war, were treacherously put to death. These expeditions were called *crypteia*. They several times rose against their masters, but were always and finally reduced.

HELSINGBORG, a seaport town in Sweden, län Malmö, beautifully situated at the narrowest part of the Sound, opposite to Elsinore. It stands at the foot of a ridge of hills, and is a well-built, stirring place; has a handsome market-place, in which is the town-house, an ancient tower called Kärnan, situated on a hill, and forming a very conspicuous object; the remains of an old castle; manufactures of leather, dye-works, tile-works, salt-works, and a spacious harbour in the form of a hexagon. Pop. (1900), 24,670.

HELSINGFORS, a seaport town of Russia, capital of Finland, on a small peninsula in the gulf of that name, 180 miles W.N.W. St. Petersburg, with which it is connected by railway. It was almost completely burned down in the wars with the Swedes, and, since 1815, has been rebuilt with great regularity. It is defended by the fortress of Sweaborg, which, though about 3 miles distant, completely guards the entrance to the harbour, and, being situated on a number of isolated rocks, is so strong as to be deemed almost impregnable. Helsingfors is the residence of the governor of Finland, the seat of important courts and public offices, and contains a university, removed from Abo in 1827, with a library of 185,000 volumes. There are a number of handsome public buildings, accommodating government and civic departments, or used for other purposes, including an imperial palace, senate-house, &c. It has manufactures of linen, sail-cloth, tobacco, &c., and a harbour, at which an important trade is carried on. Pop. (1900), 93,217.

HELSINGÖR. See ELSINORE.

HELST, BARTHOLOMEW VAN DER, a painter, born at Haarlem in 1613. Without having studied the great masters of the Italian school, he attained to a high degree of excellence as a portrait-painter. His picture in the Stadthouse at Amsterdam, representing thirty full-length figures of a train-band, with the Spanish ambassador in the midst, was called by Sir Joshua Reynolds 'the first picture of portraits in the world.' All his works show a grand manner; there is nothing frigid nor stiff. His drapery is flowing; his figures well drawn; the accessory parts are closely copied from nature. He died at Amsterdam in 1670.

HELSTON, a market-town, municipal and formerly a parl. borough, England, county of Cornwall, agreeably situated on an acclivity on the left bank of the Cober, 9 miles S.W. Falmouth. It has four principal streets, which cross each other at right angles, each having a running stream. The houses are nearly all of stone, and generally well built. There are a market-house, guild-hall, a grammar-school, and other schools; a dispensary, public reading-room, &c. The principal industry of the district is agriculture; and there is some shipping trade from Port Leven and Gweek, each 3 miles distant. Up till 1885 it sent a member to the House of Commons. Pop. in 1891, 3198; in 1901, 3088.

HELVELLYN, one of the highest mountains of England, county of Cumberland, between Keswick and Ambleside; height, 3118 feet; amidst beautiful and romantic scenery, easy of ascent, and commanding a splendid view of the lake district.

HELVETII. Between the Rhone and the Rhine, the Jura and the Rhætian Alps, lived the Helvetii, a Gallic or Celtic nation, more numerous and warlike than the neighbouring Gallic tribes. They first appear in history B.C. 107, but were not known to the Romans until the time of Julius Cæsar, who, as governor of Gaul, prevented their intended emigration, and after many bloody battles, in which even the Helvetian women fought, pressed them back

within their frontiers. The story of their meditated irruption into and seizure of Southern Gaul is circumstantially related in the First Book of the Commentaries of the Roman general, who not only repulsed them with terrible slaughter, but almost exterminated them. Not a third of those who left their homes on this ill-fated expedition ever returned. Helvetia, which was less extensive than the present Switzerland, was divided into four districts, which had an entirely democratical constitution. Cæsar subjected the country to the dominion of the Romans, who established several colonies there. After the death of Nero, the Helvetii, for refusing to acknowledge Vitellius as emperor, were mercilessly punished by Cæcina, one of his generals, and thenceforth they almost disappear as a people.

HELVÉTIUS, Claude Adrien, a celebrated metaphysician, was born at Paris in January, 1715, and received a careful education. After a course of legal study he was placed by his father, a celebrated physician, Adrien Helvétius, under his maternal uncle, D'Armaucourt, *directeur de fermes*, at Caen, for the purpose of acquiring a practical knowledge of finance. At the age of twenty-three years he obtained, through the patronage of the queen, the honourable and lucrative post of a farmer-general. As farmer-general he was distinguished by his mildness and indulgence from his colleagues, whose base practices filled him with indignation. He therefore resigned his office, and purchased the place of *maître d'hôtel* to the queen. So inordinate was his vanity for universal admiration that he even danced on one occasion at the opera. He aspired no less after literary fame. At first he directed his efforts to the mathematics, because he once saw a circle of the most beautiful ladies surrounding the geometrician Maupertuis, in the garden of the Tuileries, after his return from a scientific visit to Lapland. He next attempted to rival the dramatic fame of Voltaire by writing a tragedy. The brilliant success of Montesquieu's *Esprit des Lois* then inspired him with the bold resolution of preparing a similar work. He therefore determined to retire into solitude, and in 1751 he married Mademoiselle de Ligniville, no less distinguished for her beauty than her wit. In the retirement of his estate of Voré he devoted himself entirely to the happiness of his dependents, to domestic enjoyments, and to study. In 1758 he published his book, De l'Esprit, the materialism of which drew upon him many attacks. It was condemned by the doctors of the Sorbonne, and was publicly burned in accordance with a decree of the Parliament of Paris. Helvétius went in 1764 to England, and the year afterwards to Germany, where Frederick the great and other German princes received him with many proofs of esteem. Helvétius died 26th December, 1771, in Paris. He left behind him a work, De l'Homme, de ses Facultés, et de son Education, which was published at London the following year by Prince Gallitzin. Besides the above-mentioned works, he wrote epistles in verse, and an allegorical poem, Le Bonheur. A complete edition of his writings in fourteen vols. was published at Paris in 1795. His wife, daughter of the Count Ligniville, was one of the most excellent women of her time. After his death she retired to Auteuil, where her house, like that of Madame Geoffrin, became the rendezvous of the most distinguished literati and artists of her time. Among others, she was visited here by the celebrated Benjamin Franklin. She died August 12, 1800, at Auteuil.

HELVIN, the name of a rare mineral, bestowed by Werner, in allusion to its sun-yellow colour, found in a mine near Schwartzenberg, in Saxony, disseminated through gneiss, with chlorite, blende, garnet, and fluor, in minute tetrahedral crystals, with their solid angles truncated. These crystals cleave parallel to the faces of the regular octahedron. Its hardness is about the same with quartz; its specific gravity, 3·166 to 3·3. It consists, according to Gmelin, of silica, 33·258; glucina and a little alumina, 12·029; protoxide of manganese, 31·817; protoxide of iron, 5·564; sulphide of manganese, 14,000; and volatile matter, 1·555. Its colour varies from yellow to brown; it is translucent, with vitreous lustre. Before the blowpipe it fuses; by hydrochloric acid it is decomposed with separation of gelatinous silica and escape of sulphuretted hydrogen. Its composition is very remarkable, as it is the only specimen of the kind known: it is a compound of a silicate of iron, beryllium, or manganese, with sulphide of manganese, and perhaps with some iron. It is sometimes called tetrahedral garnet.

HELVOETSLUYS. See Hellevoetsluis.

HEMANS, Felicia Dorothea, an excellent and deservedly popular English poetess, was born at Liverpool, 25th September, 1793. Her father, whose name was Browne, was engaged in mercantile pursuits, but, not proving successful, removed with his family to an old solitary mansion called Gwrych, in Denbighshire, about 1800, and died shortly after. Felicia displayed the bent of her genius when a mere child, and wrote some tolerable poetry in her ninth year. She first appeared as an authoress, in 1808, in a volume entitled Early Blossoms, but it was subjected to harsh criticism, which she took very seriously to heart. A second volume, published in 1812, under the name of The Domestic Affections, was much more successful. The same year she married Captain Hemans. His health had suffered much during the retreat of Sir John Moore, and afterwards at Walcheren; and shortly before the birth of her fifth son he left her on the alleged ground of seeking a more congenial clime in Italy, and though he lived long after never saw her again. The marriage had evidently proved unhappy. Thus abandoned, she resumed her literary pursuits with increased ardour, made herself acquainted with Latin and various modern languages, delighting especially in the poetic literature of Germany, and wrote much both in separate works and in the periodicals of the time. At the suggestion of Reginald Heber, afterwards Bishop of Calcutta, she turned her attention to the drama, and wrote a tragedy entitled The Vespers of Palermo, which, owing partly to the friendly exertions of Sir Walter Scott, who wrote an epilogue for it, was favourably received at the Edinburgh theatre, though it had previously, in 1823, proved unsuccessful at Covent Garden. Before this time she had added greatly to her popularity by her poems entitled The Restoration of the Works of Art to Italy, The Sceptic, Modern Greece, and Dartmoor. The last in particular, in 1821, gained the prize of the Royal Society of Literature. In 1825 she took up her residence at Rhyllon, near St. Asaph, where she wrote her Lays of Many Lands, Forest Sanctuary, and Records of Woman. In 1828 she changed her residence to Wavertree, near Liverpool, where, in 1830, she published one of her most popular volumes, entitled The Songs of the Affections. She had, in 1829, visited Sir Walter Scott at Abbotsford, and in 1830 Wordsworth at Rydal Mount, and had left with each the impression of a singularly graceful and gifted woman. In 1831 she removed to Dublin. Her health had previously become infirm, but the claims upon her exertion, more especially to provide for the education of her sons, had become more urgent than ever, and she was unable to enjoy that repose both of body and mind which was essential to her recovery. Part of 1833 was busily spent in preparing for the publication of three collections of her poems, entitled Hymns

for Childhood, National Lyrics and Songs for Music, and Scenes and Hymns of Life; but in 1834 she took scarlet-fever, succeeded, in consequence of having caught cold, first by ague, and finally by dropsy, which carried her off. 16th May, 1835. Her poetry is essentially lyrical and descriptive, and is always sweet, natural, and pleasing. In her earlier pieces she was imitative, but she ultimately asserted her independence, and produced many short poems of great beauty and pathos, and evidently destined to live. Mrs. Hemans had no dramatic power, her effusions being always intensely subjective.

HEMERODROMI, couriers among the Greeks, famous for their extraordinary swiftness, and used, on that account, by the state as messengers to carry news of important events. As the name implies, they could keep on running all day, and could perform the longest journeys in an almost incredibly short space of time. They were employed, not only in times of peace, for the conveyance of letters, but also in war, as spies and bearers of orders. Of their great swiftness, the ancients report several instances.

HEMIPINIC ACID ($C_{10}H_{10}O_6$). This acid does not exist in opium, but is got by the oxidation and decomposition of various opium products, and especially from opianic acid. It forms white, flat, rhombic, crystalline plates, which dissolve in alcohol and ether. It has a strong acid reaction, and forms normal and acid salts. The taste is acid; it can be fused and even sublimed without decomposing, and then it forms brilliant plates.

HEMIPTERA, an order of insects to which the bug, the Cicada, and the Aphis or plant-louse belong. In this order the first ring of the thorax is free, the other two united; the appendages of the mouth are modified into a suctorial apparatus, and the metamorphosis is incomplete. Two leading groups are recognized, the *Homoptera* and *Heteroptera*. In the former the two pairs of wings when present are applied in rest pent-house fashion to the sides of the body. Several families are wingless. The Cicadas have a peculiar drum-like organ on the base of the abdomen. The plant-lice, as the *Coccus* which yields cochineal, and the Aphis are curiously restricted to particular species of plants. The Aphides are well known on account of their enormous fertility, the successive broods being produced as buds within the bodies of imperfect females, which are wingless. The winged sexual forms appear towards the close of the season. The Heteroptera have the wings, when at rest, placed horizontally across the body, the second pair covered by the upper, which are *hemielytra*, that is, the basal half is leathery, the distal portion membranous. The two families are *Hydrocores* or water-bugs, of which *Nepa*, the water scorpion, and the well-washers, *Notonecta* and *Hydrometra* are examples; and the *Geocores* or land bugs, of which plants and animals sustain several species, as the *Cimex* or domestic bug, and the *Pentatoma*, of which many species exist.

HEMLOCK (*Conium maculatum*), a poisonous plant of the natural order Umbelliferæ. It is a tall, erect, branching biennial, with a smooth, hollow, shining stem, usually marked with purplish spots; elegant, much-divided leaves, which when bruised emit a nauseous odour; and white flowers in compound umbels of ten or more rays, surrounded by a general involucre of three to seven leaflets. It is found in Britain and throughout Europe and temperate Asia in waste places, banks, and under walls. It is said to be fatal to cows when they eat it, but horses, goats, and sheep may feed upon it without danger. In the human subject it causes paralysis, convulsions, and death. It is used in medicine.

HEMMINGSTED, a village of Prussia, Holstein, Southern Ditmarshes, on a height between Heide and Meldorf, 29 m. N.N.W. Glückstadt. It has a church, and is memorable for the battle fought in its vicinity in 1500, when a small number of the inhabitants of the Ditmarshes defeated the King of Denmark and the Duke of Holstein, at the head of from 20,000 to 30,000 men, and secured their ancient freedom for another half century.

HEMORRHAGE (Greek, *haima*, blood, and *regnumi*, to burst), a flux of blood from the vessels containing it, whether proceeding from a rupture of the blood-vessels or any other cause. Hemorrhages produced by mechanical causes belong to surgery; those produced by internal causes, to medicine. The cutaneous system is rarely, and the cellular and serous systems are never, the seats of hemorrhages; that of the mucous membranes is the most subject to them. The symptoms of the disease are not less various than its causes and its seats, and the treatment must of course be adapted to all these different circumstances. A hemorrhage from the lungs is called *hemoptysis;* from the urinary organs, *hematuria;* from the stomach, *hematemesis;* from the nose, *epistaxis*.

HEMORRHOIDS (Greek, *haima*, blood, and *reo*, to flow), literally, a flow of blood. Until the time of Hippocrates this word was used, conformably to its etymology, as synonymous with *hemorrhage*. It was afterwards used in a narrower sense, to indicate the flux of blood at the extremity of the rectum, and in some other cases which were considered analogous to it; thus we hear it applied to the flow of blood from the nostrils, the mouth, the bladder, and the uterus. It is at present used to signify a particular affection of the rectum, although the disease is not always attended with a flux; in this sense it is also called *piles*. Certain general causes may produce a predisposition to this disease; in some cases, it appears to be the effect of a hereditary disposition; in general, it manifests itself between the period of puberty and old age, although infants and aged people are not entirely exempt from its attacks. The bilious temperament seems to be more exposed to it than any other. Men are oftener affected with it than women, in whom it is sometimes produced by local causes. It often shows itself in subjects who pass suddenly from an active to a sedentary life, or from leanness to corpulency. Any circumstance which produces a tendency or stagnation of the blood at the extremity of the rectum is to be reckoned among the local causes. The accumulation of fecal matter in the intestines, efforts to expel urine, the pressure produced by polypi, the obstruction of any of the viscera, especially of the liver, worms, the frequent use of hot bathing, of drastic purges, and particularly of aloes, long continuance in a sitting posture, riding on horseback, pregnancy, the accumulation of water by ascites,—such are some of the ordinary causes of hemorrhoids. They are distinguished into several sorts, as external, when apparent at the anus; internal, when concealed within the orifice; blind or open, regular or irregular, active or passive, periodical or anomalous, &c. There is also a great difference in the quantity of blood discharged; it is usually inconsiderable, but in some cases is so great as to threaten the life of the subject. The quality, colour, &c., of the blood, also differ in different cases. The number, seat, and form of the hemorrhoidal tumours likewise present a great variety of appearances. When the disease is purely local we may attempt its cure; but in the greatest number of cases it is connected with some other affection, or with the constitution of the subject. In these cases, if the tumours are not troublesome on account of their size, or if the quantity of blood discharged is not very considerable, cure of the primary affection should be attempted. The best

mode of treatment is then to recur to hygienic rather than medicinal influences. The subject should avoid violent exercises, but moderate exercise will be found beneficial; the food should not be too stimulating or nutritious. Travelling, or an active life, should succeed to sedentary habits. The constipation, with which the subjects of this disease are liable to be affected, should be remedied by laxatives or gentle purgatives. If bathing is used, it should be in lukewarm or cold water. Anything which may be productive of a local heat should be avoided, as warm seats, soft beds, too much sleep. If the pain is considerable recourse should be had to sedatives, gentle bleeding, leeches. If the disease appears under a more severe form more violent remedies will become necessary. If the discharge of blood becomes excessive particular care must be paid to regulate it. If the tumours acquire a considerable volume surgical operations may become necessary. If any bad consequences result from the suppression of the hemorrhoids care must be taken to give the blood the salutary direction which it had previously; this may be effected by the use of laxative baths, emollient fomentations, or the application of leeches to the anus.

HEMP (*Cannabis sativa*), a plant of the natural order Cannabinaceæ, the only other member of which is the hop (Humulus). Hemp is extensively cultivated, and important on account of the various uses of its seed and the fibres of its bark. Poultry and small birds are very fond of the former, and it furnishes an expressed oil, very good for burning, and also employed by painters; the latter is made into cordage, ropes, cables, and cloth of every quality, from that used for the sails of vessels to the fineness of linen. The stem is herbaceous, upright, simple, in Great Britain, under favourable circumstances, attaining the height of 6 to 8 feet, while in some countries it reaches the height of 12 or even more; the leaves divided into five lanceolate and coarsely serrate leaflets; the male flowers, which are on separate stems from the female, are green, resembling those of the hop; the female flowers are inconspicuous, and the fruit is a little hard capsule, containing a single seed. The plant is annual, and possesses a strong odour, with intoxicating and narcotic properties, especially in hot climates, on which account it is usual, in India and other eastern countries, to mix the leaves with tobacco for smoking. In India the plant when prepared for intoxication is known by the name of *bang* (see Hashish). Its narcotic properties reside chiefly in a resinous secretion produced in its leaves and flower-heads. The Indian variety of the plant is sometimes regarded as distinct from the European, but there is really only one species. Hemp is a native of India, Persia, and other parts of Asia, and was early transported into Europe, where it is now cultivated successfully, even in the northern parts, being largely grown in North Russia. In the U. States it is grown to a considerable extent in some states; it has also become naturalized in many parts, and is common in waste places, along roadsides, &c. The name hemp is also loosely applied to other fibres, as in the case of Manilla-hemp, sunn-hemp, &c. Sunn-hemp (*Crotalaria juncea*), which is grown all over India, is also known as Indian hemp, and must be carefully distinguished from the Indian hemp properly so called.

Hemp has been cultivated as a fibre plant from very early times. The Scythians used it for making cloth more than four centuries before Christ; and in India also it has long been grown. In Britain most of the hemp used is imported, and it is chiefly made into sail-cloth, canvas, sacking, and twine or cordage of various kinds. Sheetings, towellings, table napery, &c., are also made of hemp. Only the coarser kinds are employed in making cordage. The hemp of England is of excellent quality, and that grown in Suffolk is never used in making cordage, being too fine. In order to encourage the growth of British hemp government in 1787 granted a bounty of 3*d.* per stone on all hemp grown at home, but the plant has been little cultivated in this country for many years, as it does not pay the farmer. Large quantities are imported, however, Russia, Germany, Italy, and the U. States being the chief sources of supply. The highest prices are obtained for the Italian and Russian hemp. The hemp grown in Alsace sometimes exceeds 12 feet in height, and is upwards of 3 inches in circumference, the stalks being so deeply rooted that a very strong man can scarcely pull them up. In Italy hemp is generally cultivated, particularly near Milan and Bologna. It is there sown upon the best land, composed of rich strong loams, and is highly manured. When hemp is grown upon poor land it is finer in quality but smaller in quantity than that grown on a rich soil. It may be raised for many years successively on the same fields, provided they be well manured. In Britain hemp should not be sown earlier than the middle of April, and the first week of May is considered the best time. The seed must be sown thin, not more than 2 bushels to an acre, and if put in with a drill-plough a still smaller quantity will suffice. As the plants are either female or male, and the former only can produce seed, regard must be had to this circumstance in gathering in the harvest. For this purpose small paths are to be left open along the field lengthwise, at about 7 feet distant from each other, to allow a person to pluck the male plants first, as the female require to remain standing a month longer to admit of the seed becoming fully ripe. The male hemp is known to be ripe by the fading of the flowers and falling of the pollen, and from some of the stems growing yellow. The female plants are always less numerous than the male, and are known to be ripe by the stems becoming pale. It is advisable always to pull hemp rather under than over ripe.

The male hemp, being stripped of its leaves, and dried in the atmosphere, may be stored up, or else it may be carried immediately to the ponds to be steeped; and there is an advantage attending the steeping of it green, as it turns out of a better colour. The plants intended to raise good seed for sowing are generally sowed apart by themselves.

When the hemp is pulled, it must be taken in large handfuls, and the roots cut off; and the leaves, seeds, and lateral branches stripped off by means of a wooden sword or *ripple*. It is then made into bundles of twelve handfuls each, in order to be steeped in water. In Suffolk they usually steep it for four, five, or six days, preferring standing water, and the same water may be used three times during one season; but the first steeped has the best colour. The bundles are to be laid crosswise over each other, and care is to be taken in withdrawing them, so as not to intermingle them. It is better to let the hemp remain a proper time, and eleven days is sometimes necessary for this purpose. The slenderest hemp requires the longest steeping, and the operation is known to be completed by the inner *reed* or woody fibre separating easily from the fibres of the outer bark. When thoroughly steeped it is taken out of the water and spread out in rows on the grass to bleach. The bleaching takes three weeks or more, during which period it requires constant turning with a light, long pole. After drying it is scutched or broken by breaks and scutching-stocks, resembling those employed for flax. Beating the hemp is the next operation, which is now generally done by a

water-mill, which raises heavy beaters, that fall down alternately, and a boy attends to turn the heaps of the hemp. The hemp is now ready for being heckled, after which it may be spun.

HEMS, or HOMS (Roman, *Emesa*), a town of Syria, near Lake Kades, 90 miles north-east of Damascus. The plains of Hems have been the scene of two great battles, the first ending with the defeat of Zenobia, queen of Palmyra, by the Roman emperor Aurelian in 272 A.D.; and the second, 7th July, 1832, when a Turkish force was defeated by Ibrahim Pasha. Hems is on the railway running north from the Beyrout-Damascus line, opened to Hamah in 1902; and has a good trade. Pop. 60,000.

HEMSTERHUIS, FRANCIS, son of Tiberius Hemsterhuis. To the classical learning which he inherited from his father, he added the study of philosophy, in particular that of Socrates. The sensational system of Locke was the foundation of his philosophy, but was extended by him with great acuteness, interwoven with observations of his own, and exhibited in a manner full of life and taste. His philosophical views he has expressed in the dialogue Sophyle ou de la Philosophie. Another class of his writings refers chiefly to the philosophy of the arts and to archæology. The dialogue Aristée ou de la Divinité (2d edition, 1779) is devoted to the philosophy of religion, as well as the celebrated Lettre de Diocles à Diotime sur l'Athéisme (1785). His other writings are a dialogue Alexis, ou de l'Age d'Or (On the Golden Age), and the masterly Description philosophique du Caractère du feu M. Fr. Fagel (1773). All these writings were collected and published by Jansen, first in 1792, and in a second edition in 1809 (Paris, in two vols.) An edition by S. Van de Weyer, in two vols. 8vo, was published at Louvain in 1826. He was born in 1720, resided first at Leyden, then at the Hague, as a private individual, occupied for some time the post of first clerk in the office of the secretary of the United Netherlands, and was one of the directors of the drawing academy at Amsterdam. He died at the Hague in 1790.

HEMSTERHUIS, TIBERIUS, a celebrated Dutch philologist, was born at Groningen in 1685, and died in 1766 at Leyden, where he was professor of the Greek language and of history. In his fourteenth year he entered the university of his native city, where he studied particularly mathematics. He was not twenty years old when he was appointed professor of mathematics and philosophy at Amsterdam. Here he entered into the philological career. He now undertook an edition of Julius Pollux the lexicographer, and was thus led into a correspondence with the great Bentley, whose overpowering though friendly criticism for a short time discouraged the young man. But he soon applied himself more zealously to the study of all the Greek authors in chronological order, and with such success that he may justly be said to have been the most profound Hellenist of the age. We are indebted to him for the foundation of the study of the Greek language on the basis of analogy, for which Joseph Scaliger and Salmasius had prepared the way. Hemsterhuis was not less familiar with Latin, although his style in that language wants the easy grace which we find in Ruhnken. This philologist and Valkenaer were his most distinguished pupils. His principal works are the above-mentioned edition of the Onomasticon of Julius Pollux, Select Dialogues of Lucian, and the Plutus of Aristophanes. His grateful pupil and friend Ruhnken, in the classical memoir which he has consecrated to his memory, gives some fine traits of his character.

HENBANE (*Hyoscyamus niger*), natural order Solanaceæ, a viscid biennial plant possessing a peculiar odour. The flowers are of a dingy yellow, with purple veins. The plants of this order are generally narcotic poisons; and the juice of several, including that of the henbane, has the property of dilating the pupil of the eye.

HENDON, an urban district of Middlesex, forming a suburb of London, to the north-west of Hampstead. There are here Mill Hill grammar-school, a Roman Catholic college for missionaries, and the Brent reservoir of the Regent Canal. Pop. (1901), 22,450.

HENGIST, the founder of the Kingdom of Kent in Great Britain, and his brother Horsa were renowned among the Saxons for their bodily strength and the antiquity of their family, which derived its origin in a direct line from Odin. In 449 the Britons sued for aid from the Saxons against the inroads of the Scots and Picts. The Saxons had long been desirous of invading Britain, and therefore gladly accepted the invitation. Under the command of Hengist and Horsa they landed at the mouth of the Thames, attacked the enemies of the Britons, and defeated them near Stamford in 450 A.D. (See ENGLAND.) The victory, obtained with so much facility, convinced them that they could easily subdue a people who were unable to resist so feeble an enemy. They sent intelligence to Saxony of the fertility and wealth of the country, and represented as both easy and certain the subjection of a people who had so long forgotten the use of arms, and who were divided among themselves. As soon as they had received reinforcements from home they sought occasion for a quarrel, and uniting with the Scots and Picts, they attacked the Britons. The latter had taken up arms, deposed their king Vortigern, and placed his son Vortimer upon the throne. The war was carried on with the greatest fury. The Anglo-Saxons penetrated to the interior of the country, laying waste all before them, and practising the most shocking cruelties. The Britons were forced to flee or submit to the yoke of the victors. Some fled to Armorica (Haute-Bretagne), to which they gave their name. Hengist, who had lost his brother in the battle near Eglesford (now Aylesford) in 455 A.D., founded the Kingdom of Kent. He established his residence in Canterbury, and died about the year 488. By some of our later writers Hengist and Horsa are regarded as mythical personages.

HENGSTENBERG, ERNST WILHELM, a celebrated modern German divine and commentator, was born October 20, 1802, at Fröndenburg, Westphalia. He received his early education from his father, and in 1819 entered the University of Bonn, where he devoted himself almost exclusively to philosophy and the oriental languages. In 1823 he went to Basel, and coming under the influence of the missionary institution there, he ever after identified himself with orthodoxy, though he had previously sympathized with rationalism. In 1824 he became *privatdocent* of theology at Berlin. In 1826 he became extraordinary professor, and in 1828 ordinary professor of Old Testament exegesis at the same university, and in 1829 he received the degree of D.D. He died 28th May, 1869. His influence as leader of the orthodox party was fully established by the publication of the Evangelische Kirchenzeitung (1827), of which he was editor, and which had among its founders and contributors men of such eminence as Otto and Ludwig von Gerlach, Neander, Tholuck, Lange, Huber, Stahl, Vilmar, and Leo. Its aim from the first was to combat rationalism in every form, and to restore the orthodoxy and the discipline of the sixteenth and seventeenth centuries; and it became more and more the organ of a high church Lutheran party. Hengstenberg's first work was a translation of Aristotle's Metaphysics (8vo, Bonn, 1824). All

his subsequent works were devoted to the interpretation of the Scriptures, and to the defence of their genuineness, inspiration, and divine authority against the attacks of the critical and sceptical schools. Most of them have been translated into English. The most celebrated are his Christology of the Old Testament, Introduction to the Old Testament, Commentary on the Psalms, the Revelation of St. John, &c. A complete list of his works would be the highest eulogium of his industry, which was indefatigable.

HENLEY-ON-THAMES, a market-town and municipal borough, England, county of Oxford, on the left bank of the Thames, here crossed by a handsome bridge, 35 miles west of London, and on a branch line of the Great Western Railway. It consists of four principal well paved and lighted streets, and has an imposing Gothic church with a fine tower; several dissenting chapels, a neat town-hall with corn-exchange underneath, a working-men's institute and reading-room, and a valuable library, bequeathed by Dean Aldrich of Henley, who died in 1737, and to which all ratepayers have free access. Malt is made extensively, and there are several breweries. Pop. (1891), 4913; (1901), 5984.

HENLOPEN, a cape on the coast of Delaware, at the entrance of Delaware Bay. On it is a fixed light 128 feet above the level of the sea; lat. 38° 47′ N.; lon. 75° 6′ W.

HENNA PLANT (*Lawsonia inermis*) is a shrub bearing opposite entire leaves and numerous small flowers, which are disposed in terminal panicles, and possess an agreeable odour. Externally it bears considerable resemblance to the European privet, but belongs to the natural order Lythraceæ. It grows in moist situations throughout the north of Africa, Arabia, Persia, and the East Indies, and has acquired celebrity from being used by the inhabitants of those countries to dye the nails of their fingers and the manes, hoofs, &c., of their horses. For this purpose the leaves are dried, powdered, and made into a paste with hot water, which, when applied to the above-mentioned parts, leaves a yellow colour, requiring, however, to be renewed every three or four weeks. The Egyptian mummies have their nails stained yellow, probably by the use of the henna. This circumstance, however, is by some referred to the various drugs used in the process of embalming. It is cultivated extensively in Egypt, and the powdered leaves form a large article of export to Persia and the Turkish possessions. The colouring matter of this plant is very abundant, and it may be advantageously used for dyeing woollens, not only yellow, but brown of various shades, provided that alum and sulphate of iron be employed. The henna plant is supposed to be the *kopher* of the Hebrew, translated *camphire* in the Song of Solomon. In Cyprus and Egypt it is known by the name of *henna*.

HENNEBONT, a town in France, in the department of Morbihan, on the Blavet, 27 miles W.N.W. of Vannes. It is an ancient place, partly surrounded by fine old ramparts, and containing many old houses of picturesque appearance. Its castle, with which the readers of Froissart are familiar, has almost entirely disappeared. It has some trade in wine, corn, honey, wax, and hemp. Pop. (1896), 5854.

HENNEPIN, Louis, a French recollet friar, a missionary, and a traveller in North America, born in Flanders about 1640; died at Utrecht about 1706. He entered a convent, and being sent by his superiors to Calais and Dunkirk, the stories he heard from the sailors inspired him with a desire to visit distant countries. At length he embarked for Canada, and arrived at Quebec in 1675. Between that period and 1682 he explored the regions afterwards called Louisiana, and returning to Europe, published an account of his researches, entitled Description de la Louisiane nouvellement découverte au sud-ouest de la Nouvelle France, avec la Carte du Pays, les Mœurs et la Manière de Vivre des Sauvages (Paris, 1683, 12mo). This was followed by a work entitled Nouvelle découverte d'un très-grand Pays situé dans l'Amérique entre le Nouveau-Méxique et la Mer glaciale (1697); and another, Nouveau Voyage dans un Pays plus grand que l'Europe, entre la Mer Glaciale et la Noveau-Méxique (1698), which are continuations of the first. The geographical portion of these works is feeble, but they present some interest as descriptions of the manners of the aboriginal races which the author visited.

HENRIETTA ANNA, of England, Duchess of Orleans, daughter of King Charles I., was born at Exeter, June 16, 1644, amidst the turbulent scenes of the civil war. She was hardly three weeks old when her mother fled with her to France, and after the death of Charles repaired to the convent of Chaillot, and there devoted herself to the education of her daughter. Henrietta united with great sweetness of character the charms of a beautiful person. Her nuptials with the brother of Louis XIV., Philip of France, Duke of Orleans, were celebrated in March, 1661; and Louis XIV., to whom her hand had been offered, now seemed to regret that he had refused the lovely Henrietta. He did not conceal his admiration for her, and the princess is said not to have remained insensible to the homage of the king. This circumstance, and the indiscretion with which she permitted the attentions of some of the courtiers, excited the jealousy of the Duke of Orleans, and rendered their marriage unhappy. Henrietta would have suffered more from the severe and gloomy character of her husband had she not found protection in the king, who afterwards employed her mediation in political affairs. Louis XIV. was desirous of detaching her brother, Charles II., from the triple alliance with Holland and Sweden, in order to accomplish his plan of obtaining possession of a part of Holland. As the common method of diplomatic transactions was not sufficient for this purpose, Louis resolved to make his sister-in-law his confidant in this affair, and the Duchess of Orleans embraced his proposals with the greater readiness, as they flattered her pride and opened a wide field for her spirit of intrigue. She went, therefore, in 1670, with the court to Flanders, and, under pretence of visiting her brother, passed over to Dover, where Charles was awaiting her arrival, and there succeeded in gaining over her brother to the views of Louis. Shortly after her return she died so suddenly as to excite the suspicion of her being poisoned (June 30, 1670). Bossuet pronounced her funeral oration.

HENRIETTA MARIA, queen of Charles I. of England, was the youngest child of Henry IV. of France, by his second wife, Maria de' Medici, and was born in Paris, on 25th November, 1609. The proposed marriage between Charles, then Prince of Wales, and the Infanta of Spain having failed mainly through the artifices of Buckingham, a matrimonial negotiation was opened between the heir of the English crown and Henrietta, whom he had first met at a ball in Paris, while passing through that city on his romantic journey to Spain. The proposal was accepted, and a few days after Charles' accession to the throne the marriage ceremony was celebrated by proxy at Paris in 1625. On Henrietta's first arrival in England she enjoyed great popularity with her husband's subjects, but her bigoted attachment to Popery, combined with her hauteur and despotic ideas as to divine right, soon dissipated these favourable prepossessions. Much of Charles' subsequent arbitrary and injudicious procedure, which led ulti-

mately to his death on the scaffold, may be traced indirectly to the influence of his queen. On the breaking out of the civil war Henrietta Maria proceeded to Holland, where she procured money and troops for the assistance of her husband, and afterwards joined him at Oxford. She again returned to the Continent, and took up her abode in France till the Restoration. On that occasion she visited England with her daughter Henrietta, but soon returned to France, and died a few years afterwards, near Paris, in 1669.

HENRY I. of Germany (called *der Vogler*, *Vogelsteller*, or *Finkler*, *The Fowler;* a surname which, according to popular tradition, he received from the circumstance that the messengers of the German princes, sent to announce his election, found him engaged in fowling) was born in the year 876, and was the son of Otho the Illustrious, duke of Saxony, who had refused the regal dignity offered him in 912. Henry, on the death of his father, became Duke of Saxony and Thuringia. He was elected sovereign of Germany in 919 at Fritzlar. He had to contend with anarchy within and enemies abroad, but his prudence and activity overcame these difficulties. Suabia and Bavaria, which had refused their allegiance, were forced to submit, and Lorraine, which had been separated from Germany by the Western Franks, was reunited to the German Empire in 925. This union was strengthened by the marriage of the Duke Gisilbrecht or Gisilbert to Gerberga, the daughter of Henry. Before Henry's difficulties in Lorraine had been brought to an end, new difficulties had arisen in Germany by the inroads of the Hungarians. In a battle fought against them at Bichin Henry was defeated, and compelled to take refuge in his castle of Werla, but having by good fortune taken prisoner one of the Hungarian princes, he succeeded in inducing the enemy to conclude a truce for nine years (only for Saxony and Thuringia, however, not for the whole empire), on condition of paying a yearly tribute and releasing the captive prince. This period of truce enabled him to take measures for the future defence of the empire against their foes, by introducing a new system of military organization and tactics, increasing the number of cities, and surrounding them with walls and ditches. When these arrangements were concluded he turned his arms against various Slavonic tribes in the south, and was everywhere victorious. At the end of the nine years' truce with the Hungarians he refused the tribute. They entered Thuringia and Saxony with two armies, but were completely routed by Henry before Merseburg (in 933 or 934). They were obliged to flee with the loss of all their booty and prisoners. This success was the fruit of the improvements in discipline which Henry had introduced, and of the reputation which he had acquired among the Germans, who now willingly supported him. The Hungarians did not dare, for a long time after, to repeat their incursions into Germany. Shortly after his successes over the Hungarians, Henry forced the King of Denmark to restore the district between the Eider, Treene, and Schlei to the empire. He gave to this district the name of the Mark of Schleswig, and divided it as an imperial fief among several Saxon warriors. Henry died in 936 at Memleben, and was buried at Quedlingburg. What he had begun his son and successor, Otho I., gloriously completed.

HENRY II., THE SAINT, OR THE LAME, Emperor of Germany, the last of the Saxon line, born 973, was a son of Henry the Quarreller of Bavaria, and great-grandson of the Emperor Henry I. He inherited Bavaria on the death of his father in 995. On the death of Otho III. in the beginning of 1002 he laid claim to the empire, and although he had some difficulty in making his claim good against the other competitors for the honour, was crowned at Mayence in June of the same year. The beginning of his reign was disturbed by the rebellion of his brother Bruno and the Margrave Henry of Schweinfurt, both of whom had expected to be enfeoffed with the Duchy of Bavaria, and no sooner was this rebellion quelled than he had to proceed to Italy to assert his sovereignty there, where the Lombard cities had chosen Harduin of Ivrea as their king. After causing the iron crown of Lombardy to be placed upon his head, and taking revenge on those of the hostile faction in this part of his dominions, he was obliged to hasten back to Germany to put a stop to the aggressions of Boleslas of Poland, who, during his absence, had extended his sway over the whole of Bohemia. After repeated campaigns Henry succeeded in wresting Bohemia from his grasp, and in 1018, in the Peace of Budissin (Bautzen), reduced him to complete subjection. In the midst of these campaigns against Boleslas he had been compelled to make another expedition into Italy (1013), where Harduin had again assumed the Italian crown. On this occasion, after the subjugation of his rival, he proceeded with his consort Kunigunde to Rome, where for the first time Pope Benedict VIII. crowned him as emperor, and presented him with the golden apple, the symbol of imperial sway. He made a third expedition into Italy in 1022, when he was summoned by Benedict to give him his assistance against the Greeks, who were seeking to extend their possessions in Southern Italy. He died in 1024. It was during the reign of this emperor that provision was made for the annexation of the Burgundian Kingdom of Arles, by a treaty concluded in 1006 between him and Rudolph, the last of the line which possessed that kingdom.

HENRY III., Emperor of Germany, the second belonging to the house of the Salian Franks, son of the Emperor Conrad II., was born in 1017, and succeeded his father in the imperial dignity, 1039. He had already been chosen king in 1026. As soon as he mounted the imperial throne he showed that he was richly endowed with the qualities of an able ruler, and determined to maintain the supremacy of the empire as well over the great feudal lords as over the church. He weakened the power of the former by keeping the great fiefs when they became vacant for himself or members of his family, or by bestowing them (as in the case of Bavaria and Carinthia) upon less powerful nobles than had previously possessed them. He also extended the power of the empire by forcing the Duke of Bohemia in 1042, and the King of Hungary in 1044, and again in 1047, to accept their dominions as imperial fiefs. His influence was also paramount in Italy, especially in Milan, where he succeeded in allaying the party dissensions then prevailing, and in the south, where the Normans in Apulia and Calabria paid homage to him as their feudal superior. On the occasion of his first visit to Italy (1046) he also put an end to the contention between Benedict IX., Sylvester III., and Gregory IV. for the papacy, causing them all to be deposed, and causing Suitger, bishop of Bamberg, to be elected in their stead with the title of Clement II. The efforts of Henry were now directed towards rooting out the evils which were rife among the clergy, but not less towards securing the permanence of the influence of the empire over the see of Rome. His efforts in this latter direction, however, were thwarted by Cardinal Hildebrand (afterwards Gregory VII.), who, while appearing to aid in carrying out the views of the emperor, was secretly maturing his plans for delivering the church from the imperial supremacy. The plans of this prelate were completely prepared by the time of the emperor's death

in 1056. Two years before his death, which took place at Botfeld, in the Harz Mountains, Henry had got his son of the same name crowned as his successor. Henry III. was not only a powerful ruler, but also a patron of arts and sciences. He founded numerous schools in connection with the monasteries, and filled them with teachers from Britain; and he built the cathedrals of Worms, Mayence, and Spires, in the last of which he is buried. He, as well as his wife Kunigunde, was afterwards canonized.

HENRY IV., the son of the preceding, was born in 1050, and at the death of his father was only five years old. During his minority his mother, Agnes of Poitiers, at first took care of his education and held the reins of government; but in 1062 Hanno, archbishop of Cologne, succeeded in possessing himself of the person of the king, with which the government also came into his hands. Hanno, however, did not long enjoy his power undivided. His selfishness, ambition, and extravagance stirred up so many adversaries that he found himself obliged to allow to Adalbert, archbishop of Bremen, a share in the government and the education of the young monarch. Hanno had erred in his training of Henry on the side of severity; Adalbert, on the other hand, erred in showing him too great indulgence. By this means he won the attachment of his royal pupil, and he took advantage of this to inculcate upon him his own views concerning the absolute authority belonging to the imperial crown, to instil into him his own hatred of the Saxon princes, and also to secure for himself the chief share in the administration of the empire. To attain this last object he caused Henry, immediately after his return from his first campaign against the Hungarians in 1065, to be declared of age, although he had not then completed his fifteenth year. The pernicious counsels of Adalbert soon produced troubles, especially in Saxony, where Henry committed many acts of violence. The Saxons joined with the inhabitants of Thuringia, who suffered under the same grievances, and drove Henry from Saxony (1073), destroyed many of the castles which he had built to overawe the inhabitants, and the year after compelled him to an accommodation, in which the destruction of the remaining castles was stipulated. But some churches having been destroyed by the populace, Henry accused the Saxons to the pope of sacrilege, and thus gave him an opportunity to interfere as umpire. The Saxons offered to make every satisfaction; but Henry suddenly invaded their territory with a powerful army, and attacked them, in 1075, at Hohenberg (Homburg), not far from Langensalza on the Unstrut, where they suffered a total defeat. Henry took all their princes and nobles prisoners, sent them into other countries, and treated the people like an angry victor. The Saxons, in turn, now complained to the pope. Gregory VII. (Hildebrand), who had been elevated to the Papal chair some years before, without the consent of the imperial court, eagerly seized this opportunity to extend his power, and in 1076 summoned Henry, under penalty of excommunication, to appear before him at Rome, and answer to the complaints of the Saxons, at the same time forbidding the practice of selling ecclesiastical dignities, by which he had been in the habit of raising money. Henry regarded this threat so little that he instigated the bishops, who were assembled by his order at Worms, to renounce their obedience to the pope. Gregory, however, pronounced the sentence of excommunication against him, and absolved his subjects from their allegiance, and Henry soon found himself deserted, and in danger of losing everything. In this state of affairs he was obliged to go to Italy and make his submission to the pope. He found Gregory at Canossa, not far from Reggio, a strong castle belonging to Matilda, countess of Tuscany, whither he had retired for security. Three days successively, in the depth of winter, Henry appeared in a penitential dress, in the court of the castle, before the intercession of Matilda obtained for him an audience of the pope (January 28, 1077), when he was, after all, released from the sentence of excommunication only upon submitting to the most humiliating conditions. The insolence with which the pope used his victory produced a reaction; the Italian princes, who had long been dissatisfied with Gregory, and were desirous of deposing him, gathered round Henry, who was not disposed to fulfil the hard conditions imposed upon him, and offered him their assistance. The German princes, however, at the instigation of the pope, assembled at Forchheim in 1077, and elected Rudolf, duke of Suabia, king. Henry hastened back to Germany and overcame his rival, who lost his life in battle at Merseburg, in 1080. Gregory again excommunicated Henry; but at the Council of Brixen, in 1080, he was deposed by the German and Italian bishops as a heretic and a sorcerer, and Guibert, archbishop of Ravenna, set up in his place, with the title of Clement III. In 1081 Henry marched into Italy to take vengeance on Gregory, and appeared at Easter before Rome. He was not able in that year, however, to pursue the siege of the city, which did not fall into his hands till 1084. Gregory had meanwhile fled to the Castle of St. Angelo. Henry then entered Rome with Clement III., by whom he had himself crowned, along with his consort. Meanwhile new opposition had arisen in Germany. Count Hermann of Luxemburg had been chosen king by the party hostile to Henry, who was obliged to return to quell the rebellion. He was delivered of this rival by his voluntary abdication in 1087, and two years later (1089) was delivered by death of a still more formidable rival, Eckbert of Meissen. The course of events now called him once more to Italy. Gregory VII. had died at Salerno in 1085, and the Gregorian party had elected in his room first Victor III. and then Urban II., so that Henry was obliged to cross the Alps to defend his protégé Clement III. But the dissatisfaction against Henry in Germany had not subsided; his oldest son, Conrad, rebelled against him, but was overcome, and died at Florence in 1101, deserted by his partisans. Henry then caused his second son, Henry, to be elected his successor (1098) and crowned. But the latter, regardless of his oath not to interfere in the government during the life of his father, suffered himself to be seduced into rebellion. He made himself master of his father's person in 1105 by stratagem, and compelled him to abdicate the throne at Ingelheim Henry IV. ended his life and his sorrows in neglect at Liége in 1106. The bishop of the place buried him with imperial pomp; but his enemies caused his body to be removed to Spires, and to lie in an unconsecrated grave till the ban of excommunication was taken off five years later. Henry IV., though passionate and imperious, was endowed with many excellent qualities, both of head and heart. He was faithful to his supporters, sympathetic towards the poor and the sick, acute in council, full of resources in danger, and brave in battle. But he wanted that penetration of spirit and consistency of character that would have enabled him to solve the problem which the time presented to him, to check the insolence of the vassals and the growing power of the Papacy.

HENRY V., the son and successor of the preceding, emperor of Germany, was born in the year 1081. He made himself disgracefully notorious by his conspiracy against his father, and by his cruel treatment

of him. Scarcely had Henry V. ascended the throne when he declared himself against the usurpations of the Romish court, and the unfortunate question of investiture distracted the empire anew. In 1110 he undertook an expedition over the Alps, in order to receive the imperial crown from the pope in Rome. But as Pascal would consent to confer it only upon the condition that those rights which had already been claimed by Gregory should be formally conceded, and as the bishops continued to add fuel to the fire which was already kindled, Henry determined to put an end to the dispute by an act of violence. He caused the pope to be conveyed away from the altar while at mass, and cut down in the streets of Rome all who opposed him. After an imprisonment of two months Pascal yielded. On the 9th of April, 1111, Henry was crowned without any new conditions, and upon his knees received from the proud prelate the permission to inter in consecrated ground the remains of his unhappy father, against whom he had himself conspired. The disturbances in Germany soon brought Henry back from Italy. While he was engaged in fighting against Lothaire, duke of Saxony, the Roman bishop excited a rebellion in Italy and among the princes of the German Empire against him, and declared that the peace which had been concluded with the emperor was compulsory. This war continued two years, and devastated Germany in a shocking manner; after which Henry made a second expedition to Italy, and compelled Pascal to flee to Apulia. After his death, which took place soon after, the cardinals elected Gelasius II. Henry, dissatisfied with this, caused Bourdin, archbishop of Braga, to be chosen, under the name of Gregory VIII. Gelasius went to Vienna, where he summoned a council, and excommunicated Henry. The successor of Gelasius, Calixtus II., did the same at the Council of Rheims. By this, and by the continual insurrections of the nobility of the kingdom, Henry was at length compelled to yield, and in 1122 subscribed the Concordat of Worms. (See BISHOP.) He died at Utrecht on the 23d of May, 1125, and was buried at Spires. He was the last of the Salic or Frankish family of emperors, which was succeeded by the Suabian house. He was married to Matilda, a daughter of Henry IV. of England.

HENRY VI., German emperor, son of Frederick I. and Beatrice of Burgundy, the third emperor of the house of Hohenstaufen, was born in 1165, crowned king in 1169, and succeeded his father as emperor in 1190. In 1191, by the death of William II. of Sicily and Naples, he became heir to that kingdom through his wife Constance, but was obliged to assert his claim by force of arms, since the Sicilian states chose as their king Tancred, an illegitimate son of the brother of Constance. After being crowned at Rome by Pope Celestine III., and conquering Apulia and Naples, he returned to Germany, where he waged war against Henry the Lion till the latter submitted. Having been enriched by the inheritance of Welf VI., which fell to him after the death of the latter, and by the ransom paid by the English for Richard Cœur du Lion, whom he had seized and held captive on his return from Palestine, Henry found himself in the possession of sufficient resources to undertake a new expedition into Italy, where, meanwhile, Tancred had died (1194), and his son, William III., been declared his successor. The expedition was completely successful. Naples opened her gates to him, and Sicily at once submitted, and on the 30th of November Henry made a triumphal entry into Palermo. He disgraced his success, however, by acts of the greatest cruelty towards the defeated party. On his return to Germany Henry endeavoured to induce the Diet of Würzburg in 1196 to make the imperial dignity hereditary in his family, but his efforts towards this end were met with such opposition that he was obliged to desist. Henry VI. died at Messina September 28, 1197, and was succeeded by the rival emperors Philip of Suabia and Otto IV.

HENRY VII., Emperor of Germany, son of the Count of Luxemburg, born in 1269, was chosen emperor November 27, 1308, after an interregnum of seven months from the death of Albert I. Among the first acts of his reign were the punishment of the murderers of Albert I. and the recognition of the independence of the Swiss cantons of Schwytz, Uri, and Unterwalden, and the granting of the Kingdom of Bohemia to his son John, in the possession of which he was secured by his marriage with the Bohemian Princess Elizabeth. He then undertook an expedition to Italy, and compelled the Milanese to place upon his head the iron crown of Lombardy. Henry suppressed by force the revolt which then broke out in Upper Italy; took Cremona, Lodi, Brescia, by storm; caused his chancellor Turiani, the secret leader of this insurrection, to be burned, and then went to Rome, of which Robert, king of Naples, had possession and refused him entrance. Having captured a part of the city, he was crowned Roman Emperor by two cardinals, while in the streets and different quarters of the city the work of murder and pillage was still going on. While preparing to continue the war against Robert of Naples he died suddenly at Buonconvento, in Tuscany, August 24, 1313. The empire remained after his death without a head during fourteen months, at the end of which time Louis of Bavaria was chosen emperor.

HENRY I., King of France, born about 1006, was the third son of Robert and his queen, Constance. The eldest son, Hugh, having predeceased, and the second, Eudes, being imbecile, Henry succeeded to the crown on the death of his father in 1031. His mother's favourite was Robert, the fourth son, and hence, when her husband, in 1027, associated Henry with himself in the government, she became the head of a powerful faction opposed to him, and on Robert's death was strong enough to drive Henry into exile. He took refuge with Robert of Normandy, surnamed Robert le Diable, father of William the Conqueror, and by his aid brought Constance to terms, which exiled her from the court, but made Robert duke of Burgundy. His reign, though long, was very troubled, chiefly in consequence of his selfishness and ingratitude. Forgetting all his obligations to Robert of Normandy, he took advantage of his absence, on a pilgrimage to the Holy Land, to seize his dominions, and afterwards, with the same unprincipled design, made unsuccessful war on William, the son of his benefactor. He died on the 4th of August, 1060, and was succeeded by his son Philip, whose mother was a daughter of Jaroslav, duke of Russia.

HENRY II., King of France, born on the 31st of March, 1519, succeeded his father, Francis I., on the 31st of March, 1547. The commencement of his reign gave little promise, as he placed himself in the hands of his mistress, Diana of Poitiers, who was created Duchess of Valentinois, and filled all the places about court, as well as the cabinet itself, with her creatures. Two years after his accession he declared war against England, and so far succeeded, that, after a short period of hostilities, a peace was concluded, which gave him back Boulogne-sur-Mer for a fifth part of the sum stipulated in a treaty concluded in the previous reign. A war of much longer duration, and productive of more serious results, broke out in 1551. This war originated in disputes between Henry and the pope as to the duchies of Parma and Placentia, and was soon raging, not only in Northern Italy, but throughout Central Europe. The emperor,

Charles V., whom the pope had interested in his quarrel, would have been far more than a match for Henry, had not his resources been greatly crippled by the internal state of Germany, where the progress of the Reformation, and Charles' vain attempts to suppress it, had led to a powerful confederacy against him. Henry, though professing to be a zealous Catholic, did not hesitate to avail himself of Protestant auxiliaries. This war, in which England became involved through the marriage of Queen Mary with Philip II. of Spain, continued to devastate Europe till 3d April, 1559, when a general peace was concluded at Câteau-Cambrésis. By this peace England was deprived of her last footing in France, by ceding Calais, after possessing it for more than two centuries, and France was obliged to restore to Spain almost all the conquests which she had made in Italy and the Low Countries, but was allowed, on the other hand, to retain the German bishoprics of Metz, Toul, and Verdun, which had been conquered during the war. To confirm the peace, it had been arranged that Philip II., become a widower by the death of Mary of England, should marry Elizabeth, Henry's eldest daughter by his queen, Catharine de' Medici. In the course of a tourney held to celebrate the event, Henry, during an encounter with Lord Montgomery, captain of the Scottish guard, when both their lances were shivered, received a blow in the right eye, which shortly afterwards proved fatal. He was succeeded on the 10th of July, 1559, by his eldest son, under the title of Francis II.

HENRY III., King of France, the third son of Henry II. and Catharine de' Medici, was born in 1551 at Fontainebleau, and succeeded his brother, Charles IX., in 1574. In the previous year he had been chosen king of Poland, and when his brother's death called him to the throne of France the Poles were unwilling to part with him, so that he was obliged to make his escape by secret flight. He arrived in France just at the time when the Protestants had again taken up arms. Henry of Guise, general of the Catholics, gained the victory of Dorinans (in Marne) in 1575; but the new king, in order to put an end to a war which disturbed his pleasures, granted to the Protestants, in 1576, the edict of Beaulieu, the most favourable that they had yet received. The concessions made in this edict were much condemned by the Catholics, and led to the formation of the League, the influence of which triumphed in the estates assembled at Blois on the 16th of December, 1576. Perceiving this, Henry, although he feared the Catholics as much as the Protestants, declared himself the head of the League, thinking that this was the only way to re-establish his authority. Civil war now broke out again, but hostilities were again put an end to by a more favourable peace than the Protestants, from their success during the war, had any reason to expect, namely, the Peace of Bergerac, concluded in 1577; but as this did not satisfy the League, war broke out again in 1580, which was, however, promptly put an end to by the Peace of Fleix, concluded in November of the same year. The death of the Duc d'Anjou, the brother of the king, in 1584, was the cause of new embarrassments, as it made Henry of Navarre, a Calvinist, and hence extremely distasteful to the League, heir-apparent to the throne. The League now showed itself more active than ever. It compelled Henry, in the edict of Nemours (1585), to withdraw all the privileges that had been granted to Protestants, and then brought on another war, called the war of the Three Henries, from the circumstance that the leading persons engaged in it besides the king were Henry of Guise, the real head of the League, and Henry of Navarre. The defeat of Joyeuse, the king's favourite, at Coutras in 1587, increased the unpopularity of Henry III., who was expelled from his capital by Henry of Guise on the day of the Barricades in 1588. At a meeting of the states-general at Blois (October, 1588), where he was apparently reconciled to the Guises, he ordered their murder. Henry of Guise was assassinated December 23, while on his way to the royal cabinet, and his brother, the cardinal, was murdered the next day in prison. This murder decided the fate of Henry. Paris and several of the principal cities of the kingdom formally declared against him. Henry III. now saw no other remedy than a union with Henry of Navarre. The two princes besieged the capital, which was defended by the Duke of Mayenne (brother of Henry of Guise, and at that time the head of the League). Seventy-one doctors of the Sorbonne there declared the war against Henry of Valois (for so they called the king) justifiable. The pope promised the support of the church, and in Paris the murder of the tyrant was publicly preached. Henry was stabbed August 1, 1589, in the camp at St. Cloud, by a Dominican (Jacques Clement by name), a raving fanatic, and died the next day. Henry III. was the last of the branch of Orléans-Angoulême of the stock of the Valois, and was succeeded by Henry of Navarre, the first of the house of Bourbon.

HENRY IV. of France, son of Anthony of Bourbon, duke of Vendôme, and of Jeanne d'Albret, daughter of Henry, king of Navarre, and herself afterwards queen of Navarre. He was born in Dec. 1553, at Pau, in Béarn. Educated by his mother in the Calvinistic faith, he early joined, at her wish, the Protestant army of France, and served under Admiral Coligny. He was present at the battles of La Roche-Abeille, Jarnac, and Moncontour (1569). In 1572 he married Margaret of Valois, sister of Charles IX., and after the massacre of St. Bartholomew, which took place during the festivities in connection with this marriage, was forced to adopt the Catholic creed. For the next four years he was compelled to reside in Paris, but in 1576 he succeeded in making his escape, and after retracting, at Tours, the abjuration of Calvinism which had been extorted from him, put himself at the head of the Huguenots, and took a leading part in all the subsequent religious wars. He occupied a still more important position, when, in 1584, the death of the Duc d'Anjou, the brother of the king (Henry III.), made him presumptive heir to the crown, as descended from Robert, count of Clermont, the sixth son of Louis IX. Rejected by the Catholic party and the League as a heretic, Henry found himself obliged to resort to arms to assert his claims. In 1587, with an inferior force, he defeated the army of the League at Coutras. In 1589 he actually became king through the assassination of Henry III. But he found innumerable difficulties in establishing his claims. His Protestant religion was brought forward by all the competitors to prejudice the Catholics against him. At the head of the opposite party stood the Duke de Mayenne. Philip II. of Spain also claimed the French throne, and sent aid to the League. Henry IV. first defeated his enemies in the memorable battle of Arques (Sept. 1589), and completed their overthrow in the celebrated engagement of Ivri (March, 1590). In consequence of this victory Paris was besieged, and Henry IV. was upon the point of compelling the citizens to surrender by famine, when the Spanish general, Alexander, duke of Parma, by a skilful manœuvre, obliged him to raise the siege. Convinced that he should never enjoy quiet possession of the French throne without professing the Catholic faith, Henry at length yielded to the wishes of his friends, was instructed in the doctrines of the Roman Church, and professed the

Catholic faith, July 25th, 1593, in the church of St. Denys. He happily escaped an attempt to assassinate him; was solemnly anointed king at Chartres in 1594; and entered the capital amid the acclamations of the people. Only three provinces still held out against him, supported by Spanish troops. These were Burgundy, which Henry reduced by the victory of Fontaine-Française in 1595; Picardy, reduced by the capture of Amiens in 1596; and Brittany, which came into his hands by the submission of the Duke of Mercœur in the spring of 1598. The war against Spain was concluded in 1598, by the Peace of Vervins, to the advantage of France. The same year was signalized by the granting of the edict of Nantes, which secured to the Protestants entire religious liberty, and freed them from all political disabilities, and thus terminated a crisis in the history of France which had lasted for half a century, and threatened to ruin both the monarchy and the country. Henry made use of the tranquillity which followed to restore the internal prosperity of his kingdom, and particularly the wasted finances. In this design he was so successful, with the aid of his prime minister Sully, that 330,000,000 livres of the national debt were paid, and 40,000,000 laid up in the treasury. At the instance of Sully Henry dissolved his marriage with Margaret of Valois; the pope confirmed the divorce, and the king soon after married Maria de' Medici, niece of the Grand-duke of Tuscany. But the crafty, domineering, and ambitious Maria so imbittered the life of Henry by her constant jealousy, that he resolved more than once to dissolve his union with her; Sully, however, prevented him. The birth of an heir (Louis XIII.) for a while reconciled him with his wife. Being about to set out on an expedition to Germany, he decided that during his absence his wife should be regent; and he therefore caused her to be crowned at St. Denis in 1610. As Henry was riding through the streets of Paris, on the following day, to examine the preparations for the solemn entrance of the queen, his coach was obstructed in the street de la Feronnerie by two waggons. A fanatic, named Ravaillac, took advantage of this moment to perpetrate a long-meditated deed; he mounted the step of the coach, plunged a long two-edged knife twice into the heart of Henry, and thus ended the career of the best king France ever had. (See RAVAILLAC.) By his first wife Henry had no heir; by Maria, two sons and three daughters. By his mistresses, Gabrielle d'Estrées, Henrietta de Balzac (the Countess d'Entragues), Jacqueline (Countess of Moret), and Charlotte of Essarts, he had several children. The great benefits which Henry IV. bestowed upon France entitle him to the designation which he himself assumed at an assembly of the Notables at Rouen in 1596, the Regenerator of France (*Restaurateur de la France*). His benevolent mind, his paternal love to his subjects, his great achievements, his heart, always open to truth, though it exposed his own faults, have preserved his memory in the hearts of the nation; and his royal expression, 'I wish that every peasant might have a fowl in his pot on Sundays,' still lives in the mouths of the people; while his defects are charged to the dissoluteness of the age. To the end of his life he had to contend against the governors of provinces, Protestant as well as Catholic, who had rendered themselves almost independent under the last kings of the house of Valois. In order to re-establish the royal authority he found it necessary to hand over to the executioner his former friend and companion in arms, Marshal Biron, one of the victors at Fontaine-Française, who was accused of heading a conspiracy against the king (1602), and to commit the Count of Auvergne to the Bastille. He also deprived the Duke of Bouillon of the principality of Sedan, and only granted him his life at the intercession of Elizabeth, queen of England. Many of the acts of his internal government show that, while he aimed at restoring the prosperity of the nation by encouraging agriculture, commerce, and manufacturing industries, he was determined by all means in his power to strengthen the authority of the crown. He destroyed almost everywhere, but especially in the south, the municipal franchises which the League had revived or extended; he prohibited, under pain of death, the printing of any book which had not passed the royal censor; he required the parliament to register the edicts of the crown without remonstrance; and reformed the university in a direction which favoured monarchy. In his foreign policy Henry IV. revived the projects of Francis I. and Henry II. against the house of Austria, re-established the influence of France in the Catholic states of Italy, and after a war of little consequence with Savoy exchanged the worthless marquisate of Saluces for the provinces of Bresse, Bugey, Verbromey, and Gex, which were of importance as defending the French frontier on the side of Savoy, and intercepting the communication between that state and Franche Comté, which then belonged to Spain (Treaty of Lyons, 1601). He supported Holland in its revolt against Spain; allayed the bitterness of feeling between the Lutherans and the Calvinists, and induced them to form the Evangelical Union. Finally, in 1609, he made preparations for a war, the immediate and ostensible object of which was to restore to the Protestant heirs of the duchy of Clèves and Juliers the domains which had been seized by the Emperor Matthias, although Sully states, in his Memoirs, that these armaments were secretly designed for the carrying out of a wider plan, which aimed first at the humiliation of the house of Hapsburg and the entire alteration of the arrangement of the European states; and, secondly, at the formation of a grand Christian confederacy consisting of the states of Europe as they existed in the new organization, in which all the differences between the various states were to be settled by a European diet, and in which all forms of the Christian religion were to receive toleration, and enjoy equal political rights.

HENRY I., King of England, surnamed *Beauclerc*, youngest son of William the Conqueror, was born at Selby in Yorkshire, in 1068. He was hunting with William Rufus in the New Forest when that prince received his mortal wound in 1100. Henry instantly rode to London, and caused himself to be proclaimed king, to the prejudice of his elder brother Robert, then absent in the Crusade. To reconcile the people to his usurpation Henry issued a charter containing concessions to public liberty, which, however, operated little in restraint of his own government. He also performed another popular act, by recalling Anselm, archbishop of Canterbury. In November, 1100, he married Matilda, daughter of Malcolm III., king of Scotland. This union strengthened his party, when his brother landed an army in 1101, with a view of asserting his claim to the crown. Actual hostilities were prevented by Anselm, who induced Robert to accept a pension; and it was agreed that in the event of the death of either of the brothers without issue, the other should succeed to his dominions. This treaty did not prevent Henry from invading Normandy a short time after; and in 1106 he took Robert prisoner, and reduced the whole duchy. A contest with the Papal court, on the subject of investitures, ended in a compromise, by which he merely retained the right of temporal homage. His usurpation of Normandy involved him in continual war, which was very oppressive to his English subjects; but although William, son of Robert, escaped out of custody, and was as-

sisted by the King of France, Henry maintained possession of the duchy. His public prosperity was, however, counterbalanced by several domestic misfortunes. One of these was the loss at sea of his only son William, who was drowned in 1120 in returning from Normandy, together with his natural sister, whose cries recalled him to the sinking ship after he had got clear from it in the long-boat. Henry was never seen to smile afterwards. He had married his only daughter, Matilda, to the Emperor Henry V., and when she became a widow married her a second time to Geoffrey Plantagenet, son of the Count of Anjou. Henry died at Rouen in 1135, and was succeeded by Stephen.

HENRY II., King of England, the first of the line of the Plantagenets, born in Normandy in 1133, was the son of Geoffrey, count of Anjou, and the empress Matilda, daughter of Henry I. He early displayed an elevated character, and was invested with the Duchy of Normandy, by the consent of his mother, in 1150. The year following he succeeded his father in the possession of Anjou and Maine, and by a marriage with Eleanor of Guienne, just divorced from Louis VII., king of France, on a suspicion of infidelity, annexed that province with Poitou to his other dominions. Rendered thus potent he determined to pursue his claim to the crown of England against the usurpation of Stephen. His expedition for that purpose ended in a compromise, by which Stephen was to retain the crown during his life, and Henry to succeed at his death, which took place in 1154. The commencement of his reign was marked by the dismissal of the foreign mercenaries; and although involved with his brother Geoffrey, who attempted to seize Anjou and Maine, and in a temporary dispute with France, he reigned prosperously till the memorable contest with Thomas Becket. Anxious to repress the usurpation of the clergy, Henry in 1164 summoned a general council of nobility and prelates at Clarendon, which assembly passed the famous constitutions named from that place, the effect of which was to render the church and ecclesiastical dignitaries subject to the temporal authority. (See CLARENDON, CONSTITUTIONS OF.) The consequences of the reluctant subscription of Becket to these articles in the first instance, and his subsequent conduct, have been already related in the life of Becket. A prince of less power and policy than Henry might have yielded to the storm which followed; but although sufficiently submissive in the way of penance and expiation, he only gave up the article in the Constitutions of Clarendon which forbade appeals to the court of Rome in ecclesiastical cases, and even in that case reserved the right of exacting sufficient security from all clergy who should leave the country in prosecution of such appeals. Before this matter was terminated, Henry, in 1171, armed with a bull obtained in 1155 from Pope Adrian IV., whose authority to give away kingdoms, in this instance, he did not dispute, undertook an expedition into Ireland, a great part of which, owing to the disputes of its native chieftains, had been reduced by some private adventurers, conducted by Richard de Clare, earl of Pembroke, commonly known as Strongbow. The king found little more to do than to make a progress through the island to receive the submission of the Irish princes; and having left Earl Richard in the post of seneschal of Ireland he returned to England—proceedings so important to the future destinies of both countries having occupied only a few months. Being an indulgent father Henry had assigned to each of his four sons a provision out of his extensive territories. The eldest son, Henry, was not only declared heir to England, Normandy, Anjou, Maine, and Touraine, but actually crowned in his father's lifetime. On paying a visit to the court of his father-in-law, Louis VII. of France, the prince was induced by the French monarch to demand of his father the immediate resignation either of the Kingdom of England, or of the Dukedom of Normandy. This extraordinary request being refused he withdrew from his father's court, and was openly supported in his claim by Louis. Henry's various gallantries, exemplified in the popular and not altogether unfounded legend of fair Rosamond, or Rosamond Clifford, also embroiled him with his Queen Eleanor, who excited her other sons, Richard and Geoffrey, to make similar claims, and imitate the example of their elder brother. Many potent barons and nobles in the respective provinces were thus withdrawn from their allegiance, and Louis, king of France, William, king of Scotland, and other powers, lent spirit to the confederacy. A general invasion of Henry's dominions was in this way concerted, and began in 1173 by an attack on the frontiers of Normandy, where he opposed the storm with vigour. In the meantime the flame had broken out in England, which was overrun with malcontents, while the King of Scots made an incursion into the north. Henry, in consequence, hastened home, and to conciliate the clergy passed a day and night of penance at the tomb of Becket. His absolution was followed by the news of the seizure of King William of Scotland by Ranulf de Glanville. The spirit of the English malcontents being thus broken they rapidly submitted; and Henry, returning to Normandy, entered into an accommodation with his sons on less favourable terms than they had previously rejected; nor did the King of Scotland gain his liberty without agreeing to do homage, and yield up some fortresses. The pause obtained by these exertions of vigour and ability Henry employed in regulations and improvements which equally manifest his capacity and love of justice. He checked the prevailing licentiousness by severe laws, partitioned England into four judiciary districts, and appointed itinerant justices to make regular excursions through them. He revived trial by jury, discouraged that by combat, and demolished all the newly erected castles as shelters of violence and anarchy. The turbulence of his sons still disquieted him; but Henry, the eldest, who had engaged in a new conspiracy, was cut off by a fever in 1183, after expressing great contrition for his disobedience; and three years after, the death of the equally restless Geoffrey also released the king from newly meditated hostilities. Philip Augustus, then king of France, however, continued to foment the differences between Henry and his sons, and Richard was again prompted to rebel. A war between the two crowns followed, the event of which was so unfavourable to Henry, that he was at length obliged to agree that Richard should receive an oath of fealty from all his subjects. He also stipulated to pay a sum of money to the French king, and to grant a pardon to all Richard's adherents. The mortification of Henry at these humiliating terms was aggravated to despair when he saw the name of his favourite son John at the head of the list of delinquents whom he was required to pardon. The anguish of his mind threw him into a low fever, which put an end to his life at the castle of Chinon, near Saumur, on the 6th of July, 1189. He was buried in the church of Fontevraud. Henry II. ranks among the greatest kings of England, not only in extent of dominion, but in all the qualities which give lustre to authority, being equally fitted for public life and for cultivated leisure. He was manly in person, gifted with ready elocution, and possessed warm affections. His wisdom and love of justice were acknowledged by foreign potentates, who made

him arbiter of their differences, and regarded him as the first prince of the age.

HENRY III., King of England, son of John, was born at Winchester in 1207, and succeeded his father in 1216. At the time of his accession the country was in a state of lamentable distraction. The Dauphin of France, Louis, at the head of a foreign army, supported by a faction of English nobles disgusted with the conduct and tyranny of John, had assumed the reins of government; but being justly suspected of arbitrary intentions, was become odious to the body of the people. The cause of the young king, then only nine years of age, was espoused by the Earl of Pembroke, whose prudent government as regent in a short time compelled Louis to sue for peace, and quit the country. As Henry approached to manhood he displayed a character wholly unfit for his station. One of his first false steps was to discard his most faithful and able minister Hubert de Burgh. In 1230 he received homage in Poitou and Gascony, and from that time he began to bestow his chief favours upon foreigners, a circumstance which naturally produced great jealousy among his English subjects. His chief minister was Peter de Roches, bishop of Winchester; but he was dismissed in 1234, and his place supplied by Edmund Rich, archbishop of Canterbury. In 1236 Henry married Eleanor of Provence, which increased the dislike which his subjects already felt towards him; for she brought a new train of foreigners to the court, and encouraged her husband in the extravagant courses to which he was of himself sufficiently inclined, and which forced him to all kinds of oppressive exactions to raise money. He received frequent grants of money from Parliament, but always on the condition of confirming the Great Charter, which had been extorted from King John. Henry nevertheless continued after each ratification to act as arbitrarily as he had done before, and at length raised the national discontent to such a pitch that the nobles rose in rebellion under Simon de Montfort, the earl of Leicester, the husband of the king's sister; and in 1258, at a Parliament held at Oxford, known in history as the Mad Parliament, obliged the king to sign a body of resolutions, which threw all the legislative and executive power into the hands of an aristocracy of twenty-four barons, assisted by a lower house, consisting of four knights chosen from each county. The aristocracy, as usual, soon displayed a spirit which united both king and people against them, and the former was absolved by the pope from his oath to observe the provisions of Oxford. By the aid of his able and spirited son Edward Henry was gradually restored to authority; on which Leicester, calling in Llewellyn, prince of Wales, involved the kingdom in a civil war. The power of the barons was by this means partially restored; but great divisions prevailing, both parties agreed to abide by the award of Louis IX., king of France. The award of this monarch, given in 1264, being favourable to the king, Leicester and the confederate barons refused to submit to it, and a battle was fought near Lewes, in which Henry and his brother Richard, king of the Romans, were taken prisoners, and the person of Prince Edward also ultimately secured. A convention ensued, called *the Mise of Lewes*, which provided for the future settlement of the kingdom; but in the meantime Leicester ruled without control. To him, however, was owing the first example of a genuine House of Commons in England; for in a Parliament summoned by him in 1265, deputies from boroughs were sent, as well as knights of shires. Prince Edward at length escaped, and, assembling an army, defeated Leicester's son. The decisive battle of Evesham (1265) quickly followed, in which Leicester himself was slain; and the king, then in the hands of the rebels, being placed in the front of the battle, narrowly escaped with his life. Replaced upon the throne he remained as insignificant as ever, and the departure of his son for the Holy Land was the signal for new commotions, which were, however, terminated by his death in 1272, in the sixty-fourth year of his age, and the fifty-sixth of his reign, the longest in English history, except those of George III. and Victoria. He was succeeded by his son Edward I.

HENRY IV., King of England, the first king of the house of Lancaster, was born at Bolingbroke in 1367, being the eldest son of John of Gaunt, duke of Lancaster, fourth son of Edward III. by the heiress of Edmund, earl of Lancaster, second son of Henry III. In the reign of Richard II. he was made Earl of Derby and Duke of Hereford, and while bearing the latter title appeared in the Parliament of 1398, and preferred an accusation of treason against Mowbray, duke of Norfolk. The latter denied the charge, and offered to prove his innocence by single combat, which challenge being accepted, the king appointed the lists at Coventry; but on the appearance of the two champions at the appointed time and place, Richard would not suffer them to proceed. Both were banished the kingdom, Norfolk for life, and Hereford for ten years, shortened by favour to four, with the further privilege of immediately entering upon any inheritance which might accrue to him. On the death of John of Gaunt in 1399 he succeeded to the dukedom of Lancaster, and laid claim, according to agreement, to the great estates attached to it; but the fickle and imprudent Richard recalled his letters patent, and retained possession of the estates, soon after which he departed for Ireland. The duke, disregarding the unfinished term of his exile, embarked in July, 1399, at Nantes, and landing with a small retinue at Ravenspur in Yorkshire, made oath on his landing that he only came for the recovery of his duchy. He was quickly joined by the Earls of Northumberland and Westmoreland, the most potent barons of the north, and soon found himself at the head of 60,000 men. The Duke of York, acting as guardian in the king's absence, was unable to oppose him; and marching to Bristol, he took upon himself to execute some of the most odious of Richard's ministers without trial. The latter, on the report of these transactions, landed at Milford Haven with an army which soon melted away by desertion; and falling into the hands of his enemies, he was brought to London by the duke, who now began openly to aim at the crown. A resignation was first obtained from Richard, who was then solemnly deposed in Parliament; and Henry was unanimously declared lawful king under the title of Henry IV. In the beginning of his reign, in order to ingratiate himself with the clergy, Henry promoted a law (*de hæretico comburendo*) for committing to the flames persons convicted of the heresy of the Lollards. The death of Richard (it is supposed by violence) soon removed a dangerous rival; yet a short time only elapsed before the turbulent nobles rebelled against the king of their own creation. The first plot, in 1400, was discovered in time to prevent its success, and many executions of men of rank followed; but an insurrection in Wales, under Owen Glendower, proved more formidable. That chieftain having captured Mortimer, earl of March, who was descended from Lionel, duke of Clarence, the second son of Edward III., and therefore the lineal heir to the crown, Henry would not suffer his relation, the Earl of Northumberland, to treat for his ransom. He thus offended that powerful nobleman, who, however, with his son, the famous Hotspur, subsequently served the king effectually against the Scots, whom they

defeated at Homildon, capturing their famous leader, the Earl of Douglas (1402). An order from Henry not to ransom that nobleman and the other Scottish prisoners, whom he wished to reserve as hostages, completed the disgust of the Percies; and the fiery temper of the younger Percy being especially roused by these indignities, he immediately set free his prisoner Douglas after making an alliance with him, and marched with all the partisans of his house towards Wales to join Glendower. The king met the insurgents at Shrewsbury, and a furious battle ensued, July 21, 1403, which ended in the death of Percy and the defeat of his party. The king, who fought in the foremost ranks, was several times in great danger, and his eldest son, afterwards the conqueror of France, here first distinguished himself. Henry was merciful in this instance. The Earl of Northumberland, whom sickness had prevented from joining his son, was pardoned, and but few victims were executed. A new insurrection, headed by the Earl of Nottingham and Scrope or Scroop, the archbishop of York, broke out in 1405, which was suppressed by the king's third son, Prince John, who, by a pretended agreement, induced the leaders to disband their forces, and then apprehended them. The archbishop afforded the first example in this kingdom of a capital punishment inflicted upon a prelate; and the chief-justice, Sir William Gascoigne, deeming it unlawful, a less scrupulous judge supplied his place. The rest of this king's reign was comparatively untroubled. In 1405 James, son and heir to King Robert of Scotland, was casually captured at sea while on his way to France, and was detained a prisoner in England by the king. Henry died in March, 1413, and was succeeded by his son of the same name.

HENRY V., King of England, was born at Monmouth in 1387, and succeeded his father, Henry IV., in 1413. His dissipated youth, and fondness for joviality and low company, gave his father much uneasiness; but circumstances occurred, even in the midst of his wildness, which showed that better principles were latent in his mind. His conduct when he ascended the throne justified the best expectations. He restored their estates to the Percies, and liberated the Earl of March, who had nearer claims by descent upon the throne than Henry himself, from prison; and although the persecution of the Lollards forms a blot upon the early part of his reign, it is probable that in permitting this to go on Henry did not so much follow his own inclination as submit to the dictates of the clergy. The circumstances of France, torn asunder by the opposing factions of the Dukes of Orleans and Burgundy, afforded a tempting opportunity to an ambitious neighbour. Henry was easily induced to revive the claims of his predecessors upon that country. He accordingly assembled a great fleet and army at Southampton, and was on the point of embarkation when discovery was made of a dangerous conspiracy against his son, headed by the Earl of Cambridge, who had married a sister of the Earl of March, and sought to assert the rights of that family. The conspirators were capitally punished after an irregular trial. The king then proceeded on his expedition, and landed near Harfleur, August 14, 1415. He took that town after a siege which so much reduced his army that he was advised to return to England by sea. But Henry rejected this advice, and determined to march on Calais. On his way thither he was met on the plain of Agincourt by a French army ten times as numerous as his own. A battle took place there on the 25th of October, in which the French host was totally defeated, with a comparatively trifling loss on the side of the English. Henry did not alter his determination to return home, and the dread of his arms was the chief advantage which he reaped from his victory. A peace taking place for two years, France was left to her own dissensions, until at length, in 1417, the liberal grants of the Commons enabled Henry once more to invade Normandy with 25,000 men. To an application for peace he made a reply which showed that he sought nothing less than the crown of France; but in a negotiation with Queen Isabella he offered to accept the provinces ceded to Edward III. by the Treaty of Brétigny. The negotiation was broken off by the assassination of the Duke of Burgundy, which induced his successor to join Henry. This alliance was soon followed by the famous Treaty of Troyes (May 21, 1420), made with the French king in a state of imbecility, or rather with his queen and the Burgundian faction. By this treaty Henry engaged to marry the Princess Catharine, and to leave Charles in possession of the crown, on condition that it should go to Henry and his heirs at his decease, and be inseparably united to the crown of England. Henry, after espousing Catharine, took possession of Paris, and then went over to England to raise recruits for his army. During his absence his brother the Duke of Clarence was defeated by an army consisting mainly of Scotch troops commanded by the Earl of Buchan. In 1421 Henry himself returned to France, and his presence secured to the English arms their wonted success. A son was at this time born to him, and all his great projects seemed about to be realized, when he was attacked by a disease which carried him off in August, 1422, at the age of thirty-four, and in the tenth year of his reign. He was succeeded by his son Henry VI. Henry V., as the gallant, youthful, and successful conqueror of France, is a favourite name in English history; but he was inferior in wisdom and solid policy to many of his ancestors. His reign was consumed in ambitious pursuits, which, while they inflicted great misery on France, entailed much misfortune upon his own country.

HENRY VI., King of England, born at Windsor in 1421, crowned at Westminster in Nov. 1429, at Paris in Dec. 1430. As he was an infant not nine months old at the death of his father Henry V., John, duke of Bedford, a brother of the late king, was appointed Regent of France; and Humphrey, duke of Gloucester, another brother of the same, Protector of the realm of England, with a council at his side appointed by Parliament. In October, 1422, a few weeks after Henry's succession, Charles VI. of France died, when, according to the provisions of the Treaty of Troyes, Henry was proclaimed King of France. But the French did not quietly submit to the treaty being carried out, and a war began which at first proved favourable to the English, but in the end, after they had been roused to more effectual efforts by the heroism of Joan of Arc (1428–30), and after the English cause had suffered by the death of the Duke of Bedford (September, 1435) and the simultaneous defection of the Duke of Burgundy, resulted in the almost total loss to the English of their possessions in France. In 1453 nothing remained to them in that country but Calais. In April, 1445, Henry married Margaret of Anjou, daughter of René of Provence. Two years later Humphrey of Gloucester died, when the Earl of Suffolk acquired the chief power in the kingdom, and was created first marquis and then duke. His government was very unpopular, which caused the people to look to the claim of Richard, duke of York, whose mother, heiress of the house of Mortimer, transmitted to him the best title to the crown by inheritance. The insurrection of Cade followed, and the Duke of York returning from Ireland, a great party was

formed in his favour, headed by some of the principal nobility. He was thereby enabled to remove his enemies from the king's person, and was by Parliament declared Protector of the kingdom, the imbecile Henry being by this time unable even to personate majesty. The York and Lancaster parties were now in such a state that the sword only could decide between them; and that course of civil contention commenced, the first bloodshed in which occurred at St. Albans in May, 1455, and as far as the reign of Henry was concerned, the last in the battle of Tewkesbury in 1471. (For a somewhat more detailed account of this struggle see EDWARD IV.) When the latter took place the king was a prisoner in the Tower, where he soon after died, but whether by a natural or violent death is uncertain, although popular opinion assigned it to the violence of Richard, duke of Gloucester. Henry was gentle, pious, and well-intentioned, but too weak to act for himself. Eton College reveres Henry as its founder, as does likewise King's College, Cambridge.

HENRY VII., King of England, first sovereign of the house of Tudor, was born in 1457. He was the son of Edmund, earl of Richmond, son of Owen Tudor and Catharine of France, widow of Henry V. His mother, Margaret, was the only child of John, duke of Somerset, grandson of John of Gaunt. After the battle of Tewkesbury he was carried by his uncle, the Earl of Pembroke, to Brittany, to seek refuge in that court from the jealousy of the victorious house of York. On the usurpation of Richard the young Earl of Richmond was naturally turned to as the representative of the house of Lancaster. In 1485 Richmond assembled a body of troops in Brittany, and landed at Milford Haven, with no more than 2000 hired foreign adventurers. He was immediately joined by some leaders of rank, but had only 6000 men when Richard met him at Bosworth, with an army twice as numerous in appearance; but the defection of Lord Stanley with his forces, who joined Richmond during the battle, obtained for the latter a complete victory. Henry was proclaimed king on the field of battle, and his right was subsequently recognized by Parliament. In 1486 he married Elizabeth, daughter of Edward IV., and heiress of the house of York, and thus united the claims of the rival houses of York and Lancaster. The reign of Henry VII. was troubled by repeated insurrections. The first was headed by Lord Lovel and the Staffords, but was soon suppressed. The imposture of Lambert Simnel, who, by the contrivance of Simon, a priest, was made to personate the Earl of Warwick, son to the Duke of Clarence, whom Henry kept confined in the Tower, followed. But Henry having publicly shown the true Earl of Warwick in the streets of London, little credit was given to the impostor, and the king, collecting an army, met the rebels at Stoke, in Nottinghamshire, and totally defeated them (June, 1487). Henry spared the impostor Simnel, and displayed his insignificance by making him a scullion in his kitchen. The project of France for annexing the province of Brittany, by marriage with the heiress, induced Henry to declare war, but his measures were so tardy and parsimonious that the annexation was effected. He then raised large sums on the plea of the necessity for hostilities; and landing a numerous army at Calais in 1492, almost immediately accepted a large compensation for peace. The Duchess-dowager of Burgundy, governess of the Low Countries, had encouraged the imposture of Simnel, and now brought forward Perkin Warbeck, said to be the son of a converted Jew at Tournay, and a youth of parts and prepossessing figure. This young man gave himself out to be Richard Plantagenet, the younger of the two sons of Edward IV., supposed to have been murdered in the Tower of London, and the justice of his claim has been maintained even by some historians of a recent date. The duchess professed to be satisfied with the proofs of his identity, and acknowledged him as her nephew. He obtained assistance from France, Scotland, and Ireland, and in 1497 took advantage of a rising which had taken place in Cornwall to land there, and revive the rebellion which had by that time been suppressed. He was so far successful as to secure a large following, with which he marched to Taunton; but there his heart failed him, and he fled. After being captured by Henry he was forced to confess himself an impostor, and was then committed to the Tower, where he became acquainted with the Earl of Warwick, and persuaded him to accompany him in an attempt to escape. They were both retaken, and Warwick was recommitted to the Tower and Perkin Warbeck hanged at Tyburn (1499). Soon after, the king fixed an indelible stain on his memory by ordering the Earl of Warwick also to be executed, for merely attempting to regain that liberty of which he ought never to have been deprived. Firmly settled upon the throne, Henry now gained a high character among his brother monarchs, many of whom sought his friendship and alliance; and among these was Ferdinand, king of Arragon, a prince in crafty and cautious policy very much like himself. After a long negotiation he brought about a match between the Infanta Catharine, daughter of this sovereign and of Isabella of Castile, and his eldest son Arthur; and on the death of the latter, in order to retain the dowry of this princess, he caused his remaining son Henry to marry the widow by Papal dispensation, an event which, in the sequel, led to a separation from the see of Rome. He married his eldest daughter to James IV., king of Scotland, from which union there ultimately resulted the union of the two crowns. In the latter years of his reign especially, Henry showed himself remarkably avaricious, and never omitted his favourite pursuit of filling his coffers, employing Empson and Dudley, who practised all sorts of extortion and chicanery for this end. He died at his palace of Richmond in April, 1509, in the twenty-fourth year of his reign and fifty-second of his age. The reign of Henry VII. was, upon the whole, beneficial to his country. Being conducted upon pacific principles it put a period to many disorders, and gave an opportunity to the nation to flourish by its internal resources. His policy of depressing the feudal nobility, which proportionably exalted the middle ranks, was highly salutary; and it was especially advanced by the statute which allowed the breaking of entails and the alienation of landed estates. Many other beneficial provisions also date from this reign, which, however, was very arbitrary; and the power lost by the aristocracy for a time gave an undue preponderance to that of the crown.

HENRY VIII., King of England, son of the preceding, was born in 1491, and succeeded his father in 1509. His education had been rather that of a scholar than of a prince; but a handsome person and a frank and spirited manner rendered him the object of popular attachment, especially as successor to a sovereign so little beloved as Henry VII. No prince could succeed to a throne under happier circumstances possessing an undisputed title, a full treasury, and a kingdom flourishing in the bosom of peace. His disposition for show and magnificence soon squandered the hoards of his predecessor; and his vanity made him an early object of foreign artifice. He was prevailed upon by Pope Julius II. and his father-in-law, Ferdinand of Arragon, to join in a league formed against Louis XII. of France. Some campaigns in France followed, but the success of the English at

the Battle of the Spurs (1513), so called from the flight of the French, was succeeded by no adequate result, the taking of Tournay being the only fruit of this expensive expedition. Meantime, more splendid success attended the English arms at home. James IV., king of Scotland, having made an incursion with a numerous body of troops into England, was completely defeated and slain at the battle of Flodden Field. Henry, however, granted peace to the Queen of Scotland, his sister, and established an influence which rendered his kingdom long secure on that side. Finding himself deluded by his allies, he soon after made peace with France, retaining Tournay, and receiving a large sum of money. The aggrandizement of Cardinal Wolsey now began to give a leading feature to the conduct of Henry, that prelate being appointed chancellor in 1515. His favour was now sought by Maximilian I., emperor of Germany, who hoped to secure the support of England against France, and as Wolsey was at first neglected by the French king the German emperor gained his point; but when Maximilian was succeeded by Charles V., the hereditary king of Spain as well as the emperor of Germany, Francis found it expedient to gain Wolsey, and for that purpose entered into an amicable correspondence with them. In order to cement this new friendship the two monarchs had an interview near Calais, the magnificence of which gave the place of meeting the denomination of the *Field of the Cloth of Gold* (1520). Notwithstanding these indications, a prospect of the papacy being artfully held out to the cardinal by the young emperor Charles, his interest at length gained a preponderance in the English councils. The principles of the Reformation, propagated by Luther, were now making rapid strides, and Henry himself wrote a Latin book against the tenets of Luther, which he presented to Pope Leo X., who favoured him in return with the title of *defender of the faith*. Luther published a reply, in which he treats his opponent with little ceremony. Charles V. paid a visit to England in 1522, and induced Wolsey and Henry to declare war against France, which was invaded by an English and Flemish army, under the Earl of Surrey, but this invasion led to no more important consequences than the last. After being married to Catharine for about eighteen years, Henry had begun to feel some scruples as to the validity of the marriage, on the ground that she had previously been his brother's wife, and his scruples were no doubt increased by the fact of his having conceived a passion for Anne Boleyn, one of the queen's maids of honour. He accordingly applied in 1527 to Pope Clement VII. for a divorce, and the pope appointed the two cardinals Wolsey and Campeggio to try the case. Wolsey had at first been favourable to the project of a divorce, because he hoped by this means to detach Henry from his alliance with Charles V., who he now perceived, while pretending to support his claims to the papacy, was really thwarting his ambition; but when he perceived the desire of Henry to marry Anne Boleyn, fearing that this marriage would result in winning over Henry to the side of the reformers, since Anne Boleyn's friends belonged to that party, he did all in his power to prolong the inquiry, until the commission was at last withdrawn, and it was decided by the pope that the case should be tried at Rome. This procrastination on Wolsey's part led to his own ruin, and the action of the papacy led to the overthrow of the Papal authority in England. Henry, disgusted at these delays, eagerly caught at the advice of Thomas Cranmer, afterwards Archbishop of Canterbury, to refer the case to the universities, from whom he soon got the decision which he desired. In May, 1533, his marriage with Catharine was declared null, and as he had by that time privately married Anne Boleyn, this second marriage was a few days later declared lawful; and as these decisions were not recognized by the pope, an act of Parliament was obtained in the following year (1534), setting aside the authority of the chief pontiff in England, which was followed by another in 1535 declaring Henry the supreme head of the church. Thus was effected the great revolution by which, in ecclesiastical annals, this reign is so much distinguished. The birth of a daughter by the new queen produced a bill for regulating the succession, which settled it on the issue of this marriage, and declared the king's daughter by Catharine illegitimate. But although Henry discarded the authority of the Roman Church, he adhered to its theological tenets. While, on the one hand, he executed Bishop Fisher and Sir Thomas More (who had been appointed chancellor after the fall of Wolsey) for refusing the oath of supremacy, he displayed an aversion to the principles of the reformers, and brought many of them to the stake. His temper also grew more stern and arbitrary as he advanced in years, and his reign from this period was that of a despot who sacrificed every obstacle to his capricious will. Finding that the monks and friars in England were the most direct advocates of the Papal authority, and that they operated most influentially to create dissatisfaction among the people, he suppressed the monasteries by act of Parliament, and thereby inflicted an incurable wound upon the Catholic religion in England. The revenues of these opulent establishments were granted to the crown, which, however, was not proportionably enriched, as Henry lavished many grants of land upon his courtiers, and besides settling pensions upon the retained abbots, friars, and monks, erected six new bishoprics. Another step which promoted the Reformation was a new translation of the Scriptures into the vernacular tongue. The fall of Anne Boleyn was, however, unfavourable for a time to the reformers. Henry then married Jane Seymour, and the birth of Prince Edward in 1537 fulfilled his wish for a male heir, although his joy was abated by the death of the queen. Henry now resolved to marry again, and Cromwell, a Protestant, a favourer of the Reformation, who had succeeded More as first minister, recommended Anne of Cleves. The marriage took place in Jan. 1540, and Henry created Cromwell Earl of Essex; but his dislike to his new wife hastened the fall of that minister, who was condemned and executed upon a charge of treason. At the same time Henry procured from the convocation and Parliament a divorce from Anne of Cleves. He then married Catharine Howard, niece to the Duke of Norfolk—a union which brought him more under the influence of the Catholic party, and a rigorous persecution of the Protestants followed. Catholics who denied his supremacy were treated with equal severity. Henry now found that his new queen, of whom he was very fond, had proved false to his bed, and on further inquiry her conduct before marriage was discovered to have been loose and criminal. The king burst into tears when informed of these facts, but his grief quickly turned into fury, and she was accused and brought to the block in 1542. In 1543 he married his sixth wife, Catharine Parr, widow of Lord Latimer, a lady of merit, secretly inclined to the Reformation. This queen fell into great danger through the intrigues of the Catholic party, but found means to avert the consequences. Disease now so much aggravated the natural violence of Henry that his oldest friends fell victims to his tyranny. The Duke of Norfolk, his most trusted and successful general, and the accomplished Earl of Surrey, his son, were committed to the Tower. The latter was

tried for an alleged correspondence with Cardinal Pole, and on an absurd accusation of treasonably quartering a portion of the royal arms, and executed. The Duke of Norfolk, however, escaped through the accident of the king's death happening the day before that appointed for his execution, Jan. 28, 1547. Henry was succeeded by his son, Edward VI. As impressively depicted by the dying words of Wolsey, the chief characteristic of Henry VIII. was love of sway. This passion, which was at first compatible with generosity and feeling, at length produced an excess of pride, impatience, and intolerance, which extinguished the sentiments of humanity, and rendered him violent and sanguinary in the extreme. He made himself so much feared that no English king had fewer checks to his power; and liberty and constitutional equipoise were out of the question during the whole of his reign, or, what is worse, the forms of them were rendered purely subservient to his passions. No hand less strong than his could have so suddenly snapped the chain which bound the nation to the Papacy. The complete union of Wales with England, and the conversion of Ireland into a kingdom, date from the reign of Henry.

HENRY, MATTHEW, an English Nonconformist divine, author of Expositions on the Bible, was a native of Flintshire, and was born in 1662, received the early part of his education under his father, who was also a Dissenting clergyman, and studied for some time at an academy established at Islington. With the view of studying law as a profession he entered himself at Gray's Inn; but still he continued the study of the Scriptures, and assiduously attended the sermons of Stillingfleet and Tillotson. In 1686, having qualified himself for the ministry, he began to preach; and in the succeeding year he was settled as pastor to a congregation of Dissenters at Chester, and continued with exemplary zeal and success to discharge the duties of his office for twenty-five years, when he was removed to Hackney, in the vicinity of London, where his clerical labours were still more extended. He died of apoplexy at Nantwich in 1714, while on his return from a visit to his old congregation in Cheshire. The works published by Henry furnish sufficient proof of his learning and knowledge. He was an elegant and pathetic preacher, and he was not less distinguished by the warmth of his piety and the amiableness of his manners. Besides his greatest work, Expositions on the Bible, in five vols. folio (1710), he was the author of A Discourse on Schism, A Biographical Sketch of his father, A Scripture Catechism, Family Hymns, and several religious tracts.

HENRY, ROBERT, D.D., a Scottish divine and historian, was a native of Stirlingshire, and was born in 1718, received the early part of his education at his native village St. Ninians and at Stirling, and completed his studies at the University of Edinburgh. In 1748 he became minister of a Dissenting congregation at Carlisle, where he remained for twelve years, when he was called to Berwick, from which he removed in 1768 to Edinburgh, where he was appointed minister of New Grayfriars' Church. In 1776 he exchanged New for Old Grayfriars'. He died in 1790. He made a bequest of his library to the magistrates of Linlithgow, in the vicinity of which he had long resided during the summer season, to be the foundation of a public library for the use of the inhabitants. The first volume of his History of England upon a New Plan was published in 1771, and it excited a great deal of ill-natured criticism from a party of his countrymen, who used every exertion to detract from its merits. But he steadily continued in the prosecution of his design; and four other volumes were published during his lifetime, the last in 1785. He had prepared for the press a sixth volume, which brings down the history to the reign of Henry VIII., and which was published in 1793, with the author's life prefixed. The different periods embraced by Dr. Henry's History of Great Britain are arranged under seven heads:—1. The civil and military history; 2. The history of religion; 3. The history of our constitution, government, laws, and courts of justice; 4. The history of learning, learned men, and seminaries of learning; 5. The history of arts; 6. The history of commerce, shipping, money or coin, and of the price of commodities; 7. The history of manners, customs, language, dress, and amusements.

HENRY OF HUNTINGDON, an English historian, born towards the end of the eleventh century, and educated under Alcuine of Anjou, a canon of Lincoln Cathedral. He was made Archdeacon of Huntingdon, whence he derived his name. In his youth he cultivated poetry, and afterwards, at the request of his patron, the Bishop of Lincoln, composed a general history of England from the earliest times down to his own day. His history, which is in eight books, was edited (with an introduction) for the Rolls Series in 1879 by Mr. Thomas Arnold. The early part of the history was compiled from older writers, the contemporary part from materials of his own. Wharton has published a letter of Henry's, De Mundi Contemptu, which contains many curious contemporary anecdotes of kings, nobles, and prelates. There is a Latin poem by him in the Bodleian Library on the death of King Stephen and the arrival of Henry II. in England, which Wharton says is far from contemptible. Two MSS. of a collection of his works by himself in twelve volumes are in the archiepiscopal palace at Lambeth. The time of his death is not known, but he must have been alive in 1154.

HENRY THE LION, the most remarkable prince of Germany in the twelfth century, was born in 1129, and belonged to the celebrated family of the Guelfs. His father died in 1139 of poison. The son inherited with the large possessions the numerous feuds of his father. In 1146 Henry assumed the government of Saxony. At the diet of princes in Frankfort (1147) he demanded restitution of Bavaria, which had been taken from his father by the Emperor Conrad VII., and given to an Austrian prince. The emperor refused, and a war ensued. After Conrad's death the Emperor Frederick I., cousin of Henry the Lion, restored Bavaria to him in 1154, and Henry was then at the height of his power. His possessions extended from the Baltic and the North Sea to the Adriatic. Henry soon became involved in disputes with the clergy, who formed a confederacy at Merseburg in 1166; but Henry overcame them. About two years afterwards he separated from his wife and married Matilda, daughter of Henry II. of England. He then went on an expedition to the Holy Land, and during his absence his enemies, and even the emperor, made encroachments on his dominions. In 1174, at the head of a large body of troops, he followed Frederick I. on his fifth expedition to Italy, but left him at the siege of Alessandria. In consequence of his quarrel with the emperor, and his non-appearance after being summoned before three diets, he was put under the ban of the empire. His dominions were given to other princes. Henry defended himself, for a time, successfully; but he was at last obliged to take refuge with his father-in-law in England. In 1182 he asked pardon of the emperor on his knees, and Frederick promised him that he should retain his hereditary possessions, Brunswick and Lüneburg; but he was obliged to

leave Germany for three years, and he accordingly returned to England. He returned in 1184, and lived for some time on his possessions undisturbed; but Frederick, when about to set out on his crusade to the Holy Land, suspicious of the proud and high-minded Henry, obliged him to go once more to England for three years, or to follow him to Palestine. He preferred the first; but as the promise to leave his hereditary possessions undisturbed was violated he went back (1189) and conquered many cities. A reconciliation was at last effected between the contending parties. His eldest son had married Agnes, the niece of Frederick I., and this connection of a descendant of the mightiest Guelf with the greatest Ghibelline seemed to be the signal for a termination of the old quarrel. The quarrel between the emperor and Henry was concluded, and he died in peace at Brunswick, 1195. His tomb is still to be seen there. Henry was noble-minded, brave, and indefatigable, but stubborn, proud, and passionate. Though constantly engaged in a struggle with the clergy he was pious. He was much in advance of his age in fostering industry, science, commerce, and the arts.

HENRY THE NAVIGATOR (*Dom Henrique El Navegador*), the fourth son of King John I. of Portugal, was born in 1394. Portugal was then tranquil and prosperous, the people were active and enterprising, and the ambition of discovery and conquest almost universal. The infant Henry especially distinguished himself by his zeal. The generous youth gave early and brilliant proofs of courage. His love of arms, however, was surpassed by his love of the sciences, particularly mathematics, astronomy, and navigation. When the Portuguese conquered Ceuta in 1415 Henry distinguished himself by his bravery, and was knighted by his father, after whose death he chose for his residence the city of Sagres, in Algarve, near Cape St. Vincent, and vigorously prosecuted the war against the Moors in Africa. He erected at Sagres an observatory and a school, where young noblemen were instructed in the sciences connected with navigation. From time to time he sent vessels on voyages of discovery to the coasts of Barbary and Guinea; these expeditions, however, produced at first no important results. In one of these voyages Tristam Vaz and Gonçales Zarco discovered the Islands of Puerto Santo and Madeira, which were soon after colonized; and some years later Gonçales Velho Cabral, also sent out by Henry, discovered the Azores. It was some time, however, before any further advances were made in the exploration of the coast of Guinea, and Henry had to put up with much ignorant opposition in carrying out his purposes in this quarter. Cape Nun, it was affirmed, was the limit put by God to the ambition of man. Henry heard all the objections of his short-sighted opposers with calmness and equanimity. Gilianez, one of his navigators, offered to sail round the formidable cape, and to explore the coast of Guinea. He set sail in 1433, safely doubled Cape Bojador, and took possession of the coast by the erection of the cross. The bold adventurer was rewarded with honours and presents. The next year a larger vessel was sent out, which proceeded 140 miles beyond Bojador. These successful enterprises put a stop to censure, and Henry found more support. His brother Pedro, who administered the government during the minority of Alfonso V., effectually assisted him and confirmed him in the possession of the islands of Puerto Santo and Madeira, which Henry had before received from the late King Edward. Pope Martin V. not only confirmed the gift of these two islands, but also granted to the Portuguese all the countries which they should discover along the coast of Africa, as far as to the Indies. In 1441 Antonio Gonzalez and Nuno Tristam reached Cape Blanco; and this new success made a favourable impression upon the nation. Young men of enterprise were the more eager to engage in voyages of discovery, as they were tempted with the prospect of obtaining gold-dust. Henry had, thus far, paid all expenses of the expeditions alone; but companies were now formed of enterprising men, who ventured upon these voyages under his guidance; and the whole people soon became animated with the love of discovery. In 1445 Dinis Diaz reached Cape Verde. In 1446 Lançerata, Gomes Pires, and others took possession of the Arguim group to the south of Cape Blanco, which had been discovered three years previously, where there soon developed a profitable commerce with the natives of Africa. In 1455 Cadamosto sailed about 280 miles up the Senegal, and came to the Gambia, and on a second voyage he discovered the Cape Verde Islands. After acting as general against the Moors in 1458 Henry died at Sagres on the 13th of November, 1460. He not only laid the foundations of the world-wide commerce and the colonial possessions of Portugal, but his undertakings also gave a new direction to navigation, and form an epoch in the history of the world.

HENRYSON, ROBERT, a highly meritorious Scottish poet of the fifteenth century, regarding whose life very little is known. He was born about 1430 and died about 1506, appears to have had a university education, was probably in orders, and held some appointment as a schoolmaster at Dunfermline. His chief works are the Testament of Cresseid, a continuation of Chaucer's Troilus and Creseide; Robene and Makyne, the earliest Scottish pastoral; the Moral Fables of Æsop in Verse; Tale of Orpheus; The Bludy Serk, an allegorical ballad; &c. An edition of his works was published by Dr. D. Laing in 1865; they are also on the list of the Scottish Text Society's publications.

HEPATIC (from Greek *hēpar*, the liver), pertaining to the liver, as the *hepatic* duct or artery. See LIVER.

HEPATICÆ. See LIVERWORTS.

HEPHÆSTION, the friend of Alexander the Great, was a noble Macedonian of Pella. He accompanied the king in his Asiatic campaigns, and after the death of Clitus (328 B.C.) appears to have had the sole command of the select body of cavalry called the *hetairoi*, which was considered the highest dignity in the whole army. He died at Ecbatana (B.C. 325 or 324). Alexander, who was inconsolable for his death, had his body conveyed to Babylon, where he caused a funeral pile and monument to be erected to him, at a cost, it is said, of 10,000 talents.

HEPHÆSTUS, a god of the ancient Greeks, identified by the Romans with their Vulcanus. He presided over fire, and was the patron of all artists who worked in iron and metals. According to the Homeric account he was the son of Zeus (Jupiter) and Hera (Juno), although later traditions represent him as begotten of Hera alone. Homer says that his mother was so disgusted with the deformities of her son, that she threw him into the sea as soon as born, where he remained for nine years. He afterwards returned to Olympus, but for taking the part of his mother on one occasion against Zeus was thrown down by the latter a second time. He was a whole day in passing from heaven to earth, and fell in the island of Lemnos. He broke his leg by the fall, and ever after remained lame of one foot. Homer, however, represents him as lame from his birth. He fixed his residence in Lemnos, where he built himself a palace, and raised forges to work metals.

Dionysus (Bacchus) intoxicated him, and prevailed upon him to come to Olympus, where he was reconciled to his parents. Hephæstus has been celebrated by the ancient poets for the ingenious works and automatical figures which he made. It is said that at the request of Zeus he made Pandora, the first woman that ever appeared on earth. The Cyclopes of Sicily were his ministers and attendants; and with him they fabricated not only the thunderbolts of Zeus, but also arms for the gods and the most celebrated heroes. His forges were supposed to be under mount Ætna, in the island of Sicily, as well as in every part of the earth where there were volcanoes. Aphrodite (Venus) was the wife of Hephæstus. Her infidelity is well known. Her amours with Arēs (Mars) were discovered by Phœbus, and exposed to the gods by her own husband. No children of Hephæstus are mentioned by Homer, although later writers represent him as the father of several. Hephæstus was represented covered with sweat, blowing, with his nervous arm, the fires of his forges. His breast was hairy, and his forehead was blackened with smoke. Some represent him lame and deformed, holding a hammer raised in the air, ready to strike; while with the other hand he turns with pincers a thunderbolt on his anvil. He appears on some monuments with a long beard, dishevelled hair, half naked, and a small round cap on his head, while he holds a hammer and pincers in his hand.

HEPPENHEIM, a town of Germany, Grand-Duchy of Hesse, 16 miles s. of Darmstadt, on the railway from Frankfort to Heidelberg. It is walled, and makes a considerable figure in the German wars. Its principal buildings are an old church, a court-house, town-house, and at some distance, on a commanding height, the old castle of Starkenburg (built in 1066), long one of the most important strongholds of the electors of Mayence. Pop. (1900), 5779.

HEPTACHORD (from the Greek), a term which with the ancients implied a conjunct tetrachord, or a system of seven sounds. It was also the name given to a lyre, or *cithara*, with seven chords. The interval of the heptachord was equivalent to our seventh.

HEPTAGON, a plain figure of seven sides or angles; it is said to be regular when all the sides and angles are equal.

HEPTARCHY, the seven kingdoms into which England was at one period or other divided in Anglo-Saxon times. The kingdoms were founded at different times, and at no one time were they all independent monarchies together. In 827 King Egbert of Wessex united the other kingdoms into one, and assumed the title of King of England. See ENGLAND.

HEPTATEUCH, a name sometimes given to the five books of Moses or Pentateuch, together with the books of Joshua and the Judges.

HEPTYLIC COMPOUNDS (Greek, *hepta*, seven) are those compounds which, containing seven combining proportions of carbon, are the seventh in the homologous series of fatty acids and alcohols (see FATTY ACIDS, Table). They are a large group of bodies, and contain some which are interesting from their natural occurrence. *Heptylic alcohol* ($C_7H_{16}O$) occurs in certain varieties of fusel oil, and is a decomposition product by alkalies and heat of castor-oil. It is a colourless, oily liquid, lighter than and insoluble in water. There appear to be different kinds of this alcohol. *Heptylic hydride* (C_7H_{16}) is found naturally in American petroleum, in light coal-tar oil, &c.; it is a thin, colourless, very inflammable liquid, with a pleasant odour. *Heptyline* (C_7H_{14}) is found in the light oil from Boghead coal. It is a colourless liquid, with a garlic-like odour. The acid corresponding is called œnanthylic acid (which see).

HERA, an ancient Greek goddess (identified by the Romans with their Juno), the highest and most powerful divinity of the Greeks and Romans next to Zeus (Jupiter), of whom she was the sister and wife, was the daughter of Kronos (Saturn) and Rhea. Argos and Samos claimed the honour of her birth. According to Homer she was educated by Oceanus and Thetis; according to others, by the Hours. Her marriage with Zeus, on the island of Crete, was honoured by the presence of all the gods. According to Homer Zeus embraced her without the knowledge of her parents; and others say that he subdued her by artifice, on the island of Samos, and there married her. The poets represent Zeus as an unfaithful husband, and Hera as an obstinate and jealous wife, the result of which is frequent strife between them Many instances of this kind are related. When Hera had driven Heracles, the favourite of her husband, to Cos, by a storm, Zeus was so angry that he bound her hands and feet, loaded her with two anvils, and suspended her from Olympus. No one of the other gods could help her. During the Trojan war, having lulled Zeus to sleep, in order to give the victory to the Greeks during his slumbers, she escaped with difficulty from the blows which Zeus aimed at her when he awoke. In the oldest poetry Hera is described as a divinity hostile to Heracles, appearing unpropitious to him even at his birth, and opposing him afterwards in all his undertakings. Homer generalized this idea, and represented her as a malicious goddess of whom he made use whenever a plan was to be interrupted or an enterprise defeated. He describes minutely the art which Hera used to assist the Greeks, contrary to the command of her husband. She is also the malicious persecutor of the objects of the amours of her husband (for example, Latona, Semele, and Alcmena), and of their children by him. Among the latter Heracles and Dionysus suffered most. The Thebans likewise felt the effects of her hatred, because Heracles was born among them. She persecuted Athamas and his family because he had educated the young Bacchus. All who assumed to themselves, or attributed to others, a superiority to her, experienced her vengeance. The beauty of Hera is elevated, majestic, and calculated to inspire awe: she wanted the soft, insinuating, and heart-touching beauty of Aphroditē (Venus). In the Trojan war she was the protector of the Greeks. She sometimes mingled herself in the combat: thus, for example, Zeus once allowed her to remove Ares (Mars), the protector of the Trojans, from the battle. No one of the goddesses dared contend with her in fight. Artemis (Diana) once attempted it, but her cheeks felt the strength of the mighty Hera. Her children were Hebe, Eileithyia, Ares, and Hephæstus (Vulcan). According to the Orphic doctrines, she was the symbol of the lower air, as Zeus was of the upper air, or of the air in general. With this was joined another idea, derived from the Pelasgic religion at Samos, which represented her as the queen of the gods. To this was added the Phœnician notion; the Phœnician goddess of nature being confounded, in Greece, with Hera. She was worshipped in all Greece, but her principal seats were at Argos, in the vicinity of which was her famous temple, the Heræum, containing the noblest of her statues, that by Polycletus, and at Samos, boasting to be the place of her birth and marriage; hence one of her epithets was *Samia*. The Samian Hera was represented, on coins, with a crescent on her head, and her hands resting on two wands. The companions of Hera were the Nymphs, Graces, and Hours. Iris was her particular servant. Among animals, the peacock, the goose, and the cuckoo were sacred to her. Her usual attribute is the royal diadem, formed like a long

triangle. She often has a veil bespangled with stars, either as a covering for her head or hanging loosely behind her. On a gem in the collection of Stosch she appears in calm majesty seated on a throne, having at her back, on each side, the sun and moon, and over her head the planets, to signify that she is the queen of heaven. She is drawn in a carriage by two peacocks. The statues of Hera, among the ancients, were not very numerous, and even during the time when sculpture was in its most perfect state the Greeks possessed no particularly celebrated statues of her. Most of the portraits of Hera, on gems, are by the Greek artists in the time of the Roman emperors. The festivals in honour of Hera were called Heræa. The principal were those celebrated every fifth year at Argos, which city was considered to be especially under her protection.

HERACLES (called also *Alcides*, and by the Romans *Hercules*), the most celebrated hero of the mythological age of Greece, in whom poetry has presented a model of human perfection, according to the ideas of the heroic age, the highest bodily vigour, united with the finest qualities of mind and heart which entered into the conceptions of that period, being combined in him, and all devoted to the welfare of mankind. The hero is indeed a man, but the godlike portion of his nature is of divine origin. He is, therefore, the son of Zeus the king of the gods, by a mortal mother, Alcmena the wife of Amphitryon. His nature strives perpetually after divine excellence, but under the common conditions of humanity; that is, amid a ceaseless succession of labours and sacrifices. His indomitable perseverance gives him the victory. This victory shows us the triumph of the divine part of man's nature over the earthly. His death secures him immortality and a seat among the gods.

The birth of Heracles was attended with many miraculous and supernatural events. Heracles was brought up at Thebes; and before he had completed his eighth month the jealousy of Hera, intent upon his destruction, sent two snakes to devour him. The child, not terrified at the sight of the serpents, boldly seized them in both his hands and squeezed them to death, while his brother, Iphiclus, alarmed the house with his frightful shrieks. Zeus sought to protect his favourite in every manner, and to make him worthy of immortality. Once, while Hera was slumbering, Hermes laid the infant on her breast, that he might suck the milk of the goddess. She awoke and cast from her the hated babe. Some drops of milk that fell from her formed the milky way. Other accounts say that Hera and Athena found the infant Heracles. With the milk of the goddess he imbibed immortality. He was early instructed in the liberal arts, and Castor, the son of Tyndarus, taught him how to fight, Eurytus how to shoot with a bow and arrows, Autolycus to drive a chariot, Linus to play on the lyre, and Eumolpus to sing. He, like the rest of his illustrious contemporaries, soon after became the pupil of the Centaur Cheiron, and under him he perfected himself, and became the most valiant and accomplished hero of the age. When he had completed the years of boyhood he retired, according to the story of Prodicus, into a solitary district, and stood at the meeting of two ways, reflecting on his fate. Two lovely female figures approached, and one (Pleasure) invited him to follow her flowery path; the other (Virtue) invited him to choose a course full of labour and self-control, but crowned with honour and immortality. The suit of Virtue prevailed, and Heracles resolved to pursue her guidance without shrinking.

In the eighteenth year of his age he resolved to deliver the neighbourhood of Mount Cithæron from a huge lion, which preyed on the flocks of Amphitryon, his supposed father, and which laid waste the adjacent country. He went to the court of Thespius, king of Thespis, who shared in the general calamity, and was entertained there during fifty days. The fifty daughters of the king became mothers by Heracles, during his stay at Thespis. After he had destroyed the lion of Mount Cithæron he delivered his country from the annual tribute of 100 oxen, which it paid to Erginus. Such public services became universally known, and Creon, who then sat on the throne of Thebes, rewarded the patriotic deeds of Heracles by giving him his daughter in marriage, and intrusting him with the government of his kingdom. As Heracles, by a stratagem of Hera, was subjected to the power of Eurystheus, and obliged to obey him in every respect, Eurystheus, acquainted with his successes and rising power, ordered him to appear at Mycenæ, and perform the labours which, by priority of birth, he was empowered to impose upon him. Heracles refused, and Hera, to punish his disobedience, rendered him so delirious that he killed his own children by Megara, supposing them to be the offspring of Eurystheus. When he recovered the use of his senses he was so struck with the misfortunes which had proceeded from his insanity, that he concealed himself, and retired from the society of men for some time. He afterwards consulted the oracle of Apollo, and was told that he must be subservient, for twelve years, to the will of Eurystheus, in compliance with the commands of Zeus; and that, after he had achieved the most celebrated labours, he should be reckoned in the number of the gods. So plain and expressive an answer determined him to go to Mycenæ, and to bear with fortitude whatever gods or men imposed upon him. Eurystheus, seeing so great a man totally subjected to him, and apprehensive of so powerful an enemy, commanded him to achieve a number of enterprises the most difficult and arduous ever known, generally called the *twelve labours of Heracles*. The favours of the gods had completely armed him when he undertook his labours. He had received a coat of arms and helmet from Athēna, a sword from Hermēs, a horse from Poseidōn, a shield from Zeus, a bow and arrows from Apollo, and from Hephæstus a golden cuirass and brazen buskin, with a celebrated club of brass, according to the opinion of some writers, although according to others he cut the club for himself.

The first labour imposed upon Heracles by Eurystheus was to kill the lion of Nemæa, which ravaged the country near Mycenæ. The hero, unable to destroy him with his arrows, boldly attacked him with his club, pursued him to his den, and, after a close and sharp engagement, he choked him to death. He carried the dead beast on his shoulders to Mycenæ, and ever after clothed himself with the skin. Eurystheus was so astonished at the sight of the beast, and at the courage of Heracles, that he ordered him never to enter the gates of the city when he returned from his expeditions, but to wait for his orders without the walls. He even made himself a brazen vessel, into which he retired whenever Heracles returned.

The second labour of Heracles was to destroy the Lernæan hydra, which had nine heads, of which the middle one was immortal. This celebrated monster he attacked with his arrows; and soon after he came to a close engagement, and by means of his heavy club he destroyed the heads of his enemy; but this was productive of no advantage, for as soon as one head was beaten to pieces by the club immediately two sprang up; and the labour of Heracles would have remained unfinished had not he commanded his friend Iolas to burn with a hot iron the root of the head which he had crushed to pieces. This suc-

ceeded, and Heracles became victorious. He then dipped his arrows in the monster's gall, to render the wounds which he gave fatal and incurable.

He was ordered, in his third labour, to bring, alive and unhurt, into the presence of Eurystheus, a stag famous for its incredible swiftness, its golden horns, and brazen feet. The accomplishment of this labour occupied him for a whole year.

The fourth labour was to bring alive to Eurystheus a wild boar, which ravaged the neighbourhood of Erymanthus. This expedition is also celebrated as the occasion of one of his chief *parerga* or subordinate labours, the destruction of the Centaurs.

In his fifth labour Heracles was ordered to clean the stables of Augeas, where 3000 oxen had been confined for many years. See AUGEAS.

For his sixth labour he was ordered to kill the birds which ravaged the country near the lake Stymphalus, in Arcadia. They had brazen claws, beaks, and wings, used their feathers as arrows, and ate human flesh

In his seventh labour he brought alive into Peloponnesus a prodigious wild bull, which laid waste the island of Crete.

In his eighth labour he was employed in obtaining the mares of Diomedes, which fed upon human flesh. He killed Diomedes and gave him to be eaten by his mares, which he brought to Eurystheus.

For his ninth labour he was commanded to obtain from Hippolytē, the queen of the Amazons, a girdle which she had received from Ares, and which Admētē, the daughter of Eurystheus, desired.

In his tenth labour he killed the triple-bodied monster Geryon, king of Gades, and brought to Argos his numerous flocks, which fed upon human flesh. On the frontiers of Africa and Europe he erected two pillars (Calpe and Abyla) on each side of the Strait of Gibraltar—the Pillars of Hercules. (See HERCULES, PILLARS OF.)

The eleventh labour was to obtain apples from the garden of the Hesperides. See HESPERIDES.

The twelfth and last, and the only one mentioned by Homer, was to bring upon earth the three-headed dog Cerberus. He descended into hell by a cave in Mount Tænarus, dragged Cerberus away, but carried him back, after he had brought him before Eurystheus.

Besides these arduous labours, which the jealousy of Eurystheus imposed upon him, he also achieved others. He assisted the gods in their wars against the giants, and it was through him alone that Zeus obtained the victory. He conquered Laomedon, and pillaged Troy. When Iolē, the daughter of Eurytus, king of Œchalia, of whom he was deeply enamoured, was refused to his entreaties, he became the prey of a second fit of insanity, and he murdered Iphitus, the only one of the sons of Eurytus who favoured the addresses to Iolē. He was, some time after, purified of the murder, and his insanity ceased; but the gods still persecuted him, and he was visited by a disorder which obliged him to apply to the oracle of Delphi. He was told by the oracle that he must be sold as a slave, and remain three years in the most abject servitude, to recover from his disorder. He complied, and Hermes, by order of Zeus, conducted him to Omphalē, queen of Lydia, to whom he was sold as a slave. (See OMPHALE.) After he had completed the years of his slavery he returned to Greece, and now married Deianira, daughter of Œneus, king of Calydon. He was obliged to leave Calydon, his father-in-law's kingdom, because he had inadvertently killed a man with a blow of his fist. On his way to a place of exile he was stopped by the swollen stream of the Evenus, where the Centaur Nessus attempted to offer violence to Deianira, under the pretence of conveying her over the river. Heracles killed the Centaur with one of his poisoned arrows, and Nessus, as he expired, told Deianira to preserve some of his blood if she desired to retain the love of Heracles. Heracles was still mindful that he had once been refused the hand of Iolē; he therefore made war against her father, Eurytus, and killed him, with three of his sons, Iolē fell into the hands of her father's murderer, and found that she was loved by Heracles as much as before. She accompanied him on Mount Œta, where he was going to raise an altar and offer a solemn sacrifice to Zeus. As he had not then the tunic in which he arrayed himself to offer a sacrifice, he sent Lichas to Deianira in order to provide himself a proper dress. Deianira, desiring to regain her husband's love, sent him the tunic after steeping it in the blood of Nessus; and Heracles, as soon as he had put it on, found the poison of the Lernæan hydra penetrate through his bones. He attempted to pull off the fatal dress, but it was too late; whereupon he built himself a funeral pile on the top of Mount Œta, laid himself down upon it, and had it set on fire. When Zeus saw him surrounded with the flames, he had compassion on him and raised him to the skies. His worship soon became general, and Hera forgot her resentment, and gave him her daughter Hebe in marriage.

Heracles received many surnames and epithets, sometimes from the place where his worship was established, sometimes from the labours which he achieved. His common title Alcides was from Alceus, the father of Amphitryon. In Italy he was worshipped by the name of Hercules, a modification of his Greek name, for the genuine Italian Hercules bore the name of Recaranus or Garanus.

The principal ancient statue of this hero which remains to us is the Farnese Hercules at Naples, a work of the Athenian Glycon, representing the hero leaning on his club. There is also a famous torso of Heracles in the Vatican. His various adventures and exploits enabled the artists to represent him under a variety of forms, as a child, a youth, and a man, struggling, suffering, and enjoying, in repose and in full action. He is generally represented naked, with strong and well-proportioned limbs; and is often shown with the skin of the Nemæan lion. The myth of Heracles in its main elements was undoubtedly developed on Greek soil; but counterparts of the hero appear among many peoples, and the Greeks, no doubt, borrowed something from their neighbours. Some scholars regard Heracles as a solar hero, and the twelve labours are supposed to represent the course of the sun through the twelve signs of the zodiac.

HERACLIDÆ or HERACLEIDS, the descendants of Heracles, but more particularly those who, assisted by the Dorians, asserted by arms the claims which they had inherited to the Peloponnesus, eighty years after the capture of Troy, and, therefore, according to the usual system of chronology, B.C. 1104. This event is known in Greek history as the return of the Heraclidæ, and is the same as that known as the Dorian migration. See GREECE.

HERACLITUS, a Greek philosopher, born at Ephesus in Asia Minor, flourished about 513 B.C. He travelled in different countries, and on his return to Ephesus was offered the chief magistracy, which he transferred to his brother. He considered the state of morals in the city so bad that he preferred playing at dice with boys to attempting to govern it. He finally repaired to solitary mountains to live on roots and herbs; but, being attacked by a fatal disease, was obliged to return to the city, where he died soon afterwards, it is said in his sixtieth year. He left a work on Nature, in which he treats also of religion and politics.

It was written in an obscure and figurative style, which is partly to be ascribed to the defective state of philosophical language in his day. Some fragments only of this work remain. He is considered as belonging generally to the Ionic school, though he differed from it in important particulars. From the little of his philosophy which has come down to us it appears that he considered fire as the element of all things. He described it as an ætherial substance, not differing essentially from the air of Anaximenes. From this element, 'self-kindled and self-extinguished,' the world is evolved (not made) by a natural operation. It is also a rational principle, and the source of the human soul. It has a longing to manifest itself, and descends for this purpose from heaven, where it exists in its pure state, to earth, losing in its descent its rapidity of motion, and passing through the form of water into that of earth. The soul of man is a portion of this migrated fire in its pure state. The phenomena thus produced exists in a constant state of flux, always tending to assume new forms, and finally returning again to their source. The only repose in the universe results from the encounter of the downward and upward motion of various parts of the living fire.

HERACLIUS, a Roman emperor of the East, from 610 to 641, was born in Cappadocia about A.D. 575. His father Heraclius, exarch of Africa, had gained great renown by his victories over the Persians, and after Phocas had ascended the throne, by murdering his master, the Emperor Mauritius, was applied to by a powerful body of insurgents to declare war against the usurper, and claim the throne for himself. After temporizing for a little he declined to claim the throne, excusing himself on the ground of his great age, and sent his son Heraclius from Carthage at the head of a powerful fleet The moment the fleet appeared off Constantinople the insurgents within the city put their plans in execution, and Phocas perished by an ignominious death. Heraclius the younger now ascended the throne, and though he undoubtedly possessed considerable talents, the Roman Empire in the East was now tottering to its fall, and nothing he was able to do could save it. Before his death Mohammed had carried his victorious arms on every side, and Syria, Palestine, Mesopotamia, and Egypt had fallen under the dominion of the caliphs. He was permitted, however, to die in peace, and to transmit the succession to his son, who mounted the throne under the title of Constantine III.

HERALD. The etymology of this word is uncertain. According to some authorities it comes from a primitive German word signifying a crier, others derive it from an old high German compound, which is found existing in proper names, *hariwalt* or *hariswalt*, from *hari*, an army, and *waltan*, to manage. The office of the herald as established in the middle ages was essentially a chivalric institution, and derived its importance from the customs of chivalry. Analogies have been found between the office of a herald and the Greek *kērux* and Roman *feciales*, but these only hold good in regard to the incidental functions exercised by the heralds as messengers of peace and war. In the complex functions of the office, which were purely the growth of chivalry, it had, and could have, no precedent in antiquity. Heralds began to appear about the twelfth century, and assumed the functions which ultimately belonged to their office gradually. They appear at first to have been mere messengers or criers employed to summon the men of arms. They assumed also some of the functions of the minstrels, in recounting the warlike deeds of their masters. The office did not acquire its full importance till they began to be officially employed by princes. The word *heraldus* occurs in the imperial constitutions of Frederick Barbarossa in 1150. The functions of the herald were to carry messages of courtesy or defiance between sovereigns or persons of knightly rank, to superintend and register the results of trial by battle, tournaments, and other chivalric exercises, to record the valiant deeds of combatants, compute the slain after battle, proclaim war or peace, marshal processions and public ceremonials, and especially to regulate and determine all matters connected with the use of armorial bearings. The herald after the office was fully constituted was created with many ceremonies, and had to pass through various grades of protracted service before reaching the full dignity of a herald. According to Gerard Legh they were first couriers or foot messengers, who wore their princes' colours 'parted upright,' that is, in two colours; they were knights, but not nobles. After seven years' service they were made chevaliers of arms, and carried their sovereign's messages on horseback; on serving other seven years the knight-of-arms became a pursuivant, and was qualified at once to be a herald. He was in fact ranked as holding the lowest grade of that office, of which there were three, king-at-arms, herald, and pursuivant. The pursuivant was invested with the tabard, or herald's coat; but had to wear it crosswise, the sleeves hanging one in front, and one behind. When he became a herald the tabard was turned, so that the sleeves hung over his arms. The creation both of herald and pursuivant was attended with a baptism with wine and water. The kings-of-arms were crowned by the sovereign himself. They wore richer tabards, embroidered on velvet in place of satin, with gilt collars and coronets of sixteen strawberry leaves. Heralds are now shorn of much of their importance. They are appointed in England by the earl marshal, whose office is hereditary. The Herald's College, or College of Arms, founded by charter of Richard III. in 1483, consists of the three chief heralds (see GARTER, KING-OF-ARMS), the six subordinate or provincial heralds of York, Lancaster, Chester, Windsor, Richmond, and Somerset; two heralds extraordinary—the Surrey herald and the Maltravers herald—together with the earl marshal (the Duke of Norfolk), registrar, and secretary, in all fourteen persons. There are also four marshals or pursuivants, called blue-mantle, rouge-croix, rouge-dragon, and portcullis, who usually succeed to vacancies in the Heralds' College. The Heralds' College in Scotland consists of Lyon king-of-arms, and three heralds with three pursuivants.

HERALDRY is subject to a double definition. In its technical sense it includes the whole science of a herald's duties, as well that which relates to the marshalling of public ceremonials as to the regulation of armorial bearings. In the popular sense, in which we here use it, it is restricted to the knowledge of the forms and terms of blazonry, and of the laws which regulate the use of armorial bearings. Badges and emblems on shields, helms, banners, &c., occurred in the earliest times. In Numbers (ch. i. 52) the children of Israel are enjoined to pitch their tents, 'every man by his own camp, and every man by his own standard,' with the ensigns of his father's house. The poets of the Greeks and Romans speak of paintings and devices on shields and helmets. These symbols were moreover hereditary. Thus Xenophon relates that the kings of the Medes bore a golden eagle on their shields. Suetonius asserts that Domitian had a golden beard for his coat of arms; and Tacitus says of the ancient Germans, that they marked their shields with brilliant colours, and that certain standards were borne before them in battle. The origin of heraldic arms, properly so

called, is now by general consent attributed to the necessity which arose during the Crusades of distinguishing the leaders of the numerous and motley bands of warriors which constituted the Christian armies. The growth of heraldry was also powerfully promoted by the institution of tournaments. The use of arms began to prevail about the twelfth century, and in the thirteenth they became hereditary. The practice was then introduced of embroidering the family arms on the surcoat worn by a warrior over his hauberk. At tournaments the practice prevailed of blazoning, or proclaiming the arms of the knights who appeared to take part in them, by a herald with the sound of a trumpet. As the use of visors rendered the combatants undistinguishable, except by their insignia, this practice was no doubt suggested by its obvious convenience, and probably contributed not a little to give its peculiar importance to the office of the herald. At a tournament the mantle of the knight, with the helm and shield, was for a like reason suspended in the lists.

As the French language prevailed at the court of the Norman kings in England, French expressions have been preserved in English heraldry, while in German heraldry the terms are mostly German. Rolls of arms in England are extant in the reigns of Henry III., Edward I., and Edward II. The Roll of Caerlaverock, a poem in Norman-French, contains the names and armorial bearings of the knights and barons who attended Edward I. at the siege of the Castle of Caerlaverock, Dumfriesshire, in 1300, and exhibits heraldry already in a developed form. One of the oldest specimens of heraldic bearings extant, is the shield at Mans of Geoffrey Plantagenet, who died in 1150. Surcoats displayed armorial bearings in the reign of Henry III. The wearing of armorial insignia on banners and shields was among the earliest forms of heraldry. The use of arms on the Great Seal of England was introduced by Richard I. The use of arms by private persons was prohibited by proclamation in the reign of Henry V. All persons who had not borne arms at Agincourt were prohibiting from assuming them, unless by hereditary descent, or with the sanction of the constituted authorities. Periodical circuits, called visitations, were held afterwards by the provincial heralds, to take cognizance of the arms, pedigrees, and marriages of such as were entitled to the use of armorial bearings. These visitations continued till about the end of the seventeenth century. Their records, many of which are preserved in the British Museum and elsewhere, contain much genealogical information, and are still sought for evidence of the hereditary right to bear arms.

The study of heraldry, which in the high ages of chivalry was deemed by the great ones of the earth the first of sciences, fell on the decline of chivalry into decay and contempt, and was, according to a stock phrase, 'abandoned to the coach-painter and the undertaker.' This decline of the noble science was promoted by a very natural result of the diminution of its practical utility. In proportion as heraldry became useless its professors grew pedantic, stupid, dogmatic, and intolerable. As far as its intrinsic merits are concerned heraldry might have been allowed to sink unlamented beneath the rubbish in which it was thus buried; but modern scholarship has found a use for it in its earlier and more genuine forms, as an illustrator and interpreter of history, and its investigation has again become a legitimate pursuit.

The bearing of arms in England without competent authority still subjects the wearer to a penalty The chief courts of jurisdiction in questions of heraldry, are the Heralds' College in England, the Lyon Court in Scotland, and the Office of Arms in Ireland. The rules of heraldry now practised at the Heralds' College are comparatively modern, and differ in some respects from those of continental courts.

Blazoning, in the technology of heraldry, is the methodical description of a bearing. In the first place the shield is described according to its tinctures, figures, and partitions. The inferior parts of an escutcheon are then blazoned—the helm, with its insignia, which are trumpet, wings, and plumes, men and animals, or their members; then the wreath and its tinctures; after which the coronet, cap, &c.; finally, the supporters, the mantle, the device, and other secondary things. To historify, in heraldry, is to explain the history of a coat of arms, its origin, and the changes it has undergone. If the herald is to explain a bearing historically, he must show that this figure is the proper emblem of the family or country. He derives, for instance, from historical sources the proof that the double-headed eagle of the Roman king was first introduced in the beginning of the fourteenth century, under Albert I., and that previously, from the time of Otho II., the royal eagle had but one head; that the three leopards in the English arms were first derived in 1127, under Henry I., from the Norman house. The marshalling of arms consists in the preparation of new escutcheons. In this matter the herald either follows the orders of a sovereign, or he invents the idea, and makes the plan of the escutcheon according to his own judgment, or he composes a new escutcheon from several coats of arms. Arms may be borne by individuals, families, or communities. In heraldic science arms are distinguished by different names, to denote the causes of their being borne. There are ten classes of arms recognized by heralds, as distinguished by their origin.

1. Arms of dominion are borne by sovereigns, in respect of territories which they govern.

2. Arms of pretension are borne by those who claim the sovereignty of a territory of which they are not in actual possession.

3. Arms of community are borne by bodies corporate, as bishops, cities, universities, &c.

4. Arms of assumption are those assumed of right, without the consent of a superior. Thus, it is said the captor has a right to assume and transmit hereditarily the arms of the captured in war.

5. Arms of patronage added to their family arms as a token of superiority, right, or jurisdiction, by governors of provinces, lords of manors, patrons of benefices, &c.

6. Arms of succession quartered with the family arms, by those who succeed to estates, manors, &c., by will, entail, or donation.

7. Arms of alliance assumed by the issue of heiresses, to show their maternal descent.

8. Arms of adoption borne by a stranger in blood, who inherits estates, &c., under condition of assuming the family name of the testator. Arms of adoption can only be borne by express permission of the sovereign.

9. Arms of concession, augmentations granted by the sovereign of part of his own ensigns or regalia, to such persons as he is pleased to honour.

10. Paternal or hereditary arms are those transmitted from the first possessor to his descendants. These convey an accession of dignity as they descend; the first descendant is a gentleman of second coat armour, the second a gentleman of blood, the third a gentleman of ancestry.

The parts of arms are the *escutcheon*, the *tinctures*, the *charges*, and the *ornaments*.

Escutcheon.—The escutcheon or shield represents

the original shield used in war, and on which arms were anciently borne. The surface of the escutcheon is termed the *field*, because it contains those marks of honour which were formerly acquired in the field. The forms of the shield were of different kinds, namely, triangular, notched, and indented, called a *shield-chancre*, oval, which is called a *lozenge*, and used by females; and the square form, which is in ordinary use at present. The shield is likewise distinguished not only by the variety of its forms, but also of its position, some being borne erect and others pendant, some hanging by the right and others by the left corner. To the escutcheon belong points and abatements. The *points of the escutcheon* are certain points which are peculiarly distinguished for the location of the figures which the field contains.

These points are distinguished by the first nine letters of the alphabet, as shown in the figure in the plate, and are as follows, namely:—

A B C, *the chief*, which represents the highest and most honourable part of the shield. A is the *dexter chief* or upper *right hand* side of the shield; B, the *middle chief;* and C, the *sinister chief*, or upper *left hand* side of the shield. D, *the collar* or *honour* point, so called because eminent men wear badges of honour about their necks. E, the *cœur* or *heart*, otherwise called the *centre* or *fesse point*. F, the *nombril* or *navel* point. G H I, the *base*, that is, G, the *dexter* or right-hand *base;* H, the *middle base;* and I, the *sinister* or left-hand *base*. The French call the two first the *flanques*, and the last the base. The use of these points is to distinguish different coats of arms charged with the same figures; for arms having a lion in *chief* differ from those having a lion in *base;* and so on with the other points.

Abatements.—Abatements are certain marks of disgrace added to the coat armour of divers persons on sundry occasions, which have been distinguished by different names, as *delf, inescutcheon reversed, point-parted dexter, point in point, point champagne, plain point, gore, gusset*, and *escutcheon reversed;* but of all these abatements there is no example remaining except of the last.

Tinctures.—Tinctures or armorial colours are altogether nine, namely, two metals and seven colours, which have been distinguished by different names, and made to represent certain planets, stones, and virtues, as set forth in the following table:—

Colours.	Tinctures.	Precious Stones.	Planets.	Virtues.
Yellow.	*Or.*	Topaz.	Sun.	Faith.
White.	*Argent.*	Pearl.	Moon.	Innocence.
Blue.	*Azure.*	Sapphire.	Jupiter.	Loyalty.
Red.	*Gules.*	Ruby.	Mars.	Magnanimity.
Black.	*Sable.*	Diamond.	Saturn.	Prudence.
Green.	*Vert.*	Emerald.	Venus.	Love.
Purple.	*Purpure.*	Amethyst.	Mercury.	Temperance.
Orange.	*Tenney.*	Hyacinth.	Dragon's Head.	Joy.
Blood-colour.	*Sanguine.*	Sardonyx.	Dragon's Tail.	Fortitude.

The two first of the above tinctures are the metals, and the seven others the colours, of which the two last are not so frequently used in blazon as the rest. When not given in colours they are now represented in engraving by points and lines in place of letters, which were formerly employed; namely—*Or*, Gold, is distinguished by small dots covering the part. *Argent*, Silver, is represented by leaving the space blank. *Azure*, Blue, is shown by horizontal lines. *Gules*, Red, by perpendicular lines. *Sable*, Black, by perpendicular and horizontal lines crossing each other. *Vert*, Green, by diagonal lines running from the dexter chief to the sinister base. *Purple* is also distinguished by diagonal lines, but running from the *sinister* chief to the *dexter* base. *Tenney*, Orange, by perpendicular lines crossed by diagonal lines running from the upper right to the lower left of the shield; and *Sanguine* or Blood-red by diagonal lines crossing each other at right angles, running from the upper right to the lower left, and from the upper left to the lower right.

Furs.—Furs are a tincture composed of two or more tinctures, and are supposed to represent the skins of beasts employed for the furring, doubling, and lining of robes and garments of state; whence they have been transferred to the coat armours themselves. The two principal furs are *ermine* and *vair*. *Ermine* is represented by a white field powdered, or *semé* with black spots. When the field is black with white spots it is denominated *ermines*, to which may be added other varieties, as *erminois*, a field *or*, with black spots; *pean*, a black field with white spots, *or*, &c. *Vair* is always composed of argent and azure, represented by figures of small escutcheons ranged in a line, so that the base argent is opposite to the base azure. When the bells or cups of the same colour are placed base against base, and point against point, it is called *countervair;* and when the pieces of vair be of other tinctures they are denominated *vairy*, as vairy of gules and *or*. To these two principal furs may be added a third, called *potent*. *Potent*, otherwise called *counterpotent*, is a sort of fur which derives its name from the resemblance which the figures bear to crutch-heads, called *potents*, counterplaced.

Lines.—Lines are the boundaries or outlines of ordinaries; they are generally straight, but sometimes deviate into crooked lines, termed Ingrailed, Invected, Wavy, Nebuly, Imbattled, Raguly, Indented, Dancette, Potency, Dove-Tail. *Ingrailed*, is a line consisting of semicircles with the points turned outwards; *invected* is a line of semicircles with the points turned inwards; *wavy* or *nebuly*, so called because it represents waves or clouds; *imbattled* or *crenellé*, represents the battlements of a castle; *raguly* represents the trunk of a tree with its branches cut off; *indented* represents the teeth of a saw; *dancetté* differs from the former by having the teeth broader and shallower; *potency* takes a form like the head of a crutch; *dove-tail*, a line resembling the dove-tail joints of the joiners.

Partition Lines.—Partition lines are such as divide the shield into two or more parts, which are distinguished into *party per pale*, when the field is divided by a perpendicular line; *party per fesse*, when the field is equally divided by a horizontal line; *party per bend*, a field divided by a diagonal line from the dexter chief to the sinister base; *party per chevron* is a field divided by two half diagonal lines rising from the dexter and sinister base flanks and meeting in the collar point of the field; *party per cross*, or quarterly, is when the field is divided by two lines, one perpendicular and one horizontal; *party per saltier* is when the two partition lines, party per bend, dexter and sinister, meet in the centre of the field.

Figures.—Figures are the next essential parts of armouries, which are to be divided into Ordinaries, Charges, and Differences.

Ordinaries.—Ordinaries are figures so called because they are in ordinary use in this science. They are otherwise called *proper figures*, because they are proper to the heraldic art. They are distinguished into honourable ordinaries and sub-ordinaries, or less honourable ordinaries.

Honourable Ordinaries.—Honourable ordinaries, otherwise called simply *ordinaries*, are so named because they are often given by emperors, kings, and princes, as additions of honour to armorial bearings. They are nine in number, namely, the Chief, Pale, Bend, Bend Sinister, Fesse, Bar, Chevron, Cross, and Saltier.

Chief.—The chief is formed by a horizontal line, and contains in depth the third of the upper part of the field, '*argent* a chief *gules.*' By one of the rules of blazon, when a chief is in a coat of arms it is the last thing to be mentioned, except when it is surrounded with a bordure. When the chief is charged with any figure this is said in blazon to be *on a chief;* but when natural and artificial things are placed in the upper part of the shield, in the place of the chief, they are said to be *in chief.* The chief is formed of crooked as well as straight lines, and is therefore distinguished into the *chief crenellé, chief dancetté,* &c.

Pale.—The pale occupies the third middle part of the field perpendicularly. The pale is charged with things which are said to be *on a pale;* and when things are borne perpendicularly one above another in the centre of the shield they are said to be *in pale.* The pale has two diminutives, namely, the *pallet,* which is the half of the pale; and the *endorse,* which is the fourth of the pallet; and when the field is divided into four or more even parts by perpendicular lines of two different tinctures interchangeably disposed, it is said to be *paly* of so many pieces.

Bend.—The bend is an ordinary drawn diagonally from the dexter chief to the sinister base in the form of a belt, and occupies the third of the field. A bend is said to *surmount* when it lies over other ordinaries or other figures, keeping its just length or breadth: and things are said to be *on a bend* when the bend is charged with them; *in bend,* and *bendways,* when they are situated after the manner of a bend. The bend is said to be subject to all the accidental forms of lines, and has three diminutives, namely, the *garter,* which is half the bend: the *cost* or *cottise,* which is half the garter; and the *ribbon,* which is half the cost. When the field contains more than one bend they are not called bends but *bendlets,* or more generally *bendy,* of so many pieces; and when opposite to one another in metal and colour, they are said to be *counter-changed.*

Bend Sinister.—The bend sinister, which is the *bar* of the French, is the same in form as the bend or the *bend dexter,* but it is drawn across the field from the sinister chief to the dexter base. The bend sinister is divided into the *scarpe* or *scarfe,* which contains the half of the bend, and the *batune,* which is a fourth part of the bend sinister. The batune borne *couped* is commonly known by the name of the *bend of bastardy,* because it is the mark of illegitimacy. (See BASTARD BAR.)

Fesse.—The fesse is an honourable ordinary which occupies the third middle of the field. The fesse is said to *surmount* another figure when it lies over it, and in the same manner to be *surmounted* by it; but when the supercharge is comprehended within the limits of the fesse it is said to be a fesse charged, or to be *on a fesse.* When the fesse is placed higher than the centre it is said to be *transposed;* and when below the centre, it is *abaissé.*

Bar.—The bar is an honourable ordinary which is formed after the manner of a fesse, but occupies only a fifth of the field, and is not confined to any particular part of the field, except when there is only one bar, when it is put in the place of a fesse. Bars are mostly two in a field, sometimes three and more. When the field is filled with bars they are said to be *barry,* as 'Barry of four, six pieces *argent* and *azure,*' &c. When small figures are ranged horizontally above or below the middle of the shield they are then said to be *in bar* or *barways;* and when the bar does not touch the sides of the shield it is said to be *couped.* The diminutives of the bar are the *closet,* which is the half of the bar, and the *barrulet,* which is the half of the closet; when these diminutives are placed two and two in a shield, they are called *bars gemel.* The bar is sometimes subject to the accidental forms of lines, as *imbattled, ingrailed,* &c.

Chevron.—The chevron is an honourable ordinary, made of the bends dexter and sinister issuing from the right and left base points of the escutcheon meeting and ending pyramidically in the collar point. It occupies, according to the French, a third of the field; but according to the English the fifth. The chevron is subject to very many accidental forms, for it is *accompanied with,* or *charged with,* other figures, and is also *imbattled.* The diminutives of the chevron are the *chevronel,* which is the half, and the *couple close,* which is the fourth of its breadth. When the field is filled with pieces of equal number in the form of chevrons it is said to be *chevrony* of so many pieces, as chevrony of six, *argent* and *gules,* &c.

Cross.—The cross is composed of the pale and the fesse, which meet in the centre. After the introduction of the cross into the military ensigns of the Crusaders its use became very frequent, and its form was in consequence more varied than that of any other ordinary.

Saltier.—The Saltier or Sautoir is an honourable ordinary, composed of the bends dexter and sinister, and is supposed to represent the cross on which the apostle St. Andrew suffered. It is subject to the accidental forms of the lines, as ingrailed, wavy, &c. When the saltier is between four figures it is said to be *cantoned.* When figures are borne on the saltier it is said to be *charged,* or they are said to be *on a saltier.* Figures are also borne *saltierwise* or *in saltier.*

The *Sub-ordinaries* are the Border, the Orle, the Tressure, the Inescutcheon, the Canton, the Quarter, the Billet, the Gyron, the Pile, the Flanche, the Lozenge, the Fusil, the Rustre, the Mascle, the Fret, the Roundle, and the Guttee.

Border.—A Border goes round the extremities of the shield, and takes up mostly the fifth part of the field, but sometimes more and sometimes less. The border is subject to all the different forms of lines belonging to the other ordinaries, as *ingrailed, invected,* &c., and is also charged with different figures, from which it derives the name of *entoire* when charged with inanimate things; *verdoy,* when charged with vegetables; *enurny,* for a charge of beasts; and *enaluron,* for that of birds. Borders are also said to be componé or gobonate and chécky. A *bordure componé* is that which is filled with one rank of square pieces. When there are two ranks of pieces it is called *counter-componé;* and when there are three or more, *chécky.*

Orle.—The Orle is an inner border which does not touch the extremities of the shield. The orle is properly a diminutive of the border.

Tressure.—The Tressure is a diminutive of the orle, and consists of a trace or tract flowered, surrounding the inner part of the escutcheon as an orle. When there are two of these tracts flowered and counterflowered within and without, it is called a *double tressure.*

Inescutcheon.—The Inescutcheon represents the military shield, and occupies the fifth middle of the escutcheon. It is subject to the different accidental forms of other ordinaries.

Canton.—The canton is a square figure possessing a third part of the chief, which is used as an additament of honour, and in particular as a baronet's mark. The canton is frequently charged with other figures.

Quarter.—The Quarter is a square figure larger than the canton. This is called by the French *franc quartier.*

Billets.—Billets are oblong square figures which are supposed to represent billets or letters missive. The proper position of the billets is erect, but when in fesse or fesseways, they are said to be *couché;* and when diagonally placed, they are said to be *bendways;* and when they are placed after the manner of a crosspall, which is called by the French *pairle*, they are then said to be *en pairle.* When the field is charged with more than ten billets irregularly, it is said to be *billety* or *semé of billets.*

Gyron.—An ordinary of two lines drawn from the side of the shield, meeting in the centre or top; if these two lines are extended to the other side of the shield, they form two gyrons. When the field is divided into six or more parts of different tinctures, all the points uniting in the centre of the field, it is called *gyronny.* The gyrons are also subject to the accidental forms of lines, as ingrailed, nebuly, &c.

Pile.—The Pile is an ordinary consisting of a two-fold line formed after the manner of a wedge. It is subject to the accidental forms of other ordinaries.

Flanch.—The Flanch is an ordinary made by an arch line that swells towards the centre, and is always borne in couples. The *flasque* and the *voider*, two varieties of this ordinary, are said to be less in breadth.

Lozenge.—The Lozenge is a rhomboidal figure that has equal sides and unequal angles. The shield in which maids and widows bear their arms is of this form. When the field is filled with lozenges, it is said to be *lozengy.*

Fusil.—The Fusil is rhomboidal like the lozenge, but longer than it is broad. When the field is filled with fusils it is called *fusilly.*

Rustre.—The Rustre is a lozenge pierced round in the middle, so that the field appears through.

Mascle.—The Mascle is also a lozenge pierced, but the void or opening is in the lozenge form instead of round, as in the rustre.

Fret.—The Fret is a figure which resembles two sticks lying saltierwise, and interlaced within a mascle. It is sometimes called the *true lover's knot. Fretty* or *fretted* is said of any figures that are placed in the form of a fret.

Roundle.—The Roundle is an ordinary in the form of a ball, which receives different names in English heraldry, according to the tincture, as follows:—

If they be	*Or,*	they are called	*Bezants.*
,,	*Argent,*	,,	*Plates.*
,,	*Gules,*	,,	*Torteauxes.*
,,	*Azure,*	,,	*Hurts.*
,,	*Sable,*	,,	*Pellets.*
,,	*Vert,*	,,	*Pomeys.*
,,	*Purpure,*	,,	*Golpes.*
,,	*Tenney,*	,,	*Oranges.*
,,	*Sanguine,*	,,	*Guzes.*

Bezants represent pieces of gold or silver in coat armour. *Torteauxes* are supposed to represent *wastels* or cakes of bread. *Rings* and *annulets* were marks of nobility among the Romans, and became the prizes of tournaments and jousts; whence they were naturally transferred to coat-armour; and when these annulets or great rings are borne one within another, they are termed by the French *vires.*

Guttees.—Guttees are figures which represent drops; and, like the roundles, they vary in their names according to the tincture, as follow:—

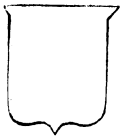
If they be	*Or,*	they are called	*Guttees d'or.*
,,	*Argent,*	,,	*Guttees d'eau.*
,,	*Gules,*	,,	*Guttees de sang.*
,,	*Azure,*	,,	*Guttees de larmes.*
,,	*Sable,*	,,	*Guttees de poix.*
,,	*Vert,*	,,	*Guttees d'olive.*

Charges are the figures of natural and artificial things, which are called *common charges*, because they are common to other sciences as well as heraldry. Animals are blazoned as to their posture and actions as follow:—*rampant*, as a lion rampant, when he is erect standing on one of his hind legs; *sejant*, or *sitting*, as a lion sejant; *couchant*, that is, lying at rest, with the head erect; *passant*, in a walking position; *gardant*, looking full-faced; *rampant gardant*, erect and looking full-faced; *rampant regardant*, erect and looking behind; *salient*, in a leaping posture; *trippant* is said of the stag when trotting; *courant*, of the stag and other animals running; *at gaze*, of the stag when he looks full-faced; *lodged*, of the stag when at rest on the ground; *volant*, of birds in general in a flying posture; *rising*, of a bird that is preparing to fly; *haurient*, of fishes when erect paleways; *naiant*, swimming of fishes. To these may be added other blazons of animals generally, as *dormant*, for a sleeping posture; *addorsed*, for two animals back to back; *nowed*, that is, knotted like a serpent; *counter-passant*, for two animals walking different ways; so *counter-salient, counter-trippant*, &c. The teeth and claws of lions and other ravenous beasts are called their *arms;* and when they are of a different tincture, they are said to be *armed;* and if their tongue be of a different tincture, they are said to be *langued.* Tame animals, as the ox, ram, &c., which are furnished with horns and hoofs different from their bodies, are said to be *armed, unguled*, or *hoofed* of such and such a tincture; but deer are said to be *attired*, on account of their antlers. Dogs, in respect to their kind, are blazoned *beating, coursing, scenting*, &c. The beaks and talons of birds of prey are termed their *arms*, whence they are said to be *armed* and *membered;* and tame birds, on the contrary, are said to be *beaked* and *membered;* but the cock is said to be *armed, crested*, and *jellopped*, that is, *armed*, for his beak and spurs; *crested*, on account of his comb; and *jellopped*, on account of his wattles. The falcon is generally borne the same as the eagle, and blazoned in the same terms, except when he has a hood, bells, virols or rings, and leashes, in which case he is said to be *hooded, belled, jessed*, and *leashed;* when in the act of striking his prey, he is said to be *pouncing.* When the heads of animals are borne, they are said to be *couped*, if cut evenly off; or *couped close*, if cut close; *caboshed*, when the head is cut off close behind the ears; and *trunked*, in particular, of bulls' heads; *erased*, if the head seem to be violently torn from the body. When the whole foreleg of a lion or other beast is borne in arms, it is termed a *jamb;* and if couped or erased near the middle joint, it is a *paw.* When the arm of a man is borne, it is either *erect*, when couped at the elbow; or *embowed*, when it forms an elbow; *dexter* for the right arm, and *sinister* for the left. The temples of a man are said to be *wreathed* when decorated with laurel, oak, ivy, &c. As to his whole dress, a man is said to be *naked* or *habited, rustre* in *armour* or in *robes.* Animals in general are said to be *crined* which have the hair of a different tincture; sometimes they are said to be *dismembered* when they are cut in pieces, but not so as altogether to destroy the form; and *debruised* when a bend or any ordinary is placed over them. The wings of birds are said to be *displayed* when their wings are expanded; *close* when they sit close to the body; *indorsed* when they sit back to back; *erect* when the points of the wings are upwards; *inverted* when the position is reversed, or the points downwards. Fishes are said to be *finned* if the fins are of a particular tincture. Of heavenly bodies, the sun is said to be *in his meridian*, or *his glory*, or *in an eclipse*, &c.; the moon, *crescent, increscent*, or *decrescent;* a comet, *streaming*, &c. Of vegetables, the tree is said to be *fructed* if bearing fruit; *acorned* if bearing acorns; *raguled* and *trunked* when its limbs are cut off, leaving only the stumps;

HERALDRY—I.

COLOURS.

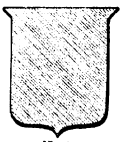

Or.


Argent.

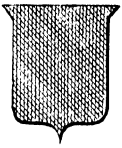

Azure.

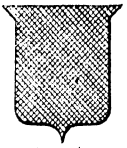

Gules.


Sable.

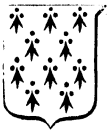

Vert.

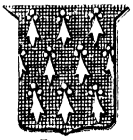

Purpure.

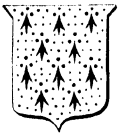

Tenny.

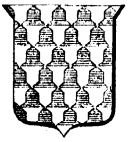

Sanguine.

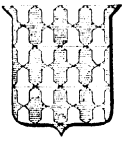
FURS.

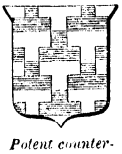

Ermine.


Ermines.

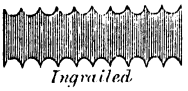

Erminois.


Vair.


Counter-Vair.


Potent counter-potent.

LINES.


Ingrailed.


Invected.

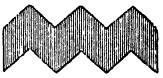

Wavy or Undy.


Nebuly.


Embattled.


Raguly.


Indented.

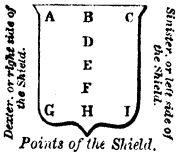

Dancetty.


Potency.

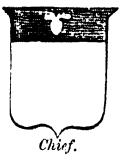

Dovetail.

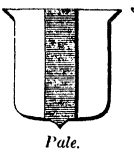
HONOURABLE ORDINARIES,

with some of their diminutives.

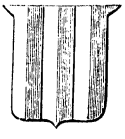


Points of the Shield.


Chief.

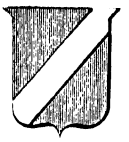

Pale.

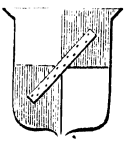

Bend.


Paly.


Bendlet.

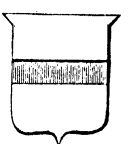

Cottised.

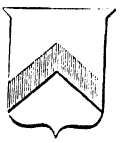

Bend Sinister.


Batune Couped

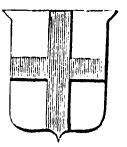

Scarpe.


Fesse.


Bar.

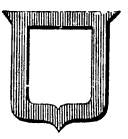

Chevron.


Couple-close.

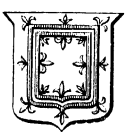

Cross.

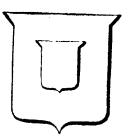

Saltire.

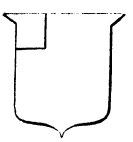
SUB-ORDINARIES.

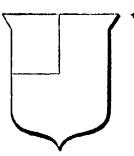

Bordure.

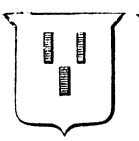

Orle.

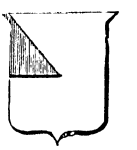

Double Tressure.

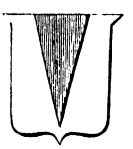

Inescutcheon.

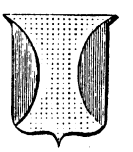

Canton.

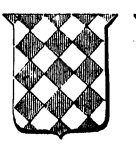

Quarter.


Billets.

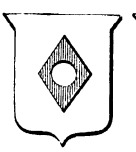

Gyron.


Pile.


Flanches.

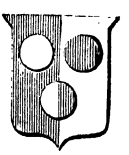

Lozenge.


Fusil.


Rustre

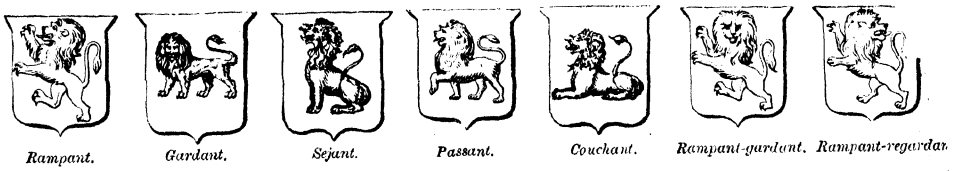

Mascle.


Fret.

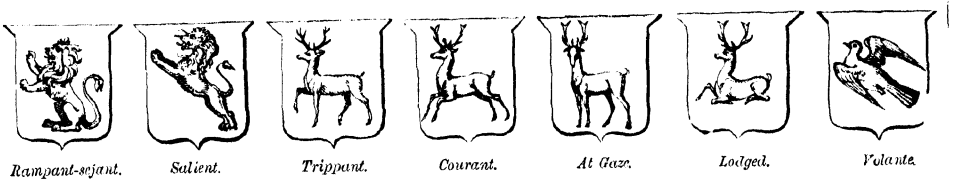

Roundel

HERALDRY—II.

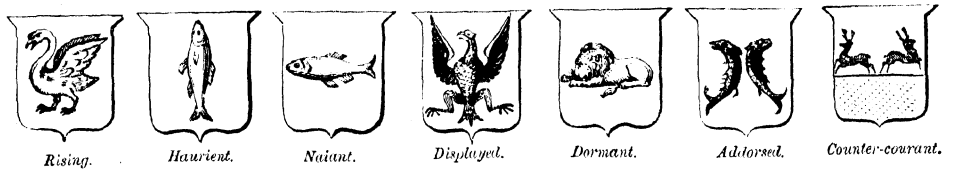
CHARGES.



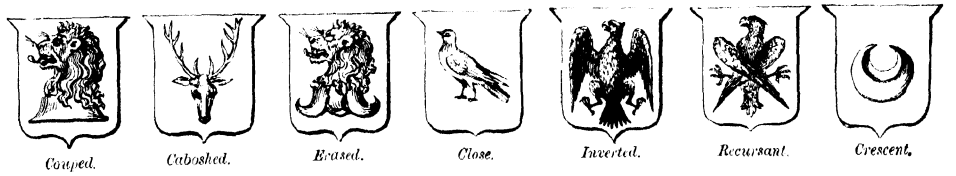
Rampant. *Gardant.* *Sejant.* *Passant.* *Couchant.* *Rampant-gardant.* *Rampant-regardant*



Rampant-sejant. *Salient.* *Trippant.* *Courant.* *At Gaze.* *Lodged.* *Volante*



Rising. *Haurient.* *Naiant.* *Displayed.* *Dormant.* *Addorsed.* *Counter-courant.*



Couped. *Caboshed.* *Erased.* *Close.* *Inverted.* *Recursant.* *Crescent.*



Increscent. *Debruised.* *Issuant.* *Demi.* *Cockatrice.* *Wyvern.* *Dragon.*

CROWN AND CORONETS.



King.



Prince of Wales.



Royal Family.



Duke.



Marquis.



Earl.



Viscount.

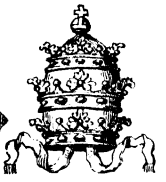


Baron.

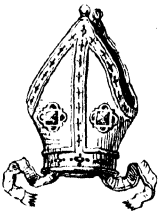


Achievement or Hatchment, comprising the Escutcheon, with its Timbers.

MITRES, HELMETS, &c.



Papal Tiara.



Bishop's Mitre.



Imperial Crown.



King.



Noble.



Abacot, or Cap of Maintenance.



Knight



Esquire

eradicated when torn up by the roots, *blasted, withered*, &c.; a branch is said to be *slipped, leaved*, &c.; leaves and flowers are said to be *pendant* or *erect*, &c. The sheaves of corn are termed *garbs*. If anything seems to be proceeding from another, it is termed *issuant*, as 'An arm *imbowed issuant*;' an arrow is said to be *barbed* and *feathered;* a castle is said to be *towered;* a key *endorsed;* colours *disveloped;* a weapon *imbrued*, that is, bloody; a horse *furnished* when bridled, saddled, and completely caparisoned. When the field is divided into four quarters, it is said to be *quarterly* when they have each their charges: these are said to be *on the first*, that is, on the field of the first quarter; *on the second*, that is, the field of the second; and when there are several metals or tinctures *of the first*, it is said to denote the first mentioned; and *of the last* the last mentioned. For some examples of charges see the plate.

Exterior Ornaments of the Escutcheon are the helmet, mantling, crest, escroll, wreath, motto, supporters, cap of dignity and crown, and are generally denominated *timbres*, whence to timbre arms is to adorn them with helmet, mantle, crest, &c.

Helmet.—The Helmet, which is placed on the top of the escutcheon, varies both in form and the materials of which it is made. Those of sovereign princes are of gold, those of the nobility of silver, and those of gentlemen of polished steel. The *full-faced helmet*, with six bars, is for the king and princes of the blood; the *sidelong helmet*, with five bars, is for dukes and marquises, &c.; the *full-faced helmet of steel*, with its beaver or vizor open, is for knights; and the *sidelong helmet*, with the vizor shut, for the esquire.

Mantling.—The Mantling or mantle was anciently fixed to the helmet, to which it served as a covering. Mantlings are now used like cloaks, to cover the whole achievement. The mantle in blazon is said to be *doubled*, that is, lined throughout with some of the favours above named. The common tincture or colour of these, both for nobility and gentlemen, is gules, but the king's is cloth of gold.

Crest.—The Crest, or Cognizance, is placed upon the most eminent parts of the helmet, but yet so as to admit the interposition of the mantle, wreath, &c. Crests were anciently worn in the field in order to distinguish the wearers from others by means of their followers, who were in the habit of wearing their leaders' crest. As appendages to the crest are the—*wreath*, which serves as a support; it is composed of two colours wreathed or twisted together; and the *escroll*, which was formerly in great estimation as a support to the crest.

Motto.—The Motto, word, or saying, consists of the word or phrase which gentlemen carry in a scroll under or above their arms.

Supporters.—Supporters were originally only ancient devices or badges, which by custom came to embellish armorial ensigns. They are called *supporters* because they hold the shield; and if they be of the figures of angels, or human beings, they are called by the French *tenents*.

Cap of Dignity.—The Cap of Dignity, otherwise called a *ducal cap*, is a head tire which dukes and commanders were accustomed to wear in token of excellency. This cap must be of a scarlet colour, and turned up with ermine.

Crowns and Coronets.—Crowns are worn only by sovereign princes, in distinction from coronets, which are worn by nobility, and are inferior to the former, both in size and richness. A comparative view of the crowns, coronets, &c., worn in England and elsewhere is given, in the plate.

HERALDS' COLLEGE. See HERALD.

HERAT (ancient *Aria*), a city in the north-west of Afghanistan, in a beautiful and fertile plain, about 370 miles west of Cabul. It is inclosed by a broad deep ditch well supplied with water from springs within the town, and an earthen mound surmounted by a lofty wall of unburned brick, and defended by a strong citadel. From each out of four of the five gates a long street of bazaars leads towards the centre of the town, and terminates in a central square. The remaining streets are narrow and dirty. The houses are generally of two stories. The caravansaries, public baths, and mosques are very numerous; and one of the last, though in a state of rapid decay, was once magnificently adorned. The most important manufactures are carpets, remarkable for their softness and the brilliancy and permanency of their colours; sword-blades, in high repute all over Persia; shoes and cloaks, and caps made of lamb and sheep skins. The trade, almost entirely in the hands of Hindus, is greatly favoured by the situation of the town on the great thoroughfare from India westward, and consists of exports of asafœtida and saffron, pistachio nuts, mastic, manna, gums, dyes, and caraway seeds; and imports of shawls, indigo, sugar, chintz, muslin, leather, and skins, partly for home consumption, but much more for re-export to Mushed, Yezd, Kerman, and Ispahan, in return for coin, tea, chinaware, broadcloth, copper, pepper, and sugar-candy. Herat was long the capital of the empire founded by Tamerlane, and was once much larger and more splendid than now. Its possession has been repeatedly contested among the peoples of Central Asia, and being regarded as a key to Afghanistan on the side next Persia and Russia it is of great importance politically. Its capture by Persia in 1856 led to a short war between Britain and Persia. Pop. about 45,000.

HÉRAULT, a department, France, bounded north and north-east by Gard, south-east and south by the Gulf of Lyons, south-west by Aude, west by Tarn, and north-west by Aveyron; area, 2393 square miles. In the north-west it is covered by the central chain of the Cevennes, and descends rapidly from them in a south-east direction towards the coast, which is low, and lined by a long series of lagoons. The chief rivers are the Hérault, Orb, and Lez, all partly navigable; but the most important water communication is the Canal du Midi, which here terminates in the lagoon of Thau. The arable land, about one-sixth of the whole, is generally fertile, and produces grain for export. The vineyards are very extensive, and many of the wines are of first quality. The mulberry is very extensively, the olive more partially cultivated; fruit is abundant; and aromatic, medicinal, and dye plants are raised on a large scale in several districts. Among the forest-trees the oak, both common and evergreen, is conspicuous. The minerals include coal, copper, slate, millstones, marble, and gypsum. Hérault includes the arrondissements of Béziers, Lodève, Montpellier, and Saint-Pons, the capital being Montpellier. Pop. (1901), 488,285.

HÉRAULT DE SÉCHELLES, MARIE JEAN, a French revolutionist, born at Paris in 1760. In 1789 he was an advocate-general in the parliament of Paris, a place which he owed to the favour of the queen, secured by his brilliant talents. He joined the patriots and distinguished himself at the taking of the Bastille. He was chosen a member of the legislative assembly and took his seat on the extreme left. In July, 1792, he joined in the declaration that the country was in danger; and he subsequently advocated vindictive measures against the royalists. He presided in the national assembly in September, and, becoming a member of the convention, he warmly engaged in the schemes of the revolutionary party. About this time he was charged with the management of some negotiations with foreign powers, but

they proved unsuccessful. He was then sent on a mission to Alsace and Savoie, and it was on this occasion he wrote home, 'I have sowed guillotines on my path and find it has produced a good effect.' In November, 1792, he was again employed as a commissioner from the convention to the army in the department of Mont Blanc, and he was thus absent from Paris during the trial of the king. He, however, in conjunction with his colleagues, Jagot and Simond, wrote a letter to the convention, charging Louis XVI. with an uninterrupted series of treasons, and recommending his condemnation, without mentioning the punishment to be inflicted. But he chiefly distinguished himself in the contest between the Mountain and Gironde parties, and he powerfully co-operated in the destruction of the latter. He was also a member of the committee of public safety. But all his services to the terrorists did not save him from the scaffold. He was denounced, March 17, 1794, for having, as was alleged, concealed an emigré, and as belonging to the faction of Danton, with whom he was executed on the 5th of April following. He has left several works literary and political, among them a philosophical work, Théorie de l'ambition, with a materialistic tendency.

HERBACEOUS PLANTS, are perennial plants of which the stem perishes annually, while the roots remain permanent and send forth a new stem in the following season.

HERBARIUM, or HORTUS SICCUS, a name applied to a collection of specimens of plants carefully dried, classified, and preserved in a suitable cabinet. When the specimens are collected, which should be in dry weather, they ought to be deposited—in a uniform manner, the flowers at one end, the roots in the other—in a japanned tin-box or vasculum. For mosses and other plants of small size a box which may be carried in the pocket is desirable. As many plants of delicate flowers and foliage will not bear transport in a vasculum, these should be at once placed in a small field-book of unsized blotting paper, with suitable boards, and straps adequate to afford the requisite pressure. The paper used for drying plants of the ordinary size for the herbarium is moderately absorbent, 18 inches long by 11 broad, and should be arranged in parcels of four or five sheets each. The requisite amount and uniformity of pressure is secured by the use of two boards, each of $\frac{1}{2}$ to $\frac{3}{4}$ inch in thickness, for the outside, and several of $\frac{3}{8}$ inch in thickness to be placed inside, one between every dozen parcels of the drying paper when filled with plants. The pressure, during a botanical excursion, may be obtained by means of a rope and a rack-pin. At home, a screw-press may be employed, or the simple and ready method may be resorted to of applying pressure by laying weights or piling books upon the bundle of paper and plants. In commencing the preparations for drying, a parcel of four or five sheets is laid on one of the stout outside boards, the plants are carefully placed upon the paper, preserving as much as possible their natural habits, and laying out the leaves and petals and other parts, so as to exhibit the characters of the foliage and flowers. Another parcel of drying paper is placed over the plants so disposed, a new set of specimens is spread out on the paper, and so on, until a dozen parcels of the paper have been laid over each other; one of the thin inside boards is then applied, and new sets are arranged, until a parcel has been accumulated sufficiently large to have the second outer board placed over all, and the pressure brought to bear. After a lapse of twelve hours the moist paper is withdrawn and hung up to dry, while the plants are transferred to a fresh supply of paper. In this manner the plants may be changed every day or two, as they are found to part with their moisture more or less freely. In the course of eight or ten days ordinary specimens will require only a slight degree of pressure. Cresses and other plants containing little moisture may require a change of paper only once or twice. Succulent plants, such as stone-crops and the house-leek (*Sempervivum*) should be killed by immersion in boiling water, and left for some time to drain, before being placed in drying paper. When the stem is thick and woody, it may be reduced to the desired thinness with a knife; and if the flower be thick and globular, as in the capitulum of the thistle, one half may be cut away without depriving it of the character of the species. It will be found of great importance to accompany each specimen laid down on the drying paper with a label containing the name, locality, &c. When the process of desiccation has been completed specimens are selected for the herbarium, and are fastened upon stiff paper 17 inches by $10\frac{1}{2}$. In fastening the plants upon paper thin glue is usually employed; or in particular cases slips of gummed paper, or a needle and thread, may be resorted to, the latter method being preferable in the treatment of ferns and grasses.

HERBELOT, BARTHÉLEMY D', a celebrated orientalist, born of a good family, at Paris, in 1625. After having gone through a course of study in the university of his native city, he applied himself particularly to the eastern languages, with a view to the elucidation of the Hebrew Scriptures. He visited Italy for improvement, and formed an acquaintance, at Rome, with Lucas Holstenius and Leo Allatius, two of the most learned men of the age. He was patronized by Cardinal Grimaldi, who in 1656 sent him to Marseilles to meet Christina, queen of Sweden, then on her way to Rome; and that princess was much pleased with his society. On his return to France the minister of state, Fouquet, received him into his family, and gave him a pension of 1500 livres. On the disgrace of his patron, D'Herbelot was fortunate enough to escape the general ruin which involved the dependants of the fallen statesman, and was appointed in 1661 oriental interpreter to the King of France. After some years he again travelled into Italy. At Leghorn he was introduced to the Grand-duke of Tuscany, Ferdinand II., who invited him to Florence, where he arrived in July, 1666. He was magnificently entertained by the duke, and was also gratified with a present of a valuable collection of eastern manuscripts. While in Italy he commenced his great work, the Oriental Library; and, being recalled to Paris by Colbert, a pension was given him, that he might be at liberty to proceed with his undertaking. It was his first design to have published his collection in the Arabic language, and types were cast for the purpose of printing it. But the death of Colbert having interrupted this plan, he recomposed his work in the French language, as likely to prove more generally useful. On the recommendation of the chancellor, M. de Pontchartrain, he was appointed to the royal professorship of Syriac in 1692. He died at Paris, December 8, 1695. His book was published in 1697, under the title of La Bibliothèque Orientale (folio). Besides this he left a collection on the same subject, entitled Anthologia, and a dictionary in the Turkish, Persian, Arabic, and Latin languages, neither of which has been printed. The best edition of the Oriental Library is that of the Hague (1777, four vols. 4to), with the Supplements of Galland and Visdelou.

HERBERT, EDWARD, Lord Herbert of Cherbury, in Shropshire, was born at Eyton-on-Severn, near Wroxeter, in 1583. At the age of 14 he was entered as a gentleman commoner at University College,

Oxford. In 1600 he went to London, and, shortly after the accession of James I., became a Knight of the Bath, having previously married the heiress of Sir William Herbert, another branch of the family. He then visited the Continent, carrying with him those chivalrous ideas with which the oath and ceremonies of the investiture of the order of the Bath seem to have impressed him. He returned to England in 1609, and in 1610 quitted it again, in order to join the English forces serving in aid of the Prince of Orange at the siege of Juliers, where he distinguished himself by his rash and romantic bravery. On the conclusion of the siege he returned to London, where he was one of the most conspicuous characters of the period. His gallantry towards a court lady, which, however, he asserts to have been without criminality, produced an attempt by her husband to assassinate him in the streets of London, which he foiled by an extraordinary effort of courage and dexterity. In 1614 he served again in the Low Countries under the Prince of Orange, and in 1619 was sent ambassador to the court of France, where he resented some high language on the part of the Constable Luynes, the favourite of Louis XIII., with so much spirit that a complaint was sent to the English court, which produced his recall. He cleared himself, however, so well to King James that on the death of Luynes he was sent back to France as resident ambassador. At Paris, in 1624, he printed his famous book, De Veritate prout distinguitur a Revelatione a Verisimili, a Possibili et a Falso, the object of which was to assert the sufficiency, universality, and perfection of natural religion, and thereby prove the uselessness of revelation. In 1624 he returned from France, and was created an Irish peer; and in 1629 he became an English baron with the title of *Lord Herbert of Cherbury*. In the civil war he at first tried as far as possible to play a neutral part, but afterwards sided with the parliamentary party chiefly with a view, it appears, to save his property. He died in London in 1648. The character of Lord Herbert is strongly marked in his memoirs, which show him to be vain, punctilious, and fanciful, but open, generous, brave, and disinterested. The De Veritate was followed by works entitled De Causis Errorum (1645) and De Religione Gentilium (1663; Eng. trans. 1709). In 1649 was published his Life and Reign of Henry VIII., which is rather a panegyric on that prince than a fair representation. The English style of Lord Herbert is strong, manly, and free from the quaint pedantry of the age. Lord Herbert was one of the first to attempt a systematic proof of the sufficiency of natural religion. 'Herbert's religious doctrine starts with the assumption that religion, which is common to the human race, consists merely of the five innate ideas or axioms that there is a God, that He ought to be worshipped, that virtue and piety are essential to worship, that man ought to repent of his sins, and that there are rewards and punishments in a future life. He regards Christianity as on the whole the best religion, because its dogmas are least inconsistent with his five primary articles.' (Sidney Lee in Dict. Nat. Biog.) His autobiography remained in manuscript till 1764, when it was published by Horace Walpole. There is a recent critical edition by Sidney Lee (1886).

HERBERT, George, younger brother of the subject of the last article, was born at Montgomery Castle, April 3, 1593, and received his education at Westminster School and Trinity College, Cambridge, of which he became a fellow in 1615. In 1619 he was chosen university orator, and held that office till 1627. His talents attracted the notice of James I., but the death of his majesty in 1625 put an end to his prospects of promotion, and in the same year he took deacon's orders, and became a prebendary in the diocese of Lincoln. In 1630 he took priest's orders, and was presented to the rectory of Bemerton, near Salisbury, in Wiltshire. He died in 1633. His friend, Nicholas Ferrar, published from Herbert's manuscript, The Temple; Sacred Poems and Private Ejaculations (Cambridge, 1633). The poetry of Herbert, in common with that of Donne and Cowley, is deformed by conceit and antithesis, and obscured by metaphysical allusion; but some of his minor pieces, in spite of their defects, are extremely beautiful, and may be said to bear the stamp of genius. Of his prose works, The Country Parson is the most celebrated. His life, by Isaac Walton, has been often published. The best edition of his works is that by Dr. Grosart (1874).

HERBERT, Sidney, Lord Herbert of Lea, an eminent statesman, was the second son of the eleventh Earl of Pembroke, and born at Richmond, Surrey, on 16th September, 1810. His mother was the only daughter of Simon, Count Woronzow, a Russian nobleman. He was educated at Harrow and at Oriel College, Oxford, and in 1832 entered the House of Commons as member for South Wilts, a constituency which he represented till a short time previous to his death. He ranged himself with the Conservative party, his first speech being delivered in 1834, against the admission of Dissenters to the universities. On Sir Robert Peel becoming premier in 1841 Mr. Herbert was appointed secretary to the admiralty, and so remained until in 1845 he was made secretary for war, with a seat in the cabinet. He became a convert to the views of his leader on the subject of free-trade, and quitted office with him in 1846. On the formation of the Aberdeen cabinet, in December, 1852, he resumed his post as war secretary, and retained it till the dissolution of the ministry under the disasters of the Crimean campaign in the spring of 1855. For a short time he acted as colonial secretary under Lord Palmerston, and in 1859, on the re-accession of the latter to office, became once more secretary for war. Early in 1861 he was transferred to the House of Lords, under the title of Lord Herbert of Lea. The fatigues and cares of office had, however, exhausted his frame and overwrought his energies, and he did not long survive this elevation of rank. He expired at Wilton House, Salisbury, on 2d August, 1861.

HERCINITE, a variety of the mineral called spinel (which see). It is composed of alumina and protoxide of iron, but it usually contains a certain amount of magnesia. It is a somewhat rare mineral, and is met with in Bohemia. It has a black or dark-green colour, with a vitreous lustre and conchoidol fracture. It is very hard, and is used for cutting and grinding glass. It is infusible, but by heating in the air the iron is oxidized, and the mineral becomes red.

HERCULANEUM, or Herculanum, an ancient city, about 5 miles S.E. from Naples, so completely buried by a stream of lava and a shower of ashes, in an eruption of Mount Vesuvius, during the reign of Titus, A.D. 79, that its site was no longer visible. The neighbouring Pompeii, on the river Sarno, one of the most populous and commercial cities of this coast, and Stabiæ, which stood on the site of the modern Gragnano, together with Oplontis and Teglanum, experienced the same fate. Herculaneum was a city of great antiquity. Its origin was ascribed by Greek tradition to Hercules, but it is not certain that it was actually founded by a Greek colony. Strabo says it was first occupied by Oscans, afterwards by Tyrrhenians and Pelasgians, and then by the Samnites. The exact time when it fell under Roman dominion is not known. It took part in the

social war against the Romans. In the time of Sulla it was a *municipium* and a fortified town, and appears to have been a place of some importance. It was situated on an elevated ground between two rivers, and its port was one of the best on the coast, but it never attained the rank of a first-class city. It suffered in A.D. 63 in the same earthquake as nearly destroyed Pompeii. In the greater irruption of A.D. 79 its position at the foot of the mountain made it the first to suffer, and from this cause the bed of ejected materials under which it was buried assumed a more compact and solid form than those which covered Pompeii. These materials consist of a volcanic tuff formed of sand and ashes, partly consolidated by the agency of water. A small population appears afterwards to have settled on its site, but it is supposed to have been again destroyed by an eruption in A.D. 472. The site of Herculaneum, though pretty well described, had been long sought in vain, when in 1713 three female statues (now in the Dresden Museum) were found in digging a well, by the direction of Prince Elbœuf, at Portici, a village situated on the site of the ancient Herculaneum. After this discovery farther excavation was prohibited by the government, and nothing more was thought of the matter till Charles, king of Spain, father of Ferdinand IV., having taken possession of the conquered Naples, chose Portici for his spring residence. Now (1738) the well was dug deeper, and traces of buildings were found. The theatre of Herculaneum was the first discovery. In 1750 a long, narrow passage, sloping down into the theatre, was opened, and is still the only way by which travellers descend to examine this structure. The excavations were continued more or less industriously for fifty years; but comparatively little progress was made, as the work was both difficult and also dangerous to the houses in the populous villages of Resina and Portici, situated above. As soon as one part was excavated and explored it was filled up with the rubbish from a new digging. The theatre is now the only building to be seen underground, and it is greatly encumbered with the supports built to sustain the rock above it. It is a noble edifice, massively built of solid stone, and seated, as has been calculated, to hold 8000 persons. It appears not to have been of great age at the time of its destruction. Bronze statues of Drusus and Antonia and of the Muses were found in various parts of the building. An inscription over the entrance of the theatre intimates that the citizens were indebted for it to the munificence of a private individual. In a square on the south of the theatre a temple was found which was connected with another temple, to the east of it, by a wide street lined with porticoes. One of these temples, dedicated to the mother of the gods, had been restored by Vespasian after the earthquake of A.D. 63. On the north of the theatre was a basilica 228 feet long and 132 broad, surrounded by a portico of forty-two columns, and adorned with paintings. Many beautiful paintings and works of art were removed from these buildings to the museum at Naples. A sumptuous private villa was disinterred, containing a number of statues, and in one of the rooms a quantity of papyrus manuscripts, chiefly of works on the Epicurean philosophy. Some of the statues are excellent as works of art, such as those of Agrippina, Aristides, the Sleeping Faun, and the Mercury. Other precious relics discovered here, and now in the museum, are busts of Plato, Seneca, Demosthenes, Scipio Africanus, Augustus, &c., beautiful mosaics, and articles of furniture. New excavations were carried out in 1828–37, and since 1868. The chief discoveries made were those of the forum, a small and elegant temple, a basilica, a dilapidated building supposed to have been an inn, dwelling-houses, tombs, &c One of the houses discovered at Herculaneum contained a quantity of provisions, none of which had been disturbed for eighteen centuries, for the doors remained fastened, in the same state as they were at the period of the catastrophe which buried the town. The family which occupied this mansion was, in all likelihood, when the disaster took place, laying in provisions for the winter. The provisions found in the storerooms consisted of dates, chestnuts, large walnuts, dried figs, almonds, prunes, corn, oil, pease, lentils, pies, and hams. The internal arrangement of the house, and the manner in which it was ornamented, announced that it had belonged to a very rich family, and to admirers of the arts; for there were discovered many pictures, vases, articles in glass, bronze, and terra cotta. Few skeletons comparatively have been found either in Pompeii or Herculaneum, so that it is probable most of the inhabitants had time to save themselves by flight. At the door of a villa in Herculaneum were found two, one of which held a key in one hand, and in the other a bag with coins and cameos. Near them were silver and bronze vessels. It was supposed that one was the master and the other the slave, and that they were suffocated under the mass of ashes while endeavouring to find the passage out. For the antiquary and archæologist, antiquity seems here to revive, and awakens sensations which Schiller has so beautifully described in the poem Pompeii and Herculaneum. The ancient streets and buildings are again thrown open, and in them we see, as it were, the domestic life of the ancients. We had never before had such an opportunity of becoming acquainted with the disposition of the houses of the ancients, and with their utensils.

Among the most interesting objects discovered here are the papyri, over 1750 of which are now in the Naples Museum. Nearly the whole were discovered in the villa above mentioned. The expectations of the learned world from these literary treasures have not been fulfilled. Hitherto the discoveries have mostly consisted of works of no great value; but still it is of some importance that we have become better acquainted with the material of the ancient manuscripts. The rolls were of a cylindrical form, and so much charred as to have the appearance of tobacco rolls. Hardly a third of them have yet been unrolled. The process presents great difficulties, from the tendency of the MSS. to crumble. Sir Humphry Davy made some experiments on them with chemical appliances without much success. The application of moisture almost entirely dissolved the manuscripts to which it was applied. One of the works is a treatise by Epicurus on Nature; there are some writings of Philodemus, a Syrian philosopher; but on the whole they are of little value. There have been published eleven volumes of the Volumina Herculanensia, containing engraved transcripts of the unrolled papyri (folio, Naples, 1793–1855), and since 1861 several volumes of a continuation of the same—Voluminum Herculanensium Collectio altera. The knowledge of ancient art has gained more by the discoveries made here than literature; many of the statues, bass-reliefs, and other works of sculpture, as well as the wall paintings, being of high value, and superior to those found at Pompeii.

HERCULES. See HERACLES.

HERCULES, one of Ptolemy's Northern constellations, including 113 stars. It is within this constellation that the point to which the sun, with its accompanying system of planets, is travelling at present is situated. The constellation also includes some remarkable star groups and nebulae, and the star Ras Algiatha, which is of the second order of magnitude —the highest order in the constellation.

HERCULES, PILLARS OF, two pillars which Heracles or Hercules is said to have erected on each side of the strait named after him, or the Strait of Gades (Gibraltar), between Europe and Africa, upon the mountains Calpe and Abyla, as the limits of his wanderings towards the west. The ancients were much divided in opinion both as to the origin and nature of these pillars, and even as to their exact position. The earliest Greek writer by whom the Pillars of Hercules are mentioned is Pindar. Pillars of Hercules are mentioned in various regions to which Hercules was supposed to have penetrated, as in the north of Germany and the west of Gaul. The Pillars of Hercules were also sometimes identified with the Pillars of Kronos or Briareus, by which the heavens were supported. The general opinion of the ancients was that the pillars occupied the site now assigned to them; but their exact position in the straits was not always clearly defined. Various legends connected opposite physical phenomena with the creation of these pillars. According to one Hercules tore the rocks asunder which had previously divided the Mediterranean Sea from the ocean. Some believed that the effect of this disruption was to lower the level of the Mediterranean so as to form the Isthmus of Suez and separate it from the Red Sea; others thought the level of the Mediterranean had been raised by its junction with the ocean. Another legend was that Hercules temporarily united the two rocks into a bridge for the purpose of conveying the herds of Geryon to Libya, and another that he narrowed the passage to shut out the sea-monsters from the Mediterranean. The subject is discussed at great length by Strabo. One of the principal parallels of latitude was drawn by Eratosthenes through the pillars. See GIBRALTAR.

HERCYNIAN FOREST (*Hercynia silva*), the general name given by the ancients to the forest-clad mountains in Central Germany, extending from the Rhine to the Carpathians. It was also applied to particular portions of the chain. Thus Strabo's description of it corresponds with the modern Böhmerwald, that of Tacitus and Pliny with the Thüringerwald, while, according to Ptolemy, it was the mountain-ridge uniting the Carpathians and the Sudetes. The name is probably connected with *Harz*.

HERDER, JOHANN GOTTFRIED VON, a classical German author, was born August 25, 1744, at Mohrungen, a small place in Eastern Prussia, where his father taught a school for girls. A Russian surgeon, struck with the talents and disposition of the youth, offered to take Herder with him to Königsberg and to St. Petersburg, and to teach him surgery gratuitously. Herder, who had no hope of being able to follow his inclinations, left his native place in 1762; but in Königsberg he fainted at the first dissection at which he was present. He now resolved to study theology. Some friends procured him an appointment in Frederick's College, where he was at first tutor to some scholars, and at a later period instructor in the first philosophical and second Latin class, which left him time to study. During this period he became known to Kant, who permitted him to hear all his lectures gratis. His unrelaxing zeal and diligence enabled him to become acquainted with science, theology, philosophy, philology, natural and civil history, and politics. In 1764 he was appointed an assistant teacher at the cathedral school of Riga, with which office that of a preacher was connected. His pupils in school, as well as his hearers at church, were greatly attached to him. In 1767 he received from St. Petersburg the offer of the superintendence of St. Peter's School in that city; but he declined this offer, and even gave up his place at Riga, in order to travel. In France he was appointed travelling tutor to the Prince of Holstein-Oldenburg, who was on a tour through France and Italy. But in Strasburg he was prevented from proceeding by a disease of the eyes; and here he became acquainted with Goethe, on whom he had a very decided influence. Herder had already published his Fragments on the More Modern German Literature, his Critical Woods (Kritische Wälder), and other productions, which had gained him a considerable reputation, though he had not at this time published anything of importance in theology; yet, while in Strasburg, he was invited to become court preacher, superintendent, and consistorial counsellor at Bückeburg, whither he proceeded in 1771. He soon made himself known as a distinguished theologian, and in 1775 was offered a professorship at Göttingen, which he, however, did not accept immediately. Just as he had settled to go he received an invitation to become court preacher, general superintendent, and consistorial counsellor at Weimar. This appointment was through the influence of Goethe. He arrived in Weimar in October, 1776. This was at the time when the Duke Augustus and the Princess Amalia had collected many of the most distinguished German literati at their court. Weimar was greatly benefitted by Herder's labours as a pulpit orator, inspector of the schools of the country, the patron of merit, and founder of many excellent institutions. In 1801 he was made president of the high consistory, a place never before given to a person not a nobleman. He was subsequently made a noble by the Elector of Bavaria. He died December 18, 1803. Among the complete editions of his works we may mention that published at Stuttgart by Meyer (1894 onwards). As a theologian Herder contributed to a better understanding of the historical and antiquarian part of the Old Testament. His Geist der Hebräischen Poesie is highly valued. He did much for the better appreciation of the classical authors, and his philosophical views of human character are full of instruction. His greatest work is his Ideen zur Philosophie der Geschichte der Menschheit (Riga, 1785 et seq.), in which all the light of his great mind is concentrated. In poetry Herder effected more by his various accomplishments, his vast knowledge, and fine taste, than by creative power; yet he has produced some charming songs; and his Cid, a collection of Spanish romances into a kind of epic, is one of the most popular poems of Germany. The style of Herder is pure and correct.

HERE. See HERA.

HEREDITAMENTS, all such things, immovable, whether corporeal or incorporeal, as a man may leave to his heirs, by way of inheritance, or which, not being otherwise devised, naturally descend. Corporeal hereditaments consist of material and tangible possessions, incorporeal hereditaments of rights and privileges not themselves tangible, though conferring claims on tangible possessions. They are defined by Blackstone as of ten sorts, namely, advowsons, tithes, commons, ways, offices, dignities, franchises, pensions, annuities, and rents.

HEREDITARY DISEASES. See DISEASES (HEREDITARY).

HEREDITY. It is a fact of observation that like tends to beget like; that, on the whole, organisms 'breed true'. The resemblances between offspring and their parents are always much greater than the differences. In other words, the innate nature or character of living creatures tends to persist in their descendants, and this is due to the genetic relation which binds one generation to another. The scientific term for this genetic relation between successive generations is *heredity*.

Similarly, all that the living creature is or has to start with in virtue of its genetic relation to parents and ancestors is called its *inheritance*. The chief problem in the study of inheritance is to measure the inborn resemblances and differences between successive generations of the same and kindred stocks, and to find some general formulæ which will fit the facts. The central problem of the study of heredity is to understand the nature of the genetic relation which binds generations together, and makes it possible that not only specific characters of importance but little trivialities of structure and habit, and not only normal qualities but abnormal as well, may be handed down hereditarily from generation to generation.

In the transmission of property we are familiar with the distinction between the inheritance and the person who inherits, but in the continuance of generations, as studied by the biologist, the distinction is impossible. At the beginning of an individual life—that is, in all ordinary cases of sexual reproduction in the fertilized ovum—the individual and the inheritance are the same. In other words, the physical basis of inheritance is in the fertilized egg-cell, which is a potential offspring. Very soon, indeed, this potential organism, this inheritance, will be affected by external influences in many ways, so that the final result will be partly due to inherited 'nature' and partly due to acquired 'nurture', but there is no doubt as to the fact that at the beginning the new individuality has its physical basis in the paternal and maternal contributions united in the fertilized ovum. To understand how the nature of an organism—that is to say, how a natural inheritance—can be condensed in a unit which is usually microscopic, or how it is able to realize itself stage by stage in the course of development, is beyond present science. But some light is thrown on the problem by the idea of germinal continuity with which Galton, Weismann, and others have made us familiar.

There is a sense, as Galton says, in which the child is as old as the parent, for when the parent's body is developing from the fertilized ovum a residue of unaltered germinal material is kept apart to form the future reproductive cells, one of which may become the starting-point of a child. Weismann, generalizing from cases where it is visibly demonstrable, maintains that in all cases the germinal material which starts an offspring owes its virtue to being directly continuous with the germinal material from which the parent or parents arose. But as a continuous lineage of recognizable germ-*cells* is often, perhaps in the majority of cases, unrecognizable, what Weismann supposes is a continuity of germ-*plasm*, that is, of a specific substance of definite chemical and molecular structure which is the bearer of the hereditary qualities. In development a part of the germ-plasm 'contained in the parent egg-cell is not used up in the construction of the body of the offspring, but is reserved unchanged for the formation of the germ-cells of the following generation'. Thus, the parent is rather the trustee of the germ-plasm than the producer of the child, and in a new sense the child is seen to be 'a chip of the old block'. Similar material to start with, similar conditions in which to develop, therefore like tends to beget like.

This conception of the continuity of the germ-plasm makes it easier to understand the fact that all the inborn characters of an organism may form part of the inheritance of the offspring. The present is the child of the past, and the past is represented in the child. Mental as well as physical qualities, tendencies to degeneration as well as to progress, and even subtle qualities such as longevity and fertility, may be inherited. It must be noted, however, that the hereditary resemblance is often far from complete, and in so far as this divergence is not directly induced from without by modifications of the offspring's body, we say that it is due to germinal variation. (See EVOLUTION.) The variation may simply be an incompleteness in the expression of hereditary resemblance, but it may also imply the appearance of some novel feature which was not expressed in parents or ancestry. It is this fact of variation which forces us to change the old saying 'like begets like' into the more accurate statement that 'like tends to beget like'. We must be careful, however, not to assume (*a*) that a character is inherited simply because it reappears in successive generations, for it may be that similar modifications are impressed upon the bodies of successive sets of offspring by the influence of similar external conditions; or (*b*) that lack of resemblance between offspring and their parents is necessarily due to incompleteness in the inheritance, for the fact that the resemblance so often reappears in the third generation makes it probable that the incompleteness is not in the inheritance, but simply in its expression. In other words, heritable characters may remain latent, failing to find expression in development, either for lack of the appropriate stimulus, or because they are neutralized by other characters. In the inheritance of diseased conditions it often happens that the constitutional tendency finds a different expression in successive generations, or that it is expressed in the sons but not in the daughters. Since it reappears in the male offspring of the daughters, the assumption of latency seems inevitable. To three common forms of inheritance the terms *blended*, *exclusive*, and *particulate* are applied, and, in the absence of space for precise definition, they may be illustrated by an example. Suppose the parents of a foal to be markedly light and dark in colour; if the foal is light brown or gray the inheritance in that respect is *blended*; if light or dark, it is *exclusive*; if piebald, it is *particulate*. These different results are often very clearly seen in hybrids, and they may be expressed in another way by reference to what is called the quality of *prepotency*, with which breeders are familiar. This term refers to the fact that in the development of a character the paternal or maternal qualities may predominate; thus, in man the father is usually prepotent as regards stature. It seems that one of the ways in which the quality of prepotency is developed is by inbreeding, and some breeders say that they can produce a horse so prepotent, so fixed by inbreeding, that it will produce its like, however mated. Perhaps a unified view of the facts may be found in the theoretical conception of a germinal struggle in the arcana of the fertilized ovum—a struggle in which the maternal and paternal contributions may blend and harmonize, or may neutralize one another, or in which one may conquer the other, or in which both may persist without combining.

A big average fact of inheritance is the sensible stability of type which persists from generation to generation, the tendency to keep up a specific average. This may be partly due to the action of natural elimination, weeding out the extraordinary deviations; but it is to be primarily accounted for by what Galton calls the fact of 'filial regression', which tends to bring the offspring of extraordinary parents nearer the average of the stock. In other words, children tend to differ less from mediocrity than their parents. This is due to that genetic

continuity which makes an inheritance not dual, but multiple. The offspring is not only the product of its parents, but of its past ancestry, and the mean of that ancestry is not (unless in cases of very careful selection) likely to be very different from that of the general population. Perhaps no general conclusion in regard to inheritance is more important than this, that a heritage is not merely dual, but multiple, like a mosaic. Galton has given an approximate formulation which applies particularly to cases of blended inheritance: 'The two parents between them contribute *on the average* one-half of each inherited faculty, each of them contributing one-quarter of it. The four grandparents contribute between them one-quarter, or each of them one-sixteenth; and so on.'

In this brief article it has not been possible to do more than indicate some of the chief facts; for a discussion of the numerous theories the literature referred to below must be consulted. Nor has anything been said in regard to the difficult questions concerning reversion and atavism, the transmissibility of acquired characters or modifications (see EVOLUTION), telegony (which see), and the like.

The term reversion is used to include cases where *through inheritance* there reappears in an individual some character or set of characters which was not expressed in the parents, but which did occur in an ancestor. The reappearance is supposed to be due to the re-expression of latent ancestral characters. Some very clear instances are forthcoming in the case of hybrids, but there can be no doubt that many phenomena which have been called reversions admit of some other interpretation.

In regard to the transmissibility of acquired characters no one can dogmatize, but it is of great importance that the precise question at issue be clearly apprehended. By an 'acquired character' the biologist means a modification of the body which has been directly brought about by the influence of surroundings or of use and disuse. It is a structural change which has passed the limits of organic elasticity, and therefore persists in the individual. But it can only be transmitted as such if it is able to affect the reproductive cells in a specific and representative way. Unless the offspring change in the same direction as that exhibited in the original modification, and unless the change reappear in some degree at birth before it can have been re-acquired as a modification, we are not warranted in speaking of the inheritance of the modification. So far as the evidence goes, there seems to be little warrant for our being other than extremely sceptical as to transmission of acquired characters.

But both in regard to these particular questions and to the whole problem of heredity there remains an urgent need for the collection of carefully determined facts, for prolonged experiment over several generations and over a wide range of subjects, and for the skilful application of statistical methods. The following works treat of this subject: — C. Darwin, Variation under Domestication (1868); Y. Delage, Hérédité (1895); F. Galton, Natural Inheritance (1889); K. Pearson, The Grammar of Science (2nd ed. 1900); M. Ribot, L'Hérédité Psychologique (trans. 1875); J. Arthur Thomson, The Science of Life (1899); A. Weismann, The Germ Plasm (1893).

HEREFORD, an inland county in the west of England, bounded north by Shropshire, south by the counties of Monmouth and Gloucester, east by Worcester, and west by Radnor and Brecknock; about 38 miles in length, south-east to north-west, and 32 miles in breadth at the broadest part; area, 840 square miles, or 537,363 acres, of which nearly 450,000 are arable, meadow, and pasture. The surface is beautifully diversified by hill and dale, noble and extensive woods and orchards alternating with rich corn-fields and verdant meadows. The county belongs wholly to the basin of the Severn, towards which river it has a general slope north to south, as indicated by the course of its rivers, the Wye and its affluents the Lugg, Arrow, and Frome, and some smaller streams. The soil is in general fertile, particularly the alluvial lands upon the banks of the rivers, but the pasture-grounds are in many places indifferent. Wheat is the principal crop, others being barley, oats, beans, pease, hops, and turnips. Orchards are numerous, and the quantity of cider made is very great, and the quality excellent. The Herefordshire cattle are held in high estimation. They feed easily, are quiet, tractable, work well, produce the finest beef, but are poor milkers. The usual breed of sheep is a cross between the Leicester and other breeds; Cotswolds are also reared. Horses are bred in considerable numbers, mostly agricultural and of good quality, in the northern parts, while both riding and coach horses of a superior description are reared throughout the whole county. Agriculture is on the whole of an improved character, although in many parts the farm buildings and the labourers' cottages are in an unsatisfactory condition, and drainage is somewhat neglected. The farms, which are held mostly from year to year, are generally large, and turnips and green-crop husbandry is the general rule. Oak timber is abundant, and forms, with oak-bark, an important article of export. The climate is various, but in general remarkably salubrious. Some medicinal springs are met with on the Hereford side of the Malvern Hills, and petrifying springs in the hilly parts of the county, where the soil is calcareous. For parliamentary purposes it forms two divisions, a northern (Leominster) and a southern (Ross), each returning one member. The only parliamentary borough is Hereford. Pop. in 1881, 121,062; in 1891, 115,949; in 1901, 114,401.

HEREFORD, a city and parliamentary borough of England, capital of the above county, on the left bank of the Wye, 120 miles W.N.W. of London. It is situated on slightly rising ground, in a fertile and well-cultivated valley, nearly in the centre of the county. The principal streets are broad and straight, the houses being mostly of brick, and the public buildings of stone. The most remarkable structure in the city is the cathedral, situated near the Wye, rebuilt, in the reign of William the Conqueror, on the site of an earlier edifice, built in 1012–56, and restored in 1863 at a cost of £48,591, under the direction of Sir G. G. Scott. Its entire length is 335 feet; width, 174 feet. None of the other churches require any special notice. The other public buildings of consideration are the college, a venerable but gloomy building adjoining the cathedral; the cathedral school; the shire-hall, a large, well-proportioned, and commodious building; the city police station and offices; the county-jail, built on Howard's plan in 1797; free library and museum, corn exchange, market-hall, and post-office. The charities are numerous, and comprise an infirmary, eye and ear hospital, maternity hospital, dispensary, girls' orphanage, &c. The manufactures are inconsiderable, consisting of leather, turnery, encaustic tiles, &c., but there are large cider manufactories and stores. The chief trade of the town is in hops, wool, timber, cider, malt, oak-bark, fruit, cattle, and other agricultural produce. There is a triennial musical festival of the united choirs of Worcester, Gloucester, and Hereford held here in September,

which continues during three days. The first charter of incorporation dates from the reign of John. The borough returns one member. Population in 1871, 18,347; in 1881, 19,821; in 1901, 21,382.

HERESY. See next article.

HERETIC, one who embraces a heresy; from the Greek *hairesis*, which orginally only meant a sect, from *haircomai* (I choose), without implying praise or dispraise. Thus we hear of the Peripatetic heresy, or sect of philosophers; and the heathens spoke of the Christian heresy, meaning merely their doctrine. When the idea of a Catholic church, its dogmas and exclusive claims to salvation, became more fully developed, the word heretic was used in a narrower sense, to indicate one who differs from the Catholic, that is, universal church, and who, at the same time, calls himself a Christian. Hence neither Jews nor Mohammedans, nor even apostates from Christianity, except very rarely, are called heretics. It is plain that the idea of a heretic presupposes the idea of a universal or general church and an established faith. Thus Christ was crucified and Stephen stoned by the Jews for heresy, or for deviating from their established church. The origin of heretics is to be referred to the time when a Christian church was publicly established, and began to acknowledge certain dogmas as orthodox, and to designate opinions at variance with them as false.

Many of the early Christians preserved their Jewish or Greek philosophical notions, and mingled them with the doctrines of Christianity. Even in the time of the apostles we find traces of the Gnostics. From them sprang the Simonians (who opposed to the Supreme God a principle of evil), the Nicolaitans and the Cerinthians, who introduced Jewish Gnostic ideas into Christianity. In the second century, we must mention particularly the Basilidians and Alogians, who denied the divinity of Christ; the Carpocratians, who maintained that the most wicked had the greatest chance of salvation; the Nazaræans, following the Mosaic law with great strictness; the Patropassians, denying the distinction of three persons in the Godhead; the Artemonians, believing in a union of a part of the Godhead with Christ at his birth; the Hermogenians, asserting the production of the human soul from an eternal but corrupt matter; the Montanists, who held their founder for the Comforter; the Sethites, who declared Seth to be the Messiah; the Quarto-decimans, who celebrated Easter like the Jews; the Cerdonians, who denied the resurrection; the Encratites, who condemned matrimony; and the Manichæans, who maintained the existence of a good and an evil principle in the Almighty, and whose tenets were based on those of Zoroaster.

In the third century there were the Monarchists, denying three persons in the Godhead; the Samosatensians and Paulinians, declaring Christ a mere man and the Holy Ghost a divine power; the Arabici, denying immortality; the Hieracites, belonging to the Manichæans; the Noetians, teaching that God the Father had become a man and suffered; the Sabellians, denying the distinction of persons in the Trinity; the Novatians, who refused to readmit those who had fallen off during the times of persecution; the Origenians, believing in the final salvation of the devil and the damned; the Chiliasts, or Millenarians, believing in a millennium; the Aquarians, using only water in the Lord's supper.

In the fourth century the principal heretical sects were the Arians, ascribing to the Son a nature and essence inferior to that of the Father; the Apollinarians, denying the human nature of Christ; the Photinians, maintaining that Christ was born of the Holy Ghost and Mary; the Macedonians, denying the divinity of the Holy Ghost; the Priscillianists, reviving the Gnostic errors; the Donatists, who held peculiar opinions respecting the church; the Euchites, ascribing to each individual an evil spirit, which could only be driven out by prayer; the Collyridians, who made offerings to Mary; the Seleucians, ascribing a bodily form to God; the Anthropomorphites, ascribing a human body to God; the Jovinians, denying the virginity of Mary; the Bonosians, or Adoptianists, considering Christ as merely the adoptive Son of God.

In the fifth century arose the Nestorians, who attributed the two natures of Christ to two persons; the Eutychians, Monophysites, and Jacobites, allowing but one person in Christ; the Theopaschites, teaching the incarnation and crucifixion of the three persons of the Godhead; the Pelagians, denying the depravity of human nature, and its salvation by grace alone. In the sixth century were the Agnotæ, teaching that Christ, in his human nature, did not know all things; the Tritheists, making three distinct Gods of the three persons of the Deity; the Monothelites, allowing only one will in Christ; the Aphthardocetes, teaching that the body of Christ was not subjected to any suffering. In the ninth century were the Paulicians, adhering to some doctrines of the Manichæans; in the twelfth century the Bogomili, teaching the creation of the world by a fallen angel, driven from heaven; the Catharists, reviving Gnostical doctrines; the Petrobrusians, rejecting the baptism of children. Among religionists stigmatized as heretics in later times by the Roman Catholic Church, were the Waldenses, the Wicliffites, Hussites, and at a later period the Lutherans, Calvinists, with all the variety of Protestant sects and churches.

It is evident that, for the historian, the word *heretic* can have only the relative meaning of *heterodox;* because as soon as the church or sect declares itself in possession of the true and sole doctrine of salvation and religious truth, it declares, by this circumstance, all other doctrines of faith heretical. Thus the Greek Catholic church declares Roman Catholicism a heresy, and *vice versa,* whilst the Calvinist declares Popery a heresy. We shall not here speak of all the persecutions which different sects have directed against those whom they considered heretics, but will only mention that, in doctrinal points, the early Christian church always made a distinction between heretics who obstinately persisted in their heresy and heretics merely through error, or who had been born in heresy. The fathers of the church declare themselves ignorant of the final condition of the latter. Again, peaceable heretics are distinguished from those whose doctrines produce public confusion and disorder. However, the general view is that all heresies lead, sooner or later, to disturbances and bloodshed.

The doctrines considered heretical by the Roman Church may be found in the Dictionnaire des Heresies, by the Abbé Pluquet, with the history, progress, nature, and also the Catholic refutations of their errors. It is well known that the Catholic Church prohibits priests from shedding blood (they were not even allowed to perform surgical operations); and hence, according to Catholic representation, death has never been inflicted upon heretics by the church, which merely declared them, after due admonition, to be heretics, excommunicated them, and gave them up to the secular government to be treated according to the laws, a view of religious persecutions which has been adopted by other sects also; but for the impartial historian, this argument can have no other weight than that the church, as such, has not ordered the execution of heretics, whilst its members were often affected by the spirit of the age, and by giving up a heretic to the secular government, aware that a painful torture and cruel death awaited him, in fact

devoted him to destruction. It must be remembered, however, that secular princes were often active in the prosecution of heretics, considering them as disturbers of the peace; and several instances are on record in which their zeal, in this respect, outstripped even that of the pope himself. Before Christianity was made the religion of the Roman state, nothing but excommunication was inflicted upon the heretic; but severe laws were passed soon after the conversion of the emperors. When the bishop excommunicated a heretic the secular authority banished him; he lost his civil rights, and was even punished with death; he could not be an accuser, witness, nor judge; could not make a will; and even his family were subjected to some penalties. The code of Justinian contains many ordinances against heretics, and the canon law made it a duty to denounce them, under pain of excommunication, even if the party were a wife or husband, parent or child, and to assist their judges without remuneration, &c. They were not permitted to be acquainted with the witnesses against them nor with their testimony; they were not allowed to have counsel nor to appeal. As early as 385 Priscillian was condemned to death as a heretic by the Spanish bishops at the council of Trèves; and the punishment of death, which the emperors ordered to be inflicted on the Arians after the Nicene council, was more commonly inflicted on heretics. But the *persecutions of heretics*, properly so called, began in the pontificate of Gregory VII., in the eleventh century. The Emperor Frederick II. authorized them against the Albigenses and Waldenses, by an edict issued at Padua in 1222. From that time persecutions of heretics took place in almost all Christian countries. Spain, Italy, and France, from the thirteenth to the sixteenth century, suffered much from these persecutions, which were often conducted with more fury as political considerations were mingled with them; and the massacre of St. Bartholomew and the acts of the Spanish Inquisition are foul blots on the page of history. The states of Germany, collectively, have never shown that spirit of persecution which has stained other countries. The Carolina does not mention heresy at all; and by the Peace of Westphalia it was settled that neither of the three confessions (R. Catholics, Lutherans, and Calvinists) should accuse the other of heresy. In England as well as on the Continent the burning of heretics was practised before 1200, and examination by torture in the case of the Templars was authorized by Edward II. By stat. 6 Rich. II. cap. xiii. heresy was punishable by imprisonment; and twenty years later (2 Hen. IV. cap. xv.—*de hæreticis comburendis*) the punishment was death by burning. This act was subsequently altered in the reigns of Henry VIII. and Elizabeth, and was repealed by act 29 Car. II. cap. ix. (1677), since which time heresy is left entirely to the cognizance of the ecclesiastical courts.

HERFORD, a town, Prussia, Westphalia, in the government and 16 miles south-west of Minden, capital of a circle of same name, at the confluence of the Aa with the Werre. It has several Protestant churches, among them the cathedral church in the Romanesque style, and the Gothic church of St. John, one of the finest in Westphalia; a R. Catholic church, a synagogue, gymnasium, school of agriculture, and other schools; flax spinning, manufactures of linen and cotton goods, leather, confectionery, carpets, tobacco, &c. Pop. (1900), 25,109.

HERIOT. See HARIOT.

HERIOT, GEORGE, founder of the hospital in Edinburgh which bears his name, and jeweller to King James VI., was descended from the Heriots of Trabroun, in East Lothian, and is supposed to have been born in June, 1563. His father was a goldsmith in Edinburgh, and a person of wealth and consideration. George followed his father's profession, and was admitted a member of the Incorporation of Goldsmiths on 28th May, 1588. About two years previously he had married Christian Marjoribanks, daughter of an Edinburgh burgess, who did not long survive the union. In 1597 he was appointed goldsmith to the queen by a charter from James VI., and on the accession of the latter to the English crown followed the court to England. Shortly afterwards he contracted a second marriage with Alison Primrose, eldest daughter of James Primrose, clerk to the Scottish privy-council, and grandfather of the first Earl of Rosebery. This union was equally unproductive of issue with the first, and terminated by the death of Mrs. Heriot, on 16th April, 1612. From the period of George Heriot's settlement in London little is known of his history. He died on 12th Feb. 1624, and was buried at St. Martin's-in-the-Fields. By his will he left nearly the whole of his fortune 'towards the founding and erecting of an hospital . . . and for and towards purchasing of certain lands in perpetuity to belong unto the said hospital, to be employed for the maintenance, relief, bringing up, and education of so many poor, fatherless boys, freemen's sons, of the town of Edinburgh, as the means which I give, and the yearly value of the lands purchased by the provost, bailiffs, ministers, and council of said town, shall amount or come to.' Accordingly such an institution was duly established, and the boys were not only taught to read, write, and cast accounts (to which the statutes of the hospital originally confined the trustees), but also Latin, Greek, mathematics, &c. Talented boys who chose a learned profession were sent to the university for four years with an annual allowance of £30. The greater number were bound apprentices to tradesmen in the city, and were allowed the annual sum of £10 for five years or a shorter period. The foundation of the present magnificent structure, known as Heriot's Hospital, was laid on 1st July, 1628; and the expense of the erection exceeded £30,000 sterling. From the rise in value of property the yearly revenue of the hospital has very greatly increased; and the governors were empowered by 6 and 7 Will. IV. to establish elementary schools within the city for the gratuitous education of poor children, sixteen day-schools being ultimately established, besides evening schools. In 1885, however, an entirely new scheme was introduced for the trust, and a great part of the funds are now devoted to the support of Heriot's Hospital School and the Heriot-Watt College. The former is a day-school for boys of ten and upwards, in which the chief subjects taught are English, mathematics, science, drawing, French and German, &c. There are 150 foundations of £20 each with free education for fatherless boys, and 100 free scholarships for meritorious pupils not foundationers; besides school bursaries of £10 each, forty in number, &c. The Heriot-Watt College is based on the already existing Watt Institution, and is a college giving a thorough technical, commercial, and literary education chiefly by evening classes, though there are also day classes. The trust also gives bursaries in connection with the university, the high school, &c. The annual revenue is now about £32,000. Some changes were made in 1897.

HERISAU, a town, Switzerland, in the cantor and 4 miles north-west of Appenzell, beautifully situated on the right bank of the Glatt, at the junction of the Brühlbach. It consists of two squares, four principal streets, with several others opening into them, and has a large and handsome church with an ancient tower, an elegant town-house, and an arsenal. The staple manufacture is muslin, plain and

embroidered. The environs abound in gardens and fine walks, and two adjoining heights are crowned by the old castles of Rosenberg and Rosenburg. Pop. (1897), 13,783; (1900), 13,501.

HERISTAL. See HERSTAL.

HERITABLE JURISDICTIONS were grants of criminal jurisdiction bestowed on great families by the Scottish crown, with a view to the more easy and expeditious administration of justice. These jurisdictions were in number about 100, and consisted of sheriffships, stewartries, constabularies, but chiefly of regalities and bailleries. In virtue of their hereditary rights the possessors of these jurisdictions exercised an arbitrary power over vassals and others within the limits of their domain, and could fine, scourge, imprison, and even in some cases put to death without interference of the common law. These jurisdictions, with other powers possessed by landed proprietors, were abolished after the last Stuart rebellion by the 20 Geo. II. cap. xliii., and compensation, amounting in all to £152,037, 12*s.* 2*d.*, was paid by government to those who suffered patrimonially by the operation of that statute.

HERITABLE SECURITIES, in Scotch law the term applied to what is known in English law as mortgages and charges on land. They were formerly distinguished into wadset, infeftment of annual rent, heritable bond, bond and disposition in security, and absolute disposition with backbond, and also reserved burdens on land. All such securities are considered as constituting a pledge of the land to the creditor until the debt is cleared off, or rather the debt is a burden on the land, so that whatever becomes of the land, into whatever number of hands it may pass, the debt still inheres in it, and must be first paid out of the proceeds, unless it is redeemed. The principal heritable security in Scotland is now the bond and disposition in security, which consists of an obligation to clear off the debt, and a disposition *pro tempore* to the creditor, by way of security until the debt is cancelled. To complete the title the bond must be registered in the Proper Register of Sasines, and it is assignable to a third party. The creditor has full power to sell the estate if the interest or principal is not paid; but must in this case account for the surplus remaining after deducting his own proper claim.

HERITOR, in Scotch law, originally signified the proprietor of a heritable subject; but in connection with parochial law it is now restricted to such proprietors of lands and houses as are liable to public burdens. The heritors, collectively, have vested in them the fee of the church and churchyard; they provide and keep in repair the church, as well as the minister's house. They may vote by proxy.

HERMANDAD (Spanish, *brotherhood*). The cities of Arragon, as they advanced in consideration, and obtained by the grants of the kings, who made use of their services against the arrogant nobility, a feeling of their own importance, frequently formed connections to defend themselves against the usurpations and the rapaciousness of the feudal nobility. This object was most clearly apparent in the brotherhood (Hermandad) formed about the middle of the thirteenth century in Arragon, and that formed about 1282 in Castile. In 1295 thirty-five cities of Castile and Leon formed a joint confederacy for the same object. Every noble who should rob or injure a member of the association, and who would not make reparation or give security for the observance of the law, was threatened with the destruction of his houses, vineyards, and gardens. Even if a nobleman had only challenged a member of the association, and refused to give security, the challenged person had the right of putting him to death. These fraternities were the model of the later Hermandad of the municipal communities, which was formed in Castile under the reign of Ferdinand and Isabella. It was established in 1486 with the approbation of the king, at a time when the nobles paid no attention to the royal commands to keep the peace, robbed the defenceless villagers and industrious citizens, and made the highways unsafe. The city authorities raised a military force, and appointed judges in different parts of the kingdom. The disturbers of the public peace were sought out by the armed bands, carried before the judges, and punished. Neither rank nor station protected the offender against the tranquillity of the country, nor could he find safety even in the churches. The nobility, who saw their turbulence restrained, and their judicial power limited by this institution, opposed it in vain; for the king protected the Hermandad, as a powerful means of preserving public peace, and at the same time an effectual means of strengthening and extending the royal power; since the forces of the city authorities composed a part of the standing army without needing to be paid by the court. The Santa Hermandad (holy brotherhood, a name which has occasioned some to confound this institution with the Inquisition, or to consider it as depending upon that establishment) had, like the earlier institution, of which it was a continuation, the object of securing internal safety, and seizing disturbers of the peace and highway robbers, but did not act except in case of offences actually committed. It consisted only of a company of armed police officers, who were distributed in the different provinces of the Kingdom of Castile, and whose duty it was to provide for the security of the roads outside of the cities. One of their strictest regulations was not to use their power within the cities. They were subject to the Council of Castile. The principal divisions of the company had fixed stations at Toledo, at Ciudad Rodrigo, and at Talavera.

HERMANN. See ARMINIUS.

HERMANN, JOHANN GOTTFRIED JAKOB, a German philologist, was born at Leipzig, 28th Nov. 1772. After studying law at the university of his native town and at Jena, he began to lecture on ancient literature at Leipzig in 1794, and in 1798 was appointed extraordinary professor of philosophy. In 1803 he became ordinary professor of elocution, with which he conjoined in 1809 the duties of the chair of poetry. These offices he continued to hold until his death, on the 31st December, 1848. His lectures were remarkable for their clearness, precision, and popularity, and materially contributed to form successive generations of able teachers. With Hermann originated valuable reforms in the method of Greek grammatical instruction; and he is especially known for his editions of the ancient writers, particularly of the Greek tragedians, and for the controversies in which his theories and assertions involved him with Voss, Creuzer, Böckh, Ottfried Müller, and other philologists. The principles of the method which he introduced into Greek grammar are explicitly developed in his De Emendanda Ratione Græcæ Grammaticæ (1801). He also attempted to develop a philosophical theory of the science of metre from the categories of Kant, and wrote on this subject his Handbuch der Metrik (1798), and the popular Latin treatise Epitome Doctrinæ Metricæ (1818).

HERMANN, KARL FRIEDRICH, a German philologist, was born at Frankfurt-am-Main, 4th August, 1804. He studied philosophy at Heidelberg and Leipsig, taking his doctor's degree in 1826. In 1832 he was appointed to the chair of philology at Marburg, and in 1833 received the additional offices of second librarian to the university, and director of the philological seminary. In 1842 he went to Göttin-

gen, where he remained as professor of classical eloquence until his death, on Dec. 31, 1855. Among the more important of his works are the Geschichte und System der Platonischen Philosophie (1839), with a complete edition of Plato's Dialogues (1851–52); Lehrbuch der Griechischen Antiquitäten (1841–52); and a posthumous work, Kulturgeschichte der Griechen und Römer (1857–58); besides treatises in Latin, editions of Persius, Juvenal, &c.

HERMANNSTADT (Latin, *Cibinium*; Hungarian *Nagy-Szeben*), a town of Transylvania, on the Cibin, in an extensive valley, bounded south by the Transylvanian Alps (Carpathians), and on other sides by lofty and picturesque hills, 54 miles S.S.E. Klausenburg. It consists of a high and a low town, and of four suburbs. It was at one time strongly fortified, but the walls, towers, and bastions have been almost entirely demolished within recent times. The high town is, on the whole, well built, consisting of several handsome squares, and regularly paved and tolerably clean streets. A succession of steep stone stairs lead down to the lower town, which is less attractive. The principal buildings are the chief Protestant church, a handsome Gothic structure, built between 1431 and the beginning of the sixteenth century, surmounted by a lofty tower, and containing numerous interesting monuments; the Roman Catholic high church; the interesting town-house, originally a fortified dwelling-house; the Brukenthal Palace, containing natural history and other collections, a library of 40,000 vols., and a picture-gallery; lunatic asylum, military hospital, barracks, &c. There is a superior gymnasium for Protestants, a royal state gymnasium, &c. The manufactures consist of woollen cloth, hats, combs, earthenware, cordage, soap, leather, &c. The trade in these articles, and also the transit trade, chiefly to and from Constantinople, are of some importance. Pop. (1890), 21,465; (1900), 29,577.

HERMAPHRODITE, a term formerly applied exclusively to signify a human creature possessed of the organs of both sexes, but now almost always applied to other animals, and to plants. It is now well known there is no such thing as an hermaphrodite in the human species. In many of the inferior tribes of animals the male and female parts of generation are found to be united in the same animal. There are both normal and abnormal or monstrous hermaphrodites. The normal kind belongs to the inferior and more simple orders of animals; but as animals become more complicated, and each part is more confined to a particular use, a separation of the sexual characteristics takes place, and they are partly united only in some particular cases. In the horse, ass, sheep, and cattle such instances sometimes occur. In the case of cattle, when a cow brings forth two calves, one a bull, and the other a cow to appearance, the cow is unfit for propagation, but the bull-calf becomes a proper bull. Such animals do not breed; they do not show the least inclination for the bull, nor does the bull ever take notice of them. Among the country people in England this kind of imperfect cow is called a *free-martin*. Dissection shows traces of the parts of both sexes. See the article MONSTER.

The combination of the two sexes in one individual is characteristic of many plants and of some animals. In plants the combination of two individuals for the fertilization of the seed is secured by this, that the stamens and pistil are not matured at the same time in the same plant. (See CROSS-FERTILIZATION in SUPP.) In animals, for instance in worms and snails, mutual impregnation is necessary, and it is possible that the elements are matured in succession, the prolonged contact of the two admitting of this safeguard against self-impregnation.

HERMAS, one of the so-called apostolic fathers, is by some supposed to be the person mentioned by that name in Rom. xvi. 14, though others maintain that he lived seventy-two years later. His name is associated with a work entitled The Shepherd, which was circulated at Rome in the first half of the second century, and held in such estimation that even a place in the canon was claimed for it. Irenæus, Clement of Alexandria, and Origen accepted it as inspired, and Eusebius says that it was read in the churches. The author of the Muratorian fragment regards the author as a brother of Pius, a second-century bishop of Rome. Another view makes the author live in the latter part of the first century, at the time when Clement of Rome flourished. The original is Greek, but until the nineteenth century it was only known in a Latin translation. The Greek text has, however, been almost completely recovered (see edition by Hilgenfeld, 1887), and a second Latin and an Ethiopian version are now known. It consists of three parts, Visions, Commandments, and Similitudes, all written in a style which shows that the author was more remarkable for the warmth of his imagination than for the soundness of his judgment.

HERMENEUTICS (formed from a Greek word which signifies to explain or interpret) is the science which fixes the principles of interpretation. The word is commonly used only of the interpretation of the sacred writings. Hermeneutics bears the same relation to *exegesis* as *theory* to *practice*. See EXEGESIS.

HERMĒS (called by the Romans *Mercurius*, and identified with their own god of that name (see MERCURY), was the son of Zeus and Maia, the daughter of Atlas. According to the legend Arcadia was his birthplace. Four hours after his birth he left his cradle and invented the lyre, which he made by killing a tortoise, and stringing the shell with three or seven strings. He then sang to it the loves of Zeus and his mother Maia. Having concealed the lyre in his cradle, he began to seek for food, for which purpose he went in the evening to Pieria, and stole fifty oxen of the sacred herd of the gods, which he drove backward and forward to confound their tracks; then, going backward himself, he drove them backward also; and after having killed two of them near the river Alpheus, roasted them by a fire procured by rubbing two sticks together, and sacrificed a part to the gods. He concealed the remainder in a cavern. He also carefully destroyed all traces of them. The next morning Apollo missed his oxen, and went in search of them, but he could discover no traces of them until an old man of Pylos told him that he had seen a boy driving a herd of oxen in a very strange manner. Apollo now discovered by his prophetic art that Hermēs was the thief. He hastened to Maia, and accused the infant, who pretended to be asleep, and, not terrified by the threat of the god that he would hurl him into Tartarus, steadily maintained his innocence. Apollo, not deceived by the crafty child, carried his complaint to the King of gods. Hermēs lied even to him. But Zeus penetrated the artifice of the boy, and perceived him to be the offender; yet he was not angry with him, but, smiling good-naturedly at his cunning, ordered him to show the place where the oxen were concealed. To secure him Apollo bound his hands, but his chains fell off, and the cattle appeared bound together by twos. Hermēs then began to play upon his newly-invented lyre, at which Apollo was so much enraptured that he begged the instrument of the inventor, learned of him how to play on it, and gave him a whip to drive the herds, thenceforth belonging to both in common. Apollo was still more astonished when the ingenious

god also gave the Pandean pipe its tones. They then concluded a contract with each other: Hermēs promised never to steal Apollo's lyre or bow, and never to approach his dwelling; the latter gave him in return the golden wand of peace, the *caduceus*. The ancients represent Hermēs as the herald and messenger of the gods. He conducts the souls of the departed to the lower world (whence he is called *Psychopompos*), and is therefore the herald of Pluto, and the executor of his commands. His magic wand had the power to close the eyes of mortals, to cause dreams, and wake the slumbering. The qualities requisite for a herald he possessed in the highest perfection, and bestowed them on others—grace, dignity, and insinuating manners. He was also the symbol of prudence, cunning, and fraud, and even of perjury. We must remember that rude antiquity did not, as we do, associate anything dishonourable or base with these ideas. Whoever was distinguished for artifice and deceit, as, for example, Odysseus, was a favourite of Hermēs, and enjoyed his assistance. Hermēs was also distinguished as the god of theft and robbery, especially when fraud and cunning were employed. The exploits of his childhood have this symbolical signification. Among the actions of his manhood the following are examples of his cunning:—He accompanied Heracles when he carried off Cerberus; delivered Zeus from the cave into which Typhon had cast him; rescued Ares from the prison in which Otus and Ephialtes had confined him; killed Argus, the keeper of the unhappy Io; assisted Perseus when he went to kill Medusa, and lent him the helmet of Pluto, which rendered him invisible, and his winged sandals; to Nephele, the mother of Phryxus and Helle, he gave the ram with the golden fleece, upon which she carried off her children when they were about to be sacrificed to the gods at the instigation of their step-mother Ino. In the wars of the giants he wore the helmet of Pluto, which rendered him invisible, and slew Hippolytus. When Typhon compelled the gods to fly before him and conceal themselves in Egypt, he metamorphosed himself into an ibis. He is also mentioned by Homer as the patron of eloquence, and still more particularly by Hesiod. Of his inventions Homer makes no mention. Later writers ascribe to him the invention of dice, music, geometry, the interpretation of dreams, measures and weights, the arts of the palæstra, letters, &c. He was also regarded as the patron of public treaties, as the guardian of roads, and as the protector of travellers. Fable relates many of his amours. His children were numerous: among them were Pan and Hermaphroditus. Hermēs was worshipped in all the cities of Greece, but Arcadia was the chief place of his worship. His festivals were called *Hermæa*, and were solemnized in various ways. In the monuments of the more ancient style of art Hermēs appears with his beard just beginning to grow; at a later period the prevailing representations of him were as an adroit herald and athlete, and he acquired the appearance of extreme youth. In this character also room was allowed to fancy. He was represented as a boy in the prime of youth, and also in the full power of early manhood. Among the curled locks of the boy appear two projecting wings. His dress consisted of a short leather tunic. In his left hand he bears a purse, and holding his right forefinger against his chin, smiles archly at some device in his mind. As a youth we find him represented in a variety of attitudes, sometimes with the purse in his hand, sometimes with the caduceus, and sometimes with a winged cap, standing, sitting, or walking. The artists of later times placed him among the youthful and beardless gods. The most prominent traits of his character are vigour and dexterity. His short hair lies curled over his head and forehead; his ears and mouth are small; his positions, whether standing or sitting, always simple and easy; his head inclined forwards, and his look thoughtful. In his beautiful and vigorous frame we see the inventor of gymnastics; in his attitude, air, and aspect we see the prudence, cunning, and good nature of one who can easily gain everybody and accomplish everything. In the representation of Hermēs of a later date the relations of corporeal beauty and mental dexterity are wonderfully preserved. He is either entirely naked, or clad only in the *chlamys*, which is not often put on with any regularity, but is merely thrown over his shoulders or wound round his arms. His head is sometimes bare; sometimes he has a pair of wings fastened on his temples, and sometimes the cap is placed on his head, to which are occasionally added wings (*petasus*). The hat, which particularly denotes a wanderer, has, in works of statuary, a flat top and narrow brim; upon vases, however, his hat is represented with wide hanging flaps and a pointed top. If the wings are not attached to a band about his head or hat, they are fastened either to his ankles or the soles of his feet, or to the caduceus alone. Artists made the cock his symbol, on account of its vigilance or love of fighting (in allusion to gymnastics); the tortoise, on account of his invention of the lyre; the purse, because he was the god of traffic; a ram and a goblet, because he was the director of religious ceremonies and sacrifices; the trunk of a palm-tree, upon which his statues lean, because he was the inventor of arithmetic and writing (upon palm-leaves); the *harpē* or sickle-shaped knife, because he was the slayer of Argus; and the hound (only upon Alexandrine coins), to indicate sagacity and vigilance.

HERMES, Georg, a German theologian, was born 22d April, 1775, in Dreyerwalde, Westphalia. From 1792 to 1798 he studied theology at the University of Münster, after which he became teacher in the gymnasium of that city, and in 1807 professor of dogmatic theology in the university. He had early studied the philosophy of Kant, and now endeavoured to construct a system on the principles of that philosopher. When the Prussian government established the University of Bonn, Hermes was appointed to the chair of Catholic theology (1820). Here he began to distinguish himself by his attempts to found a speculative, philosophic, and dogmatic school in the church itself, delivering a series of lectures which caused great sensation by aiming at an alliance between Protestants and Catholics, insisting that the difference between their views was not so great as was generally supposed. This attempt to base the positive theology of the church (a doctrine known as Hermesianism) drew around him great numbers of followers. Many of these in time filled chairs of theology in the Prussian states, and set forth their views in conjunction with their master in a magazine published at Cologne in 1832. The method which Hermes advocated insisted that the truth of revelation and of the Catholic Church should first be tested by reason, and that revelation should then be followed. He did not go so far as to declare that all the dogmas in themselves could be proved *a priori*, but to found the right of the church to teach them on the ground of reason, and thereby strengthen faith in it. Hermesianism was in fact an ingenious effort to base the doctrines of the church on Kant's system of philosophy. It aroused powerful opposition, being condemned as heretical by a Papal letter of 26th Sept. 1835. In 1831 its first expounder had died, but his scholars stoutly defended their orthodoxy, many of them repeatedly appealing to the pope, but without success.

HERMES TRISMEGISTUS, a mythical personage, the reputed author of a great variety of works, probably written by Egyptian Neo-Platonists. The Egyptian god Thot or Thoth (the Intellect) was identified by the Greeks with Hermes as early as the time of Plato. In the struggle between Christianity and Neo-Platonism the latter sought to give a more spiritual and profound meaning to the pagan philosophy by combining the wisdom of the Egyptians and the Greeks, and representing it as a very ancient divine revelation. They therefore ascribed the authorship of the highest attainments of the human mind to Thot, the Egyptian Hermes; regarded him as the source of all knowledge and inventions, the *Logos* incarnate, thrice greatest (*Tris megistos*), from whose thoughts, inscribed upon pillars, Pythagoras and Plato had derived their ideas, and whose works contained the sum total of human and divine wisdom. Clement of Alexandria mentions the contents of forty-two books of Hermes which were extant in his time. Of those which now remain, some seem to have proceeded from the school of Philo, and others are much later, and not unaffected by Christianity; some are written in a sober philosophical spirit, and others abound in fantastic astrological and thaumaturgical speculations. The most important is the Poimandrēs or Poimander, a dialogue on nature, the creation, the deity, the soul, knowledge, and similar topics, and is interesting as showing the extent to which the combination of Platonic, Christian, oriental, and Jewish notions was carried in the age in which the eclectic scheme of comprehension was founded by Ammonius. At one time the idea of the authorship of Hermes was carried still further, and applied to the whole range of literature. Iamblichus states that Hermes was the author of 20,000 works, and Manetho even speaks of 36,525 works. Several of these Hermetic books which have come down to us are in the Greek language, and others only in Latin translations; but all those now extant are of an inferior kind, and none belongs, in all probability, to an earlier date than the fourth or perhaps the third century of our era.

HERMETIC ART. See ALCHYMY.

HERMETIC SEALING is the term used to denote a very old process in which a glass vessel, such as a tube or flask, has its neck so fused together that no part of the contained matter can escape, and nothing foreign can get in. In some of the older pictorial or symbolical representations of the alchemical work, there is one depicting the sealing up of a flask by causing the neck to melt together by exposure to the flame of a blowpipe.

HERMIT. See ANCHORITES.

HERMITAGE, one of the finest French wines, which is produced along the Rhone between Valence and Valière, in the *ci-devant* Dauphiny. It is of two kinds, red and white; the former is preferred. It takes its name from Mount Hermitage, lying opposite the village of Tain. Much is exported by the way of Cette, or carried into the country to mix with inferior wines.

HERMIT CRAB. See PAGURUS.

HERMIT ISLAND, an island in the South Pacific, about 10 miles north-west of Cape Horn. It is of irregular form, deeply indented by bays and coves; shores bold and steep, surmounted by conical peaks, the highest of which is 1742 feet above sea-level. It is about 12 miles long east to west. The mountains rise at once from the water's edge, clothed for half their elevation with a low deep-green forest, and crowned with rugged precipices and gray masses of rock, while foaming cascades rush down every gulley. The natives do not often exceed 5 feet in height; they are in the most abject misery and wretchedness, wandering nearly naked through the snow, and living in wigwams affording inadequate shelter from the inclemency of the weather. They are, however, peaceable and inoffensive, cheerful and good-tempered, but indolent, leaving all drudgery to their wives.

HERMOSILLO, the principal city in the state of Sonora, Mexico, situated on the river Sonora, about 60 miles from the Gulf of California, and 78 north from the port of Guaymas, with which it has a large traffic by railway, being the principal entrepôt for the trade with the interior. It lies in a very fertile valley, is shut in on the east by a wall of rocks, and though possessing a very hot climate, is a healthy place. Large quantities of fruit are grown in the vicinity, more especially grapes, from which much brandy is made. Pop. (1895), 8376.

HERNIA (Latin, a rupture, a burst, a descent), a tumour formed by the displacement of a soft part, which protrudes by a natural or accidental opening from the cavity in which it is contained. The three great cavities of the body are subject to these displacements. The brain, the heart, the lungs, and most of the abdominal viscera may become totally or partially displaced, and thus give rise to the formation of herniary tumours. Displacements of the brain and of the organs of the chest are, however, extremely rare, and are in general the result or symptom of some other disease. Every part of the abdomen may become the seat of hernias, but they most commonly appear in the anterior and inferior region, which, being destitute in a great measure of fleshy fibres, and containing the natural openings, offers less resistance to the displacement of the viscera. They are most common in the groin, at the navel, more rarely in the vagina, at the interior and upper part of the thigh, and at its lower and posterior part. They have received different names from their positions. All the abdominal viscera, with the exception of the duodenum, the pancreas, and the kidneys, may form a hernia, but they are not all displaced with the same facility. The omentum and intestinal canal escape easily; but the stomach, the liver, and spleen form hernias, though rarely. Most of the viscera, when displaced, push the peritoneum forward before them: this membrane thus forms an envelope of the hernia, which is called the *hernial sac*. If the hernia, with its sac, can be entirely replaced, it is said to be reducible; if, from its size or other cause, it cannot be replaced, it is irreducible.

Among the predisposing causes of hernia may be ranked any circumstances which diminish the resistance of the abdominal walls, whether natural or accidental; such as the defect of fleshy fibres, the weakening of the walls of the stomach by a forced distension, as in pregnancy or the dropsy, or by an accident, as a wound. Any circumstance which tends to increase or relax the openings through which the vessels pass, as a violent extension of the body, long standing, &c., may have the same effect. Any prolongation of the viscera which tends to bring them in contact with points at which they may protrude, and articles of dress which push the organs towards the weaker parts of the abdominal wall (as corsets), may also produce the hernia. The efficient causes of the hernia are all circumstances which may break the equilibrium existing between the abdominal walls and the viscera, which react, and mutually press upon each other. The simultaneous contraction of the abdominal muscles and of the diaphragm, which takes place on every violent effort, is one of the chief of these cases. Hence sneezing, coughing, leaping, playing on wind-instruments, &c., may be the occasions of a hernia.

The symptoms of a hernia are the existence of a

tumour or swelling at any point of the abdomen, but more particularly in the region of the groin. A reducible hernia is not a very troublesome disease, but may become so by acquiring an increase of size, and the strangulation to which it is liable. A hernia is said to be strangulated when it is not only irreducible, but also subjected to a continual constriction, which may become fatal; this constriction may be produced by different causes, but it is generally produced by the opening through which the hernia protrudes. As soon as a patient perceives that he is affected with a hernia, he should have recourse to medical advice, for the disease is then in its most favourable state for treatment. The hernia is immediately reduced, and must then be subjected to a constant compression. This is done by means of the truss. (See TRUSS.) An irreducible hernia must be supported with great care. All violent exercises, and excess in diet, must be avoided. The strangulated hernia, presenting greater danger, requires more prompt relief. The object of treatment is to relieve the constriction. If the reduction cannot be effected by other means, an operation will be necessary. This consists in dividing the parts which produce the constriction. The longer this operation is delayed, the more dangerous it will become. After the parts are healed, the opening must be subject to compression, as in the case of a simple hernia.

HERO, a priestess of Aphrodite at Sestos, on the coast of Thrace. The loves of Hero and Leander, a youth of Abydos, situated on the other side of the Hellespont, are related in a poem by Musæus. Hero and Leander saw each other at a religious festival at Sestos, at which many of the people of Abydos were present, and immediately became enamoured of each other. Favoured by the darkness of the approaching night, Leander stole into the temple, and confessed his flame to the blushing maid. But the relations of Hero, and her sacred office, opposed the union of the lovers. No difficulties, however, could discourage Leander. He swam every night across the Hellespont to his mistress, guided by a torch which shone across the strait from the tower of Hero. Leander continued his visits during the stormy season of winter. On one occasion, however, the guiding light was extinguished, and his strength failed him, and the waves carried his lifeless body to the foot of the tower, where Hero anxiously awaited him. Overcome with anguish at the sight, she threw herself from the tower on the corpse of her lover, and perished.

HERO (OF ALEXANDRIA), one of the most distinguished mathematicians and mechanists of ancient times, flourished about B.C. 215. He was the author of two books on the art of constructing automata, published by Baldi at Venice in 1601; and several others which have been altogether lost, or exist only in fragments. These treated of warlike engines, of machines put in motion by the force of the air, and of several important matters in dioptrics. The common pneumatic toy, called Hero's fountain, is attributed to him, and he also describes a steam-engine, on the principle of what is now known as Barker's mill, in which the boiler is caused to revolve on a vertical axis by jets of steam issuing from lateral holes in the arms with which it is provided; and a double force-pump used for a fire-engine.

HEROD, called THE GREAT, from his power and talents, King of the Jews. He was a native of Ascalon, in Judea, where he was born 71, or according to others, about 61 B.C., and was the second son of Antipater the Idumean, who, being made procurator of Judea by Julius Cæsar, appointed him to the government of Galilee. He at first embraced the party of Brutus and Cassius, but after their death reconciled himself to Antony, by whose interest he was first named Tetrarch, and afterwards King of Judea. After the battle of Actium he so successfully paid his court to the victor, that Augustus confirmed him in his kingdom; and on all occasions his abilities as a politician and commander were conspicuous; but his passions were fierce and ungovernable. Although married to the celebrated Mariamne, a princess of the Asmonean family, her brother Aristobulus and grandfather Hyrcanus fell victims to his jealousy of the ancient pretensions of their race. His very love of Mariamne herself, mingled as it was with the most fearful jealousy, terminated in her execution; and his repentance and keen remorse at her death only exasperated him to further outrages against her surviving relations, her mother, Alexandra, and many more falling victims to his savage cruelty. His own sons by Mariamne, Alexander and Aristobulus, whose indignation at the treatment of their mother seems to have led them into some intrigues against his authority, were also sacrificed in his anger; and their deaths crowned the domestic barbarity of Herod. It was the latter event which induced Augustus to observe that it was better to be Herod's hog than his son. He rebuilt the temple at Jerusalem with great magnificence, and erected a stately theatre and amphitheatre in that city, in which he celebrated games in honour of Augustus, to the great displeasure of the more zealous of the Jews. He also rebuilt Samaria, which he called Sebaste, and adorned it with very sumptuous edifices. He likewise, for his security, constructed many strong fortresses throughout Judea, the principal of which he termed Cæsarea, after the emperor. On his palace, near the temple of Jerusalem, he lavished the most costly materials, and his residence of Herodium, at some distance from the capital, by the beauty of its situation, drew around it the population of a great city. Such, indeed, was his magnificence, that Augustus said his soul was too great for his kingdom. The birth of Jesus Christ is said to have taken place in the last year of the reign of Herod, viz. B.C. 4, the true year of Christ's birth being four years earlier than that adopted as the Christian era. This year was also signalized by the massacre of the children of Bethlehem. Herod was attacked by a languishing and loathsome disease, and the paroxysms of pain he suffered served to increase the natural ferocity of his nature. According to Josephus, he planned a scene of posthumous cruelty, which could have been conceived only by the hardest and most depraved heart. Having summoned the chief persons among the Jews to Jericho, he caused them to be shut up in the circus, and gave strict orders to his sister, Salome, to have them massacred at his death, that every great family might weep for him; which savage order was not executed. Herod was the first who shook the foundation of the Jewish government, by dissolving the national council, and appointing the high-priests, and removing them at pleasure, without regard to the laws of succession. His policy, ability, and influence with Augustus, however, gave a great temporary splendour to the Jewish nation.

HEROD AGRIPPA I., son of Aristobulus by Berenice, daughter of Salome, sister of Herod the Great, was educated at Rome with Drusus, son of Tiberius, on whose death he left Rome for Idumæa; but he returned some years after, and, being suspected of an attachment to Caligula, was imprisoned by Tiberius. The apparent misfortune proved the source of his future prosperity; for, on the accession of Caligula (A.D. 37), he was not only rewarded with a golden chain as heavy as the iron one which had bound him, but was honoured with the title of king, and received the tetrarchy of his disgraced uncle, and all the dominions of Herod the Great. It was this Herod who, to please

the Jews, caused St. James to be put to death, and St. Peter to be imprisoned. His power and opulence acquired him a great reputation, and, in a grand audience at Cæsarea, having made an oration to some deputies from Tyre and Sidon, he was hailed by his obsequious train as one who spoke like a god. His satisfaction at this flattery was soon after reproved by a violent disorder in his bowels, which carried him off in the forty-fourth year of his age, and seventh of his reign (A.D. 44).

HEROD AGRIPPA II., son of the preceding, being too young to govern, Judea was, on his father's death, reduced to a Roman province. He subsequently received the kingdom of Chalcis, and obtained the superintendency of the temple and sacred utensils at Jerusalem, together with the nomination of the high-priests. He resided much at Jerusalem, and here, together with his sister, Berenice, heard the defence of Paul, addressed to the Roman governor Festus. Being driven from Jerusalem in the revolt which proved so fatal to the Jews, he joined Cestius, the Roman commander, and, when Vespasian was sent into the province, met him with a considerable reinforcement. During the siege of Jerusalem he was very serviceable to Titus, and after its reduction (A.D. 70) he and Berenice (with whom he was suspected to have an incestuous intercourse) returned to Rome. He is supposed to have died there, A.D. 100, and in him terminated the Herodian line and family.

HEROD ANTIPAS, son of Herod the Great by Malthacē, was appointed tetrarch of Galilee and Perœa, on his death (B.C. 4). This was the Herod who put to death St. John the Baptist, in compliment to his wife Herodias, in revenge for his reproaches of their incestuous union; Herodias having been united to, and forcibly taken away from his brother Philip. The ambition of Herodias stimulated her husband to a measure which proved his ruin. His nephew, Agrippa, having obtained royal honours from Caligula, she induced Herod to visit Rome to request the same favour, where he was met by an accusation, on the part of Agrippa, of having been concerned in the conspiracy of Sejanus, and of being in secret league with the King of Parthia. This accusation being credited, he was stripped of his dominions, and sent (A.D. 39) with his wife into exile at Lugdunum (Lyons), or, as some say, to Spain, where he died.

HERODES ATTICUS, TIBERIUS CLAUDIUS (from Marathon, in Greece, his birth-place, frequently called *Marathonius*), was said to be descended from Cecrops, and distinguished for his wealth and brilliant accomplishments. He was born in the reign of Hadrian, and held several public offices under the Antonines. A.D. 143 he was appointed *eponymos* of Athens, and died, probably, after the year 180. The ruins of an *odeum* or building for musical performances at Athens, which Pausanias preferred to every other on account of its size and beauty, are the only remnant of all the public buildings, baths, canals, statues, &c., with which Herodes Atticus beautified Italy, Greece, and Asia. It was consecrated to his wife Regilla, a Roman lady. Of the oratorical talents of Herodes, which procured for him the flattering titles of the *tongue of the Greeks* and the *king of eloquence*, only one monument remains to us, and the genuineness of it is doubtful. It is a sophistical declamation On the State, included by I. Bekker in his Oratores Attici. It by no means equals his fame.

HERODIAN, a Greek historian who held several public offices at Rome, and lived till some time after the year A.D. 238. His history is written in Greek, and comprises the period from the death of Marcus Aurelius to the year above-mentioned. He himself says that the events of this period occurred in his own lifetime. The history, in which he seems to have taken Thucydides to some extent as a model, is in eight books, without chronological data, but written in a pure and dignified style, in a spirit of independence and impartiality. He has often been confounded with Herodian of Alexandria, who died A.D. 180.

HERODOTUS, the oldest Greek historian whose works have come down to us, was born at Halicarnassus in Caria, in the fourth year of the seventy-third Olympiad, B.C. 484. If by the title *father of history*, which has been bestowed upon him by the general consent, be meant that he was the first who wrote history in a more elevated manner (or, according to Cicero, *historiam ornavit*), he fully deserves that title. Many authors, such as Hellanicus of Lesbos, Charon of Lampsacus, and Dionysius of Miletus, had even in some measure anticipated Herodotus in the subject of his work; but the works of those logographers, as they are termed, were rather collections of tales more or less fabulous, narratives of travels, &c., than histories in the true sense of the word. His love of learning was early enkindled by his youthful studies, and by examples in his own family. The celebrated epic poet, Panyasis, who was regarded by several ancient critics as inferior only to Homer, was his uncle. His genius was animated by the works of the writers just mentioned: they excited in him the desire to visit the countries which were described in such glowing colours, and his circumstances permitted him to gratify his inclinations. Whether he had conceived the plan of his history, in which the results of his travels are preserved, before his long journey is uncertain. Egypt, so celebrated for the wisdom of its institutions, seems to have been one of the most constant subjects of his attention. This country had long been rendered inaccessible to the rest of the world by the jealousy of its rulers, and the prejudices of its inhabitants against foreigners. But a short time before Herodotus commenced his travels it had been opened to the Greeks; and although it was then almost entirely unknown, and every part of it has since been examined by crowds of travellers, and described in almost every language, yet no author, ancient or modern, has given a more accurate and instructive account of it than Herodotus. He did not content himself with a knowledge of places; he investigated, likewise, the productions of the soil, the manners, customs, and religion of the people, the history of the last princes who reigned before the conquest of the country by the Persians, and many interesting particulars concerning the conquest itself. The second book of his history, which is devoted to the description of Egypt, is still our richest store of information concerning its ancient history and geography. From Egypt he proceeded to Libya, concerning which he collected a mass of information equally new to his contemporaries and valuable to us. His description of the country from the frontiers of Egypt to the Straits of Gibraltar, is so consonant with the accounts of the most intelligent travellers that we cannot for a moment believe it founded on the relations of others. He asserts himself that he resided some time in Tyre. He visited the coasts of Palestine, and thence continued his route to Babylon, then opulent and flourishing. His visit to Assyria has been doubted; but if we consider the different passages of his description of Babylon, we must be convinced that none but an eye-witness could have given so exact an account of that great city and of the manners of the inhabitants. Having arrived in Scythia, then little known to the Greeks, he penetrated into its immense wilds by the routes which had recently been opened by the Grecian colonies on the Euxine, and thence

passing through the Getæ into Thrace and Macedonia, he reached Greece by the way of Epirus. Herodotus expected to find at home that honour which was due to his labours, and leisure to arrange the information which he had collected. But Lygdamis, who had usurped the supreme authority in Halicarnassus, and put to death the noblest citizens, among others Panyasis, forced him to seek an asylum in the Island of Samos.

Here, it is said by his biographer, Suidas, he wrote the first books of his history; but there is good reason to believe that they were written at a later period. Having formed a conspiracy with several exiles who entertained similar sentiments with himself, he returned to Halicarnassus, and drove out the usurper, but without much advantage to his country. The nobles who had acted with him immediately formed an aristocracy more oppressive to Halicarnassus than the arbitrary government of the banished tyrant. Herodotus became odious to the people, who regarded him as the author of their aggravated sufferings, and to the nobles, whose proceedings he opposed, so that, bidding an eternal farewell to his unhappy country, he withdrew to the recently founded colony of Thurii, in Italy, where he spent the remainder of his life. Here, at an advanced age, we are told by Pliny, he wrote his immortal work. Lucian, not a very reliable authority on such a subject, states that it was written at Halicarnassus, and that he read the nine books into which it is divided before the Greeks assembled at the Olympic games about 456. It is further stated that the work was received with so much applause that the names of the nine muses were applied to its several chapters, and that Thucydides, then scarcely fifteen years old, was present at this recitation, and shed tears of admiration. There is another tradition that Herodotus read his book at Athens in 445 or 446 B.C., and that he received a grant of ten talents (nearly £2500) from the public treasury. This tradition is not only in contradiction with the time at which he must have written his work, but is evidently but part and parcel of the charge which the Thebans brought against the historian, that he was bribed by the Athenians. Whether there is any more authority for the statement that he read the history before the Corinthians it is impossible to say with any degree of certainty. It is mentioned only by Dion Chrysostomus. On the other hand, Pliny's statement that the work was written in his old age at Thurii is strengthened by the fact that events are noticed in the body of the book which occurred so late as 409 B.C. There is no evidence that he ever made two editions of his book; there is no trace of labour or revision. Its abrupt ending, and the fact that the author did not overtake all he promised, prove almost beyond question that the history was the work of the last years of his life, and that death prevented him from completing it.

The history, as already remarked, is divided into nine books, each bearing the name of a muse, and is written in the Ionic dialect. The object of the historian is to narrate the conflict between the Greeks and Persians, the representative races of the eastern and of the western world. His first care is to trace the enmity of the two races back to mythical times, and he considers the abductions of Io, Medea, and Helen as the primary causes of the sanguinary rivalry. He rapidly passes over the mythical period to come to Crœsus, king of Lydia, of whom and of his kingdom he gives a comparatively full history. The conquest of Lydia by Cyrus induces him to relate the rise of the Persian monarchy and the subjugation of Asia Minor and Babylon. The history of Cambyses and his Egyptian expedition leads him to introduce the valuable details of the history, geography, and manners and customs of that country, which occupy the second book. The Scythian expedition of Darius causes the historian to treat of the Scythians and the north of Europe; and the subsequent extension of the Persian Kingdom affords him the opportunity for giving an account of Cyrene and Libya. In the meantime the revolt of the Ionians breaks out, which eventually brings on the conflict between Greece and Persia. An account of this outbreak and of the rise of Athens after the expulsion of the Peisistratidæ, is followed by what properly constitutes the principal part of the work, and the history of the Persian war now runs on in an uninterrupted stream until the taking of Sestos. The many digressions and episodes do not impair the plan and unity of the book, for one thread runs through the whole, and the reader rises from it as from the perusal of a grand epic poem. It is pervaded by a profoundly religious idea of a divine power, existing apart and independent of man and nature, which keeps all things in a proper equilibrium, assigns to each being its path, and keeps it within its bounds.

Besides this work, he planned a history of Assyria, but whether he carried it out is a matter of doubt. The Life of Homer, attributed to Herodotus, and printed at the end of several editions of his works, is now universally believed to be a production of a later date. The best editions of the history of Herodotus are by Wesseling (Amsterdam, 1763, folio), Schweighäuser (Strasburg, 1806, six volumes), Bahr (Leipzig, 1855–61, four vols.), Stein (Berlin, 1871, two vols.). Among English translations are those by Beloe, Cary, and Rawlinson, the last with many important notes and dissertations by Canon Rawlinson, Sir H. Rawlinson, and Sir J. G. Wilkinson. A more recent translation is by G. C. Macaulay (1890).

HEROES, a name applied by the Greeks to persons of the earlier periods, who were distinguished for wisdom, strength, or courage. They formed an intermediate link between men and gods. They were demigods, whose mortal nature only was destroyed by death, while the immortal ascended to the gods. In mythology, these demigods are styled *heroes* in a peculiar sense. The heroic age of Greece terminated with the return of the Heraclidæ into the Peloponnesus (B.C. 1100), and forms the transition from the brazen to the iron age. We find the following heroic races:—1, the *Prometheids*, from Prometheus, called also the *Deucalionids*, from Deucalion; 2, the *Inachids*, from Inachus; 3, the *Agenorids*, from Agenor; 4, the *Danaids*, from Danaus; 5, the *Pelopids*, or *Tantalids*, from Pelops or Tantalus; 6, the *Cecropids*, from Cecrops. Individual families, as, for instance, the *Æacidæ*, *Persidæ*, *Atridæ*, *Heraclidæ*, belong to one or another of these races. The heroic age is the age of romantic courage, of adventure, and wonders. The heroes are distinguished into those who flourished before the Argonautic expedition, and those who flourished after it. The most distinguished among the latter are the heroes of the Trojan war. Those of the former class are more illustrious than those of the latter; for the remoter events afforded greater scope for the embellishments of the imagination. The later heroes figured largely in poetry, and became clothed with godlike attributes; yet hardly any of them received the same homage which was paid to the earlier race. Great sacrifices were not offered to the heroes, as they were to the Olympian deities; but groves were consecrated to them, and libations poured out on their sepulchres. According to Plutarch, the Greeks worshipped the gods on the day of the new moon, and the heroes on the day after, and the second cup was always mingled in honour of them. The residence assigned to them after death is different. Bacchus, Hercules, Pollux, and some others, entered

the abodes of the eternal gods; others inhabited the islands of the blessed; and others were placed among the constellations. The ideas relative to this part of the heroic history, however, have continually varied.

HÉROLD, Louis Joseph Ferdinand, a French musical composer, was born at Paris, 28th January, 1791. His father, a professor of the piano, placed him, in 1806, under the care of Louis Adam and Kreutzer of the conservatoire, for instruction on the violin and the piano; he studied harmony under Catel, and composition under Méhul, and obtained in 1812 the first grand prize for composition at the Institut, his subject being the cantata, Mademoiselle de la Vallière. This prize entitled him to study in Rome, but his residence in that city was of short duration, he having received an appointment as piano tutor to the daughters of Murat, then king of Naples. His first opera, La Gioventù di Enrico Quinto, was received by the Neapolitan public with some applause. Returning to Paris in 1815 he published a few piano pieces of a sparkling and yet genuinely artistic character; and he co-operated with Boieldieu in Charles de France. His first serious debut as operatic composer for the French stage was with his Rosières (1817), which was very successful; this was followed in quick succession by numerous works more or less successful, among which were Marie (1826) and L'Illusion (1829). At last in 1831 appeared his Zampa, and in 1832 his Pré aux Clercs, the operas on which his fame chiefly rests, and which have gained a permanent place among operas, the former especially being still produced with acceptance in the principal cities of the Continent, in England, and America. Exhausted by the labour and excitement of getting his last opera properly put on the stage, the composer's health gave way, and he died 19th January, 1833. He left behind him an unfinished opera, Ludovic, which was completed by Halévy. See Hérold, Sa Vie et Ses Œuvres by Jouvin (Paris, 1868).

HERON, the name of grallatorial birds of the genus *Ardea*, forming with the storks, bitterns, and other birds the family Ardeidæ. The family is characterized by a thin, compressed body; a long, thin neck; a straight, narrow, pointed beak; longish, slender legs; three toes in front, the two outer united by a membrane; large, blunt wings; a powder-down patch on each side of the rump; and the often elongated feathers of the top of the head and other parts. The common British species (*Ardea cinerea*) has the legs naked above the tarsal joint, and twelve short and nearly equal feathers in the tail. It has a black crest, a white chest and forehead, and black primaries, the rest of its plumage being mainly gray. The beak is of a yellow colour, the legs are yellowish-green, and the claws are brown. The length from the tip of the beak to the tip of the tail is about 3 feet. It is an inhabitant of most parts of Europe, and is also distributed throughout Asia, Africa, and Australia. The common heron, like most of the other species, is to be found by the side of streams. It is a solitary bird, being seldom found in companies unless in the nesting season in the spring. Fish form the bulk of its food, but it also devours frogs, snakes, newts, lizards, insects, worms, and almost any kind of animal which it can contrive to capture. It roams in search of food mostly in the morning and evening. The heronry, or breeding-place of the herons, is usually found among high oak or elm trees, and the same breeding-place is used by several successive generations if they are unmolested. The large nest is made of twigs and sticks, and is lined with wool, rushes, grass, hair, and various similar materials. The eggs, usually three in a nest, are of a fairly uniform green colour. Many nests are usually found in one heronry, and sometimes the nests are built on the ground or on a cliff. The cry is a sort of *crank, crank*, uttered in a hoarse voice. The purple heron (*A. purpurea*) is a much rarer native of Britain, but is common in several parts of Europe, and is found throughout Asia, Egypt, &c. It is readily distinguished from the common species by the chestnut-purplish colour of much of its plumage, by its black claws, and its more slender neck. It feeds more exclusively by night than the gray heron, and its breeding season is rather later. The heronries of this species are usually not so high above the ground as those of the common species, and the nests are composed of sticks with some sedges and rushes. Four is the usual number of the eggs, which are not unlike those of the former species. The egrets or white herons constitute a well-marked sub-genus, which some naturalists have erected into a distinct genus *Herodias*. They are of a more slender structure all over, are all of white plumage, and have a plume of elongated feathers on the back. The largest of them is the great white heron (*A. alba*), which somewhat exceeds the gray heron in length, and has scarcely any crest. Its bill changes in colour from yellow to black, the latter being its colour during the breeding season, and the limbs are almost black. It is very rare in Britain, but is common in some parts of southern Europe. Its three eggs are bluish-green in colour. Of the smaller species of egret, the little egret (*A. garzetta*) may be mentioned as an occasional visitor to Britain. It is about 2 feet long, and has a crest of two long feathers, a long plume on the back, and a black beak and legs. The nest is placed among bushes or low trees near water, and the four, five, or six eggs are of a pale-blue colour. Other species of the genus are the goliath heron (*A. goliath*), a very large African species; the buff-backed heron (*A. bubulcus*) of the Nile, and the squacco heron (*A. ralloides*). The common heron was formerly protected in order to supply sport to the falconers. See Egret.

HEROSTRATUS. See Erostratus.

HERRERA, Francesco de, called *El Viejo* (the Elder), one of the greatest painters of the Seville school, was born there about 1576. He broke with the traditions of Spanish painting and designed with spirit and vigour, and thus became the founder of a new school. His Last Judgment, painted for the church of St. Bernard in Seville, is a master-piece of design and colouring. Equal praise is due to his Holy Family and the Outpouring of the Holy Spirit. He also worked in bronze, and it was this probably which gave rise to the charge that he was connected with coiners of false money. He had a disposition so very detestable that nobody could live with him. He went to Madrid in 1650, and died there in 1656. The Louvre contains some of his best works, among others, The Israelites in the Wilderness picking up Quails. He was also a statuary and architect.—His youngest son, Francesco, called *El Mozo* (the Younger), a fresco painter and architect, born at Seville in 1622, studied art under his father (to whom he was very far inferior as a painter), until he was obliged to leave him in consequence of his abominable temper, and went to Rome, where he remained some years. After his father's death he returned to Seville and painted for the churches. On the erection of the Seville Academy, in 1660, he was second director. He however resigned this situation and went to Madrid, where he painted the frescoes on the cupola of the choir of the church of St. Philip. The king, Philip IV., was so pleased with his work that he employed him to paint an

Assumption of Mary in the chapel of our Lady of Atocha, and when it was finished appointed him court painter. He was afterwards appointed superintendent of the royal buildings, but procured many enemies by his ambition. He died in 1685. His paintings are in Seville, Madrid, and the Escurial.

HERRERA Y TORDESILLAS, ANTONIO DE, a Spanish historian, born at Cuellar, in Segovia, in 1549 or 1559. After finishing his education he went to Italy, when about twenty years old, and became secretary to Vespasiano Gonzaga, brother to the Duke of Mantua, and went back with him to Spain when Gonzaga became viceroy of Navarre and Valencia. The latter recommended him in his will to Philip II. of Spain, and Herrera was appointed *coronista mayor de las Indias*, or Chronicler of the Indies, and retained that post under Philip II., III., and IV. He died in 1625. His principal work gives the history of the Spanish discoveries in America from 1492 to 1553. Herrera states that his object is to clear the character of his countrymen from the imputations cast on them for their conduct in North America.

HERRICK, ROBERT, an English poet of the seventeenth century, a native of London, son of a goldsmith, born in 1591, and educated at Cambridge. He became B.A. in 1616, and M.A. in 1620, and at one time studied law, but entered the church, and in 1629 was admitted to the living of Dean Prior, near Ashburton, Devonshire. Previous to this he had written much poetry, and had also indulged in the gaieties of London, where he had become a friend of Ben Jonson and other kindred spirits, and shared in their convivialities at 'the Sun, the Dog, the Triple Tun'—a period which he recalls with regretful longing. In common with many others of the Episcopal clergy, he was ejected from his living in 1647, whereupon he returned to London, and lived there on scanty means till he was restored in 1662. He died in 1674. The first collected edition of his poems was published in 1648, under the title of Hesperides, or the Works, both Humane and Divine, of Robert Herrick. Herrick sank for a considerable time into unmerited neglect. From this he was rescued by Dr. Nott, who, in 1810, published a selection of poems from his Hesperides. There are complete editions by W. C. Hazlitt (2 vols., 1869) and Dr. Grosart (3 vols., 1876). Notwithstanding his frequent coarseness in his secular pieces, his sacred poems appear to be the outcome of sincere piety. He has been pronounced by Campbell a writer of delightful Anacreontic spirit, and other critics rank him as the best of English lyric poets. Some of his songs, as Cherry Ripe, Gather the Rosebuds while ye may, &c., are still popular favourites.

HERRING. There are many species of the genus Clupea, known under the name of herring (see ICHTHYOLOGY); but the *Clupea harengus* is that which frequents our coasts in such numbers, and which furnishes so important an article of food to so many inhabitants. Herrings are found in the Atlantic from rather high northern latitudes, as low as the northern coasts of France. They are met with in vast shoals on the coast of America, as low as Carolina. In Chesapeake Bay they often cover the shore in such quantities as to become a nuisance. We find them also in the seas adjoining Kamtschatka; and probably they reach Japan. It used to be said that the great winter rendezvous of the herring was within the Arctic circle; that they continued there for many months, in order to recruit themselves after the fatigue of spawning; the seas within that space swarming with suitable food in a far greater degree than those of our warmer latitudes. But it is a rare fish in Greenland, and has never been observed in quantity in Polar seas by whalers or explorers. They begin to appear off the Shetland Isles in April and May. These are only the forerunners of the grand shoal which comes in June; and their appearance is marked by certain signs, such as the number of birds, like gannets and others, which follow to prey on them: but when the main body approaches, its breadth and depth is such as often to alter the appearance of the very ocean. It is divided into columns or shoals of 5 or 6 miles in length, and 3 or 4 in breadth; and they seem to drive the water before them with a kind of rippling. Sometimes they sink for the space of ten or fifteen minutes, and then rise again to the surface; and in fine weather reflect a variety of splendid colours, like a field of precious gems. A series of observations made by the Meteorological Society of Scotland, has shown that during the fishing season high sea temperatures are accompanied by diminished catches, and low sea temperatures by increased catches. Strong sunshine seems to have a powerful influence in driving the fish deep down below the surface. The shoals which visit the British seas pass down both coast lines; one portion takes to the eastern, the other to the western shores of Great Britain. The former proceeds southwards past Yarmouth, the great and ancient mart of herrings; they then pass through the Straits of Dover and English Channel, and after that disappear. Those which take towards the west, after offering themselves to the Hebrides, proceed to the north of Ireland, where they divide: one mass takes to the western side, and is soon lost in the immensity of the Atlantic; but the other passes into the Irish Sea, and southwards to the south of Ireland. The migrations of herrings are still to a great extent a mystery. They are too capricious to be dependent solely on the necessities of spawning; besides, we as yet know little of the spawning places of the fish. Nor can these migrations be safely attributed to the variation of food supply, the intervals of the visits to particular parts of the coasts being often very great, though adjacent districts are frequently visited during the same time. It is not from defect of food that the fish set themselves in motion, for they come to us full of fat, and on their return are almost universally observed to be lean. What their food is in other seas we are not yet informed; but in the British seas they feed much on minute crustaceans, and sometimes on their own fry. They are full of roe in the end of June, and continue in perfection till the beginning of winter. It is in summer that the great majority seem to spawn, but in certain localities numbers of them spawn in winter. How prolific they are may be guessed from the fact, that 70,000 eggs have been counted in one female. The young herrings approach the shores in summer, and may then be from half an inch to 2 inches long. At a larger size they are eaten as whitebait. Very few young herrings are found during winter, but some of the old herrings continue on our coasts the whole year. This seems to be particularly the case with the famous Loch Fyne herrings. The herring was unknown to the ancients, being rarely if ever found within the Mediterranean. The Dutch are said to have engaged in the fishery in 1164. The invention of pickling or salting herrings is ascribed to the Dutch in the fourteenth century. Since this early period the Dutch have uniformly maintained an important share in the herring fishery; but, owing to the Reformation and the relaxed observance of Lent in Catholic countries, the demand for herrings upon the Continent is relatively less than in the fourteenth and fifteenth centuries. The herring fishery of the United Kingdom is of great import-

ance, especially to many of the smaller towns on the east coast of England and Scotland. The value of the cured herrings exported annually (chiefly to Germany) is often much over £1,000,000, the largest quantity being from Scotland (sometimes over 1,000,000 barrels).

HERRNHUT, a small town or village in the kingdom of Saxony, in the circle and 18 miles south-east of Bautzen; pop. 1200. It is situated at the foot of Hutberg Mountain, 1054 feet above the level of the sea. It was founded by Count Zinzendorf, 1722, for the use of the Moravian Brethren, and it afterwards became the metropolis and centre of that sect of Christians, who, from this town, are often called *Herrnhuters*. (See UNITED BRETHREN.) The town is built with great regularity, and distinguished by the order, cleanliness, and stillness which prevail in it. It has a great variety of manufactures, principally of linen, calico, tobacco, and of articles in gold, tin, leather, &c. The objects of curiosity are the observatory and the burial-ground on a neighbouring hill, resembling a garden, and called by the brethren, *Garden of Peace*.

HERSCHEL, CAROLINE LUCRETIA, sister of the astronomer Sir William Herschel, was born at Hanover 16th March, 1750. In her twenty-second year she left her native place and came over to England to reside with her brother, then organist in Bath. When William abandoned his former profession in favour of astronomy she became his constant helpmate, and when he was appointed private astronomer to George III. she discharged efficiently all the duties of an assistant astronomer, for which she was allowed a small salary by the king. Although these duties were of a very arduous nature she yet found time to conduct a series of observations of her own with a small Newtonian telescope which her brother had made for her. She devoted special energy to the discovery of comets, and was so successful as to be entitled to claim the priority of discovery of at least five. Several remarkable nebulæ and clusters of stars included in her brother's catalogue were described from her original observations. In 1798 a valuable work from her pen was published by the Royal Society under the title of A Catalogue of Stars taken from Mr. Flamsteed's Observations, with Introductory Remarks by W. Herschel, LL.D. On her brother's death in 1822 she returned to her native country, where she died in 1848, after an unusually protracted life, distinguished by useful scientific labours. The Royal Society recognized the full value of her astronomical labours by bestowing upon her in 1828 their gold medal, and some time afterwards by conferring upon her the privileges of honorary membership.

HERSCHEL, SIR JOHN FREDERICK WILLIAM, BART., the only son of Sir William Herschel, was born 7th March, 1792, at Slough, near Windsor. He was educated at Hitcham, under the care of Dr. Gretton, then at Eton, and subsequently at Cambridge, where he distinguished himself by his mathematical genius. In 1813 he graduated B.A., and was Senior Wrangler and Smith's Prizeman. His first publication of note was A Collection of Examples of the Application o the Calculus to Finite Differences (Camb. 1820). It was not until the death of his father in 1822 that he devoted his special attention to the continuation of those labours of astronomical research which have made the name of Herschel so famous. He limited his first exertions to a re-examination of the nebulæ and clusters of stars discovered by his father, and described by him in three catalogues presented to the Royal Society, and published in their Transactions for the years 1786, 1789, and 1802. In this labour he associated himself with Mr. (afterwards Sir) James South, and in 1824 they reported to the Royal Society the position and apparent distances of 380 double and triple stars, obtained by more than 10,000 measurements. This memoir attracted the notice of the French Academy, and they voted it their astronomical prize; and two years later the gold medal of the Royal Society was awarded to each of the young astronomers. The results of the re-examination were given in 1833 to the Royal Society in the form of a catalogue of stars in order of their right ascension. The catalogue contained observations on 525 nebulæ and clusters of stars not noticed by his father, and on a great number of double stars, between 3000 and 4000 in all. Meantime he was not idle in the fields of scientific literature. An article from his pen on Physical Astronomy appeared in the Encyclopædia Metropolitana in 1828. His Treatise on Sound also appeared in the Encyclopædia Metropolitana in 1830, as did his Treatise on the Theory of Light in 1831, in which year also appeared in Lardner's Cabinet Cyclopædia his well-known Preliminary Discourse on the Study of Natural Philosophy, one of the most charmingly written books on science. In 1831 he was created a knight of the royal Hanoverian Order. In 1833 was published in Lardner's Cabinet Cyclopædia a Treatise on Astronomy, which proves his power as a popular expositor of that science. It was subsequently enlarged into The Outlines of Astronomy, of which several editions have been published. Before the publication of this work, however, he had undertaken a private expedition to the Cape of Good Hope for the purpose of carrying out in the southern hemisphere a set of observations similar to those he had made in the northern. He was offered for himself and his instruments a passage in a king's ship, but declined the offer, being resolved to bear all the expenses of the expedition himself. Four years were spent at Feldhuysen, near Cape Town (1834–37). His great object was to discover whether the distribution of the stars in the southern hemisphere corresponded with the results of his father's labours, prosecuted mainly on the opposite side of the Galactic Circle. That the observations might be strictly comparable they were made by the same method as Sir W. Herschel, and with a telescope of the same optical power. The whole number of stars counted in the telescope amounted to 68,948, which were included within 2299 fields of view. By a computation, based on the star-gauges in both hemispheres relative to the Milky Way, Sir John found that the stars visible in a reflecting telescope of 18 inches aperture amounted to 5,331,572; and, more than this, the number really visible in the telescope was vastly greater, for in some parts of the Milky Way the stars were found to be so crowded in space as to defy all attempts to count them. The results of this vast labour were published in 1847, the expense being borne by the Duke of Northumberland. On the return of the astronomer to England in 1838 he was received with every public honour; he was made a D.C.L. of Oxford; on the queen's coronation he was created a baronet. In 1848 he was president of the Royal Astronomical Society, and in 1850 was appointed Master of the Mint, an office which he resigned in 1855 on account of ill health. He died at his country residence in Kent on the 11th May, 1871, and was buried in Westminster Abbey. Besides the treatises abovementioned Sir John Herschel contributed articles to the Edinburgh and Quarterly Reviews on a wide range of subjects. Those, along with addresses delivered before the Astronomical Society and the British Association, and a number of poems, original and translated, were published in 1857. Pure litera-

ture seems to have had considerable attractions for him in his later years, for in 1866 appeared his Translation of the Iliad of Homer in Hexameters; this attempt is, however, more to be commended on the score of literal fidelity than of real poetic spirit.

HERSCHEL, Sir William, a distinguished astronomer, son of a musician of Hanover, was born there on November 15, 1738. Being destined by his father for his own profession, he was placed at the age of fourteen in the band of the Hanoverian Foot-guards. He went to England in 1757, and was employed in the formation of a military band, and in conducting, while organist at Bath, several concerts, oratorios, &c. Although enthusiastically fond of music, he had for some time devoted his leisure hours to the study of mathematics and astronomy; and being dissatisfied with the only telescopes within his reach, he set about constructing one for himself, in which arduous undertaking he succeeded, having in 1774 finished an excellent reflecting instrument of 5½ feet with his own hands. Encouraged by his success he proceeded to complete larger telescopes, and soon constructed a 7, a 10, and a 20 feet reflector, having in the latter case finished nearly 200 object-mirrors before he could satisfy himself. From this period he gradually withdrew from his professional engagements. Late in 1779 he began a regular survey of the heavens, star by star, with a 7-feet reflector, and after eighteen months' labour discovered, March 13, 1781, a new primary planet, named by him the *Georgium Sidus*, but now known as *Uranus*. George III. gave him a pension, enabling him to devote the rest of his life to astronomy. At Slough, near Windsor, he commenced the erection of a telescope of the enormous dimensions of 40 feet, and completed it in 1787. Its diameter was 4½ feet, and it weighed 2118 lbs. With this powerful instrument he continued to prosecute his discoveries, regularly communicating the results to the Royal Society till the year 1818. In 1783 he had discovered a volcanic mountain in the moon, and from further observations made with his large instrument in 1787 two others were distinguished. He discovered, as he believed, that the Georgium Sidus was surrounded with six satellites; but there are still doubts about their number. He also discovered two of the satellites of Saturn, and the fact that his system of rings revolved, and he measured his rotation and that of Venus, announced to the world that there were binary stars in the heavens, &c. The four small planets discovered by Piazzi, Olbers, and Harding—Ceres, Pallas, Juno, and Vesta—he observed with his usual accuracy. He fixed their diameter, which Schröter had determined to be from 1 to 4 seconds, at less than 1 second, and made an ingenious hypothesis in respect to their nature and formation. An account of most of his labours is found in the Philosophical Transactions and other works. Herschel received much assistance, in making and recording observations, from his sister Caroline; and latterly his brother, a skilful optical instrument maker, lent him valuable aid. In 1802 he laid before the Royal Society a catalogue of 5000 new nebulæ, nebulous stars, planetary nebulæ, and clusters of stars which he had discovered, and in consequence of the important additions made by him to the stock of astronomical knowledge, received from the University of Oxford the honorary degree of Doctor of Laws—an honour which was followed up in 1816 by the Guelphic order of knighthood from the king. He continued his astronomical observations till within a few years of his death, which took place at Slough on August 25, 1822. See Herschel, his Life and Works, by Holden (1881).

HERSFELD, a town of Prussia, in the province of Hesse-Nassau, 10 miles N.N.E. of Fulda, at the confluence of the Haune with the Fulda, here crossed by two bridges. It has some remains of walls, is very irregularly built, and has two interesting old churches, a town-house, gymnasium, grammar and industrial schools, orphan and ordinary hospitals, extensive manufactures of woollen cloth; manufactures of mixed cotton goods, soap, red and white leather, and several dye-works and worsted mills. Pop. (1895), 7413; (1900), 7908.

HERSTAL, or Heristal, a town and commune of Belgium, in the province of Liége, on the left bank of the Meuse, 3 miles north-east of Liége. In the beginning of the eighth century it was the residence of Pepin le Gros, and afterwards of several French kings of the second race; and it has a church founded by Charlemagne. Its manufactures consist chiefly of all kinds of iron and steel ware, including firearms. Coal is worked in the vicinity. Pop. (1897), 16,668; (1900), 18,195.

HERTFORD (contracted, Herts), an inland county of England, bounded on the N. by Cambridgeshire, E. by Essex, S. by Middlesex, W. by Buckingham and Bedford, about 38 miles in length, S.W. to N.E., and about 20 miles in breadth; area, 406,160 acres, of which about 340,000 are arable, meadow, and pasture. The general aspect of the county is pleasing, being diversified by hill and valley. The highest elevations, which do not much exceed 900 feet, occur in the chalk-hill ranges in the north part of the county. The abundance of growing wood adds much to the beauty of the scenery; while the great number of gentlemen's seats distributed over the county imparts to the whole an air of comfort and weath that is very striking. The principal rivers are the Lea and Colne, both of which have numerous tributaries. The climate is mild and healthy; soil various, but principally loam and clay, and generally fertile, although there are several gravelly tracts in the centre of the county that are poor and unproductive. The largest portion of the county is under tillage. Wheat, barley, and oats form the principal crops. Turnips and artificial grasses are also cultivated to a great extent. The wheat and barley are of a superior description. In the south-west parts of the county there are many cherry and apple orchards, the produce of which is sent to the London market. Large quantities of hay, of excellent quality, are grown on the meadow lands. There are no breeds of cattle peculiar to the county; nor is the rearing of live stock an object of much regard, the land being chiefly arable. The sheep are principally of the South Down and Wiltshire kinds. A considerable quantity of malt is made in various districts; and straw-plaiting affords employment to a great many females. Ribbons are made at various places; and paper is manufactured on a large scale. For parliamentary purposes it forms four divisions (Hertford, Hitchin, St. Albans, and Watford), each returning a member to the House of Commons. Pop. in 1891, 220,162; in 1901, 250,350.

HERTFORD, a market town and municipal borough of England, capital of the above county, on the Lea, 19 miles north of London, on branches of the Great Northern and Great Eastern Railways. The town contains a free grammar-school, and various others, including Christ's Hospital School. The principal public buildings, besides the churches, are—the shire-hall, in the market-place, comprising the courts of law, council chamber, and other rooms; corn exchange and public hall, free library and school of art, police offices, a new hospital, and an infirmary. The chief industrial establishments are breweries,

flour and other mills, brickworks, printing establishments, game food factory, &c. There is a good trade in corn, coal, and timber; a great deal is done in malting; and there are many corn-mills on the Lea, in the neighbourhood. In 673 a national ecclesiastical council was held in Hertford; and about the year 905 Edward the Elder built the castle, and rebuilt the town. This castle was occupied by John of Gaunt, and by the queens of Henry IV., V., and VI.; and Elizabeth also resided in it occasionally. John II., king of France, and David II., king of Scotland, were both in captivity here. Hertford returned one member to parliament from 1867 to 1885, previously two. Pop. in 1891, 9023; in 1901, 9322.

HERTZ, Henrik, a Danish dramatic poet, was born at Copenhagen of Jewish parents, 25th August, 1798. He entered the university of his native town in 1817 as a student of law, but devoted most of his attention to literature. His first works — Herr Burckhard, comedy (1826); Flyttedagen, comedy (1828); Arvingerne, a vaudeville (1829), and Gjengangerbreve (1830), were all published anonymously. The last-mentioned work was in the form of poetical epistles from Paradise, in some passages of which there was a skilful imitation of Baggesen, then recently dead. The satire was directed against Oehlenschläger, or rather against his imitators, and produced extraordinary commotion in the Danish literary world. The anonymity was preserved until 1832, in which year the poet left the Jewish community and became a Protestant. In 1833 he was granted the travelling pension with which the Danish government is in the habit of encouraging young men of letters, and took a tour to Italy, France, and Germany. On his return he became an active writer in various departments of literature, was appointed a professor, and in 1850 was granted a pension from government. He died at Copenhagen 25th February, 1870. The more important of his works, besides those already mentioned, are Amors Geniestreger, a lyrical, rhymed comedy; Svend Dyrings Hus, a tragedy; Kong Renés Datter, a charming little drama, translated into most European languages; the best English version (King René's Daughter) is the work of Sir Theodore Martin. Hertz published several novels (Johannes Johnson, Stemninger og Tilstande, &c.), but in this walk he was not so successful. His dramatic works were published in 18 vols. at Copenhagen in 1854–73, and a collection of his lyrics appeared in 4 vols. in 1851–62.

HERVEY, James, a pious and once popular divine, son of a clergyman of the Church of England, was born at Hardingstone, near Northampton, on Feb. 26, 1714. He was educated at Northampton and at Lincoln College, Oxford. Having taken orders, he accepted in 1737 the curacy of Dummer, in Hampshire. In 1738 he became domestic chaplain at Stoke Abbey, in Devonshire, and in 1740 curate of Bideford. During his residence in Devonshire he planned his Meditations among the Tombs; and an excursion to Kilkhampton, in Cornwall, occasioned him to lay the scene of his Meditations at that place. In 1743 he became curate to his father at Weston Favell, and on the death of the latter he succeeded him in his livings, both of Weston and Collingtree. He died on Christmas, 1758. The style of his writings is flowery; and hence his great popularity among readers who possess little refinement of taste. Besides his Meditations, he is the author of several other works, among which are Remarks on Bolingbroke's Letters on the Study and Use of History (1752) and Dialogues between Theron and Aspasio (3 vols., 1755), in favour of Calvinism.

HERZEGOVINA, a province nominally belonging to European Turkey, bounded on the N. by Croatia and Bosnia, on the E. by Bosnia, on the S.E. by Montenegro, and on the S. and W. by Dalmatia; length, N.W. to S.E., 140 miles; breadth, 50 miles; area, 700 square miles. The surface is generally mountainous, being covered by ranges belonging to the Dinaric Alps, sloping gradually to the Adriatic, which receives all its drainage chiefly by the Narenta. It contains many fertile valleys, and raises much excellent tobacco. The exports, not of much importance, consist chiefly of hides, tallow, cattle, wool, wax, and fruit. Mostar is the chief town. The province was conquered by the Turks in 1465. An insurrection, caused by Turkish misgovernment, broke out in July, 1875, and formed the beginning of a train of events resulting in war between Russia and Turkey. In accordance with the Treaty of Berlin (1878) the province was occupied, though not without serious resistance, by Austrian troops, and is now ruled by an Austrian military governor. Pop. about 250,000.

HERZEN, Alexander, a Russian writer, born, on Mar. 25, 1812, at Moscow, and educated at the university of that city, where he imbibed extreme philosophical and socialistic views. The policy of the government was not such as to recommend itself to revolutionary minds, and Herzen, charged with having joined in an offensive song on the emperor, was thrown into prison (1834), and afterwards exiled to Perm and Viatka. By intercession of the grand-duke (afterwards Alexander II.) he was allowed to reside in Vladimir, and in 1839 he was fully pardoned; on which he went to St. Petersburg, where he was employed as a secretary in the ministry of the interior. His outspoken radicalism again roused the jealousy of the government, and he was transferred to Novgorod, where he was appointed an imperial councillor, an office which he resigned in 1842. On the death of his father, who left him a considerable fortune, he obtained leave to travel, and from that period (1847) he never again set foot on Russian territory. He took up his abode first in Italy, then successively in France, England, and Switzerland. He died at Paris on Jan. 21, 1870. He was rather a patriot than a cosmopolite. All his efforts were for the regeneration of his own country, and his advocacy of the Slavic race to the neglect of the others threw him out of sympathy with some of the leading liberals of his age. While in London he established his famous Russian journal, the Kolokol (1857), which was secretly, yet extensively, circulated in Russia. This journal was afterwards published in Geneva in the French language, and met with but indifferent success. Among his numerous works we can only mention his Letters on Dilettantism in Science; the novels, Who is to Blame? and Dr. Krupow; Letters from France and Italy; On the Development of Revolutionary Ideas in Russia; Recollections of my Lifetime; France and England; Memoirs of the Empress Catharine written by Herself, &c., with translations into Russian of works by Louis Blanc, Mazzini, and other politicians of extreme views.

HESIOD, one of the oldest poets of Greece, was a native of Ascra, a village of Bœotia, at the foot of Mount Helicon, whence he is called the *Ascræan*. According to some authorities he practised, in Acarnania, the art of divination, which, especially in Bœotia, was closely connected with poetry. Others say he was a priest in the temple of the Muses on Mount Helicon; if this were the case, he might easily have practised both poetry and divination together. The latter part of his life he spent at Locris, and was at last murdered by two Locrians, who suspected him

of unlawful intercourse with their sister. His body was thrown into the sea, and carried to the shore by dolphins. This led to the detection of the murderers, who were apprehended and punished. Such is the tradition; but little is known of Hesiod with certainty. Even the age in which he lived cannot be precisely determined. A very common tradition relates that, in a poetical contest with Homer at Chalcis, he came off victorious. Herodotus calls him a contemporary of Homer, and says they lived 400 years before himself (about 900 B.C.) In his Works and Days (172) Hesiod says that he belonged to the period immediately following the Trojan war; but the passage is suspected by critics, and there are many reasons for supposing that he lived at a later period. Of the numerous works attributed to him three only remain. These are the Theogony, a collection of the oldest fables concerning the birth and achievements of the gods, arranged so as to form a connected whole. It is the most important and difficult of all his works. With it was probably connected the lost Catalogues of Women (or the Eoiai megalai), to the fourth book of which the second fragment (the Shield of Heracles) must have belonged. This is evidently composed of three distinct parts, only one of which is occupied with the real description of the shield. The contents of the Theogony are borrowed from earlier cosmogonies and theogonies, and the traces of the manner in which it was composed are very evident: there is a difference in the mythology, which is sometimes rude and imperfectly developed, and sometimes more perfect and refined; and a difference in the narration, which is sometimes short and plain, and sometimes diffuse and ornate. The frequent repetitions of the same fable, with variations, led to many contradictions; the additions and interpolations by later writers destroyed the harmony of the style. The third fragment is a didactic poem, Works and Days—Erga, or Erga kai Hemerai. It treats of agriculture, the choice of days, &c., with prudential precepts concerning education, domestic economy, navigation, &c. From this work the only one, according to Pausanias, which the Bœotians acknowledged as the genuine production of Hesiod (except the first ten verses, which they rejected), we learn most regarding his life and character. He and his brother Perses lived with their father at Ascra, engaged in cultivating the soil and tending cattle. After the death of their father the estate was divided between them; but unjust judges deprived the poet of half his share, and assigned it to his avaricious, and at the same time prodigal brother. Nothing remained for him to do but to husband carefully what remained; and he seems to have been a successful economist. His brother's property, on the contrary, was wasted by neglect and indolence, and lawsuits and corruption completed his ruin. The Hesiodic poems are inferior to the Homeric in almost every respect. His complete works have been translated into English verse by Elton, into prose in Bohn's Classical Library. There is a handy edition of Hesiod by F. A. Paley in the Bibliotheca Classica.

HESPERIDES, the guardians of the gold apples which Gē (the Earth) had given to Hera on her marriage. Hesiod, in his Theogony, calls them the *daughters of night*, and describes them as living beyond the ocean. According to others they were the daughters of Atlas, or of Zeus and Themis, or of Ceto and Phorcys. They were assisted in the charge of their garden by a dragon, which Hesiod calls *Ladon*. According to Apollonius the names of the Hesperides were Hespera, Erytheis, and Ægle; according to Apollodorus, Erytheia, Ægle, and Hestia Arethusa; according to Lutatius, Ægle, Arethusa, and Hesperis. Hesiod places the gardens in an island of the ocean to the west, and Pherecydes at the foot of the Hyperborean Atlas. It was the eleventh labour of Heracles to bring the golden apples of the Hesperides to Eurystheus. The hero killed the hundred-headed dragon, and the virgins fled; or, according to some, Atlas went to them and procured the apples. The apples were carried to Eurystheus, who gave them to Heracles, and he afterwards gave them to Athēna (Minerva). By this divinity they were restored to their former situation.

HESPERUS, the son or brother of Atlas, and a passionate lover of astronomy. Diodorus relates that he disappeared in a storm on Mount Atlas, which he had ascended to observe the motions of the stars. Others say he was the son of Eos and Cephalus. By the Romans, to whom he was known as Lucifer and Hesperus, he was worshipped with divine honours, and the most beautiful star in the sky, the evening and morning star (the planet Venus), was called by his name.

HESSE, or HESSIA (German, *Hessen*), a territory of Germany inhabited in the time of the Roman Empire by the Catti or Chatti, an old Germanic tribe. Germanicus is said to have destroyed their principal town, Mattium, which stood on the sites of the present villages of Grossmaden and Kleinmaden, near Gudensberg. Under the Frankish kings Hesse was governed by counts, the principal of whom were the Counts of Gudensberg of the name of Giso. By the marriage of the heiress of the last Count of Gudensberg, Giso IV., with the Landgrave Louis I. of Thuringia, this prince became sovereign of Hesse, and till about the middle of the thirteenth century the history of Hesse was identical with that of Thuringia; but on the death of the Landgrave Henry Raspe without issue, his niece Sophia, the daughter of the Landgrave Louis the Pious and the wife of Henry, duke of Brabant, claimed Hesse as well as Thuringia, and after a war of succession with her cousin the Margrave Henry the Illustrious of Meissen, she was put in possession of Hesse by treaty in 1263. Sophia's son Henry I. became the progenitor of the dynasty of Hesse, and took up his residence at Cassel. Philip I. the Generous, who succeeded William II. in his sovereignty of the whole country in 1509, and who was the earnest and zealous friend of the Reformation, divided his dominions among his four sons. The eldest, William IV., obtained one-half, including the capital, Cassel; Louis IV. one-fourth, comprising Marburg; Philip II. one-eighth, with Rheinfels; and George I. also an eighth, with Darmstadt. But Philip dying in 1583, and Louis in 1604, without children, there remained only the main branches of Hesse-Cassel and Hesse-Darmstadt.

HESSE, ELECTORAL, or HESSE-CASSEL, formerly an electorate and independent member of the Germanic Confederacy, containing 4430 square miles, with about 850,000 inhabitants, mostly Protestants. It was bounded on the north by Rhenish-Prussia and Hanover, east by Prussian Saxony, Saxe-Weimar, and Bavaria; south by Bavaria, Hesse-Darmstadt, and Frankfort; west by Nassau, Hesse-Darmstadt, and Waldeck; and for administrative purposes divided into the four provinces of Niederhessen, Oberhessen, Fulda, and Hanau. The district, with the exception of several small strips of territory, now forms part of the Prussian province of Hesse-Nassau. Hesse-Cassel is the elder branch of the Hesse dynasty, and was founded by the eldest son of Philip the Generous, the Landgrave William IV., surnamed the Wise (1567–92). He was succeeded by his son Maurice, who joined the Protestant Church, and resigned the government five years before his death to his son William V. This prince fought on the side of Sweden during the Thirty Years' war, and was put

under the ban of the empire. His brothers, Hermann and Ernest, respectively founded the lines of Hesse-Rotenberg and Hesse-Rheinfels; and on his death in 1637 his widow assumed the regency for her son William VI., and secured, as an indemnification for the losses which the country had sustained during the war, the greater part of Schaumburg and the Principality of Hersefeld. William VII. was succeeded in 1670 by his brother Charles, while another brother, Philip, founded the line of Hesse-Philippsthal. Charles's eldest son became, by his marriage with Ulrike Eleonore in 1720, King of Sweden. In 1730 he assumed the government of his native country as Frederick I., and was succeeded in 1751 by his brother William VIII., who fought under the British and Hanoverian flag in the Seven Years' war. His son Frederick II. became a convert to the Romish Church. Between 1776 and 1784 he received over £3,000,000 from the British government for the services of the 22,000 Hessians who fought against the Americans in the war of Independence. He was succeeded in 1785 by his son William IX., who, after 1803, when he was raised to the dignity of elector, reigned under the name of William I. He frequently changed sides in the French revolutionary and imperial wars, fighting first under British colours, and then as an ally of Napoleon. The French emperor, however, always viewed his conduct with suspicion, and after the battle of Jena threw troops into the Hessian territory. At the Peace of Tilsit he incorporated the electorate in the newly-formed Kingdom of Westphalia. On the overthrow of the French power William resumed the reins of government, and at once began to restore the old order of things as far as possible. On his death in 1821 he was succeeded by his son William II., whose relations to his subjects were seriously complicated by his connection with the obnoxious Countess of Reichenbach. The countess left Cassel on the outbreak of riots in 1830, and on the 9th January, 1831, the elector promulgated the long-promised liberal constitution. On the return of the countess fresh disturbances arose, which so incensed the elector that he also left Cassel and retired to Frankfort, where, after the death of his consort Augusta, he contracted a morganatic marriage with his mistress. On his death in 1847 his son, who had acted as regent since 1831, was raised to the rank of sovereign-elector. Yielding in 1848 to the demand for political reforms, but retracing his steps when the reaction set in, he gave great dissatisfaction to the people, especially in 1850, on the appointment of the unpopular minister Hassenpflug to the premiership, and of Haynau as minister of war. The excitement of the people became so intense that the elector and his premier sought refuge in flight, and invoked the aid of the other German powers. By their interference quiet was restored, and by their negotiation a new constitution was promulgated in 1852, which met with much opposition on account of its illiberal terms. From this period up till 1866 the history of Hesse-Cassel is simply a narrative of conflicts between the people for political freedom and the elector for absolute rule. The demands of the people were on several occasions strengthened by appeals to the elector from the Prussian government. At last, on the outbreak of the German war of 1866, the elector declared himself on the side of Austria, and his territory was occupied by Prussian troops. On the conclusion of the war Hesse-Cassel was annexed to the Prussian territories.

HESSE, GRAND-DUCHY OF (German, *Hessen*, formerly *Hessen-Darmstadt*), a state of Germany, consisting altogether of thirteen distinct portions. Eleven of these are quite small; six of them are surrounded by Prussian territory, and five are on the borders of Baden and Würtemberg. The other two portions, forming about nine-tenths of the whole, are separated from each other by a belt of land stretching east to west, and including part of the Prussian dominions. The more southerly of these portions forms the two provinces of Rheinhessen and Starkenburg, and is bounded north by Prussia, west and south-west by Rhenish Prussia and Rhenish Bavaria, south by Baden, and east by Lower Bavaria. The northern portion, forming the province of Oberhessen, is surrounded by the Prussian province of Hesse-Nassau; area of whole grand-duchy, 2964 square miles. Oberhessen is generally mountainous, being covered in the west by the Taunus, which in Hausberg rises to 1755 feet; in the north by the Rodhaargebirg, which in Hatzfeld attains 2730 feet; and in the east by the Vogelsberg, whose culminating point here is 3104 feet. The provinces Starkenburg and Rheinhessen are also mountainous towards their frontiers, more especially in the south-east, which is occupied by a portion of the Odenwald; and in the south-west by the Donnersberg, a northern ramification of the Vosges; but these mountains, rapidly subsiding in the interior, form extensive plains belonging to the valleys of the Main and the Rhine. To the latter river the whole surface of the grand-duchy belongs, with exception of a small portion in the north, drained by the Eder and Fulda, affluents of the Weser. The climate is greatly diversified, being cold and bleak in the mountainous districts, and mild and pleasant in the valleys of the Rhine and the Main. Here, however, some unhealthy districts are found among the extensive marshes which the Rhine has formed. The soil, particularly in the provinces of Starkenburg and Rheinhessen, is remarkably fertile, and corn of all kinds is raised in quantities sufficient to leave a large surplus for export. Hemp, flax, potatoes, and rape-seed are also extensively grown, and in particular districts tobacco and hops. The vine forms a most important object of culture, and fruit is very abundant. The right bank of the Rhine is densely, but the left bank poorly wooded, and though the extent of ground occupied by forest is nearly equal to that occupied by arable land, very little timber is exported. Horses, cattle, sheep, and swine are very numerous, but superiority of breed is not sufficiently attended to. The minerals include iron, coal, lignite, and salt; and there are good quarries of sandstone, limestone, whetstones, basalt, and roofing-slate. Agriculture and the rearing of cattle forming the principal employments, leave little room for extensive manufactures. In some districts, however, they have made considerable progress. The most important is linen. The transit trade is very considerable, and has been facilitated by the railways. The principal towns are Darmstadt, the capital; Mainz, Giessen, Bingen, and Worms. The grand-duchy is a hereditary monarchy. The constitution dates from 1820, but was somewhat modified in 1856 and 1872. The legislative power is vested partly in two chambers—an upper, composed chiefly of nobility and citizens, appointed for life by the grand-duke; and a lower, composed chiefly of deputies from the towns, villages, and rural districts. About two-thirds of the inhabitants are Protestants. Pop. in 1885, 956,611; in 1895, 1,039,020; in 1900, 1,119,893.

The grand-ducal line was founded in 1567 by George I., son of Philip the Generous (see above art.). The war of Succession with Hesse-Cassel, which broke out under his successor Louis V., continued to rage during that of his son George II. (1626–61), but was brought to a close in 1647 by the cession of Marburg and other contested localities in exchange for Giessen and other territory. During the French

revolution territory to the extent of 850 square miles, with 100,000 of a population, was lost; but by the Treaty of Lunéville in 1801 the duchy regained much more than it had lost, acquiring about 2340 square miles, with 220,000 inhabitants. Louis X. (born 1753; died 1830) joined the Confederation of the Rhine, adopting as grand-duke the title of Louis I. He obtained from Napoleon still further accessions of territory, caused his troops to act against Austria in 1809, and in concert with the French in 1813, but joined the allies after the battle of Leipzig on condition of being left in possession of the newly-acquired territory. In 1815 he joined the German Confederation, and made large cessions on the right bank of the Rhine to Prussia and other states, but obtained valuable possessions on the left bank, including Mainz and Bingen. In 1828 the grand-duke joined the Prussian Customs Union, thereby giving the first impulse to a more general union which ultimately culminated in the Zollverein. Soon after the accession of Louis II. the revolutionary movement of 1830 produced some disturbances in Hesse-Darmstadt, which were quelled by the military. The revolution of 1848 extorted from the grand-duke the concession of trial by jury. He was succeeded by his son Louis III. in 1848, who was forced to grant a number of reforms. By the death of the Landgrave of Hesse-Homburg, in 1866, the grand-duke succeeded to his dominions. In the German war of that year Hesse-Darmstadt threw in its lot with Austria. Its army was nearly annihilated at Friedberg, and it was deprived of the newly-acquired landgraviate and other districts. In 1870 the grand-duchy of Hesse entered the German empire. Louis IV., who succeeded Louis III., died in 1892. He was the husband of Princess Alice of Great Britain, and their son, Ernest Louis, is now the reigning sovereign.

HESSE-HOMBURG, before its absorption by Prussia after the German war of 1866 (see above article), a landgraviate of Germany, and sixteenth member of the confederation, consisting of two parts, the lordship of Homburg, situated N.N.W. of Frankfort, and the lordship of Meissenheim. It had an area of about 105 square miles, and 27,000 inhabitants, the greater part of them Lutherans. Both portions of the former landgraviate are mountainous, Homburg lying on the eastern slope of the Taunus; while Meissenheim is much broken by hills, generally well wooded, or, where they admit of the plough, under good cultivation. The greater part of the public revenue was obtained from the gaming-tables of the watering-place, Homburg, the capital.

HESSE-NASSAU, HESSEN-NASSAU, a province of Prussia, which includes the former Principality of Hesse-Cassel (except some small districts), the greater part of the former Duchy of Nassau, that portion of the former Landgraviate of Hesse-Homburg which lies on the right bank of the Rhine, the territory and town of Frankfort, and some small districts ceded by Hesse-Darmstadt and Bavaria. Omitting detached portions, the province is bounded by the Prussian provinces of Westphalia, Hanover, Saxony, and the Rhineland, the Principality of Waldeck, the Grand-duchy of Saxe-Weimar, and the Kingdom of Bavaria; area, 6018 English square miles. The province is divided into the two governments (Regierungsbezirke) of Cassel and Wiesbaden, the former of which corresponds very nearly to the former Principality of Hesse-Cassel. Its area is 3914 square miles, while that of Hesse-Cassel was 3698. The government of Wiesbaden principally consists of the Duchy of Nassau; its area is 2104 square miles. The greater part of this province belongs to the central German plateau, and has a very rugged surface, partly covered by branches of the Harz. These, however, nowhere attain a great elevation, the culminating point not exceeding 3600 feet. The greater part of the drainage is carried into the Werra either directly or by its tributaries; but a considerable portion in the west and south is carried to the Rhine by the Lahn, Ohm, and Main. The climate is severe in the higher districts, where corn ceases to ripen. The best climate is on the Rhine, where the most celebrated wines of Germany are grown. From the rugged nature of the surface, the extent of arable land is limited, and cultivation is chiefly confined to the narrow valleys and lower hill slopes, amounting, however, to about two-fifths of the whole surface. The system of agriculture is imperfect, and the soil mostly poor, though there are some rich tracts, especially in Nassau. The principal crops are rye, barley, and oats. Potatoes also are extensively grown, and form the chief dependence of the lower classes. Fruit is tolerably abundant, and a great part of the loftier districts is covered with extensive forests, which employ a considerable number of the inhabitants, and furnish one of the most valuable sources of revenue. There are various minerals, and valuable mineral waters at Homburg, Wiesbaden, &c. The manufactures consist chiefly of woollens, cottons, and linens. The principal towns are Cassel, the capital, Wiesbaden, and Frankfort. Pop. in 1885, 1,592,454; in 1895, 1,756,802; in 1900, 1,897,390.

HESSIAN FLY (*Cecidomyia destructor*), a fly of the family Cecidomyidæ, of the order Diptera (two-winged flies), the larva of which is very destructive to wheat, barley, and rye crops (it does not attack oats). It is so named from the unfounded belief, prevalent in America, where it is specially destructive, that it was brought over to that country in the baggage of the Hessian mercenaries employed against the Americans in the war of independence. The female fly is about a tenth of an inch in length. Its body is brown, with the upper parts, the thorax, and the head of a darker shade, approaching to black. The wings are of a dusky gray, and are surrounded with fringes. The male is somewhat smaller than the female, and has longer antennæ. The female flies usually lay their eggs on the young plants twice in the year, in May and September, the maggots being hatched in from four to fourteen days. These work themselves in between the leaf-sheath and the stem, and fix themselves near the lowest joints, often near the root, and suck the juices of the stem, so that the ear falls down at a sharp angle. These maggots turn to pupæ, from which the flies develop in about ten days. It has long been a pest in America and Germany, but did not appear in Britain, in any number at least, till the summer of 1886. It has not yet done very serious mischief.

HESYCHASTS (from Greek *hēsychazein*, to be quiet), a mystic and contemplative party among the monks on Mount Athos, noted in the fourteenth century for their fantastic notions. They regarded the centre of the stomach as the seat of the soul. Hence they were known as *omphalopsychoi*, or *navel-souls*. After long perseverance in prayer, with their chin on their breast and their eyes fixed on this supposed seat of the soul, they believed they would finally have a sensible perception of the divine light, and might enjoy the bliss of beholding God. This light they declared to be the glory of God himself, and connected with the light that appeared on the Mount of Transfiguration.

HESYCHIUS, the author of a Greek lexicon, which has probably come to us in an abridged form, and which he partly collected from former diction-

aries, and partly enlarged by many new words and examples from Homer, the dramatic and lyric poets, the orators, physicians, and historians, was a native of Alexandria, and according to the best authorities flourished about the end of the fourth century after Christ. Of the circumstances of his life nothing is known. His lexicon possesses great value, especially of an antiquarian kind, and is the most useful for the study of the Greek language of all the ancient critical writings that are extant. The best editions of his lexicon are Alberti and Ruhnken's (Leyden, 1746-66, two vols. folio), and that prepared by Schmidt (Jena, five vols. 1857-68; in a smaller form, two parts, 1864; second edition, 1867).

HETÆRA (Greek *hetaira*, a female friend), the name given by the Greeks to a concubine, a mistress, &c., as opposed to a lawful wife. But the word had various shades of meaning, from a concubine, who might be a wife in all but the legal qualification of citizenship, down to a harlot. The beauty and accomplishments of many of the *hetæræ* occasioned their society to be sought by men of the highest eminence, even Plato and Socrates. No shame was attached to associating with them. Aspasia is the most renowned of these *hetæræ*. (See ASPASIA.) *Hetæræ*, less intellectually famous, were Lais, whom Aristippus the philosopher loved, Phryne, and others. They also became famous for their connection with the works of art. Praxiteles made a marble and gold statue of the latter, and she was also the model for his statues of Aphrodite.

HETERODOX (from the Greek), meaning *believing otherwise*, in contradistinction to *orthodox*. It is sometimes used to designate one who denies the dogmas of an established church, and sometimes to one holding opinions supposed to be repugnant to the doctrines of the Scriptures. The Catholics call a person who disbelieves all or certain dogmas of the church (sanctioned by councils and the decisions of popes) a *heretic;* the Protestants prefer the milder expression *heterodox*.

HETMAN, or ATAMAN, the title of the chief (general) of the Cossacks. While the Cossacks were under Polish dominion King Stephan Bathori set over them, in 1576, a commander-in-chief, under the title of *hetman*, and gave him, in token of his dignity, a banner, a staff of command, and a seal. The hetman was chosen by the Cossacks themselves, subject to ratification by the emperor. His power was very great, extending over life and death. When the Cossacks submitted to the Russians in 1654, they retained their form of government entire. But the famous hetman Mazeppa, having espoused the party of Charles XII. in 1768, with the intention of uniting again with the Poles, Peter I. imposed many restrictions on the Cossacks, and the place of hetman frequently remained long unoccupied. The Count Rasumoffsky having been elected hetman in 1750, received, instead of the former domains and revenues, 50,000 rubles annual pay. Catharine the Great abolished altogether the dignity of hetman of the Ukraine, and established instead a government of eight members. The Cossacks of the Don have retained their hetman; but election, and everything indicative of freedom in the appointment, has been abolished, and the title of chief hetman now belongs to the heir-apparent to the crown. Count Platoff, who acted so conspicuous a part in the wars with France (1812–14), was the last elective hetman. See COSSACKS.

HEULANDITE, the name applied to a species of the zeolite family in mineralogy, by H. T. Brooke, in honour of Heuland of London. It had been confounded with stilbite, from which it differs essentially, however, in the form of its crystals, which are always some modification of the right oblique-angled prism. In hardness it is between calcareous spar and fluor spar. Specific gravity, 2·2. It is white and transparent, passing into red, when it becomes nearly opaque. It consists of silica, 59·14; alumina, 17·92; lime, 7·65; and water, 15·40, but alkalies are also sometimes present. It is chiefly found in the cavities of amygdaloidal rocks, and occurs in the Campsie Hills and other parts of Scotland, and in the trap of the Giant's Causeway. It is found in the Tyrol of a colour approaching to scarlet, and almost opaque. Finely crystallized specimens come from Iceland and the Faroe Isles, and the mineral is found in many foreign localities.

HEVELIUS, JOHANNES, known also as *Johannes Hevel*, a celebrated Polish astronomer, was born at Danzig, 28th January, 1611, and died there 28th January, 1687. After visiting the principal countries of Europe he settled in his native city, and from 1639 till his death applied himself almost exclusively to the study of astronomy. In 1641 he erected an observatory in his own house, and furnished it with a quadrant and sextant, together with large telescopes constructed by himself. His Selenographia, or description of the moon, published in 1647, was the first of numerous astronomical works of great value and authority on his favourite science. The publication of the first part of the Machina Cœlestis (1673) gave rise to a public controversy between him and Dr. Hooke, which increased to a quarrel by Hooke's dictatorial manner. Halley, who visited Hevelius at Danzig at the request of the Royal Society of London, of which Hevelius had been elected a member in 1664, reported favourably of the correctness of his observations. In the same year (1679) he suffered a great loss by the destruction by fire of his house and observatory; but he shortly after erected a new observatory, though on a less ambitious scale. In 1661 he observed a transit of Mercury, a triumph confined to Gassendi alone of all preceding astronomers. Hevelius ranks next to Flamsteed among the men of his day as a diligent and accurate observer of the heavens.

HEVES, a market town of Hungary, in the county of the same name, 55 m. E.N.E. Pesth. It was once fortified, has a parish church, a castle, with fine gardens and riding-school, and a trade in corn, cattle, tobacco, and wine. Pop. (1890), 7271.

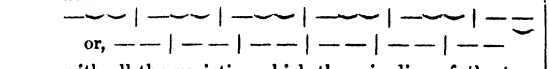
HEXACHORD (from the Greek), a chord in the ancient music, equivalent to that which the moderns call a *sixth*. A division of the scale by hexachords became common in Europe after the time of Guido d'Arezzo, apparently arising from a misuse of the syllables ut re mi, &c., used by him from the hymn to John the Baptist, to represent the degrees of the scale.—*Hexachord* is also the name for a lyre with six strings.

HEXAGON (Gr. *hex*, six, and *gonia*, angle), a plane figure bounded by six straight lines. When these lines are equal the figure is called *a regular hexagon*. The side of a regular hexagon is equal to the radius of the circumscribing circle. Of the three figures that completely occupy space when any number of them are placed in juxta-position, namely, the equilateral triangle, square, and hexagon, the hexagon contains the greatest area within a given perimeter; hence the cells of bees, being of a hexagonal form, inclose the greatest possible space with the least expenditure of wax.

HEXAHEDRON (Gr. *hex*, six, and *hēdra*, base), a figure having six faces, or a solid bounded by six planes. A hexahedron whose opposite sides are parallel is called a parallelopiped. The term cube is now generally applied to the *regular hexahedron*, which has six equal square faces, twelve equal edges,

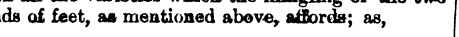
and eight solid angles, formed by the meeting of three plane right angles.

HEXAMETER (from the Greek *hexametros*), a verse of six feet. It is the heroic or epic measure of the Greeks and Romans, the finest examples of which are the two great poems ascribed to Homer, the Iliad and the Odyssey, and the Æneid of Virgil. The sixth foot is always a spondee (two long syllables) or a trochee (a long and a short). The five first may be all dactyles (one long syllable and two short), or all spondees, or a mixture of both. The scheme of this verse then is—

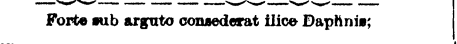


or, — — | — — | — — | — — | — — | — —

with all the varieties which the mingling of the two kinds of feet, as mentioned above, affords; as,



Forte sub arguto consederat ilice Daphnis;

or, 

Qui Bavium non odit amet tua carmina Mævi;

and so on. This immense variety of which the hexameter is susceptible, its great simplicity, its flowing harmony, and its numerous pauses, constitute the charm of this admirable verse, and adapt it to the most various subjects. A spondee is rarely used in the fifth foot, and then in Latin the word with which the verse ends is generally composed of four syllables, and the fourth foot at least must be a dactyle; as,

Cara deûm soboles, magnum Jovis incrementum.

The prevalence of the dactyle or spondee in the hexameter depends much upon the genius of the language; thus the dactyle is more frequent in Greek than in Latin, and in German than in Greek. It is evident that the hexameter requires distinctly long and short syllables, and cannot, therefore, be formed in languages whose prosody is regulated by the accent and not by the *quantity* of the words, as Italian, French, Spanish, English, &c., more particularly in the latter. The French and Italian writers, however, early attempted the hexameter, as well as Sidney and Southey in English; but without success. More recent English poets have also tried it, as Clough and Kingsley. Longfellow has made extensive use of the hexameter in his poetry, though the critics are divided as to the question of his success. In no modern European language have hexameters become truly naturalized, except in German, to which this measure, skilfully used, seems nearly as well adapted as to the Greek. Fischart attempted the German hexameter in the sixteenth century. In the middle of the eighteenth century it was used and recommended by Klopstock, Uz, and Kleist, but was still in a very rude state. Goethe's hexameters are exceedingly rude, and very often as poor as their sense is beautiful. John Henry Voss improved the German hexameter by the excellent translation of Homer, and his valuable Zeitmessung der Deutschen Sprache (Königsberg, 1802).

HEXAPLA (Greek, *hexapla*, 'the six-fold'), a collection of the Holy Scriptures in six languages, applied particularly to the combination of six versions published by the Greek bishop Origen, containing the Hebrew text with a transcript of it in Greek characters, the Septuagint, and three other versions, those, namely, of Aquila, Symmachus, and Theodotion. Origen's purpose was to restore the purity of the Septuagint text, by bringing it into closer agreement with the original Hebrew. Explanatory notes were occasionally given in the margin. A good edition of the extant fragments of the Hexapla is that of Field (1875), but since its publication Mercati (1896) has recovered other fragments.

HEXHAM, a market town of England, in Northumberlandshire, situated on the right bank of the Tyne, about 1 mile below the junction of the north and south branches of that river, which, about ½ mile from Hexham, is crossed by a handsome stone bridge, 20 miles west from Newcastle. It has some tolerably wide streets; the greater number, however, are ancient, very narrow, and irregular. The market-place is a spacious, well-paved square, and contains the Moot Hall, an ancient stone building, formerly used as the court-house of the bishops and priors of Hexham. The Abbey church was originally a cruciform structure in the early English style, but suffered so severely during the middle ages that now only the transept and chancel remain. The nave and lady chapel are about to be rebuilt. There are a free grammar-school, and several other schools; a dispensary, and a number of small charities. The trade of Hexham is now confined to supplying the wants of the fertile agricultural district around it. Hexham is supposed to have been the old *Alexodunum*. In the seventh century a monastery was founded here by St. Wilfrid, and a bishop's see soon afterwards established. The diocese was subsequently united to Lindisfarne. The town and part of the church were burned by the Scotch in the time of Edward I. On March 9, 1761, a formidable riot arose from an attempt to ballot for a succession of men for the militia, after the term of three years prescribed by law had been served, when forty-five persons were killed, and 300 severely wounded by the fire of the military. Pop. in 1891, 5945; in 1901, 7071.

HEYNE, Christian Gottlob, a distinguished scholar, was born September 25, 1729, at Chemnitz, in Saxony. His father was a poor linen weaver, and Heyne could hardly obtain the slight assistance which was necessary to gratify his early wish of being instructed in the Latin language. From 1741 to 1748 he attended the Lyceum at Chemnitz, whence he proceeded to the University of Leipzig in 1748, where he devoted himself with great zeal to the study of the classics and classical antiquity. A Latin elegy, composed by Heyne at the request of the Reformed Congregation of Leipzig, on the death of their pastor, made him known to the minister of state, Count Von Brühl, in whose library he was appointed copyist. The only benefit that he derived from this appointment was an enlarged acquaintance with the works of ancient literature, for which his inclination became every day more settled. Necessity at first compelled him to undertake several translations; for the difficulties of his early life were almost incredible, but his endurance and his conquest of them mounted to heroism. The first classic of which he undertook an edition through inclination was Tibullus, which he published for the first time in 1755. The moral tone of his own mind also led him to the writings of the stoic Epictetus, of which he published an edition in 1756. These two works made him known abroad. At Ruhnken's recommendation he received, in 1763, an invitation to succeed Gessner as professor of eloquence and poetry at Göttingen. He was soon after (1764) appointed first librarian and counsellor, in which position he remained till his death. Heyne has earned the reputation of being one of the most distinguished teachers and scholars of Germany. His particular merit consists in having raised the knowledge of antiquity and classical literature from the dust of the schools into the region of practical and intelligent interest. He esteemed the study of the languages, of grammar, and metre as the foundation of the further study of classic literature, but by no means as themselves the ultimate object. This is shown by his editions of the poets, which gained him the most extensive reputation, of Tibullus, and

especially of Virgil. His principal work, which employed him for eighteen years, was his great, though unfortunately unfinished, edition of Homer. After giving a final revision to his works, an attack of apoplexy terminated his well-spent life, July 14, 1812, in the eighty-third year of his age. His Opuscula Academica were published at Göttingen in six vols. 8vo (1785–1811). See Heeren's Life of Heyne (Göttingen, 1813).

HEYWOOD, a municipal borough in Lancashire, on the banks of the Roach, about 8 miles north-west of Manchester. It has rapidly increased in population and importance, owing largely to the erection of extensive cotton mills, and it is now a busy manufacturing town. The making of power-looms, iron and brass founding, boiler-making, and all branches of cotton spinning and manufacturing, are extensively carried on. Pop. in 1901, 25,461.

HEYWOOD, JOHN, an English dramatist who lived in the first half of the sixteenth century, and died at Mechlin about 1580. Neither the date nor the place of his birth is known with certainty, but it is said he was educated at Oxford. He was a paid musician at the court of Henry VIII., with whom he became a favourite on account of his sprightliness and skill in music. His zealous attachment to the Roman Church recommended him to Queen Mary; but this very circumstance rendered him an object of suspicion during the succeeding reign, and he found it expedient to retire to the Continent. Heywood's dramatic works may be classed as Interludes, standing between the miracle-plays and the drama proper. The earliest of them, 'A Merry Play between the Pardoner and the Frere, the Curate and Neybour Pratte', was written before 1521. Another famous piece is the Four P's, an interlude in which figure 'a Palmer, a Pardoner, a Potycary, and a Pedlar'. His allegory of the Spider and the Fly (London, 1556) fully reveals Heywood's Roman Catholic proclivities. By spiders, the Protestants are meant; by flies, the Catholics; Queen Mary is the maid; the civil sword is her broom; her master is Christ, and her mistress, Mother Church. He is also well known as a writer of epigrams; and various other things came from his pen.

HEYWOOD, THOMAS, a dramatist and miscellaneous writer who lived in the reigns of Elizabeth, James I., and Charles I., and died about 1650. He was born in Lincolnshire and educated at Cambridge, and was long a player as well as a playwright. He is perhaps the most fertile of English dramatists, having composed wholly or in part 220 different plays. Of these only about twenty-four remain, of which the one most admired is A Woman Killed with Kindness. The Four London Prentices has also been highly eulogized. Charles Lamb calls Heywood 'A sort of prose Shakspere', and his rank as a dramatist has been considered not inferior to that of Massinger, Ford, and others of his contemporaries. In 1874 The Dramatic Works of Thomas Heywood were edited by J. Pearson. This edition does not contain The Captives, a play subsequently recovered, and edited by Mr. Bullen in 1883.

HEZEKIAH (*Hizkiyah*, generally *Hizkiyahu*, strength of Jehovah), the twelfth, and one of the best of the kings of Judah. He succeeded Ahaz about 726 B.C., when he was twenty-five years of age, and died about 698 B.C. He had no sooner mounted the throne than he initiated a system of reform, on the injunctions of Isaiah, and broke up the idolatrous customs into which the people had fallen during the life of his father. He also endeavoured to repair the injury done by national defeats and losses. He purged, repaired, and reopened the temple with magnificent sacrifices and a splendid ceremonial. So extreme was his indignation against idolatry that he destroyed the brazen serpent which was said to be the one used by Moses in his miraculous healing of the Israelites. To do this required much strength of mind, and a courage equal to defy popular prejudice. Isaiah, the noblest and most eloquent of prophets, confirmed Hezekiah in his faithfulness, and the dictates of piety and political expedience were in complete unison. With patriotic zeal he assumed the aggressive against the Philistines, and not only rewon the cities lost by his father, but dispossessed them of most of their own. In this war he squandered the national resources, and failed to pay the tribute to Shalmanezer agreed to by his predecessor Ahaz. A siege, abandoned only in the fifth year, followed this policy, and all Judea trembled with anticipation of an Assyrian invasion, which was only averted by the heroic resistance of the Tyrians. During the siege of Samaria Shalmanezer died, and was succeeded by Sargon, who conducted a futile invasion in the fourteenth year of Hezekiah's reign. At this time the King of Judah had a dangerous illness, which threatened serious complications, and the kingdom was in a difficult crisis, for the king had no heir, Manasseh not being born till long afterwards. To the king's anguish and prayer Isaiah was ordered to administer comfort and the promise of a fresh lease of life. Much has been written to little purpose about the nature of his malady, the most reliable finding being that it was fever, terminating in abscess. Among the ambassadors who came with letters and gifts to congratulate him on his recovery was the viceroy of Babylon, to whom he unfortunately, though from perfectly justifiable motives, displayed the royal treasures. For this he received a terrible rebuke, and he was told by Isaiah that from Babylon would come the ruin and captivity of Judah. The greater part of the Scripture records bearing on the reign of Hezekiah is occupied by the two invasions of Sennacherib, to meet the first of which the King of Judah by presents and entreaties courted the alliance of Egypt, strong in chariots and cavalry, an arm in which Judah was weak, a procedure for which he incurred the censure of Isaiah. Sennacherib besieged Jerusalem with mounds, and Hezekiah, to rid the country of its enemies, promised 800 talents of silver and 30 of gold. On this Sennacherib marched into Egypt, but his expedition proving futile he made a second invasion of Judah, and attacked the stronghold of Lachish. From Lachish he sent an army against Jerusalem, and the ministers of Hezekiah were filled with anguish and dismay. The piety of the king was of more avail than arms, and the result of prayer was a prophecy of immediate deliverance. 'That night the angel of the Lord went out and smote in the camp of the Assyrians 185,000 men.' Among the many conjectures as to the agent of this destruction, the most probable is that it was the pestilence. Several of the Psalms are supposed to allude to the discomfiture of Sennacherib, for example, xlvi.–xlviii., lxxvi. Hezekiah did not long survive this deliverance, and after a reign of nearly twenty-nine years he died at the age of fifty-four, and was buried with much pomp amid universal mourning. To him we are indebted for at least one portion of our present canon (Prov. xxv. 1). He was one of the best kings of Judah. Among the many highly useful works executed by him, the aqueducts of Jerusalem take a foremost place. During his reign was the golden age of prophetic poetry, for in addition to Isaiah there flourished then Nahum and Micah.

HIBERNATION, See DORMANT STATE.

HIBERNIA, the ancient name of Ireland, applied to it first by Julius Cæsar. Pomponius Mela calls it *Iverna;* Ptolemy, *Iuvernia;* others, *Overnia, Bernia, Iris.* Aristotle mentions this island by the name of *Ierne,* and at the same time speaks of Albion. These are, he says, 'two islands called Britannic, beyond the Celtæ.' The inhabitants of Britain told Cæsar that Hibernia lay west of their island, and was only half as large. Ptolemy, who received more correct accounts from merchants who had been there, makes but few mistakes in his account of its size, form, and situation; and by means of their information he was enabled to form a chart of Hibernia, and to give tolerably accurate accounts of its coasts, rivers, promontories, and inhabitants. Agricola made preparations for conquering the country, but his design was not executed. Hibernia, therefore, was never reduced to subjection by the Romans. See BRITAIN and IRELAND.

HIBISCUS, a genus of plants, natural order Malvaceæ. The petals of *Hibiscus Rosa-sinensis* possess astringent properties, and the Chinese use them to blacken their eyebrows and the leather of their shoes. In India sun-hemp is procured from *Hibiscus cannabinus.* The order to which the Hibiscus belongs is wholly destitute of all hurtful qualities. The wood is always very light, and of little value. The bark is so tenacious as to be manufactured into cordage, and several species of Hibiscus are utilized in this way in tropical countries. The whips with which the negro slaves were lashed in the West India Islands were manufactured from the bark of *Hibiscus arboreus.* A few of the species are slightly acid, and the seeds of one, *Hibiscus Abelmoschus,* or *Abelmoschus moschatus,* are considered cordial and stomachic, and are mixed with coffee by the Arabians. Some are favourite hot-house plants. The fruit is used in an unripe state, and the ripe seeds are sometimes used in soups as barley.

HICCUP, or HICCOUGH, is a spasmodic affection of the diaphragm caused sympathetically by the irritation of structures supplied by nerves communicating with the phrenic nerve. Though generally a trivial and transient inconvenience, its occurrence in the last stages of acute disease is a grave, and often a fatal symptom, indicative of a general giving way of the nervous system. Obstinate hiccup occurs occasionally in the persons of young females of a hysterical tendency, and may continue for weeks without being capable of being subdued by any kind of treatment. Fasting, or a sudden stimulant introduced into the stomach, is one of the most ordinary provocatives of hiccup, and the affection generally subsides of its own accord. Nothing removes it more effectually than some active emotion of the mind suddenly excited. Hiccup is a common symptom of dyspepsia, and is often observed in abdominal diseases when terminating fatally, and is especially a symptom in some forms of hernia. Many remedies have been suggested for it, such as holding the breath as long as possible, tying a belt tightly round the waist, and the frequent swallowing of small rounded pieces of ice.

HICKES, GEORGE, D.D., an eminent English divine, philologist, and antiquary, of uncommon abilities and learning, was born at Newsham, Yorkshire, 20th June, 1642. In 1659 he entered the University of Oxford, and was elected a fellow of Lincoln in 1664. The following year he received his degree of M.A., and took orders in 1666. In 1673 he travelled with Sir George Wheler in France, and in 1676 he became chaplain to John, duke of Lauderdale, whom he accompanied to Edinburgh in 1677, when that nobleman was appointed high-commissioner to the General Assembly of the Church of Scotland. The University of Glasgow bestowed on him the degree of D.D. in 1678, and a similar honour from Oxford was conferred on him the following year. In 1681 he was appointed one of the chaplains to the king, and in August, 1683, he was elevated to the dignity of dean of Worcester, but of this he was deprived in February, 1690, for refusing to take the oaths to King William III. after the Revolution. He followed the fortunes of James II., and was consecrated suffragan Bishop of Thetford in 1694 by the non-juring archbishop Sancroft. He died December 15, 1715. Of his numerous and able works the most important are Institutiones Grammaticæ Anglo-Saxonicæ et Mœso-Gothicæ, &c. (Oxon. 1689), and Linguarum veterum septentrionalium Thesaurus Grammatico-Criticus et Archæologicus (two vols. folio, Oxon. 1705). This latter work is now very scarce.

HICKORY, the common designation in America for several species of walnut, which, however, form the genus *Carya,* of the natural order Juglandaceæ, and differ from the true walnut. *Carya alba,* the common hickory-tree, produces an edible nut. The wood is tough and elastic. *C. oliviæformis* yields the pecan-nut, which is used like the walnut. All the species of *Carya* are exclusively confined to North America. See WALNUT.

HIDALGO, a Spanish nobleman of the lower class. (See GRANDEES.) To the lower nobility pertain the *cavalleros, escuderos,* and *hidalgos* (from *hijo d'algo,* son of something). There were *hidalgos de naturaleza,* of noble birth, and *hidalgos de privilegio,* that is, those on whom the king had conferred nobility in reward of distinguished services, and those who purchased nobility. The latter possessed all the rights and privileges of the other nobles, but were not so highly respected. With the exception of some old houses and knights of orders, the *hidalgos* differed little from the commoners. The Portuguese *fidalgo* has the same signification. The title is now obsolete.

HIDE, OF LAND. See HYDE.

HIERAPOLIS (Turkish, *Pambuk-Kaleh,* 'cotton castle'), a ruined city, Asiatic Turkey, near the right bank of the Lycus; 121 miles east by south of Smyrna. It was finely situated on a broad terrace, bounded on the north-east by a mountain range, and on all other sides by extensive and fertile plains. The principal ruins are a theatre and gymnasium; but other remains, including rows of columns, walls, and sepulchral monuments, are scattered over a large area. It was famous for its thermal springs, which, from the quantity of lime which they contain, have formed many remarkable stalactites and incrustations. The most remarkable specimen of these is seen on the cliffs over which the water of the springs falls. Each cascade has incrusted a deposit of snowy whiteness, and the whole looks as if a river had been suddenly stopped in its course and turned into stone. These incrustations are mentioned by Strabo. Hierapolis owed its ancient celebrity, and, it is conjectured, its sanctity also, to these remarkable springs. The place takes its modern name Pambuk-Kaleh, from the white appearance of the cliffs which support the terrace on which the ruins of the city stand.

HIERARCHY (from *hieros,* sacred, and *archē,* government), sacred government, sometimes used to denote the internal government of the church, sometimes the dominion of the church over the state. In the former sense, the hierarchy arose with the establishment of the Christian church as an independent society. Although elders, called *presbyters,* stood at the head of the earliest congregations of Christians, their constitution was democratic, each of the members having a part in all the concerns of

the association. The government of the congregations was gradually transferred into the hands of their officers, as was natural when the congregations had become societies of great extent. In the second century the bishops acquired a superiority over the presbyters, and became the supreme officers of the congregations, although the presbyters retained some share in the government. The bishops in the capitals of the provinces, who were called *metropolitans*, soon acquired a superiority over the provincial bishops, and exercised a supervision over them. They were themselves subject to the bishops of the principal cities of the Roman Empire, Constantinople, Antioch, Alexandria, and Jerusalem, who received the title of *patriarchs;* and thus a complete aristocratic constitution was formed, which continued in the Greek Church, while, in the Latin, the aristocracy was transformed into a monarchy. The Roman bishop acquired the primacy over the others, and the opinion having become prevalent that the apostle Peter had founded the Roman Church, and that its bishop was his successor, his authority constantly increased, and he gradually became the monarchical head of Western Christendom.

The word *hierarchy* is frequently used in the second sense, viz. of the relations of the church to the state, in which the church is not only independent of the state, but even claims a superiority over it. In the first centuries the church had no connection with the state. It did not seek to acquire influence over the state, and the state sometimes persecuted the Christian religion. After the church was amalgamated with the state, in the time of Constantine the Great, it obtained protection, but was dependent on the temporal rulers, who asserted the right to convoke the general councils, and to nominate the metropolitan bishops, and even frequently interfered in the internal affairs of the church and its dogmatic discussions. It was the same in the Gothic, Lombard, and Frankish states, which were erected on the ruins of the Roman Empire. The German emperors, and especially Charlemagne, also exercised over the church the rights of sovereignty, which the Roman emperors had possessed; and after the feudal system had arisen in the German Empire the bishops held the church lands as fiefs received from the temporal princes; and even the Roman bishop, in his temporal character, stood in a feudal relation to the Frankish princes. But the germ of the hierarchical system already existed at this period in the idea of the church as a society always enlightened by the Divine Spirit, and in the idea, borrowed from Judaism, of a priesthood instituted by God himself, by which the clergy acquired dignity surpassing all temporal grandeur, and an authority emanating not from the state, but from God himself. But the hierarchical system could not be completely developed from these germs till the Roman bishop became the undisputed head of Western Christendom, by which unity and strength were infused into the exertions of the spiritual power. For several centuries the importance of the Roman bishop continued to increase: his power was especially augmented in the ninth century, by the Pseudo-Isidorian collection of canons, some forged, some interpolated, the object of which was to exalt the ecclesiastical authority above the secular. (See POPE.) Gregory VII. exerted the most undaunted courage and liveliest zeal in the eleventh century, to enforce the claims of the hierarchy; and the principal means which he adopted for attaining this object were, to deprive the princes of the right of investiture (see INVESTITURE), and to introduce celibacy among the clergy. (See CELIBACY.) Gregory did not wholly accomplish his object; but his successors pursued his plan with perseverance and success, and their efforts were favoured by the Crusades, which were undertaken at the close of the eleventh century, and prosecuted for two centuries. These wars promoted a tone of public sentiment favourable to the claims of the church, and as they were deemed of a religious character, they afforded the popes numerous opportunities to take part in the general affairs of the European nations, and to direct the undertakings of the princes. Amid these wars was developed the idea of the unity of the Christian church, with the vicar of Christ at its head.

Thus, from the end of the eleventh to the middle of the thirteenth century the idea of a hierarchy was accomplished. The church became an institution elevated above the state, and its head, endowed with a supernatural fulness of grace, stood, in public opinion, above all secular princes, in their disputes with whom, the popes were generally victorious. Urban II., Paschal II., and Innocent III. and IV., in particular, knew how to maintain their superiority over the princes, and to exercise a powerful influence on the affairs of the European nations. The popes, however, were no more ambitious than the princes, and only acted in conformity with their character and relations, when they attempted to render the church independent of the political power, and to elevate it above the state. Since the hierarchy rested on public opinion, it was necessary for it to preserve this public opinion by every means, and to suppress whatever threatened to change it. It therefore exerted a pernicious influence by establishing inquisitions, and restricting the freedom of the mind. But, on the other hand, it was in early times productive of much good, by serving as a point of union to the European nations; by constituting a balance to the military and political power; by frequently composing the differences of the princes, checking the outbreak of wars, and giving religion an influence over the barbarous nations of the middle ages.

From the fourteenth century the Papacy, and with it the hierarchy, began gradually to decline. This was manifested by the disputes of the popes with Philip the Fair and Louis the Bavarian, which did not terminate to their advantage, as had been the case before. To this must be added the removal of the popes to Avignon, and the great schism which resulted in the councils of Pisa (1409), Constance (1414), and Basle (1431), where the popes appeared as parties before a higher tribunal, and it was proclaimed that the councils are superior to the popes. But what was of yet greater importance, public opinion gradually began to alter; and in many places the doubts started by Wickliffe and Huss found adherents. Meanwhile the popedom and the hierarchical system stood uninjured in its outward forms till the beginning of the sixteenth century. But at this time the edifice, already tottering, was vehemently agitated by the Reformation. In that portion of Western Christendom which separated from Rome the hierarchy altogether ceased. The Catholic Church continued, indeed, even after the Reformation, to assert its hierarchical pretensions, but it was obliged to renounce one privilege after another: the Papal power declined, and, in practice, became more and more dependent on the civil authorities. However the term *hierarchy* is still in common use to denote the governing and ministering body in the church, according to its several gradations. Strictly it can be applied only to those churches which are ruled by bishops, such as the Roman Catholic Church and the Anglican Church, which also holds the theory of a hierarchical gradation of rank and authority. Both the churches named comprise the three orders of bishops, priests, and deacons. Those Lutheran communities which still retain the title of bishops, con-

cede so little of independent jurisdiction to the office, that the gradations in the ministry can scarcely be regarded as having a strict hierarchical character.

Hierarchy is also used to denote a division of the angels, prevalent in the middle ages. An account of the opinions on this subject may be found in the Celestial Hierarchy, a work erroneously ascribed to Dionysius the Areopagite. The number of hierarchies was three, each subdivided into three orders: hence Tasso (Jerusalem Del. xviii. 96) marshals his angels in three squadrons, and each squadron in three orders, and Spenser repeatedly mentions the 'trinal triplicities.' The first hierarchy consisted of cherubim, seraphim, and thrones; the second, of dominions, virtues, and powers; and the third, of principalities, angels, and archangels. Milton, to whose machinery in his divine poem many of the popular opinions on the subject may be traced, often alludes to this classification; as for instance,

> 'Thrones, dominations, princedoms, virtues, powers,
> Hear my decree.'

HIERO I., King of Syracuse in Sicily, brother and successor of Gelon. On his accession to the throne of Syracuse Gelon conferred on Hiero the government of Gela, his native place, and on his death left him (B.C. 478) a sceptre, which he had (so to speak) rendered legitimate by his virtues. Hiero's reign, though less glorious than the preceding, was marked by a peculiar splendour on account of his generous encouragement of learning. But the recollection of his predecessor, whose memory was highly revered, exposed the faults of Hiero in a strong light in the beginning of his reign, when he behaved in a tyrannical manner. Dazzled by greatness, corrupted by flattery, and suspicious in the extreme, Hiero at first encouraged spies, and surrounded himself with foreigners and mercenaries, fearing a rival in every one more virtuous and able than himself. His brother Polyzelus was particularly an object of his jealousy, and wishing to get rid of him, he gave him the command of the troops sent to aid the town of Sybaris against Croton. But Polyzelus, penetrating his intentions, fled to the court of his father-in-law, Theron, king of Agrigentum. The protection that he enjoyed here was the cause of a war, which Hiero terminated by doing a service to his enemy. The inhabitants of Himera had been governed tyrannically by Thrasydæus, son of Theron. Wearied with oppression, they proposed to Hiero to deliver him their city. The King of Syracuse informed Theron of it, who, in consequence, made a proposal to terminate the differences subsisting between them by a permanent peace. Hiero received the sister of the King of Agrigentum in marriage, and Polyzelus was restored to his brother's favour. Without manifesting military talents, Hiero ended with success all the wars which he was obliged to undertake. He expelled the inhabitants of Naxos and Catana, peopled both cities with a new colony, gave the latter a new name, Ætna, and, as its founder, took the surname *Ætnæus*. Soon after Hiero's death the Catanians made themselves masters of their former country, and expelled the new settlers, who built, at a short distance from Catana, another city called Ætna, and Catana resumed its primitive name. Though some blemishes tarnish the first years of Hiero's reign, he compensated for his first faults by the noble actions which signalized the remainder of his life. A long sickness which befell him was the main cause of this alteration. Since he could no longer occupy himself with the cares of royalty, he collected around him a society of learned men, and thus becoming acquainted with the pleasures of learning, he never afterwards ceased to value it. His court became the rendezvous of the most distinguished men of his time. The names of Simonides and Pindar appear among those of his most constant companions, and when Æschylus left Greece, he betook himself to Hiero, to close his days in his kingdom. Bacchylides, Epicharmus, and Simonides were likewise residents at his court. Xenophon would not, in his dialogue on the qualities of kings, have placed words in the mouths of Hiero and Simonides in contradiction with their actions; and the title Hiero, which he gives to his book, contains the finest eulogium of this monarch. According to Ælian and Pindar, few princes were to be compared with him. He was several times victor in the Grecian games. Pindar has celebrated his victories: several odes of this poet are filled with his praises. Hiero died at Catana, 467 B.C., and left the crown, which he had worn eleven years, to his brother Thrasybulus, who lost it, however, one year after.

HIERO II., King of Syracuse (275–215 B.C.), was the son of Hierocles, a noble Syracusan, who claimed a descent from the family of Gelon. In early youth he distinguished himself by his brilliant qualities, and applied himself, with spirit and success, to military exercises. He was, on that account, distinguished by Pyrrhus, king of Epirus, who was then master of Sicily, and who, by leaving the island to itself, gave rise to confusion and anarchy. The Syracusans, acquainted with the qualities of Hiero, conferred on him the supreme command (275 B.C.); and it was not difficult for him subsequently to arrive at the royal dignity. During Hiero's reign began the first Punic war, in which he was, at first, an ally of the Carthaginians, and was defeated by the consul Appius Claudius, who had come to the aid of the Mamertines. He then saw that the best course for him was to espouse the cause of the Romans, since the victories of the Carthaginians in Sicily could be of no benefit to him, but, on the contrary, would be likely to render them dangerous neighbours. In order to avert the war from his states, he sent ambassadors to the consuls Otacilius and Valerius, to offer a treaty of peace and alliance. Though he showed himself more favourable to the Romans by providing them, during the first Punic war, with necessaries of all kinds, he did not refuse the Carthaginians the aid they asked in the servile war, and was able, by his adroitness, to preserve the friendship of both. The glory of Hiero and the prosperity of Syracuse culminated in the period which intervened between the first Punic war and the second; for in that season of peace Hiero enacted wise laws, and was wholly devoted to the happiness of his subjects. The encouragement which he extended to agriculture enriched him and doubled the revenues of the state. He kept his word pledged to his allies, and when the Romans underwent a total defeat from Hannibal at Thrasymene, Hiero proffered them provisions, men, and arms, and sent them a golden statue of Victory, 320 lbs. in weight, which they accepted as a happy augury. This kind attention consolidated the league between Rome and Syracuse; and even the loss of the battle of Cannæ, which was followed by the defection of all the other allies of Rome, did not shake his fidelity. Hiero devoted himself to the construction of military machines of all kinds, under the direction of the great Archimedes. With the intention of surpassing the magnificence of all other kings, he built a ship, which had never been equalled for magnitude and splendour, and from the description of it, preserved in Athenæus, it must have resembled a floating city. But it being discovered that Sicily had no harbour adequate to the reception of this immense structure, Hiero resolved to make a present of it to King Ptolemy; and as Egypt was at that time in want of corn, took this opportunity to send a great supply of grain to Alexandria. Hiero died B.C. 215. As his



Hieroglyphic Inscriptions and Design in Relief from the Tomb of Prince Rahotep at Medum (ab. 2800 B. C.). After *Flinders Petrie.*

The Prince is represented as sitting at table clad in a leopard's skin: the inscriptions enumerate various articles buried in the tomb for his use in the other world.

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son Gelon died before him, he left the crown, after wearing it fifty-four years, to his grandson Hieronymus.

HIEROGLYPHIC WRITING. The word hieroglyphic represents the Greek compound *ἱερογλυφικὰ*, which is built up of *ἱερὸς* (*hieros*), sacred, and *γλύφω* (*glypho*), I engrave; the substantive *γράμματα* (*grammata*), writing, being understood. The Greek word designates the inscriptions sculptured on buildings in Egypt, in the belief that the writing was symbolical, was confined to sacred subjects, and legible only to the priests. The term has since been applied beyond its etymological value to designate paintings, also, of such objects as in Egypt are carved in stone, whether on stone or other material. The term has also been applied to picture-writing in general, such as that of the Mexicans and the still ruder pictures of the North American Indians. Hieroglyphs, as those of Egypt, have been supposed to be derived from picture-writing, of which, indeed, many scholars state them to be a development. The present article will be limited to the Egyptian system of writing, embracing the hieroglyphic, hieratic, and demotic.

The history of writing shows that but few original systems have been invented. (See ALPHABET and WRITING.) The Egyptian, however, is one of the few, and its origin goes back to a date exceedingly remote. It has been supposed that some allusions occur in the Scriptures to the hieroglyphs of Egypt, but this is doubtful. Herodotus, who travelled in Egypt, and gives much information concerning it, which he obtained from the priests, of course through interpreters, gives no account of the language nor of the writing. The language and writing of Egypt must have been understood by Greek officials while under Greek rule, and by Roman officials while under Roman rule. The educated classes of Greek and Roman society took no interest in the study of languages, and philology as a science had no existence. Under these circumstances the books necessary for the study of the Egyptian language and writing were probably sought for only by those persons who were qualifying to become officials in the administration of the province. It is probable that the Alexandrian library contained adequate books on the history, language, science, and literature of Egypt, but these perished if they ever existed, and no key to the Egyptian inscriptions remained.

Earnest endeavours were made on the revival of learning in Europe to read the hieroglyphic writing, and all the passages likely to be of assistance scattered through the pages of Greek and Roman authors were carefully collected and laboriously studied by learned men, but without success. The key was not found in those passages, nor was it deducible from them. The utmost that could be obtained was accomplished by the penetrating genius of Bishop Warburton, who proved—1st, that it was the written language of the country; and 2d, that it was adopted to record openly and plainly the laws, policies, public morals, history, and all kinds of civil matters. But no further advance was made until the discovery of the Rosetta stone.

M. Bouchart, an artillery officer of the French army during Napoleon's expedition to Egypt in 1799, while engaged in some works on the redoubt of St. Julian at Rosetta, discovered the fragment of an oblong slab of black syenitic basalt bearing a triple inscription, one under the other. The upper one was in hieroglyphics, the lower one in Greek, and the middle one is stated in the Greek one to be enchorial or popular. The value of this stone, since called the Rosetta stone, was at once perceived. The success of the British arms under Nelson and Abercrombie placed the French army, and all that its scientific staff had collected in Egypt, in the hands of the British. The Rosetta stone, therefore, instead of gracing the Louvre, graces the British Museum, to which it was presented by King George III. The Rosetta stone forms a conspicuous object in the gallery of Egyptian sculpture in the British Museum. It is a fragment, for about one-half of the upper inscription, the hieroglyphic, is broken off and lost. The centre inscription, the enchorial or demotic, is entire, and the lower one, the Greek, is nearly so. The Greek inscription states the inscription to be a decree of the priesthood in synod at Memphis, in honour of Ptolemy V., to commemorate benefits conferred on them, and ordering the decree to be placed in every temple of the first, second, and third rank in the country, in the three forms of writing. As soon as this was known the three inscriptions were accurately copied, engraved, and impressions freely distributed over Europe. The learned men of Europe were freely supplied at the cost of the British government, and scholars now saw the possibility of understanding Egyptian writing.

Dr. Thomas Young, an eminent mathematician, man of science, and classical scholar, directed his attention to the great Egyptian problem of the day, and opened the way; but he was soon surpassed by Champollion, whose brilliant discoveries have immortalized his name. Most of the scholars, like Dr. Young, began the study of the Rosetta stone by comparing, not the hieroglyphic, but the enchorial with the Greek, and proceeded in the following method:—

1st. It was observed that the words Alexander and Alexandria, occurring in the fourth and seventeenth lines of the Greek inscription, corresponded with two groups of characters in the second and tenth lines of the enchorial inscription.

2d. A group of characters found in almost every line was supposed to be the word 'and.'

3d. A group of characters repeated twenty-nine times could only correspond to the word 'king' in the Greek, which with its compounds occurs thirty-six times.

4th. The word 'Ptolemy' occurs eleven times in the Greek, and a group supposed to correspond to it occurs fourteen times in the enchorial.

These were the first steps in the comparison, which was followed by a comparison of other groups in relation to Greek words. The investigation was most laborious, but it proved that the enchorial inscription contained the same subject-matter as the Greek, and although the enchorial could not be read, for as yet there were no data for the phonetic powers of the elements of those groups, therefore none to indicate the nature of the unknown language, yet scholars felt satisfied that progress was made in the study.

Dr. Young prepared himself for continuing his investigation by the study of the Coptic language, which Akerblad, the Swedish philologist, had done, and began the analysis of the groups into which the enchorial had been divided. Akerblad found in the enchorial the Coptic words *Chemi*, Egypt; *phuro*, king; *nierpheui*, temples; *Ueb*, priests, and other words, from which he determined the phonetic value of sixteen characters. Dr. Young, proceeding rather as a mathematician than a linguist, confirmed Akerblad's sixteen characters, and added thirteen more. He pointed out 150 more groups corresponding to words in the Greek inscription, and thus he greatly increased the materials for linguistic investigation.

The reason of the concentrated attention of scholars being given to the enchorial inscription instead of to

the hieroglyphic one was, that as the latter was only a fragment, it could not so readily be compared with the Greek as the enchorial could. Dr. Young continued his studies of the enchorial by the use of papyri which he found in Egyptian collections deposited in various museums in Europe. He found that these papyri contained the same figurative representations at the head of their several sections. He was collating the book of the dead, or ritual, as it has been called. The great work on Egypt published by the French government in sections, 1809–1828, contains a copy of the ritual in hieroglyphics, but other copies are in a character which at first sight appears to be the same as the centre inscription of the Rosetta stone, and actually has some signs in common with it, but essentially differs from it. This is the hieratic.

The learned world was now satisfied that the enchorial inscription of the Rosetta stone is essentially alphabetic, although the most advanced student was yet unable to read it. Still some words could be read, and from those words the language was deemed to be Coptic, in consequence of which the Coptic language was ardently studied. And attention was now given to the hieroglyphic inscription to determine the phonetic value of its elements, by means of comparing it with the Greek and the enchorial. This was found to be far more difficult than the preceding laborious comparison. The first attempts of Dr. Young were hailed as promising success, and by anticipation he was deemed to have solved the problem. The phonetic principle, so clear in the enchorial, was first applied by Young to the hieroglyphic inscription, and that with some success, but the same principle, with modifications, was developed much farther in the hands of Champollion, and subsequently by his disciples. In the small obelisk at Philæ a Greek inscription on its base and hieroglyphics on the shaft were shown to be the same; and lastly, the decree of Canopus in Greek and in hieroglyphics fully justified Egyptologists in their renderings of hieroglyphic texts.

Hieroglyphs are representations of objects or parts of objects, which are chiefly carved in stone and often brilliantly coloured. Some hieroglyphs, however, are only painted on the material, whether stone, wood, or papyrus. The objects represented include the heavenly bodies, and terrestrial objects, as men, parts of men, animals, parts of animals, trees; and the following list, taken from Champollion, shows his classification, and number of objects included in each class:—

Celestial bodies	10
Human beings in various attitudes	120
Parts of human bodies, as the eye, hand, &c.	60
Wild quadrupeds	24
Domestic quadrupeds	10
Parts of quadrupeds	22
Birds and parts of birds	50
Fishes	10
Reptiles and parts of reptiles	30
Insects	14
Plants and parts of plants	60
Buildings	24
Furniture	100
Dresses, parts of dresses, weapons	80
Tools and instruments	150
Vases and cups	30
Geometric forms	20
Fantastic forms	50
Total	864

Some of these are repetitions, but many forms have been added, and now over three thousand are known, but only a few hundreds were in common use. Chevalier Bunsen classifies his list as follows:

Ideographs	620
Determinatives	164
Phonetics	129
Mixed signs	56
Total	969

Bunsen's classification is that of the function of the hieroglyph in expressing the intended sense.

Ideographs comprise all non-phonetic signs, except such as form a class of their own, either as generic specifications of a preceding word, called a determinative, or as possessing the peculiarity of being used commonly with phonetic supplements, and forming mixed signs. The figure of a man, a woman, a calf, indicate, even when accompanied by phonetic hieroglyphs, simply those objects. The representation of such natural objects as an antelope, an ass, and the like, does not require anything to explain it. The figure explains itself, as it does in any ordinary representation. Under a figure of an antelope it is unnecessary to write 'an antelope,' for it is at once recognized to be an antelope. But there are many objects which are difficult to recognize, especially when represented by mere outlines of those objects, and which are called *linear* hieroglyphs. How is a child to be distinguished from an adult? How is a temple to be distinguished from a house? How is wine to be distinguished from water or from milk? Water was expressed by three zigzag lines, one above the other, to represent waves or ripples of running water, milk by a milk-jar, oil by an oil-jar, and so the thing contained by the container. Fishing by a pelican seizing a fish, *i.e.* fishing; seeing and sight by an eye. It is obvious that such ideographs write the idea very differently from those in which the figure of a man represents a man. They are tropes or metaphors, common enough in speech, in which one thing represented means another thing suggested by the representation. Such hieroglyphs are mentioned by Clement of Alexandria, A.D. 210, and described by him as tropic. Champollion terms them symbolic. This mode of representation is an extension of the primitive idea of representing objects by pictures of the objects; but tropes exist in language, and their expression by a hieroglyph is merely conveying a trope by a picture or a carving, instead of, as we do, by an alphabetic language. How were adjectives to be expressed, as colours for instance? Colours are abstract words taken from the coloured thing, whatever it may be; thus red from something red. In hieroglyphs a red bird is employed to express the abstract colour red. Thus the concrete is put for the abstract, as in other cases a part is put for the whole, the effect is put for the cause, the instrument for the action of it, as a plough for ploughing.

And beyond all this, the emblems of the gods were adopted to represent the gods, as if the Romans had adopted the figure of a club to mean Hercules, the trident to mean Neptune, and the thunderbolt Jupiter; thus an ibis on its standard means the Egyptian god Thoth, an ass seated on his haunches means Set or Typhon. The ritual, or Book of the Dead, indicates the existence of an inward or esoteric meaning in these emblems or signs of the gods. The representation of a god by means of an animal's head, instead of the proper head, on a human body is symbolical and expressive. The symbol of Venus in classical mythology is her dove, that of Juno her peacock; now the Egyptians would place the dove's head on the shoulders of Venus, and that of the peacock on the shoulders of Juno, in place of their own heads, to indicate the two goddesses. The symbols were understood by the Egyptians, and we consider them simply as a part of their system of writing, without regard to their effect on the sense of beauty.

Determinatives.—Ideographic hieroglyphs are divided into two classes. The preceding class contains all those which represent one idea, either direct or by metaphor. The class called determinatives represent also modifications of the primitive idea, and are therefore generic signs. Thus the sign by which a preceding figure of an animal is stated to belong to the genus of quadrupeds, is placed after the figure of an ass or a goat, and is a determinative. Now the figure of an ass or a goat is plain enough of itself as an ideograph, and the determinative does not make it plainer. But more than this, a determinative is placed after the name of the animal has been written phonetically, that is to say, by signs having alphabetic values. Determinatives are much used in three systems of writing, each of which is said to be based on picture-writing, viz.: the Chinese, the Assyrian including the Babylonian, and the hieroglyphic system of Egypt. The function of a determinative, as it exists in Chinese, Assyrian, and Egyptian, may be illustrated in our own language, thus the words man, kingdom, city, river, god, goddess, woman, may be considered determinatives in the subjoined phrases:

The man Josephus.
The kingdom France.
The city Babylon.
The river Thames.
The god Neptune.
The goddess Diana.
The woman Esther.

Determinatives in the Egyptian hieroglyphs comprise certain grammatical signs, as the semicircle or segment, the feminine sign of nouns, the extended arms with the palms of the hands downwards to express the negation of the sentence they precede.

Phonetic Hieroglyphs are those which are used to write the sounds of speech. The invention of an alphabet, no matter what may be the shape of the letters, is the great triumph of writing, and hence the value of phonetic hieroglyphs. The discovery of this function of hieroglyphs by Young, and afterwards by Champollion, who appears to have been ignorant of Young's discovery, was not accepted at first, for it was difficult to admit that figures of birds and beasts could serve the same purpose as the letters of an alphabet, although it was obvious to those who examined the subject that such figures, as representatives of sounds, were found to be subject to the same conditions as the letters of an alphabet in the work of writing words.

The Greek inscription of the Rosetta stone states it to be in honour of Ptolemy, and a careful study of the hieroglyphic inscription compared with the Greek one showed that the name of Ptolemy was written in an oval or *cartouche* as it is technically called. The only way of writing a foreign proper name was deemed to be by means of phonetic hieroglyphs, and accordingly Dr. Young attempted to determine the phonetic values of the hieroglyphs contained in the oval, and he partly succeeded. Champollion proceeded on the same idea and succeeded. The phonetic values of some hieroglyphs, as used to write proper names in cartouches, were now made out.



Cartouche of Ptolemy, *i.e. Ptolemaios.*

The cartouche of Mr. Bankes' obelisk at Philæ was known, by its Greek version on the base, to contain the name of Cleopatra.

These two cartouches are commonly taken to illustrate the subject.

1. The first hieroglyph in the name of Cleopatra is a knee, which is *kne* or *kle* in Coptic, and represents the K of Kleopatra. K does not occur in the name Ptolemaios.

2. The second hieroglyph in Kleopatra is a lion couchant, which is *laboi* in Coptic, and *labu* in the old Egyptian, and represents the L of both names. In Kleopatra it occupies the second place and in Ptolemaios the fourth.



Cartouche of Cleopatra, *i.e. Kleopatra.*

3. The third hieroglyph in Kleopatra is a reed, which is *aké* in Coptic and *aak* in the old Egyptian, and represents the E of Kleopatra. The reed is doubled in Ptolemaios and occupies the sixth and seventh places, where it represents the diphthong *ai* of Ptolemaios.

4. The fourth hieroglyph in Kleopatra is a noose, which represents the O of both names, and occurs in the third place of Ptolemaios.

5. The fifth hieroglyph in Kleopatra is a mat, which represents the P of both names, and is the initial of Ptolemaios.

6. The sixth hieroglyph in Kleopatra is an eagle, which is *akhoom* in Coptic, and represents the A, which is found twice in the name Kleopatra, but does not occur in the name Ptolemaios, although the diphthong *ai* occurs as described above, No. 3.

7. The seventh hieroglyph in Kleopatra is a hand, which is *toot* in Coptic, and represents the T of Kleopatra, but does not occur in Ptolemaios, where it might be expected to occupy the second place. The second place of Ptolemaios is occupied by a semicircle, which is found at the end of feminine proper names, and is the Coptic feminine article T.

The researches of Champollion satisfied him of the existence of homophones, or characters having the same phonetic value, and which might be interchanged in writing proper names. It is an interesting circumstance that the T immediately following the P in the name of the god PTAH, just as it does in Ptolemaios, is written by the semicircle and not by the hand.

8. The eighth hieroglyph in Kleopatra is a mouth, which is *ro* in Coptic, and represents the R of Kleopatra. There is no R in the name Ptolemaios.

9. The ninth hieroglyph in Kleopatra is the eagle, which is explained in No. 6 above.

10. The semicircle is the T of Ptolemaios (*vide* No. 7) which with

11. The egg found at the end of proper names of women is a feminine affix.

In the name of Ptolemaios there is still the M and the S to account for. The fifth hieroglyph in the cartouche of Ptolemaios is a geometrical figure, consisting of three sides of (probably?) a parallelogram, but now called a hole, because the Coptic *mu* has that signification, and represents the M. The hook represents the S of the word Ptolemaios.

This view of Champollion's is satisfactory so far as it goes, and no student of Egyptian has the slightest doubt that the two cartouches contain the Greek names of Ptolemaios and Kleopatra phonetically written, but we cannot shut our eyes to the fact that Champollion gives no hieroglyph for the E nor for the second O of the word Ptolemaios. A careful study of other cartouches of the Greek and Roman periods of Egyptian rule enabled Champollion to extend his knowledge of the hieroglyphic alphabet, and to prove the existence of an extensive system of homophones. An examination of the Rosetta stone, even by those unacquainted with the subject, will show that the mass of hieroglyphs are precisely the same as those found in the cartouches of the foreign

rulers of Egypt. In the Greek inscription it is stated that *Ptolemy is beloved by Phtha*, in Coptic the name is *Ptah*. Now the name of the god is expressed by the mat = P (see No. 5 above), which is followed by the semicircle = T (see No. 7 above), and that by a hieroglyph which was deemed to express H. And which subsequent researches proved to be H.

Champollion lays it down as a fundamental principle, that the figures selected as alphabetic signs were those of objects, the names of which begin with the sound to be expressed. Examples of the application of this principle occur in his analysis of the cartouches of Ptolemy and Cleopatra. In the case of many of these signs the agreement between the initial sound of the Coptic name of the object figured as a hieroglyph and the phonetic power of the sign is perfect. The principle, however, is more fascinating than sound. Many Egyptologists from Spineto downwards have supplied a table, such as may be constructed from Champollion's examples.

Hieroglyphic figure.	Coptic name of the object figured.	Phonetic value.
An eagle ..	Akhoom	A.
A reed ..	Akè	A.
A lion ..	Laboi	L.
An owl ..	Monlag	M.
Water ..	Moon	M.
A hole ..	Mu	M.

and so on.

It is obvious that if this principle be sound, the number of hieroglyphs might be almost indefinitely extended. The rule said to be adopted in the selection of the hieroglyph is to take that object which accords best with the name to be written, thus in the name of a king only those objects of a noble or exalted character are adopted. The reader has only to refer to the hieroglyphs in the cartouches of Ptolemy and Cleopatra to see the worthlessness of the principle, for a mat is not a noble object to represent the initial sound of Ptolemy and the fifth sound of Cleopatra. The unsoundness of the reason alleged for the selection of the homophones adopted does not affect the certainty of the great discovery of the phonetic values of the hieroglyphs in those cartouches, for it is the application of those phonetic values to the cartouches of ancient Egypt which revealed the names of the Pharaohs and other kings and queens of the earlier cartouches of monarchs found in the lists of Manetho and other ancient authors.

Dr. Young died in 1829 and Champollion in 1832, both before and since which, Egyptian studies have been pursued with ardour by able men well qualified by education and a wide range of study for the work. Wilkinson, Birch, Hincks, Goodwin, Renouf, and others in England; Chabas, Lenormant, and others in France; Leemans in Holland; Bunsen, Lepsius, Brugsch, and others in Germany; Rosellini, Salvolini, and others in Italy, have advanced our knowledge of the hieroglyphs, of the language, history, polity, and antiquity of ancient Egypt so much, that most recondite questions can now be discussed by means of the matter recorded on the monuments themselves. And it is most interesting to know that by means of such knowledge the accounts of Greek and Roman authors can be understood.

The application of the phonetic alphabet, derived from the phonetic values of the hieroglyphs contained in the cartouches, to the ordinary hieroglyphic texts revealed the words of those texts, and thus the lost language of Ancient Egypt was gradually recovered. M. Quatremère, in his Recherches sur la langue et la littérature de l'Égypte, attempted to prove the identity of the Coptic with the language of the Pharaohs, and his view met with a favourable reception, but an accurate knowledge of the Coptic caused its rejection by English scholars, and the gradual recovery of the old Egyptian language by means of the hieroglyphics proved the English Coptic scholars to be right. The Coptic language was the language of Egypt at the time when Christianity was introduced into the country. When Egypt was under Greek rule the Greek language became that of the court, of official life, and of affairs connected with the state. The Greek words, brought by Greek civilization, were gradually absorbed into the Egyptian language, the organic life of which modified their forms to adapt them to its grammar, and finally so disguised them, that it is now often difficult to identify and separate the absorbed Greek element. The Coptic alphabet is the Greek alphabet, with additional letters to write sounds not found in the Greek, and it is most interesting to observe that the shapes of these letters are evidently taken from the Egyptian Hieratic alphabet, so that they are actual Egyptian forms.

Long-continued study of Egyptian texts in Hieroglyphic, Hieratic, and Demotic writing resulted in a more accurate knowledge of the Egyptian language, and this threw a flood of light on the phonetic values of the written signs, which reflected back light on the language itself. The study of the ritual, or Book of the Dead, of which an immense number of copies were made, for it was in use during many centuries over the whole of Egypt, in which the subject-matter was the same, the sequence of ideas the same, but in which the scribes varied many expressions, and even introduced slight changes, enabled scholars to obtain a deep insight into the language of Egypt and its expression in writing. The grammatical and lexical differences between the Coptic and the old language of Egypt became manifest, and the phonetic powers of the hieroglyphs better defined, as the syllabic values became distinguished from the alphabetic values.

The following fifteen letters compose the alphabetic system of the Old Egyptians from the earliest times—

A	K	S
I,E	I,R	T
U,OU	M	G
B	N	Kh
F,V	P	H

The syllabic signs are more numerous. The oldest Egyptian words are monosyllabic, so that the syllable and word are conterminous. Syllables could be formed

1. Of a vowel and consonant, as *ar* or *ir*, the eye, which is found in the name Arsinoe.
2. Of a consonant and vowel, as in *ma*, or mother.
3. Of two consonants and a vowel.
   - α The vowel between the two consonants, as the syllable *mes*, a strap.
   - β The vowel after the two consonants, as the syllable *pti*, a bow.

There are 103 syllabic signs.

The hieroglyphs having these syllabic and alphabetic values also denote the objects which they represent, thus the eagle denotes the eagle, and it expresses the alphabetic value A, the mouth denotes the mouth, and it expresses also the value R.

Mixed Signs.—There are groups of hieroglyphs of which one element is an ideographic sign, to which a phonetic complement is added to indicate the pronunciation of the ideographic sign. The words of a text could be written in hieroglyphs in three ways—

1. By phonetic hieroglyphs.
2. By ideographic hieroglyphs; and
3. By a combination of both.

The two following examples are taken from Dr. Birch's Introduction to the study of Egyptian Hieroglyphs, published in 1857.

	Hieroglyphs.	The Signification.
1. Ideographic hieroglyph	Figure of a man with his hands raised in prayer	Supplication.
2. Phonetic hieroglyph	The word *Suashi* phonetically written	Supplication.
3. Mixed hieroglyphs	The word *Suashi* phonetically written followed by the ideographic hieroglyph of a man with his hands raised in prayer	Supplication.
1. Ideographic hieroglyph	Figure of two human arms, one holding a shield, the other a javelin	To fight.
2. Phonetic hieroglyph	The word *Kal* phonetically written	To fight.
3. Mixed hieroglyphs	The word *Kal* phonetically written followed by the ideographic hierograph of the two human arms, one holding a shield, the other a javelin	To fight.

The ideographic hieroglyph of the first example, consisting of the figure of a man with his hands raised in prayer, symbolically and well expresses the idea of supplication. The significance of the symbol is undoubted. The word *Suashi*, phonetically written, signifies supplication. And the combination of the word *Suashi* with the ideograph shows, as in a dictionary on Egyptian authority, the signification of the ideograph. The second example, in like manner, and on the same authority, shows the signification of the ideograph to fight. Each word is expressed twice, once by an ideograph, and once phonetically, so that, alternately, we have the symbolic figure for the written word, and the written word for the figure.

The tombs of the twelfth dynasty at Benihassan abound with examples of these mixed hieroglyphs, in which accurate representations of objects, as of animals, plants, &c., are accompanied by the names of those objects phonetically written.

Ideographic, phonetic, and mixed hieroglyphs occur in the same texts, and no instance is known of a text being written throughout in phonetic hieroglyphs. It may be readily supposed that such combinations of hieroglyphs present great difficulties to a translator, and especially to students, but an experienced Egyptologist has but little difficulty in reading such texts.

The old Egyptian language has been recovered from oblivion, by means of the successful study of the hieroglyphs. Texts are read, grammars and lexicons compiled, and the labours of Egyptologists have long been directed to discover the relationships of the particles of the language to its substantives and verbs, which shows that our knowledge of the language is at once both comprehensive and minute.

As an appropriate specimen of the language, the subjoined hymn to the Nile transliterated into Roman letters, and translated into English by Dr. Birch, may prove interesting.

	Sha en Hapi.	A Hymn to the Nile.
	Nether ek Hapi	Incline thy face, O Nile
	shem em ta an'	coming safe out of the land
	er sankhu kam	vivifying Egypt
	amen sam kek em hru	hiding his dark sources from the light
5.	hes nu sem	ordering his sources
	an shau ammeh	the streams of his bed
	Kam an Ra	are made by the sun
	er sankh hu abu neb	to give life to all animals
	S'hur set hu tem	to water the lands which are destitute
10.	nau pe haa	coming all along the heaven
	mer en tufa kherp nefrs	loving fragrance offering grain
	s'hut teba en Ptah	rendering verdant every sacred place of Phtha.

The numerals belong to arithmetic, and to those sciences in which number is an element. A short vertical line expresses the numeral one, and the first nine units are expressed by strokes, which are arranged in groups.

$\mid = 1.$	$\mid\mid\mid = 6$, as $3 + 3$.
$\mid\mid = 2.$	$\mid\mid\mid\mid = 7$, as $4 + 3$.
$\mid\mid\mid = 3.$	$\mid\mid\mid\mid = 8$, as $4 + 4$.
$\mid\mid\mid\mid = 4$, as $2 + 2$.	$\mid\mid\mid\mid\mid = 9$, as $3 + 3 + 3$.
$\mid\mid\mid\mid\mid = 5$, as $3 + 2$.	

The expression of the numerals therefore implies addition, just as the Roman numerals do, but, unlike the Roman numerals, do not also involve subtraction.

Hieratic Writing.—The great principle laid down by Dr. Young, that the hieroglyphic is the basis of all Egyptian writing, has been abundantly proved, and is universally accepted by Egyptologists. The hieratic is a cursive hieroglyphic writing, in which the beautifully accurate stone-cut figures are not produced in *fac simile* on the papyrus, but are indicated on it. The hieratic forms of the objects being as near to the hieroglyphic forms as our ordinary writing is to Roman type. Egyptian writing is an inheritance transmitted to the Egyptians from their ancestors, for the names of the kings of the third dynasty, which was in power during about the eleventh century of the empire, display the same system of hieroglyphic writing. And hieratic writing is nearly as ancient. The hieratic appears as a contraction of the monumental carved hieroglyphs on the external linen wrapper of the body of King Antef, portions of which still adhere to the varnish lining of the wooden sarcophagus of the king, where it may be seen in the British Museum. King Antef heads the eleventh dynasty. The inside of the sarcophagus of Mentuhotep, the fourth king of this dynasty, was covered with a hieratic ritual, which was copied by Sir J. Gardner Wilkinson. The stone-mason's hieroglyph marks on the stones of the pyramids of the fourth dynasty are almost in the hieratic character of later times. These are all contemporaneous records of the several dynasties.

The study of the hieratic inscriptions is important to a full understanding of the language, as well as to enable the Egyptologist to read records of a private nature, for the hieratic was adopted for memoranda, for keeping accounts, for correspondence, for literary exercitations, as for songs, hymns, tales, and especially for rituals. The writing is in horizontal lines from nine to eleven on a page which are read from right to left; the beginning of each section, and occasionally important words, being written in red ink, while the body of the writing is in black ink. The ends of the lines of verse are indicated by red dots placed above the line, and corrections also are made in red ink. The papyri are only written on one side, but occasionally also on the back. And some are endorsed on the back, with the titles of their contents, or dates, or miscellaneous notices.

Many of these papyri are published, and contain most interesting matter relating to civil administration, to political and religious controversy, to malpractices of administrators of crown lands, to finance, to external politics, to military matters, to astronomy, to medicine, to astrology, to encomiums of the monarch, and to many other matters both of a public and private nature.

The *Enchorial* or *Demotic writing*, called by the Egyptians *Skhai en shai*, that is, the writing of books, is of modern origin compared with the hieratic and hieroglyphic. It was in use for about 800 years, from 650 B.C., but only in *civic* documents, and it never superseded the hieratic, much less the hieroglyphic systems for sacred purposes and the formal objects of literature. See Egypt.

HIEROMANCY, that species of divination which predicted future events by the inspection of sacrifices.

HIERONYMITES, or JERONYMITES, hermits of St. Jerome (Hieronymus), an order of religious persons established in 1374, who wear a white habit with a black scapulary. The Hieronymites grew out of the third order of St. Francis, and gradually forming themselves into a community had their rule, founded on that of St. Augustine, confirmed by Pope Gregory XI. In the Netherlands and in Spain, where it was devoted to a contemplative life, and possessed, among other convents, the splendid one of St. Lawrence, in the Escurial, the sepulchre of the kings, this order became one of the most opulent and considerable. In Sicily, the West Indies, and Spanish America the order (which has never been politically important) possesses convents.

HIERONYMUS, ST. See JEROME (ST.)

HIEROPHANT was the first priest or director of the Eleusinian mysteries, and could be chosen only from among the descendants of Eumolpus, who was regarded as the founder of these mysteries, and the first hierophant. It was required that his exterior appearance and dress should correspond to the elevated office with which he was invested. It was necessary for him to be somewhat advanced in manhood, to be without visible defect, to possess a pleasant voice, and to be of unspotted character. After his election he was not allowed to marry; and, with a view of suppressing all sensual desires in their birth, he was obliged, like the other priests of Demeter, to wash himself in the juice of hemlock. Other accounts say that these priests even drank the juice. It is also asserted that second marriage alone was interdicted to them, and that their wives could participate in certain occupations, such as adorning the statues, &c. In the mysteries the hierophant represented the Demiurge or creator of the universe, and it was his office and that of the descendants of Eumolpus generally, to preserve and interpret the unwritten laws, according to which the slanderers of the divinity and the defamers of her solemnities were punished. In the inferior mysteries it was his office to introduce the novice into the Eleusinian temple, and to initiate those who had undergone the final probation into the last and great mysteries. In the great mysteries he was the sole expounder of the secret instruction to which the initiated were finally admitted. In public solemnities it was his office to carry the statue of the goddess, adorned with magnicent robes. See ELEUSIS.

HIGHLANDS OF SCOTLAND, one of the greater divisions of Scotland, applied to the mountainous part of the country to the north and north-west, in contradistinction to the Lowlands, which occupy the east, south-east, and south district. The Western Isles are also comprehended in the Highland district. There is no political or civil boundary between these two grand divisions of Scotland, the line of demarkation being vague and indefinite. Generally the term Highlands is applied to that portion of the country where the Celtic language and manners prevailed, and still linger on in spite of modern tendencies to produce national uniformity in these respects. The Highlands are generally subdivided into two parts, the West Highlands and the North Highlands; the former of which contains the shires of Argyll and Bute, and part of Perth and Dumbarton; and the latter comprehends the counties of Inverness, Ross, Sutherland, the districts of Athole, Rannoch, and the Isles of Skye, Lewis, and others belonging to Inverness and Ross. The mountainous parts of Banff, Moray, Aberdeen, and Kincardine are also recognized as forming part of the Highlands; while the Orkney and Shetland Isles are excluded, because their inhabitants are of Scandinavian origin. The length of the mainland district, from Dumbarton to the borders of Caithness, is upwards of 200 miles, and its breadth varies from 80 to 100. The whole of the district is wild, rugged, and mountainous in the highest degree; many of the mountains are elevated to a great height, while some of the vales at their base for months never feel the rays of the sun. These vales are generally occupied by lakes, or the precipitous rivers which pour in torrents from them. The principal rivers of the country have their rise amongst these wilds, descending to the ocean with great rapidity; the Tay, the Spey, and the Forth are formed from the junction of the numerous streams from the hills.

The openings or passes from the Lowlands into the Highlands were originally so wild and narrow that they appeared almost impassable till they were extended by art. Amongst these passes the most extraordinary are—Balmaha, on Loch Lomond; Aberfoyle and Leny, in the district of Menteith; the Pass of Glenalmond, north of Crieff; the entrance into the district of Athole by Dunkeld, over Mount Birnam; the Pass of Killiecrankie, and some beds of rivers. This natural boundary was one of the principal causes that the Highlanders remained a distinct race from the inhabitants of the plains (the Lowlanders). A very remarkable feature of the Highlands is the line of valleys (Glen More or the Great Glen) from Inverness to Fort-William, containing a series of navigable lochs, which are united by artificial channels, and form the Caledonian Canal. The loftiest mountains of Scotland, Ben Nevis, Ben Muich-dhui, and others, are in the Highlands. The Highlands appear in majestic grandeur from these mountains. Towards the summits the soil is barren; lower down is a thin covering of heath, where none but birds of prey, white hares, and ptarmigans are met with. Farther down still live red-deer and grouse; and on fertile plains interspersed with rich heath are numerous herds of sheep. At the foot of the mountains beautiful valleys are formed, traversed by rivers from the hills, or inclosing splendid lakes, or covered with wood, or producing different kinds of corn. Many of these valleys have numerous inhabitants, whose principal property consists in cattle. The territory mainly peopled by the Gaelic or Celtic race consists of Sutherland, Caithness (partly), Ross and Cromarty, Inverness, Argyle, Arran, the Hebrides, and part of the counties of Nairn, Moray, Banff, Aberdeen, Stirling, Perth (the greater part), and Dumbarton. The Gaelic-speaking inhabitants call their country *Gaelach* (land of the Gaels) or *Albannach*. The names of *England* and *Scotland* are of course foreign to the Gaelic dialect. The English are called by them *Sasunnaich* (Saxons); the Lowlanders, *Sasunnaich* or *Gaill* (strangers).

While, after the union of the Picts and Scots (see SCOTLAND), in the ninth century, the Scotch Lowlands, by the intercourse with Southern Britain, gradually became more and more civilized, the social relations of the Highlanders assumed a peculiar character, having for its basis the circumstances of the original Celtic inhabitants. The condition of the country, and the motives which led them to fix their residence there, determined the nature of their institutions. The division of their country into single valleys, glens, and islands, separated either by mountains or inlets of the sea, necessarily led to the formation of small tribes; and men of considerable property or distinguished talents, under whose command the others had fought, or under whose protection they had settled, became chiefs. As the inhabitants of these valleys had little intercourse with each other, on account of the natural condition of the country, each valley became the territory and property of a tribe,

which had arms for defence, a sufficient number of artisans for their confined wants, pasture for their cattle, wood for building, &c., moss and turf for burning, and a territory for hunting. These tribes were without inducements to change their habitation, to invite foreigners, or to promote a general intercourse among the various settlements; so that each of them isolated itself. Thus the nation was split into single masses, connected, indeed, by the same language and customs, but living under different rulers. Thus was formed, in each tribe or clan, a patriarchal government, a kind of hereditary monarchy, founded rather on custom and confirmed by general consent than regulated by laws. The Highlander honoured in his chief the descendant of a distant ancestor, from whom the whole clan was believed to have sprung. The more the ties of real or supposed relationship contributed to union and friendship in the clan, the easier were the members excited to violence by injuries from without their limits, as there was no general government to look to for protection. A necessary consequence of the isolation of each clan was that each concluded marriages chiefly within itself; and thus a general relationship really grew up. Many of the members, therefore, had the same name with the chief, so that a feeling of kindred and mutual attachment existed. Towards all the chief stood in the light of a superior, commander, and judge. The whole system of the clans rested essentially upon the power which custom gave the chief in virtue of primogeniture. He was generally, yet not always, proprietor of the whole territory of the clan, or of the greater part, yet not with absolute right of possession. A certain portion of the best part of the territory was allotted to him as his special property. The rest of the land was distributed, for longer or shorter periods, among that class of the clan which consisted of the farmers. These were the near relations of the chief, or the descendants of a distant and common chief. To these brothers, nephews, cousins, the chief gave land on condition that he might resume it at pleasure, or on lease for a short time, or (which was the general mode) as a kind of mortgage redeemable on the payment of a fixed sum. After two generations these portions of land were generally resumed in order to be conferred on nearer relations, upon which the descendants of the former possessors returned to the class of the common members of the clan. This change of property was so common that the ordinary class were confirmed by it in their belief of their original relationship with the chief, as in each generation some families joined them whose ancestors had belonged to the kindred of the chief. Sometimes, however, the young relations received land in perpetual possession, or acquired property by inheritance, marriage, or other means. In such cases they retained their original rank, and generally each stood at the head of a subdivision of a clan, which considered him as its immediate head, though they always remained dependent on the chief of the clan, and generally even tributary. The largest clans often had several of such subdivisions. The chieftains of the branches were honoured as noble, and called themselves *Daoine uasal*, or gentlemen. A feather upon the cap designated their rank. These again parcelled their portions into smaller farms, which they let to people of the common class for a rent. Generally these stood in the same dependence upon their immediate lord as the latter upon the general chief.

When the population in these narrow and sterile valleys increased, the means of support soon became scarce. The strict separation of the clans, and the hereditary enmities not unfrequently existing between them, prevented emigration to the neighbouring valleys, and still more to the lower country. The consequence of too great a population was indolence. The younger sons of the more distinguished part of the clan, who joined the common people reluctantly, showed a contempt for peaceful occupations, and collected the most courageous youths of the tribe, with whom they went on predatory expeditions (called *creachs*) against the Lowlands and hostile clans. As the chief wealth of the country consisted in cattle, hostilities were generally commenced by driving away cattle. There existed also a class of bold adventurers called *cearnachs*, employed on expeditions of uncommon peril or by which uncommon honour was to be gained. In later times, however, their profession consisted in gathering tribute from the lower country, or payment for protection against depredation, called *blackmail*. One means of support for the younger sons of the chiefs was the military service in France and Spain; and the fame of the deeds of their countrymen in foreign countries nourished the martial spirit at home. A warlike disposition and contempt of labour was found even among the lowest classes. The labour of the field was left mostly to old people and women, whilst the vigorous men spent their time in idleness, in hunting, or in active sports. Mechanics stood in higher esteem than mere farmers. Weaving was a labour for women; but the men only were tailors. The smith who made arms, or at least mended them, was particularly esteemed, and belonged to the household of a chief; yet most of the arms used were sent from the Lowlands. The chief generally lived surrounded by his dependants. His castle was the place where rewards were distributed and the most envied distinctions were bestowed. The chief did not distinguish himself by the splendour of his dress or household, but merely by a more numerous household and more guests. What he received from his dependants was again consumed for their liberal entertainment. Every member of the clan was welcome in the castle, and was, according to his rank, treated with a civility and delicacy of which elsewhere little is known. This treatment elevated the clan in their own esteem, and drew still closer the ties between them and their chief, whose power, though mildly exercised, was, according to its nature, absolute. The laws which he administered were simple. Esteem of his authority and gratitude for his protection were natural consequences of his patriarchal government. Hence the unshaken fidelity of the clans, of which the Scottish history affords so many splendid instances, particularly in the civil wars of 1715 and 1745. Sometimes there was a deviation from this constitution of the clans; and even the right of inheritance, on which the whole institution was founded, was disregarded in particular cases. There are also examples of deposing unworthy chiefs; and during the troubles after the Revolution (1688) a chieftain was deserted by his whole clan because he wished to lead it against the banners of the house of Stuart, and thus loyalty triumphed over the strong bond of vassalage.

In the earliest times the Highland chiefs owed allegiance to the native princes, by whom the Scottish kings were acknowledged as sovereigns merely in name. Among these native princes were the powerful lords of the Isles, who flourished from very ancient times to the reign of James V. They ruled over all the Western Islands (the Hebrides), from Islay north, and over the western part of the county of Inverness, and as powerful allies exerted an influence over the greater part of the Highlands. The Earls of Athole, of Mar, of Lennox, and other powerful lords, governed the remainder. These islands first became dependent upon the Scottish crown in the commencement of the fifteenth century; nevertheless the divisions which afterwards took place among the

clans did not contribute much to strengthen the power of the kings of Scotland; and although the tribes could no more, as in earlier times, under one head, disturb the peace of the land, yet, when a common cause united some of them, they broke from their mountain-holds and descended into the plain country. During the disturbances which distracted Scotland after the death of James V. the independence of the Highland chiefs was still more confirmed. When, in the seventeenth century, the martial spirit declined in the Lowlands of Scotland, the Highlanders showed for the first time a decided superiority in the art of war, which contributed much to infuse into them a higher feeling of their own power and to make them more obstinate in their adherence to their native customs. But not long after the first victories which they had obtained in the Lowlands they were severely chastised by Cromwell in their own mountains. He placed strong garrisons in several places, commanded flying divisions of the army to pass through the mountains, search the most secret lurking-places, and dismantle the castles of the chiefs, and at length compelled the clans to lay down their arms and give security for their peaceful conduct. After the restoration of the house of Stuart the yoke imposed by Cromwell was removed from them; the fortresses which had been built for their subjugation were destroyed or forsaken; and the laws against the predatory expeditions of the Highlanders were no longer enforced. Under these circumstances the old constitution of the clans was again strengthened. During the reigns of William III. and Queen Anne, the government, being employed in wars upon the Continent, thought it best to preserve quiet in the Highlands by the distribution of money. It was during the reign of the former that the dastardly massacre of Glencoe took place. See GLENCOE.

The alarm occasioned by the insurrection in 1715 in favour of the house of Stuart, led to the adoption of various measures to break the power of the chiefs. By the Clan Act (so called) the property of the vassal who had taken arms in a rebellion was given to his feudal lord who had remained faithful; and where the case was reversed, the loyal vassal was allowed the entire property in lands which he had held of a rebellious chieftain. Another statute relieved the vassals from their duty to follow their feudal lord in the chase, and to fight in his private quarrels. The third measure was the disarming of the Highlanders; but this was so negligently performed, that most of the adherents of the house of Stuart were able to conceal their weapons, in order to employ them upon a favourable opportunity against the government. The most effectual of all the measures was the making of roads from the Highlands to the Lowlands, under the superintendence of General Wade, about 1725–26, by which means, in the course of time, a gradual blending of the inhabitants of both parts of the country took place. But other circumstances occurred, which produced in the sequel a violent dissolution in the relations of the clans. The exasperation occasioned by the proceedings of government made the people so much the more susceptible to the promises and encouragements which the house of banished princes did not spare. The chieftains made every effort to maintain their threatened power, and to destroy the effect of the innovations with which the government sought to weaken the bonds of the clans. A dangerous means, to which the government had recourse, favoured the designs of the Highlanders. About the year 1729 companies were formed among the Highlands, of which the sons of the chieftains, or the distinguished vassals, were appointed officers; but the chiefs themselves had the highest command. These companies, six in number, were usually called from their dark-coloured tartans the *Black Watch* (*Freiceadan Dubh*). Their duty was to execute the law for disarming; to terrify the discontented; to prevent meetings of the people, and conflicts between hostile clans; and, particularly, to check predatory excursions. With this view they marched through the land, and had thus an opportunity to become acquainted with the boldest individuals; and it is certain that the chiefs knew how to employ this institution for their own purposes. So much, at least, is clear, that the Black Watch was a means of nourishing the warlike spirit which the previous measures of the government were intended to repress. The rebellion in 1745 was a consequence of the secret disaffection of the Highlanders, and of instigations from abroad. The event of the contest gave the government an opportunity of destroying the patriarchal constitution of the Highlanders, by the abolition of heritable jurisdictions and of the ancient privileges of the chiefs, about 1748. A law was also passed for disarming them, and they were even prohibited from wearing their national dress, a prohibition not formally removed till 1782. The establishment of the Highland and Agricultural Society in 1784, and the planting of schools and churches, have tended much to ameliorate the condition of our Celtic compatriots.

The arms of the Highlander were the sword upon the left side, and a short dagger upon the right, a musket, a pair of pistols, and a target. In the want of a musket, or if ammunition failed, a weapon was used, called a *Lochaber axe*, suited either for cutting or thrusting. Each clan formed under the command of its chief a regiment, whose companies consisted of separate families, each under the direction of its head. The highland dress, as it is so well known at the present day, is modern in a good many of its features, and especially so in the great variety of tartans or checks that have been invented, and of which each clan now appears to claim one.

Courage and love of freedom, attachment to country and domestic ties, hospitality and a social disposition, honesty in private intercourse, and inviolable fidelity to trust reposed in them, were the distinguishing characteristics of the Highlanders, and are so still, notwithstanding all the changes which their manners have undergone in later times. A knowledge of books was but little diffused, and only among those of high rank, who were educated partly in France. But the history of their native land, poetry, and music were darling pursuits even among the common people. Each chief had his bard, who sung the deeds of his race, and of the individual members of the clans. These singers were held in high esteem, and were, like the *senachies*, or the elders of the tribes, the preservers of old stories, which they retained in memories strengthened by continual exercise, in the absence of a written literature. The favourite musical instrument was the bagpipe, and its lively sounds in battle supported the animation of the contest. A warm imagination, affected in a lively manner by the sublimity and the perfect solitude of the landscapes of their country, was the source of many of their peculiar superstitions.

The greater portion of the people in the Highlands joined the Free Church in 1843, and the United Free Church is still much stronger than the Established Church. There are also some Episcopalians and Roman Catholics. In the Island of Barra more than half of the population are said to be Roman Catholics. In all Scotland, in 1901, 28,106 persons were returned as speaking Gaelic only, 202,700 as speaking both Gaelic and English.

The political measures of 1747–48 gave the first impulse to the great change which took place in the course of time in the manners of the Highlanders,

although it did not manifest itself decidedly till twenty years later. This change was seen in the whole character and condition of the Highlanders, and not merely in their manners and exterior, but even in the appearance of their country. Lands which were long under the plough became wild; whole valleys once the dwelling-place of powerful clans were made desolate; and families which, like Alpine plants, were rooted in their native soil, saw themselves compelled to seek support in manufacturing cities, or to emigrate to America.

The character of the Highlanders has lost much of its romantic and chivalrous tone. One of the most striking traits of the altered Highlander is his great indifference to the old relations of the clan, although long after the abolition of clanship the attachment of the people to their chief continued, and what the law denied fidelity gave undiminished. The great increase of sheep-breeding and the appropriation of large tracts to game have tended much to depopulate the Highlands. Thousands, to whom the home of their fathers offered the prospect of poverty, have emigrated to America. Despite, however, the outcry that has often been made respecting this depopulation, it cannot be denied that it has been the means of adding much to the prosperity of the Highlanders, by forcing the common people to more remunerative industries than their native region could supply and by raising the value of land.

HIGHMORE, Joseph, a portrait and historical painter, born in London, June 13, 1692. He early displayed a strong partiality for the fine arts, which was discouraged by his family, who placed him in a solicitor's office. The whole of his spare time was, however, devoted by him to the study of his favourite pursuit; and immediately on the expiry of his clerkship, when he was twenty-two years of age, he abandoned the law; resolved to trust in future to his talents as a painter alone for his chance of fame and fortune. The year following he married, and continued rising in reputation, till, on the revival of the order of the Bath, he was selected as the artist to be employed in painting the knights in full costume (1725). The years 1732 and 1734 were spent by him in professional tours through the Netherlands and France, and on his return he applied himself with renewed exertions to the cultivation of an art which he exercised nearly half a century. He died in 1780. Among his best paintings are the Hagar and Ishmael in the foundling hospital; the Finding of Moses, &c. As an author he is known by the Critical Examination of Rubens' two Paintings in the Banqueting House, Whitehall (4to); Observations on Dodwell's Pamphlet against Christianity; the Practice of Perspective (1763); and two vols. of Moral and Religious Essays; with a translation of Brown, on the Immortality of the Soul.

HIGHNESS, a title of honour given to princes and princesses. English princes and princesses take the title of *royal highness*. The princes and princesses of imperial houses are styled *imperial highness*; the crown prince and princess of the German Empire are styled *imperial and royal highness*. The princes and princesses of the German royal houses are called *royal highness*; and in Germany there are also in use the title *grand-ducal highness* and that of *highness* simply.

HIGH-PRIEST, the head of the Jewish priesthood. In the books of Moses the holder of this dignity is simply designated the priest, the epithet *high* occurs on one or two occasions, but as a distinctive epithet it appears to have been added subsequently. The formal consecration of Aaron, the brother of Moses, together with his sons, to a hereditary priesthood, is recorded in Exod. xxviii. The high-priesthood continued in the line of Aaron, sometimes in one, and sometimes in another branch of it, until the coming of Christ. After the subjugation of the Jews by the Seleucidæ, the Ptolemies, and the Romans, it was often arbitrarily conferred by the foreign masters. In the time of our Saviour it appears to have been held by several priests alternately. The dignity of the priest's office is indicated by the splendour and costliness of his garment, which was among the most beautiful works of ancient art. The breastplate of the high-priest is particularly celebrated. It was called *urim* and *thummim*, that is, according to Luther, *light* and *right*. According to other commentators it received its name from twelve precious stones, which were set in gold, and on which the names of the twelve tribes were engraved. In this dress the high-priest appeared as the holiest and highest person of the nation in the exercise of his official duties. To him belonged the regulation and superintendence of the worship of God, the declaration of the oracles of Jehovah to the people (he alone being permitted to consult them on important public occasions), and the preservation of the national sanctuary. Although the administration of justice was committed to particular judges, yet to him the last appeal was made in difficult cases, even in temporal affairs, and nothing important in war or peace could be undertaken without his assent. He was called by way of distinction *the priest who stands before the Lord;* he occupied the peculiar situation of a mediator between Jehovah and the nation. Once a year he entered alone into the holy of holies (the innermost part of the tabernacle, afterwards of the temple), and by his prayers and sacrifices on this occasion the whole Jewish people believed that God was reconciled to them, and all their sins forgiven.

HIGH-SEAS. Among maritime nations both in ancient and modern times the necessity for some international regulations to govern their communications by sea has been felt. The views of jurists on this subject have fluctuated between two opposite principles. States possessing a powerful marine, and especially an extensive coast-line, have naturally been disposed to push their privileges to the utmost, and to claim exclusive accession to, or a superiority and protective rights over extensive tracts of the ocean highway. The weaker maritime states, on the other hand, and the commercial rivals of these most specially privileged, have contended for the liberty of the seas. The most memorable instance of this controversy occurred in connection with the claims arising out of the great maritime discoveries of the Portuguese at the close of the fifteenth century. Under the grant of Pope Alexander VI. the Portuguese claimed the right to exclude other nations from the seas between the eastern coast of Africa and the coasts of India. Against this claim Grotius wrote his celebrated treatise, the Mare Liberum, which appeared in 1609. The English, who had their own claims of jurisdiction, were not then, or for long after, prepared to admit the liberty of the seas, and Selden replied (1639) with his Mare Clausum. Grotius argues almost exclusively from natural right, Selden from historical precedent. Since then the doctrine of international law has tended more and more to the principle of liberty, the only difficulty being in the case of seas wholly surrounded by a small number of states. The general principle of international law now accepted is that the jurisdiction of maritime states extends only for 3 miles, or within cannon range of their own coasts; the remainder of the seas being high-seas, accessible on equal terms to all nations. Inland seas and estuaries, of course, are excepted.

HIGH-STEWARD, COURT OF THE LORD, a tribunal in England instituted for the trial of peers indicted for treason or felony, or for misprision of treason or felony, but extending to no other offences. The office of lord high-steward is a very ancient one, being formerly one of the great hereditary dignities of the kingdom. It was held by the Earls of Leicester till forfeited in the reign of Henry III. He had the administration of justice and other affairs of the realm, both civil and military, under the king. The power of the office being so great it was afterwards granted only on special occasions, for the purpose of presiding in the court above mentioned. When an indictment against a peer is found by a grand jury of freeholders in the King's Bench or at assizes, it is removed by a writ of *certiorari* to the Court of the Lord High-steward, the only plea which can be received by the King's Bench being one of pardon. The lord high-steward is then appointed by commission under the Great Seal, giving him power to try the case *secundum legem et consuetudinem Angliæ*. The peers who have a right to sit and vote in the court are summoned twenty days before the trial. While Parliament is in session the court before which the trial takes place is the High Court of Parliament, over which the lord high-steward presides. During the recess the court is the Court of the Lord High-steward, and he is sole judge in matters of law, as the lords triers are in matters of fact. Bishops, not being subject to the jurisdiction of the Lord High-steward, cannot sit in his court, but they may sit in the High Court of Parliament till the court proceeds to a vote of guilty or not guilty. By the charters of the Universities of Oxford and Cambridge certain offences charged against scholars, or other privileged persons of the university, are tried before a high-steward appointed by the chancellor of the university.

HIGH-TREASON. See TREASON.

HIGH-WATER, that state of the tides when they have flowed to the greatest height, in which state they remain apparently stationary for a short time, after which the water begins to ebb. See TIDES.

HIGHWAYS. See ROADS.

HILARION, ST., a Christian anchorite of the fourth century, born at Gaza about 291. On his conversion from heathenism he became the founder of monachism in Syria, after the example of St. Anthony, whom he had seen in the deserts of Egypt. To this purpose he dedicated the whole of his possessions, and by the fame of his sanctity induced many to join him. His death took place in the year 372.

HILARY, ST., a Christian prelate of the fourth century, one of the early fathers of the church, born at Poitiers, of which city, after his conversion from heathenism, he became the bishop about 350. His zeal in favour of the Athanasian doctrine respecting the Trinity, which he defended with much energy, drew on him the persecution of the Arian party, with Saturninus at its head, who prevailed on the Emperor Constantius to exile him into Phrygia. After several years spent in banishment he was permitted to return to his see in 362, where he occupied himself in committing the arguments for his side of the question to writing, and continued to distinguish himself as an active diocesan till his death in 367 or 368.—There was another St. Hilary, a Bishop of Arles, a Semipelagian in his opinions, who was the author of a life of St. Honoratus and some devotional tracts. He died in 449, and was also canonized.

HILARY TERM, one of the four English law terms, during which the superior courts at Westminster were open. It begins on the 11th and ends on the 31st of January. It is supposed to be named after St. Hilary.

HILDBURGHAUSEN, a town of Germany, formerly the residence of the Duke of Saxe-Hildburghausen, but now belonging to the Duchy of Saxe-Meiningen. It stands on the right bank of the Werra, and is dull and poorly built. It comprises an old town, a new town, and two suburbs. There are a town-house of the 14th century, an old castle used as a barracks, several churches, &c. The manufactures include wool, toys, agricultural machinery, tiles, physical instruments, &c. Pop. (1900), 7502.

HILDBURGHAUSEN, SAXE, an ancient Saxon duchy, now united with Meiningen. It is situated on the southern declivity of the Thuringian Forest, and is moderately fertile. By the Treaty of Division (1826) between Coburg, Hildburghausen, and Meiningen, Hildburghausen received the Principality of Altenburg, taking the name of Saxe-Altenburg, and in return gave up the territory of Hildburghausen to Meiningen.

HILDEBRAND, See GREGORY VII.

HILDEN, a town of Prussia, in the Rheinland, on the Itter, 9 miles E.S.E. of Düsseldorf, with thriving silk, woollen, carpet, leather, and other manufactures. Pop. (1895), 9487; (1900), 11,296.

HILDESHEIM, a city of Prussia, in the province of and 20 miles south-east of Hanover, formerly the capital of a principality and a bishopric dating from the time of Charlemagne. It is an ancient and interesting place, surrounded by shady alleys and walks, has many towers, and narrow crooked streets, lined with mediæval timber-framed houses with projecting upper stories, bay-windows, and rich carved work. The chief building is the cathedral, mainly a Romanesque structure of the 11th century, with brazen doors of the same century, a font of the 13th century, the 'Jerusalem cross', probably of the 8th century, and other ancient treasures. St. Michael's Church (11th century, restored in 12th and 13th) and St. Godehard's Church (12th century) are among the finest Romanesque churches of Germany. Other buildings are the town-house, the Templar house, and the butchers' guild-house, one of the finest timber buildings in Germany. Many private houses date from the 16th and 17th centuries. The institutions include a Protestant and a Roman Catholic gymnasium; a real-gymnasium, agricultural school, deaf and dumb institution, museum, &c. The industries embrace sugar-refining, tobacco and cigars, iron-founding, agricultural machines, &c. Pop. in 1895, 38,977; in 1900, 42,973.

HILL, AARON, an English poet and miscellaneous writer, was born in London on Feb. 10, 1685. He was educated at Barnstaple and Westminster School. His father, originally a gentleman of good estate in Wiltshire, left him almost wholly unprovided for; which circumstance obliged him to quit Westminster School at the age of fourteen. His relation, Lord Paget, being ambassador at Constantinople, he ventured, uninvited, to join him, and a tutor was provided for him, under whose care he travelled through Palestine, Egypt, and various parts of the East. In 1703 he returned to England, and after the death of Lord Paget he travelled for three years with Sir William Wentworth. In 1709 he published a Full Account of the Ottoman Empire, partly from materials collected in Turkey; which publication, although it obtained much notice, the author himself subsequently regarded as a crude and juvenile performance. About 1709 he became manager of Drury Lane Theatre, a post which, however, he soon gave up. While in the management of Drury Lane he wrote his first tragedy of Elfrid, and at the Haymarket he produced Rinaldo, an opera. He also wrote poems. In 1724 he commenced a periodical paper called the Plain Dealer. In 1731 he rewrote

his Elfrid, which he brought forward under the title of Athelwold. He afterwards translated in succession the Zaire, Alzire, and Merope of Voltaire, all of which show him in the light of a superior dramatic translator. He died in February, 1750, and was buried in Westminster Abbey. His versions of Zaire and Merope kept the stage for a considerable number of years. Hill engaged in many speculative schemes, which mostly ended in failure. He is also known for his literary warfare with Pope.

HILL, Rev. Rowland, son of Sir Rowland Hill, Bart., of Hawkstone, in Shropshire, was born there in 1744, and educated at Shrewsbury, Eton, and St. John's College, Cambridge. While yet at Eton he embraced the views of the Methodists, and at Cambridge he preached in the prison and in private houses before entering into holy orders; he also preached in the tabernacle and chapel of Whitfield in London—a step which at once identified him with the Calvinistic Methodists. Family influence prevented him, however, from formally joining that body, his avowed predilection for which at the same time rendered it extremely difficult for him to obtain ordination in the church. At length he obtained a title to orders in 1773, and was ordained deacon. In imitation of his friend Whitfield he soon began to preach in barns and meeting-houses, and in streets, fields, and highways. In 1783 he laid the foundation of Surrey Chapel, in the Blackfriars Road, London, where he spent about the half of every subsequent year, employing the rest of the time in provincial excursions. Hill was celebrated for his humour, which he often introduced in the pulpit. He visited Scotland three times, the last in 1824. His preaching to immense crowds attracted the notice of the General Assembly, which issued a pastoral admonition against itinerant preachers. He published sermons and other religious works, of which the best known are his Village Dialogues (1810), which had reached their thirty-fourth edition in 1839. He died on the 11th April, 1833. His life was written by the Rev. W. Jones. See also Memorials by Rev. J. Sherman (1857).

HILL, Rowland, Viscount Hill, was a nephew of Rowland Hill, the celebrated preacher. He was the fourth of a family of sixteen, and after his birth his father succeeded to the family title as Baronet (see above article). Rowland was born at Prees, Shropshire, 11th August, 1772. He entered the army in 1790 as ensign in the 38th foot, but afterwards, having obtained leave of absence, spent a year in improving his military knowledge at the Academy of Strasburg, and then made a tour through Germany, France, and Holland. After resuming his situation in the army he obtained the rank of captain in 1793, and acted as aide-de-camp to the three generals who commanded successively at Toulon. Soon afterwards he became first major and then lieutenant-colonel of the 90th, and he attained the rank of colonel in 1800, becoming major-general in 1806; lieutenant-general in 1812. After serving with the 90th at Gibraltar and other places he took part with it in the Egyptian campaign. On his return from Egypt he was stationed for some time in Ireland, whence, early in the summer of 1808, he embarked with his brigade for the Spanish Peninsula. During the whole of Sir John Moore's advance and retreat he was indefatigable in his exertions, and with a corps of reserve protected the embarkation of the army at Coruña. He returned to England in 1809, but very shortly after again embarked for the Peninsula, and thereafter took a distinguished part in the glorious campaigns of the Duke of Wellington. In particular he received honourable mention in the House of Commons for his services at the battle of Talavera, where he gallantly repulsed the enemy at the point of the bayonet, and gave high proof of military talent by the surprise and capture of a considerable corps at Arroyo dos Molinos. His services were no less conspicuous at the desperate fight of Almaraz. He continued to serve with the Peninsular army till the battle of Toulouse. In 1812 he was made a K.B., and in 1814, on being made a peer by the title of Baron of Almaraz and of Hawkstone, Parliament voted an annuity of £2000 to him and his heirs-male, with remainder to his nephew. On the Peace of Paris in 1814 he returned to the bosom of his family at Hawkstone, but was soon recalled to active service by the return of Bonaparte from Elba in 1815. At the battle of Waterloo Lord Hill commanded the right wing of the British, had a horse shot under him, and added to the laurels which he had previously gained in many fields. After the restoration of the Bourbons he held the second command in the army of occupation. In 1828 he was appointed general commanding-in-chief of the British army. This important office he continued to hold under several successive ministries to the satisfaction of all parties, and only resigned it a few months before his death, which took place on 10th December, 1842. He was made a viscount on 3rd September, 1842. See Sidney's Life of Lord Hill (1845).

HILL, Sir Rowland, the great reformer of the postal system, was born at Kidderminster on 3rd December, 1795. His father, Thomas Wright Hill, opened a school near Birmingham, and it was under his careful tuition that Rowland was brought up. This school was afterwards removed to Bruce Castle, Tottenham, and in it the future reformer held the office of teacher till 1833. In 1835 he was appointed secretary to the commissioners for the colonization of South Australia. Two years later he published a pamphlet recommending the adoption of a low and uniform rate of postage throughout the kingdom. The scheme was approved by a committee of the House of Commons, which examined its details in 1838, and reported that the evidence proved that from the old state of things injurious effects resulted to the commerce and industry of the country, and to the social habits and moral condition of the people. Early in 1840 the penny postage system was carried into effect, with the assistance of Mr. Hill, who, for this purpose, received an appointment in the Treasury. He had to contend against great official opposition, but succeeded in his task. Sir Robert Peel's government, which followed that of Lord Melbourne in 1842, unable to stop the working of the new system, meanly dismissed its author without reward or employment. The public, however, justly considered him ill-used, and he was presented in 1846 with a public testimonial of the value of £13,000. On the return of the Whigs to power in 1846 Mr. Hill was made secretary to the Postmaster-general, and in 1854 chief secretary to the Post Office. Sir Rowland, on whom the rank of K.C.B. was conferred in 1860, retired from the Post Office four years later with a pension of £2000, besides a grant of £20,000 voted by Parliament. He died on the 27th August, 1879, and was buried in Westminster Abbey. The History of Penny Postage, by his brother, was written under his direction.

HILLA, a town of Asiatic Turkey, 60 miles south by west of Bagdad, on both sides of the Euphrates, among the ruins of ancient Babylon. It is poorly built, but has some manufactures. Pop. 10,000.

HILLEL, a celebrated Jewish rabbi, the details of whose history are almost exclusively matter of tradition. He was born at Babylon about B.C. 112.

He came to Jerusalem, it is said, at about forty years of age, and put himself under the tuition of Shammaï, another celebrated teacher of high rank in the Sanhedrim. He afterwards established a school in opposition to Shammaï, which was distinguished by a certain amount of liberalism. It was less hostile to the Romans and other Gentiles than the school of Shammaï. He established a method of interpretation of the Bible according to fixed rules, and endeavoured to refer all religious laws to it. He, however, attempted to evade the law of Moses in regard to the Sabbatic year. He was celebrated for his humanity. He is said to have been descended from David, and to have lived, like Moses, 120 years. He is usually called the elder, to distinguish him from another Jewish doctor of the same name of the fourth century of the Christian era, who established the Jewish calendar upon a cycle of nineteen years, and the Jewish custom of dating from the commencement of the world, the previous eras being the departure from Egypt and the entrance of Alexander into Jerusalem. He is said to have been frequently consulted by Origen, on account of his knowledge of the Old Testament.

HILTON, WILLIAM, an historical painter, was born at Lincoln on 3d June, 1786, and at the age of fourteen was apprenticed to John Raphael Smith, the celebrated mezzotinto engraver. After remaining with him for some time he abandoned engraving, and entered as a student of the Royal Academy. As early as 1803 a picture entitled Banditti was exhibited by him; but throughout his life his works never received that share of public attention which their excellence fairly entitled them to, and which has been more liberally accorded since his death. He was elected an associate of the Royal Academy in 1813, and a royal academician in 1818. Several years afterwards he succeeded Thomson as keeper of the Academy. After a life of disappointment and unrequited toil, he expired on 30th December, 1839, at the age of fifty-three. Among the most important of Hilton's pictures are Nature Blowing Bubbles, Una Entering the Cave of Corycea, Jacob Separating from Benjamin, The Triumphal Entry of the Duke of Wellington into Madrid, The Rape of Europa, Edith and the Monks Discovering the Dead Body of Harold, Sir Calepine Rescuing Serena, The Murder of the Innocents, Mary Magdalene Washing the Feet of Christ, and last, not least, The Crucifixion.

HIMÁLAYA (Sanskrit, *Himálaya*, the abode of snow), a chain of snowy mountains, the most elevated on the earth, which separates the Indian Peninsula on the north from Northern Asia. Theoretically, these mountains are regarded by some authorities as part of a great mountain-chain running across the entire continent of Asia, and the Hindu Kush range, west of the Himálaya, may plausibly be regarded as a continuation of the latter, but the greater part, particularly the Chinese portion, of the supposed transcontinental range is unexplored; it is therefore advisable to consider the Himálaya as embracing only that chain of mountains which forms the northern boundary of Hindustan between the Indus on the west, and the Brahmaputra in the east. These rivers spring from the snows of Kailása, a mountain group rising in the rear of the Himálaya, above the high plains of Tibet, and taking opposite directions nearly parallel to the Himálaya range, both subsequently assume a southern course, and cut the mountains, the former in lat. 34° 30′ N.; lon. 72° 40′ E.; the latter in lat. 27° 45′ N.; lon. 95° E.; the Indus then flows south to the Indian Ocean, the Brahmaputra taking a sinuous course mostly south-west to the Bay of Bengal, thus forming the natural boundaries on the west and east of the peninsula of Hindustan. The direction of the Himálaya range from the Indus is for about a third of its length from north-west to south-east, for about a similar length it curves gradually to the east, and maintains that direction during the remaining third. Its length is about 2000 miles, average breadth about 180 miles. Along the whole range of the Himálaya, except at the western extremity, the vicinity of the snowy crest, both on north and south, is occupied by Bhotias, or people of Tibetan origin and Mongolian race. At the north-west end the Hindus (Aryan) occupy the whole south face, and have even crossed the ridge; but east of the sources of the Ganges the Bhotias descend towards the plain, and are found more unmixed the further we go east. In the lower region of the middle Himálaya a few Tamul tribes (originally inhabitants of the plains) are found. Some of the Mongolian tribes, as the Ghoorkas, have lost their distinctive characteristics by intermarriage with the Aryans. Notwithstanding the great extent of the inhabited Himálayan region, and the warlike habits of many of its tribes, it is, taken altogether, politically weak; for it is but a long chain of petty states, separately strong only in defence, and incapable of union.

The great plain of India, south of the Himálaya, has a general elevation of 1000 feet above the sea, the deviations from which are not of sufficient importance to break the general uniformity of the plain, along which the commencement of the mountain region is everywhere marked in the most distinct manner. The ground sinks gradually, for a short distance, towards the foot of the Himálaya, the marshy hollow being covered with thick jungle (properly *jangal*) or forest, frequented by elephants, and the chief haunt of the tiger. A transverse section of the range from the plains of India to the highlands of Tibet presents first the marshy hollow infested with wild beasts already referred to, which is called Tarai or Tarayani, the passage through. It is remarkable for its insalubrity. Behind it rises the low range of sandstone hills, called the Sivalik, which is sometimes covered and totally concealed by enormous fragments of other kinds of rock. The lofty summits in the rear rise in ranges one above the other, beyond a low range in front, and in remote distances is seen an apparently continuous range covered with snow, and rising at some points to such a height as to be visible at a distance of 200 miles. This loftiest range is composed not of any continuous chain, but of numerous summits at very different distances, which, being projected on the same level in the field of view, coalesce in vision, owing to their uniform whiteness, and present the appearance of one wall of snow. The dry sunny slope on the Tarai side of this range is called the Bhaver, covered with forests of immense timber, in which the sal or sála (*Shorea robusta*) and teak predominate. The longitudinal valleys in the interior are called Dhúns; in their jungle and dense forests, frequented by elephants, and in their pestiferous atmosphere they resemble the tracts immediately below them. Such is the lower region of the Himálaya, which may be considered as extending, on the north side of the Dhúns, up to an elevation of 4000 feet above the sea. Thence, to the height of 10,000 feet, may be marked out as the middle region. The upper region of the Himálaya, comprising the snow fields, terminates above, at the ridge of the Ghâts or Passes, at a general elevation of 16,000 to 18,000 feet. The general height of the Himálaya is double that of the Alps; the passes over the former ordinarily exceed, often by half a mile, the elevation of Mont Blanc. The Ibi-Gamin Pass in Garhwal, the highest of all, is 20,457 feet, the Mustagh, 19,019 feet, the Parangla, 18,500 feet, the Kronbrung, 18,312 feet, and the Dura Ghât, 17,750 feet high; and there

are several summits in the Himálaya which approach closely to double the absolute elevation of the greatest of the Alps, and 120 of them are stated to be above 20,000 feet.

The rivers of the Panjab (Five Waters) spring from a portion of the great chain which may be considered a distinct group under the title of the Western Himálaya. The Jhelam rises in the province of Kashmir, the most northern of India. The Chenab, Ravi, and Bias all rise in the snowy mountains of the Pariyat, which border Ladakh. The Satlej or Sutlej springs from the south-west foot of Kailása, from the north-western and south-western extremities of which flow the Indus and the Brahmaputra. After flowing some distance north-west, parallel to the Himálaya, it turns south-west, and cuts the chain. Some of the peaks of the Western Himálaya, such as that of Ibi-Gamin, rise to a height of 24,000 to 25,000 feet. Thus the easternmost river of the Panjab leads us to the middle of the Himálaya, where, between the range of Kailása in the rear (21,000 feet) and the widely-spread snows of Jawáhir or Nanda Devi in front (25,661 feet) lies, at a height of nearly 15,000 feet, the sacred lake of Mánasarovara. This portion of the snowy range, including the sources of the Ganges and Jamna, is regarded by the Hindus with peculiar veneration, and deserves, on every account, to be grouped apart as the Central Himálaya. The western commencement of this division of the chain may be placed in lon. 78° E., though, behind the mountains, the Satlej reaches further east. Jamnotri, the triple-peaked mountain, 25,749 feet high, at the foot of which the Jamna takes its rise, is regarded by the Hindus as holy ground. Numerous warm springs, issuing, in some instances, from beneath the snow, add to the sanctity of the place. This river, before entering the plains, waters the fertile valley of Sirmor. From the sources of the Jamna the mountains east rise gradually till they attain a height of 22,000 feet. Here, under the Panchaparvata or Five Mountains, rise the streams which unite to form the Ganges. The valley of the upper Ganges is named Garhwal, and is altogether a land of narrow defiles and hill forts; to the south and east lies Kamáon, separated from the higher land of Garhwal by the river Pindar. In the lofty mountains south-east of Nanda Devi lie the sources of the Gogra, more anciently named the Saraju; the alpine land which it visits in its downward course is not known by any collective name, but is usually described as the twenty-two principalities. Here, in Nepal, we have reached the highest part of the Himálaya, as far as it is known and measured. The Dhawalagiri has an elevation of 26,826 feet, the Gaurisankar or Mount Everest, the highest known mountain in the world, is 29,002 feet; the Yassa group rises to the height of 26,680 feet, the Ibjibia group to 26,306. The rivers from these mountains all unite into two principal streams, the Gandak and the Kusi, both of which fall into the Ganges. Going farther east, in Sikkim, or on its borders, we find Kanchinjinga, the western peak of which is 28,156 feet high, the eastern 27,815 feet, while the Kábru ridge rises to 24,015 feet. Sikkim forms a comparatively narrow but interesting territory, walled in on three sides by stupendous mountains from 17,000 to 28,000 feet high. And here terminates the region of the middle Himálaya; most of the streams from which, from the Jamna in the west to the Kusi in the east, unite in the Ganges. The Tista, however, from Sikkim enters the Brahmaputra. The Eastern Himálaya, which extends from Sikkim east to the Brahmaputra, and completes the chain, sends all its waters to the last-named river, and is all comprised in the country named Bootan. A little to the east of the Sikkim Himálaya the Chamalari is seen to attain the height of 23,944 feet. About 250 miles further east a conspicuous group has been observed with two peaks, named the Gemini or Twins, 21,500 feet high. Thence towards the east the mountains sink rapidly, and may be said to disappear altogether on the right bank of the Brahmaputra; east of this river the snowy heights recommence.

The snow ridge of the Himálayas proper, as far as examined, consists everywhere of granite, with which are immediately associated gneiss and mica slate, followed, in descending, by metamorphic and secondary rocks till we arrive at the more recent alluvial deposits. The same series of rocks is found in the table-land of Tibet at different elevations. Tertiary deposits of immense depth and extent occur both on the table-land of Tibet and the plains of India. Lacustrine deposits are of frequent occurrence; and it has been even asserted that indubitable traces of the former presence of the sea may be found at a great elevation. Fossil remains of the largest extinct mammalia lie in heaps at the foot of the Sivalik Hills; and it is reported that similar bones, prized for their colossal size, are sometimes brought from Tibet by native traders. Earthquakes are still frequent within this region; and hot springs gush forth in abundance, even from beneath the snow. During the south-west monsoons, May to September, the snows diminish rapidly. In the latter month snow begins to fall. The snow descends lowest in the eastern part of the Himálaya, which reaches 6° further south than the western. The reason of this has been ascertained to be the greater dryness of the western region, which affords a much smaller supply of snow. The Western Himálaya is dry in the extreme, while in the eastern district the rain-fall is very considerable. The limit of perpetual snow in the middle division (lon. 78° E.) is stated to be about 15,500 feet on the south side, and 18,500 feet on the northern. In Sikkim the snow line descends on the south side to 14,500 feet, while on the north it rises to a level of 19,600 feet. The existence of glaciers of smooth ice on the Himálaya has been fully established.

The vigorous vegetation of the plains is continued with little modification up to a height of 4000 feet. The largest timber trees abound in the forests of the Bhaver and the Dhuna, and tree-ferns of stately growth mix with European species. Rice is cultivated in the valleys, and is sometimes succeeded in the same year by wheat. Barley grows at a higher level. The oak, maple, elm, &c., grow at a height of 7000 feet, and the fruits cultivated in Europe grow wild, and maize and millet are the chief summer crops. Above this height various species of pine-trees grow more numerous, but cease about 11,500 feet. Junipers ascend 1000 feet higher, the rhododendron and Lonicera reach 17,000 feet high, and a humbler vegetation, 19,000 feet. The lower region of the Himálaya is the favourite abode of the elephant and rhinoceros, and of the huge ox called the arnee and the wild buffalo. Deer and antelopes are numerous. Apes also are found in the lower region, and one species in the pine forests, at a height of 9000 to 11,000 feet. Carnivorous animals are more numerous and in greater variety in the lower valleys, but they extend even to the highest inhabited region, where the ounce, the mountain-fox, and the wild cat are to be found. In the middle region the true ox, the common hare, and several species of deer are found. The wild goat and sheep inhabit a higher region. The feathered tribes are numerous, widely diffused, and so migratory as to make it difficult to classify them as to habitation. The common fowl and the francolin prefer the forests at the foot of the mountains; the bustards, the middle region; the pheasant species, the pine woods higher

up. Doves are found of different species in all the zones. The birds of fine plumage belong chiefly to the lower region; singing birds are more widely diffused; and the birds of prey are found everywhere.

HINCKLEY, a market town of England, in the county of Leicester, 12 miles south-west of Leicester, near Watling Street. It contains many good houses, an ancient church (restored in 1875 and the following years), with a tower and finely-proportioned spire, besides other places of worship, a well-endowed grammar-school, a town-hall, free library, and large board schools. The staple trade is hosiery, but there are also large boot and shoe factories and brickworks. The town was created a barony soon after the Conquest. Near it are some interesting Roman remains. Pop. in 1901, 11,304.

HINCMAR, Archbishop of Rheims, ecclesiastic and statesman, was born about 806. He was at first a monk in the Abbey of St. Denis, governed by the Abbot Hilduin, whom he accompanied to Saxony in 830, when he had been disgraced by the emperor, and afterwards, by his influence at court, procured his pardon. Charles the Bald withdrew Hincmar from his monastery, of which he was then treasurer, and brought him to court, making him abbot of two monasteries, in neither of which, according to the custom of the time, he was compelled to live. In 845 he was elected archbishop of Rheims at the Council of Beauvais, which deposed his predecessor Ebbonius. In this position he exercised extensive political as well as ecclesiastical authority. A German monk, Gottschalk, having been condemned by the Council of Mayence for teaching a doctrine of predestination derived from St. Augustine, was remitted in 848 to Hincmar as his metropolitan. Hincmar finding him contumacious caused him to be beaten with rods and imprisoned, but he also attempted to answer him, and seems to have fallen into an opposite heresy of semi-pelagianism greater than that of his opponent. Gottschalk found supporters, and the matter was warmly debated, but never definitely decided. Another dispute into which he entered with Rothad, bishop of Soissons, whom he deposed, brought him into collision with Pope Nicholas I., who restored the bishop. On another occasion, when he refused, at the command of the Emperor Lothaire, to ordain Hilduin bishop of Cambrai, the pope sustained his decision. He also persecuted his nephew Hincmar, bishop of Laon, who was deprived of his diocese, and afterwards had his eyes put out with a hot iron. Notwithstanding the violence of his temper and the frequent disputes in which he was engaged, which are an indication of the anarchy both in civil and ecclesiastical government of the time, he was a man of enlightenment, one of the best scholars of his age, and was distinguished as a defender of the liberties of the church, although it would perhaps be more correct to say of his own authority, both against the pope and the emperor, He wrote two treatises on Predestination, and numerous other works, all included in Migne's Patrologia. He died at Epernay, where he had taken refuge from a marauding inroad of the Northmen, in 882.

HIND, the female of the stag, or red-deer. See DEER.

HINDLEY, a town of England, in Lancashire, 3 miles south-east of Wigan. All Saints' Church, in classical style, dates from the seventeenth century, and the church of St. Peter, erected in 1866, is a handsome edifice in the Gothic style. There is an endowed grammar-school, founded in 1632, and various other schools, a reading-room, and lending library. The town contains extensive cotton-mills, which employ a large part of the population. Coal abounds in the district. Pop. (1901), 23,504.

HINDU KUSH, or INDIAN CAUCASUS, a mountain system of Central Asia. It stretches south-west from the Pamir plateau through Northern Afganistan, merging in the range west of Cabul known as the Koh-i-Baba. It separates the basin of the Cabul river on the south from that of the Amu Daria on the north, and is now known not to attain a greater elevation than 20,000 feet. The geological structure appears to be a nucleus of granite overlain by gneiss, mica and chlorite slate, mountain limestone, and fossiliferous sandstone. The principal minerals are silver, lead, iron, zinc, and antimony. The mountains are very deficient in timber, and have in general a very barren appearance, the green spots being almost confined to the banks of the rivers. The most important of these are the Oxus or Amu Daria and the Helmund. The chief passes are 9000 or more feet high.

HINDUS. See INDIA.

HINDUSTAN. See INDIA.

HINDUSTANI. See INDIA.

HIOGO, or HYOGO, a town of Japan, island of Hondo, on the bay and 10 miles from the town of Osaka, one of the ports thrown open to commerce in 1867. It consists of Hiogo proper and of the adjacent town and port of Kobé, where the foreign merchants reside, and most of the foreign trade is carried on, and which has grown up since 1863, and now surpasses Hiogo. Hiogo (or Kobé) is the port both of Osaka and Kioto, being joined to both by railway. Paper is manufactured, and locomotives and ships are built. It has a large export and import trade, the chief exports being cotton, yarn, matches, copper, rice, matting, tea, straw-plaits, camphor, silk, and fans. Pop. (1899), 215,780.

HIP-JOINT, the two bones of the hip, called the *pelvic* bones, articulate together and with the *sacrum*, which is placed between the two, and transmit the weight of the body to the lower limbs. On the external face of each pelvic bone is a deep, hemispherical cavity, called the cotyloid cavity, which receives the head of the thigh-bone, and forms with it the articulation of the hip. The *femur*, or thigh-bone, the longest and strongest bone in the skeleton, is almost cylindrical, and is curved outward, which gives it greater strength. At the upper extremity the femur is supported by a neck, united to the body of the bone at an obtuse angle. This obliquity increases the distance between the two femurs, and gives the body a broader base. The head of the femur fills the cotyloid cavity, but is not all contained in it. The edge of the cavity is surrounded by a highly elastic, circular, fibro-cartilaginous ring, embracing the head of the femur, and acting as a valve which hermetically closes the articular cavity, in which the head of the femur is retained by atmospheric pressure alone. The inclosing of the head of the femur in the cotyloid cavity gives the articulation of the hip greater solidity, which is augmented by the muscles and ligaments which hold the parts together, as well as give them motion, so that it is only by the greatest violence that the head of the femur can be forced out of the cavity. This articulation is of the same nature with that of the shoulder, and like it permits the movement of the limb in every direction, though to a less extent in the case of the leg than of the arm. A disease of the hip-joint, *morbus coxarius*, chiefly attacks children of a scrofulous disposition between the ages of seven and fourteen. The first symptom is generally pain in the knee, and it frequently ends in the formation of abscesses in the hip or thigh.

HIPPARCHUS. See HIPPIAS.

HIPPARCHUS, the founder of physical astronomy, was born at Nicæa in Bithynia, and lived about B.C. 160–125. His industry, love of truth, and great abilities are celebrated by the ancients, especially Ptolemy, who lived about 250 years after Hipparchus, and was his first follower; and nearly all that is known of the astronomical labours of the older astronomer is from his writings. Indeed, it is not always easy to distinguish between what is due to Hipparchus and his own work. Delambre has taken pains to separate them in his Histoire de l'Astronomie ancienne. His judgment of Hipparchus is that he was one of the most wonderful men of antiquity, and the greatest name of all in the sciences not purely speculative. He first ascertained the true length of the year, discovering that the 365 days 6 hours assigned to the solar years was about 5 minutes in excess. From his observations he concluded that the eccentricity of the sun's orbit was $\frac{1}{24}$th of its semi-diameter, and the sun was at its most distant point from the earth when it was in the 24th degree of the sign of the Twins. He also calculated the first tables of the sun and moon, and ascertained the distances and magnitudes of the sun and moon more accurately than had been previously done. By means of an ingenious direct method, which is known by the name of the diagram of Hipparchus, he thought he had found that the distance of the sun from the earth was 1200, and that of the moon 50 of the earth's semi-diameters, and that the diameter of the sun was $5\frac{1}{2}$ times greater than that of the earth, while that of the earth was $3\frac{1}{2}$ times greater than that of the moon. The sudden appearance of a new star induced him to undertake a calculation of the whole number of stars in the firmament, and thus to execute the first catalogue of the fixed stars. Not less important was his discovery of the precession of the equinoxes. He also rendered important services to geography, and may be said to have furnished the true foundation of mathematical geography when he taught how to employ latitude and longitude for the purpose of fixing the position of places on the earth's surface. The greatest circumference of the earth he estimated at 275,000 stadia, the length of the known inhabited land at 70,000 stadia, and the breadth, from the equator to Thule, at 46,200 stadia. Of his works all that remains is a Commentary on the Astronomical Poem of Aratus.

HIPPARION, a genus of fossil mammals, about the size of a moderate horse, found in the tertiary strata of Europe. From the horse it is distinguished by having three toes on either limb, the median bearing a large hoof, the two lateral not extending beyond the fetlock; whereas in the horse these, the second and fourth, are represented by mere ossicles, the rudiments of the metacarpal and metatarsal bones, and in the Anchitherium these toes are of the same length as the median, taking part in locomotion. Further, the pattern of the grinders in the upper jaw differs, that which in the horse is a fold of the inner surface being a distinct pillar in *Hipparion;* on the outer surface of the deciduous molars of the lower jaw there is a pillar as in stags, to whom the hipparion further offers resemblance in the pit which lies in front of the orbit, in the same position as the *larmier* of the stag. *Hipparion* has a less specialized type of structure than the horse, that is, assuming both to have descended from a common stock, the one line of descent terminated in *Hipparion;* the other is not yet extinct, but the variations of the ancestral structure have been greater in the genus which has survived. The pliocene strata of Vaucluse have yielded *H. prostylus*, Gerv., and others; the miocene of Germany and Greece contain *H. gracile*, Kaup. the *Hippotherium* of some writers.

HIPPEL, Theodor Gottlieb von, a German humorist and miscellaneous writer, was born 31st January, 1741, at Gerdauen, in East Prussia, where his father was rector of an academy. In his sixteenth year he was sent to the University of Königsberg to study theology, but becoming acquainted with the Dutch councillor Woyt, a celebrated jurist, who received him into his house and recommended to him the study of law, his pursuits received a new direction. He also became acquainted at Königsberg with the Russian lieutenant Von Keyser, who took him to St. Petersburg and introduced him to aristocratic society. Home-sickness brought him back to Königsberg, where he was employed as a tutor in a cultivated family. Having fallen in love with a rich maiden of family, he determined to devote his time entirely to the study of law, which he hoped would secure him a more rapid promotion. In 1762 he gave up his tutorship and applied himself with incredible self-denial and zeal to this object. At length he gave up his love that he might be able in a single condition to devote himself more exclusively to study. At first employed as a legal adviser, he became in 1780 directing burgomaster of Königsberg, and police director, with the title of privy councillor of war and state president. His family was at last ennobled. He died 23rd April, 1796, leaving considerable wealth. His character is said to have been full of singularities and contradictions. His works, which he took great care to publish anonymously, are full of wit and humour, with a playful and digressive fancy, but with frequent indications of earnestness of purpose. Among his works are Über die Ehe, On Marriage (Berlin, 1774); Über die bürgerliche Verbesserung der Weiber, On the Improvement of the Social Condition of Women (1792); Über weibliche Bildung, On Female Education (1801); three volumes of biographies, some plays and political satires, and an autobiography. His works have been published in fourteen volumes (Berlin, 1828–31).

HIPPIAS, tyrant of Athens, son of the great Pisistratus, after whose death (B.C. 527) he assumed the government, in conjunction with his brother Hipparchus. The government seems to have been conducted on the whole with ability and moderation until the latter was assassinated (B.C. 514) during the Panathenæa, while conducting a solemn procession to the temple of Minerva, by a band of conspirators, under two young Greeks, Harmodius and Aristogiton. Hippias now seized the reins of the government alone, and revenged the death of his brother by imposing taxes on the people, selling offices, and putting to death all of whom he entertained the least suspicion, after having forced them to confess by the most dreadful tortures. The Athenian exiles formed a plan to free their country from the yoke. They found means to bribe the priests of the Delphic oracle, which commanded the Spartans to release the Athenians from the tyranny of the Pisistratids. In compliance with the command of the divine Pythia, Sparta broke off her alliance with the tyrant of Athens, who was obliged to yield to the united attack of his foreign and domestic enemies. Hippias was expelled from the city B.C. 510. But the means by which the voice of the oracle had been gained did not remain a secret, and the Spartans endeavoured to induce their allies to attempt the restoration of Hippias, whom they invited to Sparta, but without success. Hippias now sought protection and support from Artaphernes, the satrap of Sardis, and induced Darius, who was already irritated against the Athenians on account of the assistance which they had rendered to the Asiatic Greeks, to require them to receive Hippias. Their decisive refusal kindled the first war of the Persians against the

European Greeks. But the battle of Marathon in 490 destroyed, with the army of Darius, the hopes of Hippias. The time and place of Hippias' death are not known. According to one account he fell in the battle, according to another he died at Lemnos on his return.—There was also a sophist of this name, a contemporary of Socrates, who has given name to two dialogues of Plato, the Greater and Lesser Hippias.

HIPPOCAMPUS. The fantastic members of this genus are not less remarkable in their habits than in their appearance. They belong to the family of osseous fishes known as *Syngnathidæ*, in which the mouth is reduced to a small orifice at the end of a tubular snout; the gills are in tufts, and the external aperture is not a cleft, as in ordinary fishes, but is reduced by adhesion of the margins of the gill-cover to a small opening, which is high up, near to the occiput. A single dorsal fin is placed opposite the anus. Ventrals wanting, dorsal very small, and in some genera, or in the males only, absent. The males have a marsupial pouch. The genus *Hippocampus* has the occiput elevated, the facial bones united to form the tubular snout; the body surrounded by rings of bony plates, which give the body an angular form, heptangular in the abdomen, quadrangular from the vent backwards. This quadrangular portion terminates in a taper tail without fin, and is prehensile, so that the animal can grasp with it the stems of plants. Moored by this end, the animal sways to and fro, presenting a singular resemblance to a horse-head, a resemblance which becomes ridiculous in front view, the pectoral fins projecting like ears, a little below the elevated poll. It is an animal of great intelligence and vivacity, and forms an interesting study in the aquarium; the eyes moving independently of each other, and the unerring precision with which it seizes prey recalling, as has been suggested, the chameleon, which it likewise resembles in the iridescence of the body. The male carries about the ova either glued together and attached to his body, or in a pouch formed by symmetrical folds of skin on the ventral surface, in front of or behind the anus. The two sexes present somewhat similar appearances at different seasons, the female bulky with ova, the male thereafter increasing in dimensions as his progeny grow in size. *H. antiquorum* is the common species.

HIPPOCENTAURS, in mythology, a species of monsters, sprung from the union of Centaurus and the Magnesian mares. See CENTAUR.

HIPPOCRATES, the most famous among the Greek physicians, founder of a school in medicine, and author of the first attempt at a scientific treatment of medicine. He was born in the island of Cos, according to the generally received account, B.C. 460, but according to some writers much earlier, and belonged to the celebrated family of Asclepiads, or descendants of Æsculapius, from whom Hippocrates was the seventeenth in descent. His father, Heraclides, a physician, instructed him in medical science, which he also studied under Herodicus, and it is said also that he was a pupil of Gorgias of Leontini. Besides practising and teaching his profession at home he travelled on the continent of Greece, and died at an advanced age, according to Clinton B.C. 357, at Larissa, in Thessaly. He enjoyed during his life a high reputation as a professor of medicine, established the fame of Cos as a medical school, and took the first rank as a writer on the science. To the few facts known of the life of Hippocrates have been added a multitude of fables, which belong to various ages and countries, and which not infrequently bear traces of the time and place of their origin. His writings, which were early celebrated, became the nucleus of a collection of medical treatises by a number of authors of different places and periods, which were long attributed to him, and still bear his name. The Hippocratic collection as a whole cannot be traced higher than the period of the Alexandrian school in the third century B.C. They appear to have been collected at the time of the formation of the Alexandrian Library, and have since been the theme of a line of commentators extending over upwards of 2000 years. They were held in esteem by both Greek and Latin writers, and were translated into Arabic. In the middle ages their reputation somewhat declined, but has revived again in modern times. The first known commentator on Hippocrates was Herophilus, who flourished between the third and fourth century B.C. The most ancient commentary extant is that on the De Articulis by Apollonius Citiensis, who is supposed to have lived in the century B.C. The most voluminous as well as valuable of ancient commentaries are those of Galen (A.D. 130 to 200). The first Latin edition of Hippocrates printed was that of Fabius Calvus (Rome, 1528, folio); the first Greek edition was the Aldine (Venice, 1526, folio). The best edition now is that of Littré (in ten vols. 8vo, Paris, 1839–61). It contains the Greek text, with a French translation, a general introduction, and an argument to each treatise, together with philological and scientific notes. Dr. F. Adams translated the authentic works into English (1848–49).

The Hippocratic collection consists of more than sixty treatises. It contains, along with the genuine works of Hippocrates, works of earlier, contemporary, and later origin, and of course each successive critic differs somewhat from his predecessors in assigning the exact share of Hippocrates in the collection. The works which are considered as most unquestionably his are the first and third books on epidemics; the aphorisms; on diet in acute diseases; on air, waters, and localities; on prognostics; on wounds of the head. The aphorisms are probably only indirectly the production of Hippocrates. They are a collection of passages from other portions of his works, together with some from treatises of which the authorship is doubtful. They may either have been collected by himself in his later years or by a subsequent editor of his works. The medical treatment of Hippocrates consisted chiefly in attention to diet and regimen. His writings are in the Ionic dialect, and his style is concise, and sometimes obscure, which has been attributed to some of his writings being merely collections of notes.

HIPPOCRENE (The Horse's Fountain), a spring on Mount Helicon, a mountain in Bœotia, consecrated to the Muses, the waters of which possessed the power of poetic inspiration. It was sacred to the Muses and Apollo. It is said to have risen from the ground when struck by the hoofs of Pegasus. Aganippe was another sacred fountain here.

HIPPODAMIA was the name of several females of antiquity—for example, of the wife of Pirithous (see PIRITHOUS), king of the Lapithæ. The most celebrated is the daughter of Œnomaus, king of Pisa in Elis. On account of a prediction that he was to be murdered by his future son-in-law he made a condition that all the suitors for his daughter should contend with him in a chariot-race, and if he should overtake them before they arrived at the goal should fall by his hand. He thus succeeded in slaying thirteen, or, as some say, seventeen suitors, when Pelops, by corrupting the charioteer, caused Œnomaus to be upset in the middle of the course, by which means he lost his life. Thus Hippodamia became the wife of Pelops, and mother of Atreus and Thyestes. She committed suicide from grief at the accusation of having misled these sons to fratricide.

HIPPODROME (from *hippos*, horse, and *dromos*, course, race) was the name, among the Greeks and Romans, of the public place where the horse and chariot races were held; also of the races. An account of these is given in the Iliad, book xxiii. lines 262–650. The critical point of the race was turning the goal, which had to be done so sharply that the charioteer was often thrown and the chariot sometimes broken. Of all the hippodromes of Greece the most remarkable was the one of Olympia, of which a description may be found in Pausanias. After this one there was none more remarkable than that of Constantinople, which still fills the traveller with astonishment. Severus began the erection of this splendid structure, and Constantine finished it, in imitation of the great circus at Rome. It was surrounded by two ranges of columns, raised one above the other, and resting on a broad foundation, and adorned by an immense quantity of statues of marble, porphyry, and bronze of men and beasts, emperors and athletes. Among other remarkable monuments of art the four bronze horses of Lysippus stood here, which have migrated from Greece to Rome, Constantinople, Venice, and Paris, and have at last been transported back to Venice. The Turks call this place the *Atmeidan*, that is, *horse-place*, and thus recall to the mind its former destination. It is at present 400 paces in length, 100 in breadth, and, passing over many slight irregularities, almost quadrangular; and, notwithstanding the corroding touch of time, some remarkable relics of antiquity are still found here.

HIPPOGRIFF, the name of a fabulous animal, a griffin, whose body terminated in that of a horse.

HIPPOLYTUS. See PHÆDRA.

HIPPOLYTUS, an early ecclesiastical writer, the details of whose history are involved in much obscurity. After becoming acquainted with Irenæus in Gaul he came to Rome about 190, and having taken a prominent part in ecclesiastical and theological discussions, was chosen bishop of Rome in opposition to Pope Calixtus I. (217), against whom he was supported by a party in the church till deported to Sardinia about 235, where he is supposed to have soon after died. He holds an important position among the early fathers for his knowledge of the philosophical and gnostic systems, and as a defender of the *logos* doctrine. His writings, which were in Greek, are mostly lost, but we possess the greater part of a work against heresies attributed to him; part of a commentary on Daniel (partly discovered in 1891), &c. See Bunsen, Hippolytus; and works by Ficker (1893) and Achelis (1897).

HIPPONAX, a Greek poet, born at Ephesus 540 years before the Christian era. His satirical raillery obliged him to flee from Ephesus. As he was naturally deformed, two brothers, Bupalus and Anthermus, made a statue of him, which, by the deformity of its features, exposed the poet to universal ridicule. Hipponax resolved to revenge the injury, and wrote such bitter invectives and satirical lampoons against them that they hanged themselves in despair.

HIPPONOUS, the original name of the celebrated Bellerophon, the son of Glaucus and of a daughter of Sisyphus, king of Corinth. He is said to have received the name of Bellerophon from having killed a noble Corinthian called Bellerus. According to one account, having unintentionally killed his brother, he fled to Proetus, king of Argos, who received him hospitably, and purified him according to the Greek rites. But Queen Antea soon conceived a criminal love for the youth; and when Bellerophon, revering the rites of hospitality, did not return her affection, she avenged herself by calumniating the innocent youth to her husband. Proetus sent him to his father-in-law, Iobates, king of Lycia, with tablets having characters engraved on them which were of dangerous import to the bearer. Iobates, in compliance with the hospitable custom of the heroes of antiquity, entertained the stranger during the space of nine days before he inquired into the object of his visit; and having on the tenth day learned his commission, he also feared to lay hands on his guest. He ordered him, however, to kill the Chimæra, a monster which had three heads, and breathed fire, being convinced that no valour would enable him to sustain this combat. But Bellerophon, mounted on Pegasus—a present from Pallas—fought in the air, and overpowered the monster. After this Iobates sent him against the Solymi, and then the Amazons, whom he conquered. Iobates then, recognizing the divine origin of the youth, gave him his daughter Philonoë in marriage, and shared his kingdom with him. The children of Bellerophon were Isander, Hippolochus, and Laodameia. His after-history is differently related. According to some he attempted to rise with Pegasus to heaven, but Zeus sent a gadfly which stung the winged horse so that he threw his rider, who in consequence became lame or blind. Homer, who knows nothing of the story of Bellerophon killing the chimæra by the aid of Pegasus, makes him, after he had incurred the hatred of the gods, wander lonely through the Aleïan field, avoiding men and consumed with grief.

HIPPOPOTAMUS, the typical genus of a family of the order Ungulata, with an even number of toes, of which only two living species are well ascertained; recent observations, however, have shown that others lived in the earlier ages of the world. The hippopotamus is fully equal to the rhinoceros in size, and is not less formidable. He has four cutting teeth in each jaw, those in the lower jaw straight and pointing forward nearly horizontally, the two middle ones being the longest. The canine teeth or tusks are four in number; those in the upper jaw short, those in the lower very long and obliquely truncated. They are sometimes 2 feet in length, and weigh upwards of 6 lbs. These tusks are in great request with the makers of artificial teeth, as they are not subject to turn yellow. In figure the hippopotamus more closely resembles an unwieldy ox than any other animal. A male hippopotamus has been known to be 17 feet in length, 7 in height, and 15 in circumference. The head is very large, being 8½ feet in length; the mouth is amazingly wide, the ears small, pointed, and lined with fine short hairs; the eyes and nostrils are small; the lips very thick, broad, and beset with a few scattered tufts of short bristles; the body is thinly covered with very short whitish hair, more sparingly distributed on the under parts; the tail is short, slightly compressed, and almost bare; the legs are short and thick; the feet large, the toes four, each furnished with a hoof, and all resting on the ground; the skin is very thick and of a dusky colour. See illustration at UNGULATA.

The hippopotamus is confined to Africa, and abounds most in the lakes and rivers of Abyssinia and the equatorial regions; but the animal is also found in considerable numbers in the Gambia, Niger, &c. They formerly were plentiful in South Africa, but they are now nearly extinct, though still found about the mouth of the Orange, on the upper Zambesi, in Zululand, Mashonaland, &c.

The hippopotamus appears to have been well known to the ancients, though their descriptions of its form and habits are inaccurate. Thus Aristotle and Pliny describe it as having hoofs like an ox, a mane like a horse, a flat nose and a tail like a hog. That the latter author should have been so erroneous is extraordinary, as several of these animals had been exhibited at Rome. Scaurus during his ædileship had

five crocodiles and a hippopotamus in a temporary lake. and Augustus produced one on the occasion of his triumph over Cleopatra, and we find the figure of it on medals and mosaic pavements. But the ancients knew no other mode of description than that of comparing the parts of an unknown animal with those of animals well known, hence giving rise to innumerable errors. The *behemoth* of Job is considered by commentators to be the hippopotamus, as the description of his size, manners, food, and haunts is not unlike those of the latter animal. Among the fables of the ancients respecting it is, that it vomited fire, and Pliny relates that this animal, when he feels his habit overcharged, repairs to some place covered with sharp reeds, and obtains a discharge of blood by lying down upon them in such a posture that they pierce the tender parts of his skin. Among the ancient Egyptians it was revered as a divinity, as it is among the negroes of Congo, Elmina, &c.

The great strength of the hippopotamus would render it one of the most formidable of quadrupeds were its disposition ferocious; but it is comparatively mild and gentle, except under great provocation or when wounded. When excited, however, its fury is remarkable; it often destroys boats with its teeth, or upsets them by raising them on its back. There is no doubt that it can be tamed. Live specimens are to be seen in the Zoological Gardens at London and elsewhere, and even in travelling menageries. The first hippopotamus seen alive in Europe in modern times was brought to London from the White Nile, and arrived in May, 1850. The voice of the young is a squeak like that of a hog; that of the adult is said by some writers to resemble the neighing of a horse, whilst others represent it as a loud sonorous noise, between the bellowing of an ox and the roaring of an elephant. Despite the unwieldiness of his body and the shortness of his legs the hippopotamus can move with remarkable swiftness upon land; when pursued, he takes to the water, and, plunging in head foremost, sinks to the bottom, where, it is said, he can move along with the same slow and stately pace as in the open air. He can continue thus immersed for five minutes, or even longer, without even raising his nostrils above the surface for breath. In manners the hippopotamus resembles somewhat the hog. His sleeping place is usually muddy islands overgrown with reeds; in these places also the female brings forth. She goes with young nearly eight months, and produces but one at a birth. She is often seen in the rivers with her calf on her back. The hippopotamus is mainly a nocturnal animal, especially in regions where it is hunted with vigour. While it is resting in inactivity various insect-eating birds wander about on its back hunting out the numerous parasites which infest it. These birds are also said to act as sentinels in giving it warning of approaching danger.

Although the hippopotamus is an inhabitant of the waters, his food is entirely of a vegetable character, in search of which he leaves his liquid residence and ranges along the banks, committing wide devastations through all the adjoining country. On the banks of the upper Nile and other streams he often defeats the hopes of the husbandman, whole fields of grain and sugar-cane being not only destroyed to satisfy his appetite, but also trampled down by his great weight. It has been asserted that the hippopotamus devours great quantities of fish; but it appears from the best evidence, both of travellers and from his anatomical structure, that he is nourished exclusively on vegetable food. The stomach, like that of the ruminating animals, is divided into three or four pouches, and there is no cœcum.

The flesh of the hippopotamus is eaten in Africa, and many of the aboriginal peoples are extremely fond of it. The fat resembles lard. The choice pieces are said to be the gelatinous part of the feet and the tongue. The hide, which, as has already been stated, is very thick, is converted by the negroes into shields, and is also used in making the whips known as *sjamboks*. The teeth are esteemed as furnishing excellent ivory. The modes of capturing these animals, adopted by the natives of the regions where they abound, are various. A common mode is by means of pitfalls dug in places which are frequented by the hippopotami, and carefully concealed by a covering of branches, leaves, grass, &c. Another mode common in some parts is to use a kind of trap, which, as described by Livingstone from observation of it on the Zambesi, consists of a beam 5 or 6 feet long, armed with a spear-head or hardwood spike, covered with poison and suspended to a forked pole by a cord, which, coming down to the path, is held by a catch, to be set free when the beast treads on it, so that the sharp spike will enter its back. The most dangerous method is harpooning them; this, however, is a very common mode in Africa, and it is said that it is by no means rare to see ten or a dozen canoes employed in this kind of chase. Some of the natives catch them by driving them into a pool where there is no vegetation, and keeping them there till starvation makes them an easy prey.

The Liberian hippopotamus (*H. liberiensis*), found in Western Africa, is a much smaller and lighter animal, blackish above and whitish below. Its length is only about 6 feet. The remains of several extinct species have been discovered in Europe. The largest is the *Hippopotamus antiquus*, or *H. major*, Desmarest, larger than the existing species; the bones of this animal are found in considerable numbers in the Val d'Arno Superiore in Tuscany, near Montpelier and Paris in France, and at many places in Britain. The islands of Malta and Sicily have yielded many remains of a small species known as *H. minutus*, and also of a rather larger one, *H. Pentlandi*. Several interesting fossil species have been obtained from the Pliocene and Pleistocene deposits of some parts of India, a country which, like Europe, contains no living species. *H. palæindicus* and *H. nomadicus* occur in the valley of the Narbada. Burma yields remains of *H. irawadicus*, and from the Himalaya region *H. sivalensis* is represented. Algeria also yields a fossil species, and likewise Madagascar. Falconer and Cautley recognized two groups in the family, that to which the existing species, *H. amphibius*, as well as the fossil species of Europe, belong, all these possessing two incisors on either side of each jaw, and hence called *Tetraprotodon*; and the *Hexaprotodon* group, in which there were three incisors. To the latter belong several of the Indian species.

HIRING, in law, a contract by which one person acquires for a fixed period the use of the property or services of another in consideration of some compensation or reward. The Roman law distinguished four kinds of hiring: hiring of a thing (*locatio rei*), hiring of work and labour (*locatio operis faciendi*), hiring of care and services to be performed on the thing delivered (*locatio custodiæ*), and hiring of the carriage of goods (*locatio operis mercium vehendarum*). The three last come under the head of hire of labour and services. In English and Scotch law most of these matters are treated of under other heads. In general, hiring is regarded as a contract and treated according to the terms agreed upon by the parties, or according to the custom of the kind of contract entered on. In English law it is defined as a contract of bailment. See BAILMENT.

HIRSCHBERG, a town, Prussia, province of Silesia, 26 miles south-west of Liegnitz, capital of a circle of the same name, beautifully situated in a valley of the Riesengebirge, on the Bober, where it is joined by the Zacken. To distinguish it from other towns of the same name it is sometimes called Hirschberg am Bober. It consists of the town proper, partly surrounded by walls with three gates, and of suburbs; is regularly built, has a Protestant church, with a large dome and a fine organ, as also a cemetery, in which are some curious monuments; four Roman Catholic churches, one of them a handsome Gothic structure; a gymnasium, industrial and other schools; a savings-bank, orphan and ordinary hospital; manufactures of paper, linen, and cotton goods, lace, porcelain, earthenware (stoves, &c.), cement, window blinds, cigars; and a trade in linen, which here has its central entrepôt for the province. The environs of Hirschberg are beautiful, and furnish fine promenades. Pop. (1900), 17,865.

HISPANIA. See SPAIN.

HISPANIOLA. See HAYTI.

HISTOLOGY, the study of the tissues which enter into the formation of an animal and a vegetable, and their various organs. It comprehends their functions, mode of development, and chemical transformations, and forms the basis of the sciences of anatomy and physiology. The elementary organic tissues have been variously arranged by anatomists, and only become visible by means of the microscope, which accordingly constitutes an indispensable adjunct in histological investigation, and requires to be of first-class excellence. See TISSUE.

HISTORY (Greek *historia*, from *historeō*, I inquire into) is used by Herodotus in the sense which it has since retained, of a narrative of events and circumstances relating to man in his social or civic condition. The term history has been applied by extension to any narrative or account of connected facts or investigations: thus we have Natural History, embracing in its widest sense the whole of the natural sciences; and we have innumerable more restricted applications, as histories of trades, inventions, discoveries, of institutions of a more or less public character, family histories, and the great department of individual history or biography. All these applications of the term are in their own way perfectly natural and convenient. But the term history, when used without qualification, is, by common consent of accurate writers in all languages in which it is employed, limited, as already defined, to accounts more or less extended of what relates to man in his social or aggregate condition. This use of the term restricts the field of history much less than it appears to do. It hardly, if at all, diminishes the number of facts and circumstances coming within its range, even according to the widest definition of natural history, but it practically restricts them by conditioning the order of their admittance. All these things affect human society, but they do not affect it in the same degree. The fundamental fact which assigns to history its peculiar province is that the tendency of men to unite in society has produced various aggregate masses of human beings, which, whether moving from one place to another, or settled in a defined territory, possess a sort of organized unity or common life, which is continued from one generation of men to another. It was the record of the acts of this common life, which exists in the society, and does not die with individuals, as observed in particular communities, that formed the task of the earliest historians; and it is a similar record of the acts and circumstances of such communities or quasi-independent aggregates of human society called nations, kingdoms, republics, states, or commonwealths which forms the staple of history to this day. These communities, though possessing an organic life, which may in a sense be said to be self-derived and independent, are found on examination to be in two respects closely related to each other. When the records of various nations are compared it is found that the separate collective lives which they commemorate present, along with remarkable differences, still more remarkable resemblances and parallelisms. Although these parallelisms are greatest in nations having something in common in race, circumstances, or education, they are to be found even in those of the most different races, and the furthest removed in time and place from each other. Again, when the contemporary history of various nations is looked at, it is not found to consist of so many distinct though resembling views of separate and isolated subjects, but often of different views or portions of the same subject. Each state is found to be in close relations, whether of friendship or hostility, with others, pursuing in war, policy, or commerce, ends sometimes common with, sometimes antagonistic to those of the states around it. As civilization extends the number of states embraced in these common relations multiplies, and the number, variety, and intricacy of the connecting interests becomes vastly augmented, a community of communities rises into existence, and this new development of social life possesses an organism and laws, has a continuous vitality or independent life, exercises an influence, and has consequently a history of its own. In how many European wars have particular communities lost or forgotten the special interest that led them into the war, and continued to fight for the general idea until some new turn of events has awakened them to the consciousness that they have insensibly drifted into fighting against themselves. Both of these causes, the parallelism in the history of different states, and the relations of states one to another have given rise to the development known as universal history, which is concerned alike with tracing all the causes of resemblance and difference in the collective life or civilization of different communities, and of recording the reciprocal bearings of the actions of these communities on their relations with one another. Modern facilities for recording have so multiplied the materials for history, and modern research has discovered so many new applications of these materials, that a new and important department has been added to history in sectional studies or connected views of particular phases in the life of society: thus we have the history of commerce, of colonization, &c. But the field of history proper is so far restricted as to its subject, that only the doings of a community possessing something of an independent organic life can constitute it. We may speak of the history of a club, a legal society, a civic corporation, but these do not belong to the great domain of history, which also excludes individual or family histories, except in their political bearings, and requires as its subject the life, for a longer or shorter period, of a communi holding its organization by an inherent right, and deriving it from a superior. A city in independ or rebellion, or a church which claims independ of civil law—in general, any association holdin and for itself, and entering into sovereign rel with other associations, is in this higher s proper subject of history. But while only s states can have a history in the full sens term, these are sometimes so large, and communities so independent in their socia tion, as to require separate histories. So dependent states too may have been, likely to become independent; but w tinue in dependence, their history m

more or less defective in the political element. The details which go to make up history are conditioned by the limitations of the subject thus defined. Everything that is within human knowledge, and much that is beyond it, bears on universal history at some point or other; but in selecting a particular subject, as the history of a particular state for a given period, the historian limits himself by preference to those facts which have the most immediate bearing on his subject, and according to the extent of his scheme will be the number of facts he is able to admit into it. In a detailed history of the Napoleonic era a somewhat minute account of the circumstances connected with the birth and early training of Napoleon Bonaparte might with perfect propriety be given, as tending to form a more accurate conception of the master-spirit of the age, and in general in introducing any important character a historian renders a great service to his readers by indicating so much of his previous career as to enable them again readily to identify him, but to give distinct biographies even of all the important characters would disintegrate the most detailed history, and only make it irrelevant and ridiculous. It would thus appear that even particular histories are limited rather by the limited range of human faculties, and the laws of proportion which these impose, than by the conditions of the subject itself. The life of every peasant in France affects to some extent the history of France. If he is industrious he adds to the wealth of his country; if he is idle he adds to its poverty; by marrying he may contribute to increase its population; by remaining single he helps to retard or keep it stationary. If he is loyal and patriotic, or factious and intriguing, liberal or conservative, moral and religious or the reverse, he contributes in all these ways influences infinitesimal in relation to the mass, but of the very same kind and weight as the other influences of a primary order, which, by combination and mutual pressure, go to make up the mass of sensibility and capacity for action, which, when it receives a common direction from some ruling mind, becomes the collective life of France. Yet it is much if a historian in the midst of complicated political transactions occasionally bestows a few pages on the peasantry of a country in the mass.

History has been defined as being or containing an art, a science, and a philosophy; but before proceeding to notice the various theories regarding it, it will be convenient to take a glance at the extent and divisions of the field of history as actually cultivated. History may be conveniently divided into ancient, mediæval, and modern. In each of these periods a connected group of nations is to be found, which, by their mutual action on each other, have produced the general state of civilization during the period in the principal or ruling populations of the world. This progressive civilization has been transmitted in a course never wholly interrupted down to the present time, and is now the heritage chiefly of the European na-ions, their American descendants, and such Asiatic, ican, and other communities as are under their ediate influence. In each of the periods there e been nations, as in India or China, which have r had no relations with the common group, or exercised a comparatively feeble and intermit-fluence on it, but which, either alone or in a f their own, have maintained an independent on, and have kept or transmitted records ess authentic of their progress. We shall selves in the present outline to the former

st histories are to be found in the can-f the Old Testament, which are received d by the leading bodies of Christians as of divine inspiration and authority. In the books of Moses we have the only primeval history. Beginning with the creation of man, he traces the descent of Abraham, the ancestor of the Jews, from the first pair, and gives an outline of the history of the world up to the commencement of his Jewish history, containing such important incidents as the general deluge, the confusion of tongues, the dispersion of men in various nations over the earth, which are mentioned by no other historian, and must either be accepted or rejected on his testimony. Some critics have affected to treat the history of Moses as mythical, but it will be found to differ materially from other myths in the plainness and consistency of the narrative, and in the entire absence in the deeds of his heroes of the element of the marvellous, which is strictly confined to cases of divine interference. The chronology of Moses, from variety of versions and of principles of interpretation, has hitherto baffled the ingenuity of critics, and no explanation of it can be said to be satisfactorily established. Leaving out of view the biblical records, the earliest historical documents show mankind divided over the earth in various groups of nations belonging to a few leading races markedly distinguished from one another, and speaking languages similarly grouped and distinguished, namely, as the numerous dialects derived from a few parent stocks. From the earliest period these various races seem as at present to have in some instances kept themselves well distinguished; in others to have become blended by extensive migrations. The date of the earliest historical records is a much disputed point of criticism on which we do not here enter. To the Jewish historians after Moses we are indebted for a continuation of Jewish history, either in the form of chronicles, or mixed up with visions and prophecies, together with many valuable notices of the surrounding nations, concerning which they are frequently our only sources of information. With the exception of monumental remains, inscriptions, coins, and other relics, the Greek writers who investigated eastern records and traditions are our only other authorities for eastern history during the greatness of Egypt, Assyria, Babylon, and Persia. Along with those the Ethiopians, lying beyond Upper Egypt; the Phœnicians, Medes, Lydians; the Mongolian tribes, described as Scythians and by other vague names; the inhabitants of Arabia and of part of the Indian peninsula, that is, the inhabitants of Western Asia and the contiguous portion of Africa, formed the principal groups of nations in the cycles of civilization preceding the period of authentic Greek history. Magnificent architectural remains, some astronomical records, and other hints of scientific progress; confused accounts of extensive wars and conquests, leaving a strong impression of the absolute despotism of the rulers and the helpless subjection of the peoples, make up the general picture of a period extending over much more than 1000 years, and which doubtless had more attractive details to those who were better acquainted with it. The Jews with their literature and laws, and the Phœnicians with their commerce, make perhaps the most notable variations on this prevalent impression.

The earliest Greek historian was Herodotus, and nearly contemporary with him were Thucydides and Xenophon. The former dealt largely with eastern history. Herodotus proposes as the end of his history to describe the triumph of Europe in its struggle with Asia. He had visited Egypt and the East, and he describes the countries around Greece, but it is on Greece that his history centres. It thus marks the introduction both of a new epoch in history and of a new sphere to which its interest is to be transferred. The era of classical history, as it is called,

embraces the history both of Greece and Rome; and the Greek and Latin historians, whether treating of their own or other countries, are likewise termed classical. The leading Greek historians besides those named are Polybius, Dionysius of Halicarnassus, Diodorus Siculus, Arrian, and Plutarch. Of these and most of the other names mentioned in this article fuller details will be found elsewhere. The early history of Greece is remarkable for richness in mythological detail, and mythology, in the case of nearly every country, precedes authentic history. Herodotus treats, by way of introduction, of the mythical period, and ends his history with the invasion of Xerxes (B.C. 480–78). Thucydides, again, treats in a philosophical spirit of the contemporary history of Greece. After Xenophon, who continued the history of Thucydides down to the battle of Mantineia (B.C. 362), contemporary writers of Greek history are rare. The early history of Rome, like that of Greece, is largely mythological. Its principal historian is Livy, whose history, only part of which is extant, extended from the foundation of the city almost to the beginning of the Christian era, and who, with the Greek historian Polybius, is the chief authority for the Punic wars. The principal names among the Roman historians, besides Livy, are Sallust, Cæsar, Suetonius, and Tacitus. The history of Rome is carried down by the last of these writers almost to the close of the first century of the Christian era. From this time till the reign of Constantine Roman history is imperfectly recorded. From Constantine to the division of the empire by Valentinian in 364 contemporary historians are more numerous, and ecclesiastical history takes the form of a distinct branch of literature. To the beginning of this period belongs Eusebius. The ecclesiastical spirit which pervades the whole period of the middle ages had already begun to dominate the empire, and from the dissolution of the unity of imperial rule the new epoch which it distinguishes may be formally dated. The fall of the Roman Empire, and the gradual rise and formation of the modern European family of states, is the chief political distinction of this epoch. Although, as might be expected from the nature of the events it comprises, many parts, especially of the earlier portion of the history of this epoch, are obscure, yet it may as a whole be distinguished historically by a considerable advance in one respect even over the classic periods of Greece and Rome. Although comparatively destitute of great historians, the different countries into which Europe was divided had, in the cloisters of the monks, numerous chroniclers or writers of annals. At no previous time were the independent sources of historical information, at least those to which we now have access, so numerous. At the brightest periods of Greek and Roman literature we know little of other countries but what is directly told by the classic writers, and even in the histories of the dominant states themselves there are considerable *lacunæ*. We have here, however, independent records of numerous different states, and authentic history not only in its general results, but in its minute divergences, begins to be securely seated. Historically the middle ages may be called the era of annals. It is true that many of these chronicles are of a very low class. They are frequently written in annual sections, in chronological order, and without continuous narrative. This was the general form adopted by the monks in what are called the dark ages. All the mediæval historians were not, however, mere chroniclers, but the extended and narrative histories, even when strictly contemporary, were often largely mixed with mythical and even purely imaginative details. This was still more the case with the compilations of the period. The laws of historical evidence, and the value of historical accuracy, were unknown or unregarded. But there were always exceptions to this prevailing character, and in its later period the mediæval era can boast historians of a higher class. Gregory of Tours in France, and the venerable Bede in England, both ecclesiastical historians, are the names most worthy of mention in the early middle ages. From the eighth to the thirteenth century Italy had numerous Latin chroniclers. History received a fresh impulse, especially in France, from the Crusades: Joinville, Froissart, and Commines are all eminent writers of contemporary history. In Italy too, from the thirteenth century, vernacular historical writers of a superior order are found. The Eastern Empire had also its chroniclers, various collections of whose works have been made. The only one of its historians who has acquired much European renown is Anna Comnena, the daughter of the emperor. The Scandinavian annals during the middle ages have an original and distinctive character. The close of the middle ages, and the opening of the period of modern history, is distinguished as the period of the revival of letters, or according to the more general and accurate French term, the *Renaissance*. The modern period has many marks which justify us in regarding it as distinct from the mediæval. The fall of the Greek Empire, the immediate occasion of the revival of Greek learning in Europe, is usually regarded as the dividing line. The discoveries of navigators, by which America and India were opened up to Europe, suddenly expanded the influence of European civilization over a widely-extended area, and the impetus thus acquired has since caused it to penetrate with a force which is still growing to the most remote and inaccessible regions of the earth. The Reformation, by establishing liberty of opinion, overthrew the ecclesiastical domination by which the middle ages were distinguished, and prepared the way for the conquest of political liberty and the establishment of popular influence as a preponderating power in state constitutions and in social life. The art of printing has given literature and science a stability and permanence hitherto unknown. The materials for historical composition have been vastly increased: the era of annals is ended, and that of statistics has begun. With this increase in amount and security in the preservation of material, various changes in historical method have been made, and the science of historical criticism has been established. Hence in regard to history the modern era has a retrospective aspect. In virtue of historical criticism modern historians have taken possession of past epochs, and in modern history may be comprehended both the history of modern times and modern contributions to universal history. The modern era has one other distinction of great importance in a historical point of view: it is unfinished. There is in fact no absolute break in the progress of human affairs, but the epochs into which history is divided are not merely arbitrary and conventional. We recognize in past cycles of progress elements in the combinations of society which have passed away, and we can to a certain extent sum up the results of these past combinations, and estimate their value. The new forces which have taken the place of the old, from the Renaissance to the Reformation, are still in full process of development in the forms of modern civilization. Minor movements, which may be said to constitute on a smaller scale complete cycles of progress, have since then taken place. There have been the English Revolution and the French Revolution, and there has been more recently a general overturning of despotism throughout Europe, followed by a partial reac-

tion, which may, perhaps, for the present be said to have fixed the results of the revolutionary movement. But the same forces which have produced these, among other results, are still in active operation, and have not even yet reached their full development, so that it is impossible for any one to foresee when or how the present cycle of progress will culminate, or in what new combinations it will result.

The race of modern historians may be said to begin with the revival of letters; but even in the nineteenth century the principles of historical criticism have been remodelled, nor can they even yet be said to be fixed on a permanent basis. We shall not attempt anything like a classified enumeration of modern historians, but shall only, as in previous epochs, mention a few leading names by way of illustration. In Italy Macchiavelli, Guicciardini, and Muratori are among the leading national historians. The last has collected the Italian chroniclers from A.D. 500 to 1500. Of Spanish historians we may mention Mendoza, Morales, and Herrera. Germany had few distinguished historians before the eighteenth century; but since then historical criticism, like other branches of learning, has made great progress in Germany, and Niebühr, Ranke, Neander, Gervinus, Schlosser, and many others have acquired a European reputation. In France and England also the names are almost too numerous for selection. Mézeray, Bossuet, Montesquieu, Voltaire, Thierry, Sismondi, Guizot, Thiers, Martin, and Michelet are well known. Of English historians Burnet, Clarendon, Gibbon, Hume, Robertson, Hallam, Macaulay, Mill, Grote, Carlyle, Freeman, Froude, Green, Stubbs, Burton, and many other names will readily suggest themselves. English literature has also been enriched by the works of such American historians as Prescott, Irving, Bancroft, and Motley. The Danes, Russians, Swedes, Bohemians, and other Scandinavian and Slavonian nations have also their historians, but their works are comparatively little referred to in English literature

In dealing with the theories of historical method a few observations on the qualifications of the historian will be a necessary preliminary, and in this respect history may be fitly treated as an art. The reason why it is desirable to begin the consideration of theories of historical method with the qualifications of the historian, is because the historian must always be an individual, and as such limited in his powers. A long list might easily be made of the collateral branches of knowledge of which the historian ought to be master; but in truth there is no limit to them, and it is sufficient to observe that the historian ought to be a man of good general education, and of competent knowledge of the world. Modern science, while it has greatly increased the difficulties of the historian's task, has given him innumerable collateral aids, and on these he must rely if he is to do his work efficiently. Chronology is rather a branch of history than a collateral study; in the first rank of collateral sciences may be ranked geography, biography, and law. There are also various collateral studies requiring much labour, and which are exclusively or chiefly valuable for their historical uses; such are heraldry, numismatics, and in general the whole range of antiquarian sciences. Further than this we need not go, as all the sciences might be named in turn. That which qualifies a historian for a particular task is the consciousness of some special qualification for it. The facts of history are so innumerable, and the theories to which they may give rise so diversified, that there is ample scope for all the individual appreciations which may be made of any section of it. Perhaps the art to which history may be most aptly compared, although the comparison is from the greater to the less, is painting. It has often been observed that although nature supplies materials in abundance to the artist, she refuses to make pictures. In like manner, and with equal truth, it may be said that human society does not make history, but only supplies materials to the historian. In choice of subject, mode of treatment, proportion, colouring, and all the details of art, the historian, like the artist, is left entirely to himself. The subject of course imposes certain conditions, but these the artist may modify by proposing to treat the subject in any special way he chooses. If the history, for example, of a particular state for a particular period is chosen, there are certain fixed conditions to be complied with. There are public official acts, such as laws and treaties, which must be recorded; but the mere recording of these is the work of a chronicler, not of a historian. For the purposes of a historian the relative value of public acts differs incalculably, and of many of them even the minutest historian will take no notice, yet how innumerable are the antecedents and consequents even of the most unimportant, of which an exhaustive history would have to take cognizance. But while the historian is necessarily silent as to many official acts, the interpretation of others will strain his faculties to the utmost. In dealing with such matters the historian may be guided by either of two distinct principles, each of which when fairly applied is equally legitimate in its own way: he may deal with the transactions, or with the causes and results of particular transactions which he deems most important in themselves, or with those which he considers himself best qualified to illustrate. He may be a party historian writing to vindicate his party, a specialist having a particular theory of the period to elucidate, or a historian for the sake of history itself. The qualifications of a historian, as an artist, ought to be both general and special. The general qualifications imply not only good general education, but superior natural capacity. He is the guide of other men in the department of knowledge which of all others, perhaps, requires most practical wisdom. According to Lord Bacon's celebrated division, history is that department of human knowledge which relates to memory, while philosophy relates to reason, and poetry to imagination. Whatever may have been the case in the dawn of history, there does not now seem to be the slightest reason for associating it more than any other branch of knowledge with memory; but from the extreme difficulties of historical investigation, difficulties which affect not merely as in natural science matters of fact, nor as in philosophy matters of speculation, but both matters of fact and speculation involved in a web of human interests and passions in every variety of complication, the quality which ought to be specially associated with the work of the historian is judgment. This is in fact the creative faculty in history, and that which distinguishes it from mere chronicle. The historian ought also to be not only wiser but better than other men. He must weigh evidence not merely as a lawyer, but as a man, and his judgment must have that intuitive delicacy which is derived only from extensive knowledge of human nature, combined with benevolence and purity of intention. The last general qualification of a historian we shall mention is his style. The style of a historian is not merely his method of composing sentences, but his entire mode of framing and presenting his conceptions to his readers. The best historians have always been distinguished for the elevation of their style, and the subject before him often leads the historical writer, who enters thoroughly into it, to a sustained eloquence of the highest kind.

The special qualifications of the historian lead us to the consideration of history as a science. When a historian has chosen his subject, whatever may be his qualifications for it, he has no right to be idle. If he is a general historian he will be expected to form a special acquaintance with the science and literature of the period he proposes to illustrate, and to master its statistics, and its social as well as political movements. With whatever theoretical views he approaches his task he is bound to conform his work to established laws of criticism, to submit his facts to patient and impartial investigation, and to suppress nothing consciously in deference to his own particular theories. These are the scientific requirements of his art, and he is to be condemned as a historian if he neglects them, whatever his special object as a historical writer may be. Early writers of history, both classical and mediæval, deemed themselves justified in making free use of mythological materials in their histories, when authentic facts were not accessible, and sometimes when they were distasteful. Certain old historians, such as Boece, deliberately coined fictions for the glorification of their country, and the classical writers before them frequently trode in the same track. Niebühr, who had made himself intimately acquainted with the history and mythology of antiquity, thought he had materials for reconstructing the ancient history of Rome by a process of constructive criticism. His work has, however, been subjected to severe criticism by Sir George Cornwall Lewis and other historical writers, and has not as a whole stood the test. Sir George Lewis lays down the canon of criticism, that the testimony of contemporary witnesses is the indispensable condition of genuine history. The faith often too readily reposed in ancient monuments is affected by this principle. Evidence of the accuracy of the information, and honesty of intention of the inscriber is necessary to give validity to an inscription. When we consider moreover the difficulty of constructing authentic history even from contemporary evidence, of which every newspaper reader may judge, some idea may be formed of the formidable nature of the historian's task. The application of these rigid rules must tend to restrict the domain of history, but perhaps the loss is more apparent than real. Another observation of Lewis, that negative results are important and useful, as well as positive, is in this connection well worthy of being remembered. Myths once considered as purely local have by philological investigation been traced up to general figures of speech contained in the common sources of languages widely sundered. But while the topographical value of the myth has thus been destroyed, it still remains a fact of history. The different form it takes among different peoples indicates differences of character, and it may possibly also be assumed to have a positive historical significance, though of a different kind from that formerly attributed to it. A mythical ancestry is not usually considered very creditable to the individual who assumes it, and when a people adopts a mythical history it may perhaps be concluded that their authentic history has hitherto contained little of importance. As a man who has distinguished himself looks round for an ancestry, so a nation when it has come to achieve a place in history is willing to show that its beginnings have been worthy of its subsequent renown. The myth in such cases is not likely to conceal so much glory as the imagination may be ready to concede. The case is somewhat different with the losses of history from the destruction of records; but as this can only happen in the case of forms of civilization which have not been able to maintain themselves, we may perhaps have in their actual remains, and the fact of their passing away, the most valuable records they had to leave us. The work of reconstructing history will, however, always present attractions to the imagination, and independently of any recognition it may obtain from authentic history will maintain its own place in literature.

The theoretical views with which historians may approach their task remain to be considered, as constituting the philosophy of history. This is an ancient distinction. Without bringing something in the form of theoretical principles to his task the historian would be unable to perform it. All historians, ancient and modern, have observed analogies and apparent repetitions in the actions they have recorded, and they have attributed the similarity of actions to similarity of causes. Thus Thucydides was called a philosophical historian, because he showed a marked disposition for tracing facts to their origin and drawing conclusions. Aristotle attempted to reduce the principles of history to order and form them into general laws, and the same attempt has been made by other philosophers down to modern times. The various views with which historians write may be classified, and we shall attempt a division of them into a few leading varieties, premising that the different classes frequently cross each other. The first, and perhaps the largest class, is what we may call practical historians. These are those who, without any special theory, adopt the views of the society in which they happen to live, or of some particular section of it, and appeal without any special preparation to a common judgment assumed to exist between their readers and themselves. Such a historian may observe a progression in the state of society from a previous condition to the one actually existing, and of which he approves as preferable; and he may take up some part of this progression, and narrate it with criticism founded on this judgment, in which he counts on the sympathy of his contemporaries, and probably of their descendants; or he may apply the general principles of justice and expediency which he assumes to be prevalent in the society he addresses to any historical subject. The characteristic of this class is its dependence on sympathy. A writer who distinctly proclaims himself an advocate of particular views may interest us even when we dissent from his opinions; but one who assumes our coincidence of judgment repels if he fails to secure it. As types of this class we may mention Hallam and Macaulay. The next class of historians may be called political. They differ from the preceding only in being open and avowed advocates of a class of opinions current in the society to which they belong. Sir Archibald Alison may be taken as a representative of this class. A third class consists of those who adopt defined views of the particular period in illustration of which they write, as Gibbon and Montesquieu in his Grandeur et Décadence des Romains. To this class belong all specialists and historians who describe particular eras and evolutions. The fourth class consists of historians who take as their guide general philosophical principles, in addition to any practical views or defined views of particular periods, and who may consequently be called distinctively philosophical historians. As an illustration of this class we shall take first what may be called the religious view of history. A practical or special historian may have religious views, and may be ruled by them consciously or unconsciously in the formation of his judgments; but what we understand by the religious view of history, is the special application to the facts of history of particular views of divine government or interference, and the attempt to trace the connection of one with the other. As an example of such a work we may mention D'Aubigné's History of the Refor-

mation. A fifth class may also be mentioned, which professes to record events without pretending to judge of them. The French historian, Augustin Thierry, is said to represent this school, but its scheme may fairly be dismissed as impracticable. To write history without judging it is not given to man. Isolated events may be so recorded, but wherever there is a record of a connected series of events the judgment of the historian insensibly mingles with it. Until recently this enumeration of methods of writing history might perhaps have been considered exhaustive; but another theory of method has lately acquired so much importance as to demand more particular notice, we mean the theory of induction, which, though it claims to be scientific, we class for reasons which will presently appear as philosophical. According to Edgar Quinet the idea of universal history is a modern one, and the idea that universal history consisted in the preparation of all things for the coming of the Messiah is the first which has marked history with a philosophical character. Quinet seems to have overlooked the primitive history of Moses; but, according to his idea, Christian divines from Augustine and Eusebius to Bossuet are to be credited with the first application of a universal philosophical principle to history. Until comparatively recent times no other universal principle but the religious one was attempted to be systematically applied to history. Montesquieu's work L'Esprit des Lois may perhaps be considered as a feeling for some such principle. He collects many evidences of the operation of general causes in human affairs; but while he may be considered a precursor of the theorists, he cannot himself be held responsible for any general theory. Giovanni Battista Vico, an Italian philosopher, who died in 1744, seems to have propounded the first general theory of history. It was based rather on a view of divine Providence than of strict natural law. His view was that human affairs moved in a cycle beginning with a religious epoch, passing through a heroic, and ending with a human or rational period, out of which the religious was evolved again. Herder adopted the natural theory that history is the necessary result of the exercise of human faculties in the midst of various natural surroundings. He carried his studies into the phenomena of animal life, natural science, geographical conditions, &c., thus extending the lines of investigation opened by Montesquieu. Kant, in his idea of a universal history in a cosmopolitan point of view, gave a powerful impulse to the theory of natural evolution. 'Whatever,' he said, 'might be the conception of the liberty of the will which one may form in a metaphysical point of view, its phenomena, human actions, are determined, as well as every other kind of natural events, according to universal laws of nature. It is to be hoped that history, which is occupied with the narrative of these phenomena, will, when it contemplates the play of the liberty of the human will on a large scale, discover a regular course in it; so that what seems irregular and capricious in individual cases shall appear as a continually progressing, though slow unfolding of its original tendencies.' At length a bold attempt was made by Henry Thomas Buckle to lay down the natural principles of evolution, and illustrate them in a practical example in his History of Civilization in England, which his early death unfortunately prevented him from carrying out. Buckle observes that the spirit of generalization is less active among historians than among men of science, which he attributes partly to the inferior ability of the former, partly to the difficulties of the subject. He holds that the phenomena of history, like those of natural science, are capable of discovery or prediction by a process of scientific induction. He distinguishes the ideas which influence human actions into two classes, the intellectual and moral; and he holds that while the former are capable of continuous progress with the progressive advance of human knowledge, the latter are comparatively constant, and that their relative force consequently diminishes as the force of the intellectual increases. The great impediment to this advance is what he calls the protective spirit, which is chiefly represented in the interference with the natural progress of society by governments and priests. For all notions of supernatural, or direct divine interference in human affairs, Buckle has one name, superstition; and he believes that superstition will diminish proportionally with the advance and general diffusion of scientific knowledge.

The theory of scientific induction has had other able advocates both in this country and the Continent, but it has not hitherto been attended with any practical results at all commensurate with the pretensions of its exponents; nor is this matter of much surprise, seeing that it necessarily deals much more in assumption than is consistent with the existence of an inductive science. Some of the positions of its supporters indeed may be freely admitted, and for others a wide observation of the course of history appears to afford plausible ground, but this is only when they are kept within limits inadequate for the purposes of an exhaustive science. It is certain that many of the facts in human history are to be accounted for on general principles, and it is in the highest degree likely that the wider our acquaintance with history becomes the greater will be the number of facts of this kind that we shall be able to discover. It is also certain that exceptional and erratic developments in history, local, tribal, or national peculiarities are often to be explained by the operation of natural causes, climate, soil, long-continued habits, &c. If on these and like grounds it is proposed to establish a science of historical induction with a view to ascertain how far it will carry us in accounting for the facts of history no exception can be taken to the reasonableness of the proposal. This is what has been done by Montesquieu, but the zeal of the modern advocates of the induction theory has carried them much further; they boldly assert the theoretical practicability of an exhaustive induction, and assume that, as in other sciences, the results of their method will be in proportion to their progress towards this consummation. But the theory of an exhaustive induction from the facts of history, howsoever propounded, will ally itself only with a positive philosophy. Two things it must necessarily exclude, the power of the individual will and the operation of supernatural agency in human affairs. It is on this ground that we consider the inductive theory entitled only to rank as one of the philosophical methods of viewing history, and not as exclusively a science of history. Like other philosophical methods it brings with it to the investigation of history not only a method but a theory, and the examination of that theory belongs to philosophy and not to history. It is true the advocates of the theory allege historical grounds for their positions, and these in regard to the two points alluded to we shall here examine.

The majority of historians, like the majority of mankind, have always associated religion in some way with human affairs. If we examine particular instances of this association we shall undoubtedly discover that great mistakes have been made in connection with it. Many of these mistakes have been demonstrated by the progress of science, others have been condemned by the common sense of mankind. No one now believes in the polytheism of

Greece and Rome, and many ancient notions of divine or superhuman interference in the affairs of men have thus passed away. The Christian religion has introduced or carried down from the Jewish another series of ideas of divine or spiritual influence. In modern history we have had many opportunities of observing the misapplication of this class of ideas also. The older historians of Great Britain were in the habit of attributing many things to divine interference which no historian of the present day would dare to do. Hence it is argued that the result of the progress of science has constantly been to remove the supernatural further from the sphere of human affairs, and that it only requires a more complete diffusion of scientific knowledge to put an end to the notion of supernatural interference altogether. But the historical evidence for this conclusion, so far from being complete, is not even uniform. The idea of a divine Providence is not peculiar to the Christian religion. It has been shared by men of every country, irrespective of their peculiar creeds. The religions that have passed away had this in common with the religion that has succeeded them, so that even their disappearance cannot be counted a complete triumph to the opponents of the general doctrine. However this doctrine may be slighted by a class of modern critics, moreover, they have not even succeeded in convincing the whole of their own class. There are still scholars and men of science who believe in Providence. The most thoughtful historians, in particular, have always been ready to refer much in human affairs to a divine guidance. It is true that, in particular cases, many things referred to Providence might have been explained by natural causes, and that the doctrine of Providence has thus often stood as the representative of the ignorance or indolence of the historian. This may very well serve as a lesson of caution, but it will not suffice as a foundation for the inference that no supernatural interference with human affairs ever takes place. It is quite conceivable that there might be a constant divine guidance of these affairs so conducted that while men might be able to discover that they were in some way supernaturally affected, they could in no instance accurately define the mode or extent of interference. Unless, then, it can be proved by an exhaustive examination of all the facts that neither upon the minds nor the circumstances of the actors in history any supernatural influence has ever been exerted, the conditions of an exhaustive induction cannot be brought within the domain of history. It is evident that this proof can never be made complete, hence the advocates of the inductive theory have no right to call their method exclusively a science of history. There is no fact in history of which the causes, whether natural or supernatural, can be exhaustively known, and when a historian has used all diligence in investigating the facts, he does not act more unphilosophically in referring the unknown residuum to a divine guidance, including therein any unknown natural causes, than in referring the whole to such causes. In regard to the minds of men themselves, it is well known that the motives by which they are influenced are not purely rational. Imagination, at least, plays a considerable part in them, and who is able to say that no divine influence is exerted in the modes in which natural objects impress them? This at least is a permanent part of man's nature, and no prospect could be more hopeless than the expectation of the inductionists that science will ever reduce men to *mere* reasoning machines, working only on strictly known data. Imagination, however, though not bounded by logical rules, is in its nature essentially reasonable. Its office is to go before and anticipate the formal decisions of reason, and in doing so it has often done science good service. When the historian finds something extraordinary in a particular course of events, an extended order and sequence, for example, which seem beyond human skill and arrangement, this intuitive faculty often leads him to refer the whole to a divine guidance. Can he be charged with violating any principle of science or philosophy in doing so? It would seem indeed that in so acting he is only obeying an inherent tendency of the human mind to refer the unknown to a first cause instead of to secondary causes. If such a tendency is implanted in the mind of man by his Creator it must be of itself a vast moral force, combining with, but not reducible to, the ordinary or scientific data of human intelligence. The search for secondary or intermediate causes which science inculcates does not necessarily interfere with the existence of such a tendency, but only corrects or postpones its application. The search for causes in connected sequence must necessarily be endless, but the mind of man seeks repose, and can find it only in going straight through the intermediate to the final cause. The general practice of historians, therefore, of referring human affairs ultimately to a divine Providence is entitled to some weight, as well as particular instances of their errors in assuming special interferences. And if in addition to any such natural tendency a historian, on grounds independent of history, believes in a particular revelation of the will of God, such as that contained in the Christian religion, he is no more than the Positivist open to the reproach of superstition for bringing his views into his treatment of history. In each case the belief must be tried on its own grounds. If there is a divine plan in history it must necessarily be the thing most worthy of study. The idea that amid the ever-changing scene there is one constant Actor gives a unity and sublimity to the study of history that no theory of evolution can possibly supply. It would indeed be rash for men to assume that even supposing the divine Being to have a purpose in human history they are competent fully to comprehend it, but it would be equally rash to assume that they are incapable of knowing anything of it. Reason would rather seem to indicate that it may be of a nature fitted for their instruction. The religious historian is not to blame in seeking indications of this plan. The theory already referred to, which is shared by all the leading Christian historians, that ancient history was a preparation for the coming of Christ is supported by a far stronger array of cumulative evidence in history itself than any of the positions of Buckle; and the correlative theory, which is equally the faith of Christians, that all subsequent history is a preparation for the second coming of Christ, while giving a unity and moral purpose to the whole, leaves as ample scope for any reasonable theory of natural development as the most ardent evolutionist need desire. Particular interpretations of particular epochs is more dangerous ground, but cannot be forbidden to the religious any more than to the philosophical historian. A devout Protestant, for example, could hardly help seeing a divine purpose in the Reformation; and, in general, if a divine plan is admitted at all, any complete evolution of history must necessarily be admitted to be part of it, while the particular interpretation of the evolution must always be at the historian's own risk. Further than this a prudent historian will hardly seek to go.

The position of the inductive theory is hardly more fortunate in regard to individual influence in history. It is to the theory a rigid necessity that this influence should be wholly eliminated, and it is sufficiently remarkable that Buckle, who starts with the determination of drawing his philosophical principles by

an inductive process from historical facts, arrives at a necessitarian doctrine as rigid as that of the highest Calvinist. In this, as in the previous case, the inductive theory has some plausible ground to go upon. To the superficial reader of history individual influence seems to be the omnipotent and all-ruling force. As we look more closely, this predominance rapidly diminishes, and to the practised eye of the evolutionist it gives way to the prostration of absolute impotence. To older philosophers the concurrence of the man and the epoch seemed at least a striking and remarkable coincidence; to the believer in a divine Providence it was a proof of design; to the evolutionist the man is simply the creation of the epoch. This theory is to a great extent true; but its truth does not extend far enough to destroy all the disturbing effects of individuality. The English Reformation, for example, owed much to the character of Henry the Eighth, but the uxoriousness of Henry can hardly be said to have been evolved out of the circumstances of the epoch. The period of the French Revolution again afforded great facility for the rise of a soldier like Napoleon, but can it be credited with giving Napoleon the great administrative ability which enabled him to stamp a permanent character upon the epoch? Moreover, there appears to be no evidence that among the various improvements going on in the world any one has in the least degree enlarged the average capacity of the human intellect. If we take individual specimens, the best men of the present day are probably not superior in intellectual capacity to Moses or Socrates. On the other hand, it may be granted that modern civilization has tended considerably to suppress individuality, and seems likely to do so still more in the future. But even with this favourable circumstance there appears to be little prospect of the induction principle ever being carried much beyond the domain of political economy in its widest sense, within which its greatest strength has hitherto been shown. If we were disposed to make a contribution to the inductive philosophy it would be in the form of a law, which, though founded on a very commonly observed series of facts, we have not yet seen formally laid down, and which we may call the law of the economy of motive. This law is founded on one of the most general facts of history, the strong tendency of human nature to imitation. This tendency has been observed in every epoch. It has greatly influenced the European group of nations, for example, even in the times when communication between them was most rare and difficult, and has often maintained a social equilibrium in communities which otherwise seemed tending to chaos. The law which we propose to deduce from this tendency may be illustrated in this way. When two nations go to war, one of them at least must have a distinct motive for doing so. It is less necessary that there should be a distinct motive for a third nation to join them, and the necessity diminishes again in the case of a fourth, and so on, the force of every additional example being added to the last, until at length the historian ought, perhaps, to consider the probability to be against the existence of an independent motive, and to admit it with difficulty. That imitation has a real influence even in regard to war, might be proved by numerous instances both ancient and modern. But the power of imitation increases with the mass, and is necessarily greatest in popular movements. At the present day, when society is governed so largely by the popular will, and when the facility of communication is welding the most civilized nations into one, an immense economy of motive is effected, which ought to be greatly to the profit of the evolutionist. No one, indeed, can help remarking the strong tone of imitation in modern society. But even with all this compression of individuality human nature has not wholly lost its energy, and we may still count in each recurring crisis on some individual springing up into some act of unprompted activity. On the whole, we may, perhaps, safely conclude that history will continue to be a series of human judgments upon human affairs, and that however its methods may be modified by auxiliary aids the true types of the historian will still be original observers like Herodotus, Joinville, and Froissart, men of constructive genius like Gibbon, and philosophic critics like Montesquieu.

HITCHCOCK, EDWARD, an American geologist, was born at Deerfield in Massachusetts on May 24, 1793, and died at Amherst in the same state, on February 27, 1864. After being principal of Deerfield Academy and for four years minister of a Congregational church at Conway, Massachusetts, he was appointed in 1825 professor of chemistry and natural history at Amherst College, and in 1845 president of the same college and professor of natural theology and geology. In 1850 he visited Europe as commissioner appointed by his native state to examine the agricultural schools there. In 1854 he resigned the presidency of Amherst College, but he retained his professorship till his death. Hitchcock's works include Geology of the Connecticut Valley (1823); a popular work on Elementary Geology; Religion of Geology (1851); and Reminiscences of Amherst College (1863).

HITCHIN, a market town of England, in the county of Hertford, 34 miles north of London. It lies in a fertile valley, is for the most part built of brick, and the streets are generally spacious. The parish church, St. Mary's, is of the later style of English Gothic, and contains some fine brasses of the 14th, 15th, and 16th centuries, and a fine altar-piece by Rubens. The town-hall includes a public library and mechanics' institution; and other buildings are the corn-exchange, grammar-school, orphanage, Brotherhood House, and alms-houses. There are malting-houses and breweries. Many females are employed in straw-plaiting. Lavender, for the making of lavender water, is largely grown here. Hitchin gives name to a parl. div. of the county. Pop. (1891), 8860; (1901), 10,072.

HITTITES, the name of several peoples mentioned in the Old Testament, and in Egyptian and Assyrian inscriptions. In the Old Testament the name is applied to three more or less distinct groups, namely, (1) the 'children of Heth' from whom Abraham purchased a burying-place (Gen. xxiii; see also xxvi. 34); (2) a people or group of peoples which inhabited Palestine before the Hebrews and resisted their invasion (Ex. iii. 8, 17; Josh. xxiv. 11, &c.); (3) a kingdom in north-eastern Syria (1 Kings x. 29; 2 Kings vii. 6), with which Solomon formed marriage alliances (1 Kings xi. 1). The first group dwelt around Hebron in southern Palestine, and the Hittites mentioned in connection with David, of whom the chief was Uriah, may be their descendants. The second group of Hittites dwelt among the mountains of central Palestine (Josh. xi. 3), and the third group, united in some sort of empire, had their seat still farther north. Of this Hittite empire we learn more from the Egyptian and Assyrian records than from the Old Testament. The Heta, according to the hieroglyphic inscriptions, offered a vigorous resistance in northern Syria to the Egyptian king Thutmosis III. (18th dyn.; c. 1560 B.C.), and to his successors of the 19th dynasty, Sethos I., Ramses II. and III.,

c. 1350–1200 B.C. Carchemish, Kadesh, and Hamath were among their chief cities. The cuneiform inscriptions contain notices of a people called Hatti who frequently fought with the Assyrians from the time of Tiglath-pileser I. (c. 1100 B.C.) till that of Sargon II. (721–704 B.C.), after which they are no more heard of. The Hittite monuments and inscriptions which have been found in Carchemish, Hamath, and neighbouring places, as well as throughout Asia Minor, appear to belong to the Assyrian period. The inscriptions have not yet been properly deciphered, but they appear to be written in characters similar to Egyptian hieroglyphs, and Jensen is of opinion that their language is an Aryan one, a sort of ancestor of Armenian. See Perrot and Chipiez's History of Ancient Art in Sardinia, &c. (vol. ii. 1890); works by Sayce and Wright; Jensen's Hittiter und Armenier (1898); and the article in the Ency. Bibl. (vol. ii. 1901).

HIVAOA, an island in the South Pacific Ocean, the largest of the south-western group of the Marquesas; 22 miles long east to west; about 10 miles greatest breadth. It is mountainous, and bears indications of volcanic eruptions. Pop. about 3000.

HIVE. See APIARY.

HIVITES, a Canaanitish tribe who in the time of Joshua are represented as dwelling in Mount Hermon from Mount Baal-Hermon to the entering in of Hamath, the valley between the ranges of Lebanon. Solomon subjected them to a regular tribute, as he did the remnants of the other tribes which still survived in the land (1 Kings x. 20, 21). Their name never occurs after Solomon's time.

HOADLY, BENJAMIN, an English prelate and celebrated controversialist, born on the 14th of November, 1676, at Westerham in Kent, entered Catherine Hall, Cambridge, as a pensioner in 1691, obtained a fellowship, and resigned it on marrying and becoming lecturer of St. Mildred in the Poultry, London. While thus officiating he became rector successively of St. Swithin's and St. Peter-le-Poor, and began to acquire distinction as a controversialist. His first appearance in this character was as the opponent of Mr. Calamy, a celebrated Dissenting minister, and led to the publication of his work in defence of conformity to the Church of England. His next opponent was the celebrated Dr. Atterbury, in answer to whom he published a defence of civil liberty, under the title of The Measures of Obedience. This work was so acceptable to the House of Commons that they presented an address to Queen Anne, recommending him for his signal services in the cause of civil and religious liberty. In 1710 he obtained the valuable rectory of Streatham, and shortly after the accession of George I. became such a favourite at court that in 1715 he was appointed Bishop of Bangor. His connection with this diocese is remembered chiefly on account of the notoriety obtained by what was called the Bangorian Controversy, which he originated by the publication of a sermon on the text, 'My kingdom is not of this world'. The see of Bangor he exchanged for that of Hereford in 1721, which he in 1723 quitted for that of Salisbury. He at last became stationary in that of Winchester, which he had occupied for above a quarter of a century when he died, on the 17th of April, 1761, aged eighty-five. His works were collected and published in 1773, in three vols. folio They are able, but abound in long and intricate sentences, on which account Pope celebrates him for his 'period of a mile'.

HOANG-HO, or YELLOW RIVER, a large river in China, the sources of which are in mountains in the Koko-Nor territory, north from Tibet, about lat. 34° 30′ N., and lon. 97° 30′ E. After flowing in all directions except south, through a winding course of several hundred miles, it proceeds nearly due north to about lat. 41°; then east for 200 miles, when it suddenly bends round, and flows directly south for other 200 miles; then turns abruptly east, and flows in that direction till it reaches Lung-men-kau, when it diverges to the north-east, and falls into the Gulf of Pe-che-le about lat. 37° 30′ and lon. 118° 30′. Its length is estimated at about 2600 miles, although the distance, in a direct line, from its source to its mouth, is only about half that. Formerly, after reaching Lung-men-kau it flowed south-east instead of north-east, and discharged itself into the Yellow Sea in lat. 34° N., and lon. 120° E. It is a turbid, furious, and impracticable stream, and is but little used for navigation. From its frequent floods the cities on its banks are in constant danger of being submerged; to prevent which, and other damage, great expense is incurred in maintaining artificial embankments. In its progress the Hoang-ho receives very few tributaries. It derives its name from the vast quantities of yellow mud held in a state of solution by its waters.

HOAR-FROST. See FROST.

HOBART, or up to 1881 (when the name was officially changed) HOBART TOWN, the capital of Tasmania, is picturesquely situated at the foot of Mount Wellington, on the river Derwent, about 12 miles from its mouth. The city proper is built in the form of a square on a series of hills, the wide, well-laid-out streets crossing each other at right angles. It is lighted with gas and electricity, and well supplied with water. Among the public buildings are the government house, a palatial castellated pile of white freestone; the government offices, the houses of parliament, the town-hall, with public library attached, the post-office, museum, Freemasons' Hall, the Episcopal and Roman Catholic cathedrals, the latter rebuilt in 1881, and several other places of worship, a technical and other schools, the general hospital, the new town invalid depot, and other charitable institutions, three market-houses, a theatre, &c. The principal places of out-door recreation are Franklin Square, near the centre of the town, provided with seats and sheltering trees, and containing a statue of Sir John Franklin, formerly governor of Tasmania; the Queen's Domain, the Royal Society's Gardens, &c. There are breweries, flour-mills, tanneries, woollen factories, an iron-foundry, jam factories, &c.; and in connection with the shipping three first class patent slips for the repair of large vessels. The harbour is easy of access, having sufficient depth for the largest vessels, and a capacity for almost any number. There is also ample wharf and dock accommodation for the loading, discharging, and repairing of ships. Regular steam communication exists between Melbourne and Sydney, and the Union steamers call on the way to and from New Zealand. Hobart is connected by rail with Launceston. Pop. (1900), 30,687; with suburbs, 42,000.

HOBBEMA, MEINDERT or MINDERHOUT, considered, next to J. Ruysdaal, the best of the Dutch landscape-painters, and as a colourist reckoned even superior to Ruysdaal. Various places have been mentioned as that of his birth, and for long the date was not known, but it has at last been discovered that he was born at Amsterdam in 1638. He died at Amsterdam in Dec. 1709. The figures in his landscapes are painted mostly by Berchem, Van de Velde, Lingelbach, and J. Van Loo. His paintings consist chiefly of forest scenes, ruins, villages, &c., and justly entitle him to a high place among landscape-painters, from the careful execution of the

details, particularly the foliage, the clearness of the composition, the strength and beauty of the colouring, and the fine shading of the tints. He so strongly resembles Ruisdael that he is generally supposed to have been his scholar, and some works formerly thought to be those of Ruisdael have now been discovered to be the productions of Hobbema. Some of the most celebrated works of this master are to be found in public or private galleries in France, Germany, and England. His greatest painting, A View in Holland, with figures painted by Adrien van de Velde, is contained in the Lyttelton collection.

HOBBES, THOMAS, a celebrated moral and political writer and philosopher of the seventeenth century. He was born April 5, 1588, within the borough of Malmesbury, in Wiltshire. In 1603 he became a student of Magdalen Hall, Oxford. In 1610 he set out on a tour with the son of Lord Hardwicke (afterwards Earl of Devonshire), through France and Italy; and after his return to England he resided several years in the Devonshire family as secretary to Lord Hardwicke. During this period Hobbes became acquainted with Lord Bacon (some of whose works he translated into Latin), Lord Herbert of Cherbury, and Ben Jonson. The first performance which he published was a translation of the history of Thucydides (1628). On a subsequent visit to the Continent he became acquainted with Gassendi at Paris, and Galileo at Pisa. In 1637 he returned to England, and resided much at Chatsworth till 1641, when, alarmed at the probability of political commotions, he went to Paris. He stayed abroad some years, and during that time published most of his works. In 1642 first appeared his treatise De Cive, afterwards published in England, with the title of Philosophical Rudiments concerning Government and Society, or a Dissertation concerning Man in his several Habitudes and Respects as a Member of Society, first Secular and then Sacred. His writings on mathematics are not important, yet he was employed to teach Prince Charles (afterwards Charles II.) the elements of mathematical philosophy. In 1650 was published, in London, a small treatise by Hobbes, entitled Human Nature; and another, De Corpore Politico, or Elements of Law, Moral and Politick. But the most remarkable of his works is his Leviathan, or the Matter, Form, and Power of a Commonwealth, ecclesiastical and civil (printed in London, 1651, folio). This greatly alarmed the ecclesiastics of those days, and drew on the author much literary hostility. Returning to England he was well received by the Devonshire family, in which he passed the remainder of his life. He continued to employ his pen on philosophical topics; and in 1654 he published a Letter about Liberty and Necessity. In 1658 appeared his Dissertation on Man, which completed his philosophical system, a work containing some singular notions relative to the moral and intellectual faculties of the human species. After the Restoration Hobbes was favourably received by the king, who promised him his protection, and settled on him a pension of £100 a year out of his privy purse. He was visited by Cosmo de' Medici, then prince and afterwards Duke of Tuscany, and by other foreigners of distinction. In 1666 his Leviathan was censured in Parliament, and a bill was introduced into the House of Commons to provide for the punishment of atheism and profaneness, which gave him great uneasiness. On this occasion, it is supposed, he composed his learned and ingenious work, entitled a Historical Narration concerning Heresy and the Punishment thereof, to show that he was not legally chargeable with heresy in writing and publishing his Leviathan. Among the principal literary labours of his later years were translations of Homer's Iliad and Odyssey in verse, which passed through three editions within ten years, though utterly destitute of poetical merit. His Decameron Physiologicum, or Ten Dialogues of Natural Philosophy, was published in 1678; as was also a Dialogue between a Philosopher and a Student of the Common Law of England; and in 1679 he consigned to the care of a bookseller his Behemoth, or a History of the Civil Wars from 1640 to 1660, which did not appear till after his death. That event took place December 4, 1679, at Hardwicke, a seat of the Earl of Devonshire, in Derbyshire. The first collected edition of his Latin works was published at Amsterdam in two vols. 4to, in 1668. His complete works, including both Latin and English, were first published in the edition of Sir William Molesworth (London, 1839–45, sixteen vols. 8vo). See Prof. Robertson's monograph (1886).

Few authors have encountered more opposition than the philosopher of Malmesbury. The imputation of irreligion was brought against him by his literary antagonists, and the justice of the charge cannot possibly be denied. Both with respect to religion and government he ascribes great weight to the will of the civil magistrate. And his sentiments on this point, together with his doctrine that a state of nature must be a state of perpetual hostility, in which brute force must supersede law and every other principle of action, have perhaps been most generally objected to. Yet his claim of obedience to existing authorities is qualified by the assertion that it is no longer due than while they can afford protection to the subject. He says expressly, '*Obligatio civium erga eum qui summam habet potestatem, tandem nec diutius permanere intelligitur, quam manet potentia cives protegendi.*' The philosophy of Hobbes, so depreciated among his contemporaries, has been more or less adopted by Locke, Hartley, Hume, and Priestley.

HOBBY. See FALCON.

HOBHOUSE, JOHN CAM. See BROUGHTON (LORD).

HOBSON'S CHOICE, a proverbial expression, denoting without an alternative. It is said to have had its origin in the practice of Hobson, a carrier at Cambridge in Milton's time, who let horses to the students, and obliged his customers to take the horses in rotation, that they might be worked equally. Milton wrote two epitaphs upon him.

HOCHE, LAZARE, general in the French revolutionary war, was born 1768 at Montreuil, near Versailles. He took service in the regiment of French guards when sixteen years old. On the outbreak of the revolution he joined the popular party. He greatly distinguished himself at the siege of Thionville and the defence of Dunkirk, and shortly afterwards, when scarcely twenty-five years of age, received the command of the army on the Moselle. Though at first compelled to retreat before the Duke of Brunswick, he afterwards defeated General Wurmser at Weissenburg; delivered Landau; took Germersheim, Spires, Worms, &c.; and drove the Austrians out of Alsace. The glory he acquired by these victories excited the jealousy of Pichegru, who accused Hoche of aiming at a dictatorship, in consequence of which he was removed from the head of the army which he had led to victory, on the pretence of being intrusted with a higher command, and then arrested and committed to prison (1793). In 1794 he was released, and towards the end of the same year was appointed commander of the army destined to quell the rising in the west, and afterwards to that in La Vendée, and in both cases he showed the capacities of a statesman as well as a general. In 1796 he conceived the plan of attacking Britain, by making a descent on Ireland. He accordingly set sail in December from Brest, but a storm dispersed the fleet: he found himself alone near the coast of the

enemy, and he was obliged to return from his expedition without having even effected a landing. After his return he received the command of the army of the Sambre and Meuse. He opened the campaign of 1797 by a bold passage over the Rhine in the face of the enemy. In four days he had marched with his army 35 leagues, had been victorious in three battles and five skirmishes, and taken Wetzlar, when he was stopped in the path of victory by the news of the armistice concluded in Italy. He died suddenly in September, same year (1797), soon after being placed at the head of the combined armies of the Sambre and Meuse and the Rhine and Moselle.

HOCHHEIM, a town in Prussia, in the province of Hesse-Nassau, 4 miles E.N.E. of Mayence. It is famous for its wine, called in Germany *Hochheimer*, from which is derived the English name *Hock*, applied indiscriminately to the wines of the Rhine, Main, &c. Pop. (1895), 3083; (1900), 3478.

HOCHKIRCH, a village in Saxony, 6 miles E.S.E. of Bautzen. It is memorable as the spot where, in 1758, the Prussians, under Frederick the Great, were surprised during the night by the Austrians, under Marshal Daun, and lost 100 cannon and 9000 prisoners. Marshal Keith, a Scotchman, and one of Frederick's best generals, was killed, and is buried in the church, where a monument has been erected to him.

HÖCHSTADT, a village in Bavaria, on the left bank of the Danube, near which the battle of Blenheim was fought. See BLENHEIM.

HOCK. See HOCHHEIM.

HODEIDAH, a seaport of Yemen, Arabia, on the Red Sea, a place of considerable and increasing trade. In 1897 it exported coffee valued at £534,141; the total imports were £705,231. Pop. 50,000.

HOEVEN, JAN VAN DER, a Dutch naturalist, born at Rotterdam in 1802; died at Leyden in 1868. After obtaining the degree of Doctor of Philosophy in 1822, and that of Doctor of Medicine in 1824, he set up as physician in Rotterdam, and in 1826 was appointed extraordinary, and in 1835 ordinary professor of zoology in the University of Leyden. His principal work is Handboek der Dierkunde (Handbook of Zoology; Leyden, 1827–33), in which he treats of the whole sphere of zoology from a physiological point of view. An English translation by Professor Clark was published in 1856–58. Among his other works may be mentioned his Bijdragen tot de natuurlijke Geschiedenis van den Negerstam (Contributions to the Natural History of the Negro Race, 1842); Bijdragen tot de natuurlijke Geschiedenis van den Mensch (Contributions to the Natural History of Man), forming a series of articles in a Dutch journal of natural history and zoology; and Philosophia Zoologica (1864). He also published a large number of interesting monographs, especially a description of the male *Nautilus Pompilius*, till then unknown, which has been translated into several languages. Among his other monographs are those on the *Cryptobranchus Japonicus*, *Ornithorhynchus paradoxus*, and the *Menobranchus*.

HOF, a town in Bavaria, Upper Franconia, on the left bank of the Saale, 30 miles N.N.E. of Baireuth. It is regularly built, and has four Protestant churches, a gymnasium (formerly a Franciscan monastery), hospital, and orphan asylum; woollen, linen, cotton, leather, and paper manufactures, and some general trade. Both marble and ironstone are worked in the vicinity. At Hof the Saxon and Bavarian Railway crosses the valley of the Saale by a viaduct 616 feet long and 88 feet high, composed of eight arches, each 56 feet in span. In 1759 it was the scene of a victory won by Prince Henry of Prussia over the Austrians. Pop. in 1895, 27,556; in 1900, 32,782.

HOFER, ANDREAS, commander of the Tyrolese in the insurrection of 1809, during the war between Austria and France, was born in 1767 at Passeyr, and carried on a trade to Italy in wine and horses. In 1796 he led a rifle company against the French on Lake Garda, and after the Peace of Lunéville took a prominent part in the organization of the Tyrol militia. In 1809 he took the lead in an insurrection of the Tyrolese for shaking off the yoke of Bavaria, to which their country had been transferred by the Treaty of Presburg. Every success attended the enterprise. Between the 11th and 13th of April, 1809, almost the whole country was conquered, and 8000 of the best troops of Bavaria were made prisoners by the peasants. April 12 Hofer forced a battalion of Bavarians in the plain of Stertzing to surrender. His people advanced on the Bavarian artillery with hay-carts, and attacked the cavalry with pitchforks, flails, and clubs. They rolled trunks of trees and rocks down upon their enemies, and made cannon of wood with iron hoops. Women and children were seen fighting, or loading the rifles of the men. Northern and Middle Tyrol having been freed from the Bavarians, Hofer advanced with Hormayr into Southern Tyrol, from which Baraguay d'Hilliers was driven out with great loss. Meanwhile the French, after the victory of Eckmühl and Ratisbon, had advanced towards Vienna. The Bavarians now invaded Tyrol with great devastation. On the day of the surrender of Vienna General Chasteler suffered a defeat near Morgel. He retreated to the central position of the Brenner, and fought his way through the enemy, leaving General Buol with a small corps for the defence of Tyrol. Hofer now appeared upon the Brenner, and became the idol of the Tyrolese. Two battles, fought on the 25th and 29th of May, 1809, near the Isel Mountain, in sight of the city of Innsbruck, forced the Bavarians again to leave Tyrol. At the beginning of June Hofer and his band took part in the relief of Count Leiningen, who was besieged in Trent. He was upon the point of joining the regular troops, who were to take possession of Klagenfurt, and to restore to the closely-blockaded and suffering Tyrol a communication with the interior of the imperial states, when further operations were suspended by the armistice of Znaim. In August, 1809, however, he again appeared as the chief leader of the Tyrolese. The second battle of Mount Isel (August 13) compelled the Marshal Duke of Dantzig to evacuate Tyrol. Hofer now carried on the military and civil administration, under the most singular circumstances, till the Peace of Vienna was proclaimed (October 14), shortly after which he declared his submission to the Viceroy Eugene, and to the commander-in-chief of the Bavarians. In the middle of November, misled by the false reports of some of the insurgents, he commenced hostilities anew, and thus forfeited the protection of the amnesty. He remained concealed for some time in an Alpine hut in Passeyr, amidst snow and ice, but was at last treacherously betrayed to the French, and carried to Mantua, where he was tried by a court-martial and shot, February 20, 1810. His family was indemnified for the loss of their property by the Emperor of Austria in 1819, and his son ennobled.

HOFFMANN, ERNST THEODOR AMADEUS, or, properly, ERNST THEODOR WILHELM, a German novelist, was born at Königsberg, in East Prussia, January 24, 1776, where he studied law. He afterwards held a judicial appointment at Berlin. He was appointed in 1800 assessor in the government of Posen; in 1802, councillor in the government of Plozk; and in 1803 proceeded in the same official character to Warsaw. The invasion of the French, in 1806, finished his career in that city. Without

prospects in his native country, and without property, he employed his musical knowledge as a means of support for several years. In 1816 he was reinstated as councillor in the court of judicature of Berlin, where he died, June 25, 1822. From his youth he devoted all his leisure hours to the study of music. Among his works are the Phantasiestücke in Callot's Manier (Bamberg, 1814); Die Elixire des Teufels (Berlin, 1816); the Nachtstücke (1817); the Serapionsbrüder (twenty-three tales, in four vols., Berlin, 1819, et seq.); and many others. Hoffmann was an irregular and unhappy man. He possessed much imagination and talent, but little soundness of mind; and his habits were intemperate. His judicial duties, however, were faithfully performed. In his longer novels he has a strong tendency to make use of supernatural machinery; but his master-pieces are his short tales (such as Meister Martin und seine Gesellen, Das Majorat, Fräulein Scudéry, Doge und Dogaresse, &c.), in which he entirely dispenses with that means of exciting and sustaining the attention of the reader. One of the latest collective editions of his works is that by R. Boxberger, with biography (6 vols. 1873).

HOFFMANN, FRIEDRICH, the most celebrated individual of a name and family distinguished in the annals of medicine, was born in 1660 at Halle, in Saxony, where his father was an eminent physician. He studied medicine at Jena under Professor Wedelius. In 1680 he attended the chemical lectures of Caspar Cramer at Erfurt, and, returning to Jena, took the degree of M.D. in 1681. After travelling through Holland and England to restore his shattered health, he settled in 1685 as a physician at Minden. He removed to Halberstadt in 1688, to settle there as public physician. On the establishment of the University of Halle, Hoffmann in 1693 was appointed by the Elector of Brandenburg primary professor of medicine and natural philosophy, and intrusted with the task of forming a medical faculty. He improved the spirit of medical education, promoting among the students of the university a disposition for inquiry highly favourable to the progress of knowledge. In 1718 he commenced the publication of a work entitled Systema Medicinæ rationalis, which was received with great approbation by the faculty in different parts of Europe. In this system of medicine he exhibits his peculiar theoretical opinions, the chief feature of which is the doctrine of atony and spasm, afterwards made the foundation of a medical hypothesis by Dr. John Brown. Much of the humoral pathology was retained by Hoffmann, whose speculations are chiefly important as having given an impulse to future inquiries. He made a useful collection of the most important cases which occurred to him in his practice as a physician, and published them under the title of Medicina Consultatoria. After a long life devoted to the cultivation of medicine he died at Halle in 1742. His works were collected after his death at Geneva, 1748–1765, in eleven volumes, folio.

HOFLAND, BARBARA, a well-known authoress, whose maiden name was Wreaks, was the daughter of a manufacturer at Sheffield, and was born there in 1770. She early lost her father, and at the age of twenty-six married Mr. T. B. Hoole, who died in the course of two years, and left her with one child in embarrassed circumstances. She was consequently led to turn her literary abilities to account, and published by subscription, in 1805, a volume of poems, which found a large sale, and enabled her to commence a school at Harrogate. In 1808 she married, as her second husband, Mr. Hofland, the eminent landscape-painter. In the course of her long life, which terminated on 9th November, 1844, she produced numerous works of fiction, chiefly tales for young people, which were extremely popular, and were translated, many of them, into various languages. They number about seventy, and among them may be mentioned more especially the Son of a Genius, the Clergyman's Widow, Self-denial, Decision, Adelaide, the Czarina, Tales of the Priory, Tales of the Manor, Emily, and Beatrice.

HOG or SWINE (*Sus*), the typical genus of the family Suidæ of non-ruminant ungulate quadrupeds. The genus as established by Linnæus was much more comprehensive than it is now. The generic characters are: six incisors in the upper jaw, converging; six in the lower jaw, projecting; two canines in the upper and two in the lower jaw, very long; fourteen molars in each jaw; the snout prominent, truncate, and containing a prenasal bone, an ossification of the cartilaginous nasal septum; feet with four toes, two of which reach the ground. The known breeds of pigs are descended from two stocks, of which the common wild boar (*Sus scrofa*) and the *Sus Indica* of Pallas are the respective types.

The common hog (*Sus scrofa*), in a tame state, is almost universal, except in very high latitudes. In the forests of South America it is found in vast droves, derived from the European varieties which have become wild. The numerous native breeds once found in so many districts are now almost lost, having been crossed by varieties of the *Sus Indica* breed. Domestication has changed the form and proportions of the body, the colour, &c.; thus the skull is higher and broader in proportion to its length, and it is more upright in the occipital region. The common hog appears to enjoy none of the senses in perfection except that of smell; this, however, is acute, and the hog is used, in some parts of Italy, in hunting for truffles, which grow some distance under the surface; and it is stated that a gamekeeper in England actually broke in a sow to find game, and to back and stand like a pointer. When she came on the cold scent of game she slackened her trot, gradually dropped her ears and tail till she was near, and then fell on her knees. So stanch was she that she frequently remained upwards of five minutes on her point. As soon as the game rose she always returned to the keeper, grunting for a reward, which consisted of a sort of pudding made of barley meal. Hogs hear distant sounds; but their sense of hearing is by no means acute. In their taste they discover a strange degree of caprice; for whilst they are singularly delicate in their choice of herbs, they will devour with voracity the most nauseous and putrid carrion. At times they even satisfy their insatiable appetite with their own young; and they have been known to attack and mangle children. The eyes of the hog are remarkably small and sunken. His form is inelegant, and his motions uncouth and unwieldy. His appearance is always slothful and stupid, and if undisturbed he would sleep most of the time that was not devoted to satisfying the calls of appetite. Thus his whole life is a succession of torpor and gluttony; and if supplied with sufficient food, he often becomes so fat as to be incapable of motion. The hog seems to be affected by the approach of stormy weather in a very extraordinary manner. On such occasions he runs about in a restless and perturbed state, uttering loud cries. The sow brings forth from the sixteenth to the twentieth week after conception, and has usually two litters in a year. Her offspring are very numerous, a litter consisting of from ten to even twenty; but she can bring up no more than she has teats, which are twelve in number. The natural term of the life of these animals is from fifteen to thirty years, and they continue to increase in size and strength until they are from four to five years of age. As might be supposed from their habits, they are

much infested by vermin of different kinds, and are also liable to many disorders, particularly those arising from gluttony. Notwithstanding all these repugnant qualities of the hog, he is of incalculable benefit to mankind. His flesh is pleasant, substantial, and nutritious, particularly to persons employed in hard labour. Pork takes salt better than almost any other meat, and hence forms an important article in military and naval stores. The lard of the hog is used in a variety of preparations, and the bristles are used in large quantities in the manufacture of brushes, whilst the skin is in equal demand among the saddlers. In Minorca it is said that the hog is used as a beast of draught. Abnormal varieties have been found at all times, and in many localities; but the solid-hoofed varieties which have been called species are in truth only 'sports.'

The wild boar, from which most of our domesticated varieties are derived, is found in most parts of Europe and Asia, and is by no means so stupid or filthy an animal as the tame hog. His snout is longer, his ears shorter; he roots up the ground in a different manner, ploughing it up in furrows; his tusks are larger, some of them being 10 inches in length, bent circularly, and exceedingly sharp at the points. The wild boar, for the first three years of his life, follows the sow, the whole litter living in a herd together. This appears to be for the purpose of mutual protection against their enemies; for when attacked they give each other assistance, the strongest facing the danger. When the boar, however, has attained his full size and strength he ranges the forest alone and unsupported, dreading no single creature, not even man himself. Hunting this animal has always been a favourite amusement. The dogs used in this sport are of the slow, heavy kind, usually a kind of small mastiff. When the boar is roused he goes slowly and uniformly forward, frequently stopping and facing his pursuers, often inflicting severe and even mortal wounds. He is at last despatched by the hunters, either with fire-arms or strong pikes termed *boar-spears*. A chase seldom terminates without the maiming or destruction of some of the dogs.

The other stock (*S. Indica*), the Chinese breed, has more divergent premolars, a wider palate, and broader skull, characters which are not acquired by the varieties of the first-mentioned stock. The wild progenitor of this stock is not known, but it is represented in the Aru Islands, in Java, China, Siam, and by the curly-haired breeds of South-eastern Europe and Turkey, though in this last-mentioned area intermixture with *S. scrofa* is almost certain. The antiquity of these breeds is great; domesticated pigs of the *S. Indica* type existed in the stone period, and perhaps another stock, now lost, divided with them the south of Europe.

The Chinese or Siam breed is distinguished by having the upper part of its body almost bare, its belly hanging nearly to the ground, its legs very short. Its general colour is a dark gray. The flesh of this variety is peculiarly white and delicate, and forms the principal animal food of the inhabitants of the Pacific area. They are fed on the bread-fruit, either in its natural state or made into a sour paste, yams, &c. This nutriment renders the flesh juicy and delicious. These animals are also considered as the most acceptable offering that can be presented to the gods. The enumeration of the domestic varieties would occupy too much space; but we would refer the reader to special works on the subject, such as Long's Book of the Pig (1889).

Guinea Hog (*Sus porcus*, Gm.). In this variety the head is small, the ears long, thin, and pointed; the tail long, naked, almost reaching the ground; the hair on the body is short, reddish, shining, and softer than in the other varieties; the back is nearly naked. This animal is common on the Gold Coast, and it is also said to have been naturalized in Brazil.

Babyroussa (*Porcus babyroussa*). This is a gregarious animal, and is found in large herds in Java, Amboyna, &c., but not on the continent of Asia. The babyroussa is about the size of a large hog, but has much longer legs. It is generically distinct from *Sus*, having four incisors in the upper and six in the lower jaw; two canines in each jaw, the lower similar to those of the pig, but the upper are curved upwards and backwards towards the forehead, being 12 inches in length, of a fine, hard grain, like ivory; as the animal advances in age they become so long and curved as to nearly touch the forehead. The ears are small, erect, and pointed. See BABYROUSSA.

As allied to the hog, we should also mention the genus *Phacochœrus*, or wart-hogs, so called from the large fleshy warts or wens on the cheeks. *P. Æliani*, Ælian's wart-hog, is a native of North Africa. The skin is of an earthy colour, and, with the exception of a bushy mane arising between the ears and stretching along the back, is scantily covered with bristles. The peccaries (*Dicotyles*) also belong to the swine family. (See PECCARY.) They possess a glandular body, situated on the loins, and secreting a disagreeably smelling substance. This gland taints the flesh unless removed immediately after death.

HOGARTH, WILLIAM, a truly great and original painter of life and manners, was born in London in 1697. His father, who was the son of a yeoman in the neighbourhood of Kendal in Westmoreland, kept a school in the city. Hogarth was bound apprentice to Mr. Ellis Gamble, a respectable silversmith of Cranbourne Street, Leicester Fields, who employed him in engraving ciphers and crests on spoons and pieces of plate. Having been accidentally present at a drunken fray one Sunday at a public-house on the road to Highgate, his humour in sketching characters was first displayed by his drawing one of the unfortunate combatants streaming with blood. Soon after he produced a print of Wanstead Assembly. In 1720 he commenced business for himself, painting portraits, and making designs and book-plates for the booksellers, &c. He also painted small groups or family pieces, for which he was very inadequately remunerated, and had sometimes much difficulty in procuring any payment after his pictures were finished. As an instance, it is related that a very ugly and deformed nobleman having sat to him, the likeness produced was so strong that his sitter refused to have it, and Hogarth, after several pressing letters for payment, at length told him that if he did not send the money for it he should add a tail and some other appendages, and sell it to Mr. Hare, a famous wild-beast man, who had applied to have it to hang up over his booth. This stratagem had the desired effect; Hogarth received the money, and the nobleman put the picture in the fire. In 1729 Hogarth was secretly married to the only daughter of Sir James Thornhill, and soon after commenced his celebrated series of pictures called the Harlot's Progress. In the year 1733 this work brought his great powers fairly before the public, for at a meeting of the board of treasury one of the members carried the third print, just then published, and showed it to the other members, as containing, among other excellencies, a striking likeness of Sir John Gonson, and on the board's breaking up all the members went and purchased impressions. Such was now the great sale and popularity of his works that they were copied and pirated, and he was in consequence obliged to apply to Parliament for a protecting act to secure to artists the fruits of their industry, such as had been already granted to authors. Some-

notion may be formed of the hold the Harlot's Progress took of the public mind, by the fact that it was converted into a pantomime and a ballad opera, and represented on the stage. The scenes were also engraved in a small size, to adorn the fans of ladies of rank and fashion. In 1745 he issued proposals for an auction of his original pictures, including those illustrating the Harlot's and the Rake's Progress. The total sum which he raised on this occasion was £427, 7*s.*, an amount which was no doubt smaller than it would have been but for certain whimsical restrictions which Hogarth himself made as to the manner in which the sale was to be conducted, and which was certainly small compared with the value of the pictures. By this time, however, Hogarth was in easy circumstances. The same year his prints of Marriage à-la-mode appeared, which were very successful. But as it had been observed by his detractors that he only painted the dark side of human nature, he commenced a set of designs for a work to be called the Happy Marriage, which, however, he never finished. In 1749, having paid a visit to France, he was arrested at Calais while sketching the gate of the town, and on his return he commemorated the affair in his excellent print, 'O the Roast Beef of Old England,' or, 'The Gate of Calais.' He now purchased a small house at Chiswick, where he chiefly resided, going occasionally to his house in Leicester Fields. In 1753 his work on the Analysis of Beauty appeared; in writing which he was assisted successively by Dr. Benjamin Hoadly the physician, Mr. Ralph, Dr. Morell, who finished it, and the Rev. Mr. Townley, who wrote the Preface. This work was translated into German in 1754, into Italian at Leghorn in 1761, and into French in 1805. In 1762 his health began to give way. He complained much of an inward pain, which was followed by a general decay. The last year of his life he spent chiefly at Chiswick in retouching his plates; in which labour he was assisted by several other engravers. He died there on October 25, 1764. His death was caused by an aneurism of the great artery.

In originality of imagination Hogarth may be placed on an equality with Shakspere, and in point of execution as a painter he is superior to most artists of the age in which he lived. His genius is at all times enlisted on the side of virtue and morality. He holds the mirror up to nature, and 'through the eye corrects the heart.' He exhibits vice in all its deformity; villany is stripped of its cloak, and held up to detestation. There are irresistible power and pathos in the successive scenes of his works. You see his heroes advancing step by step in their career on wickedness; you know where it must end, yet the 'last scene of all' seldoms fails to stir your feelings deeply.

The works of Hogarth have been frequently republished. Dr. Trusler, of Bath, was author of the earlier notices in the editions accompanied by illustrative letterpress (Hogarth Moralized, London, 1768); but Charles Lamb is his best general expositor. His own portrait, painted by himself, with his favourite pug dog, and his six pictures of Marriage à-la-mode, are now placed in the National Gallery. His four pictures of the Election form the richest ornaments of the Soane Museum, London. A catalogue of all his prints will be found in the fourth volume of Walpole's Anecdotes. A multiplicity of local and temporary circumstances introduced into his pictures has rendered notes necessary to a due comprehension of them—a task which has been well performed in the Hogarth Illustrated of Ireland. The best edition of his works is that published by Messrs. Boydell (atlas folio, London, 1790), the plates of which, retouched by Heath and others, have been published several times since, in particular by Bohn. There is a handy edition, with an introductory essay by James Hannay, and descriptive letterpress by Trusler and Roberts. An edition by J. Ireland and J. Nichols, with 150 facsimiles of the originals, may be recommended.

HOGG, James, more familiarly known by the name of the *Ettrick Shepherd*, was born in Selkirkshire in 1770, not, as he himself states, on the 25th of January, 1772, and after receiving a very scanty education, which scarcely sufficed to enable him to read with ease, began to earn his bread by daily labour as a shepherd. Among the first works that came into his hands were the Life of Wallace and the Gentle Shepherd. After perusing them, not without difficulty, he commenced at the age of eighteen to make his first attempts in verse, and found no limits as to quantity, though the quality was, according to his own account, 'bitterly bad.' These attempts, however, had the effect of bringing him under the notice of Sir Walter Scott, by whose advice he published a volume of ballads under the title of The Mountain Bard. This volume, though evidently the production of a rough, untutored mind, contained many indications of true poetic genius, and, together with an Essay on Sheep, which gained the prize of the Highland Society, put him in possession of as much money as tempted him to engage in an ill-judged agricultural scheme. Its failure brought him to Edinburgh, where he determined to trust for subsistence to his literary labours. He first published the Forest Minstrel (1810), which produced him no pecuniary return, and then started a weekly periodical entitled The Spy, which, after a short time, became defunct. His prospects were now dark indeed, and some friends who had generously assisted him had begun to fear that he would soon add another to the too many instances of prematurely extinguished genius, when he suddenly (in 1813) produced a great sensation in the literary world by the publication of the Queen's Wake, a series of songs or ballads in honour of Queen Mary, strung together by a rambling narrative, forming together a collection which promises to take its place among the finest poetical productions of our language, and among which the poem of Kilmeny especially has secured the admiration of all lovers of true poetry. He was now at the summit of his popularity and fame. Shortly after he was placed in a position of more comfort and independence by receiving from the Duke of Buccleuch the small farm of Altrive Lake, on the Braes of Yarrow, at a merely nominal rent, for which, indeed, no rent was ever claimed. In 1815 he published his Pilgrims of the Sun. Several subsequent attempts, as Mador of the Moor, The Poetic Mirror, and Dramatic Tales, not meeting with the success which he expected and thought they deserved, he turned his attention to prose, and produced The Brownie of Bodsbeck, and other tales. Shortly after appeared the Jacobite Relics, the second volume of which, published in 1821, contained some admirable lyrics. It was followed almost immediately by Winter Evening Tales, which, with a sprinkling of legendary ballads, contains many prose tales of great excellence, and met with much success. In 1822, on the occasion of the visit of George IV. to Scotland, Hogg welcomed him with the Royal Jubilee, a Scottish masque, in which the serious and ludicrous are strangely blended. Allured, perhaps, by the astonishing success of the Waverley novels, he attempted to distinguish himself in the same walk of literature, and produced two novels, in three vols. each, entitled The Three Perils of Man and The Three Perils of Woman. They produced little sensation, and are already forgotten. His next, and indeed his last

most important work, entitled The Shepherd's Calendar, was contributed to Blackwood's Magazine, in which, owing to a very questionable use of his name and abuse of his good-nature, he long occupied a more prominent place than his own contributions gave him. The Calendar, however, consisting of a series of prose sketches relating to subjects on which he was entirely at home, is perhaps, after the Queen's Wake, the most finished and interesting of all his productions. In 1832 he paid a visit to London, in connection with the proposed publication of a cheap edition of his works, and became for a time the lion of the day. By the failure of his publisher this enterprise came to grief. Among his best publications was one on The Domestic Manners and Private Life of Sir Walter Scott (1834). He died at Altrive Lake on 21st November, 1835. In personal appearance Hogg was about the middle height, well-built, active, and muscular, with sandy hair, expansive forehead, ruddy cheeks, and sharp, lively, gray eyes. His language, in ordinary conversation and with all classes of society, continued genuine Scottish to the last, and his dress at home among the hills was that of a humble hill farmer; but on his visits to town, when he usually wore a suit of black, he rather resembled the minister of some remote rural parish.

HOG-PLUM, the name given to the fruit of several species of *Spondias*, a genus belonging to the natural order Anacardiaceæ, mostly natives of the West Indies, the islands of the Pacific Ocean, and other inter-tropical regions. The species of *Spondias* are shrubs or trees with alternate pinnate leaves with a terminal leaflet. The flowers are white or red, arranged in axillary or terminal panicles. *Spondias lutea* or Mombin and *Spondias purpurea* are the species which produce the fruit to which the name hog-plum is usually applied, from the fact that it is eagerly devoured by hogs in the West Indies. The fruit of the former species is yellow, and smaller than that of the latter, which is of about the size of an ordinary plum and of a bright red colour on the side which is turned to the sun. The taste is somewhat bitter and aromatic. The fruit of the *Spondias cytherea* or *dulcis* (now considered as belonging to a separate genus *Poupartia*) is called the *Tahiti hog-plum*. The tree which bears the fruit is large and graceful, rising to the height of 50 feet. The fruit itself is oval, of a fine golden yellow colour when ripe, very smooth, and disagreeable to the smell. The pulp is soft, and covers a great stone surrounded with fibrous spines. It is peculiarly grateful from its cooling and, at the same time, aromatic qualities. Its flavour very much resembles that of the pine-apple. The leaves are of a dark clear green, among which the smooth fruit hangs like burnished gold.

HOGSHEAD, a liquid measure formerly in use in England. Its capacity varied in different cases. For beer it was 54 gallons, for rum 45 to 50 gallons, for brandy 45 to 60 gallons, and for different kinds of wine it varied from 46 to 93 gallons. In the United States the measure is still in use, being equivalent to 63 American gallons or 52·485 imperial gallons.

HOHENLINDEN, a village of Bavaria, 20 miles east of Munich, celebrated for the victory gained by the French under Moreau over the Austrians under the Archduke John, December 3, 1800. The French took nearly eighty pieces of cannon, 200 caissons, and more than 10,000 prisoners, with three general officers.

HOHENLOHE, one of the mediatized principalities of Germany, containing 680 square miles, now chiefly under the sovereignty of Würtemberg, and partly under that of Bavaria.

HOHENSTAUFEN. In the battle of Merseburg (1080), between the Emperor Henry IV. and his competitor Rudolph of Suabia, Frederick of Staufen, lord of Hohenstaufen, in the modern Kingdom of Würtemberg, at that time in Suabia, between Gmünd and Göppingen, displayed so much courage under the eyes of the emperor that he was rewarded with the Duchy of Suabia, and received Agnes, daughter of Henry, in marriage. Thus was laid the foundation of the future greatness of a house whose elevation and fall are among the most important epochs in the history of the German Empire. Frederick (died 1105) left two sons, Frederick and Conrad; the elder succeeded him as Duke of Suabia, and the younger was invested (1112) by his uncle, the Emperor Henry V., with the Duchy of Eastern Franconia. After the death of the Emperor Henry V. (1125), who was the last male of the Franconian line, his two nephews, Frederick II. (the One-eyed), duke of Suabia, and Conrad, duke of Franconia, appear to have aspired to the German crown; but their connection with the late emperor was made the ground of opposition by the directors of the election, the Archbishop of Mayence and the Papal legate; and Lothaire of Saxony was elected. This circumstance, with the demand made by the new emperor of the restitution of all the possessions acquired by the lords of Hohenstaufen during the preceding reign, produced a fierce war between the emperor and the two brothers. Lothaire would have been overpowered in this contest had he not preserved himself by a union with Henry the Proud, duke of Bavaria, to whom he gave his daughter and the Duchy of Saxony. Frederick II. was unable to withstand the overwhelming power of both, since his brother Conrad, after his return from the Holy Land, had undertaken a campaign to Italy, where he had caused himself (1123) to be proclaimed king. The Peace of Mühlhausen (1135), between Lothaire and Conrad, put an end to this Ten Years' war. Conrad renounced his title of King of Italy, but received the first rank among the dukes, and both he and his brother regained all their lands. After Lothaire's death (1137) Conrad, duke of Franconia, of the house of Hohenstaufen, was raised in the beginning of the following year to the throne of Germany, with the title of Conrad III. The inextinguishable hatred of the Guelfs against the house of Hohenstaufen (Ghibellines), the first germ of which lay in the alliance between Henry, duke of Saxony, and the Emperor Lothaire, was still more inflamed by the Emperor Conrad III. placing Henry under the ban, depriving him of his feudal possessions, and otherwise injuring him, because he refused to obey his order to relinquish the Duchy of Saxony, which he held with that of Bavaria, it being contrary to the German constitution for a prince to hold two duchies. After the death of Conrad III. (1152) the confidence which was felt in the Hohenstaufen family caused the choice to fall on his nephew, Frederick III. of Suabia, son of Frederick II. (the One-eyed), called among the German kings Frederick I. Barbarossa (the Red-beard), who was followed by Henry VI. (1190), who added by his wife the Kingdom of Sicily and Naples to the hereditary dominions of the family; and he again by Otto IV. (1197) and Frederick II. (1215–50), all belonging to the same house. After the death of Frederick II. his son Conrad was acknowledged as his successor, with the title of Conrad IV., by most of the states of the empire; but Innocent IV. laid him under an interdict, declared him to be deprived of all his lands, and persecuted him with relentless hatred till his death in 1254. After the death of Conrad IV. his illegitimate brother Manfred possessed himself of the crown of Sicily; but he lost his life and his crown in a battle near Benevento (1266), and the kingdom for which he strove then passed to Charles of Anjou, the brother

of the French king Louis IX. The severe and cruel government of Charles raised up a powerful party against him; their love for the noble house of Hohenstaufen was awakened, and Conradin, the only son of Conrad IV., was called from Bavaria, where he had hitherto lived, in order to ascend his rightful throne. He obeyed the call; but at the battle of Tagliacozzo, on the 23rd of August, 1268, had the misfortune to be taken prisoner by his rival, who had him, two months later, publicly executed at Naples. The possessions of the family fell, after the death of Conradin, to Bavaria, Baden, and Würtemberg. The fame of the family of Hohenstaufen is rendered imperishable by the political greatness to which the Fredericks in particular attained by means of their wisdom, virtue, and power; by their struggles to free Germany from the dominion of the pope; by the order which they introduced into all the states of the empire; by the encouragement which they gave to commerce and trade; and likewise by their unwearied care to promote the sciences and arts.

HOHENSTEIN-ERNSTTHAL, a town of Germany, in the Kingdom of Saxony, 10 miles north-east of the town of Zwickau, on the slope of a lofty hill. It was constituted in 1898 by the union of Hohenstein and Ernstthal. It has manufactures of woollen and cotton goods and hosiery; spinning-mills, dye-works, tile-works, and a chalybeate spring. Pop. (1900), 13,397.

HOHENZOLLERN, a small territory of Germany, since 1849 an administrative division of Prussia, formed by the union of two principalities—Hohenzollern-Hechingen and Hohenzollern-Sigmaringen. It consists of a long, narrow, irregular strip of country, entirely surrounded by Würtemberg and Baden; area, 441 square miles. The princely family of Hohenzollern dates from Thassilo, Count of Zollern, who died about 800 A.D. There have been several lines and branches of the Hohenzollerns, the main one being represented by the present imperial family of Germany. Pop. (1895), 65,752; (1900), 66,780.

HOKITIKA, a town of New Zealand (South Island), capital of the province of Westland, and the principal place on the west coast, at the mouth of the river Hokitika. It owes its rise to being the centre of the productive gold-fields discovered in 1865. The town is well laid out and substantially built, the principal public buildings being the town-hall, the post and telegraph office, mechanics' institute, court-house, several churches and schools, theatre, banks, hospital, lunatic asylum, Westland Institute, &c. There is a good quay, and other harbour works by which access from the sea has been greatly facilitated, but the place is not very progressive. There are breweries, a tannery, saw-mills, and other manufacturing establishments. Pop. (1886), 2687; (1901), 1943.

HOLBACH, PAUL HEINRICH DIETRICH, BARON OF, philosophical writer, was born at Heidelsheim, in the Palatinate, in 1723. He was educated in Paris, where he passed the greater part of his life, and died at Paris on Jan. 21, 1789. He was benevolent and even-tempered. He was the centre of a circle of men of wit, but of infidel principles, using his great fortune, says Rousseau, generously, and appearing to advantage in the learned society which he gathered round his table. His guests were *philosophes* of too free a turn of thinking to be admitted to the dinners of Madame Geoffrin. He was the author of a great number of works, most of which were anonymous or pseudonymous. He contributed many papers on natural history, politics, and philosophy to the Encyclopédie; he also translated a German work of Waller on mineralogy, Akenside's Pleasures of Imagination, some essays of Tindal, Hume, &c. The principal work attributed to him, which appeared in 1770 under the name of M. Mirabaud, and which excited much attention in the learned world, is the Système de la Nature ou les Lois du Monde Physique et Moral. It has been supposed by some that Diderot had some hand in the composition of this work. He afterwards published Système social, or Principes naturels de la Morale et de la Politique—a development of the previous work, showing the application of the principles promulgated in it to morals and politics; Bons Sens, or Idées naturelles opposées aux Idées surnaturelles—a sort of atheist's catechism; Éléments de la Morale universelle; &c. &c. Voltaire characterizes his chief work as execrable in morality and absurd in physics, and Frederick the Great undertook to refute it. According to Holbach matter is the only form of existence, and everything is the effect of a blind necessity; instead of God, whom he asserts to have been invented by theologians, he substitutes Nature, which he considers an assemblage of all beings and their motions.

HOLBEIN, HANS, a celebrated painter, son of a less famous painter of the same name, was born at Augsburg in 1497. He and his brother Ambrosius in all probability received instruction in painting from their father, and about 1515 the two brothers went to Basle, where Hans was for a time engaged in illustrating books. At Basle he also painted his earliest portraits, and in 1517 he went to Lucerne. Here he painted the house of Jacob von Hertenstein, designed windows, and executed other works. Returning to Basle in 1519, he became a burgher in the following year, and during a seven years' residence in that city he executed many works of great importance. Among them were wall paintings of classical subjects in Basle town-hall, a Last Supper, a Passion series, The Dead Christ, a Nativity, Adoration of the Magi, Madonna and Saints, the great Madonna with the Meyer family (now at Darmstadt, fine copy in Dresden), Venus, Lais Corinthiaca, three portraits of Erasmus, a portrait of Bonifacius Amerbach, and illustrations to several editions of the Bible. In 1526 he went to England. Letters from his friend Erasmus, whose famous Praise of Folly he had illustrated by a series of drawings, procured him subsequently the patronage of the chancellor, Sir Thomas More, who took him into his own house, employed him to delineate the portraits of most of his own personal friends about the court, and introduced him to the notice of Henry VIII., who, with all his faults, was a liberal encourager of the fine arts. Among the portraits produced by him during this period are those of More, Archbishop Warham, Bishop Fisher, and several other distinguished persons. From 1528 till 1532 he was again in Basle, but in the latter year he returned to England, where he was destined to spend nearly all the remainder of his life. At the command of the monarch, Holbein drew the portrait of the dowager Duchess of Milan, whom Henry entertained thoughts of espousing; also that of Anne of Cleves, the original of which was afterwards considered by his fastidious patron so far inferior in point of beauty to her picture that his disgust was expressed in terms less courtly than sincere. Holbein also painted most of the principal English nobility, who showed themselves eager to encourage an artist ranking so high in the favour of Henry. These portraits place Holbein among the world's greatest portrait-painters. Some of his earlier productions, especially his Dance of Death, are also very celebrated, and have perhaps contributed as much to his reputation as his later productions. The Dance

of Death comprises a series of illustrations, the earliest of which were designed between 1523 and 1526, but owing to the death of Lützelberger, his block-cutter, in the latter year, they were discontinued for a time. In 1538 he completed and published the series. Among the pictures of Holbein's last period are The Ambassadors (1533), and portraits of Hans of Antwerp (1532), English Lady and Gentlemen (1534), Sir Richard Southwell (1538), Duke of Norfolk (1539), Thomas Cromwell, Lady Jane Seymour, Henry VIII. (1542, unfinished), and others. Holbein died at Whitehall of the plague between Oct. 7th and Nov. 29th, 1543, and is supposed to be buried in the church of St. Katherine Cree. Comparatively few of Holbein's pictures are still extant in England, great numbers of them having been destroyed by the Puritan fanatics, or sold by public auction and dispersed over Europe. Many of them also perished in the great fire in London in 1666. Holbein also excelled in wood-engraving, and before his visit to England had produced a large number of wood-cuts. He was one of the earliest to paint portraits in miniature. A correct idea of Holbein's drawings (in red and black pencil) for the portraits of illustrious persons of the court of Henry VIII. may be obtained from Bartolozzi's Imitations (London, 1792). The best edition of his series of ninety small wood-cuts, illustrative of the New Testament, is that of Lyons, 1539, very rare. A collection of engravings of his finest pictures was published at Basel in 1780–92. See Woltmann's Holbein und seine Zeit (2 vols. 1874), Wornum's Life and Works of Holbein (1867), and Knackfuss's Holbein der Jüngere (1896).

HOLBERG, LUDWIG, BARON, the father of modern Danish literature, was born at Bergen, in Norway, in 1684; died at Copenhagen January 28, 1754. While studying at the University of Copenhagen he lost his father, and thus found himself without resources to continue his studies, which obliged him to return home and support himself by teaching, with no better prospect than that of receiving some day the charge of a country parish. Dissatisfied with this outlook he determined to try his fortune abroad, and with this intention set sail for Amsterdam. After reaching as far as Aix-la-Chapelle, and deriving no other benefit from his journey than an improved acquaintance with the French language and some knowledge of music, he returned to Christiansand, the chief trading town in Norway, where he again resorted to teaching for support, by which he gained in a short time enough to enable him to proceed to England. Here he lived at Oxford for fifteen months, teaching music and modern languages, and diligently applying himself to the study of modern history and British philosophy. In 1712 he returned to Copenhagen, and then set out as companion to a young nobleman on travels through Germany. On his return to Copenhagen he was appointed by Frederick IV. (whose life he had written) supernumerary professor in the university, and received from him a small pension (1714). Soon after he proceeded to Paris, where he spent the most of 1714 and 1715 using all the means in his power to acquire a thorough mastery of the French language, for which purpose he visited the libraries and schools of the city by day and the theatres with equal assiduity in the evening, and took every opportunity of disputing with the theologians of St. Sulpice and the wits of the coffee-houses. In 1715 he quitted Paris, and after paying a six months' visit to Rome returned to Copenhagen in the end of 1716. In 1718 he was appointed to an ordinary professorship in the university of that city, where after this date he chiefly resided till his death. In 1735 he was unanimously elected rector, and in 1737 treasurer of the university in which he held his professorship, and in 1747 he was raised to the rank of baron. Holberg's numerous productions in various departments of literature, as well as the important and salutary influence which he exercised upon his countrymen, place him in the front rank of the literary men of his age. He was a man of naturally weak constitution, but by strict moderation he preserved himself in tolerably good health to the age of seventy. He was extremely versatile—now devoted to history, now to poetry, and now to the drama; but during his whole life he was a sworn enemy to pedantry, theological disputatiousness, and scholastic metaphysics. When it came to his turn to fill the chair of metaphysics at the University of Copenhagen he delivered a pompous panegyric on the subject, which was in reality a covert satire on it. His works may be divided into four classes—poems, stage pieces, philosophical treatises, and historical works. His poems are chiefly of a satirical nature. The most celebrated among them is Peder Paars, a comic heroic poem in fourteen cantos, which is still regarded throughout the Scandinavian countries as a master-piece, and the hero of which has become the national comic impersonation in Denmark. It has been translated into several languages. Almost equally famous is his Nicolas Klimm's Subterraneous Travels, a satirical romance in prose, originally written in the Latin language, but translated into seven modern European languages shortly after it appeared, into Danish first by Baggesen (1789). His stage pieces are all either comedies or farces, and are nearly all characterized by true comic power. They are far too numerous to mention. Among his philosophical writings the most important is his Moral Reflections (1744). His historical works include The Political, Ecclesiastical, and Geographical Condition of the Danish Monarchy, a work of great value as a source of information to historical inquirers, A General History of the Jews, and A History of Famous Men and Famous Women (1739–45), which is the best of all his historical works. The dramatic works of Holberg appeared at Copenhagen between 1731 and 1754 in seven vols., and have since been published at the same place in 1847–54. A translation of them into German was published at Copenhagen in 1750–55, and another by the celebrated Oehlenschläger at Leipzig in 1822–23. The select works of Holberg, edited by Rahbeck, were published at Copenhagen in 1806–14.

HOLCROFT, THOMAS, a dramatist, novelist, and miscellaneous writer, born in London in 1745; died there in 1809. His father was a shoemaker, and the son followed the same occupation, which he relinquished when young to try his fortune on the stage. His scheme did not succeed, and he then turned his attention to dramatic composition, and produced several pieces, of which the most popular is The Road to Ruin (1792), still frequently performed. On the occurrence of the French revolution Holcroft displayed much zeal in the cause of liberty; and his conduct, with that of other individuals, having excited the alarm of government, he was included in the famous prosecution for treason instituted against Hardy, Horne Tooke, Thelwall, and others in 1794. The persons just mentioned having been acquitted Holcroft and the rest were discharged without being brought to trial. He continued to write for the stage with great assiduity, and published a multitude of works, original and translated, among the former of which were some clever novels. His last publication was A Tour in Germany and France (two vols. 4to). His Memoirs appeared posthumously in 1816. Holcroft is stated to have been the first who introduced on the English stage those since popular entertainments termed *melodramas*.

HOLCUS, a genus of grasses, extremely common in some pastures. Whether because of their innutritious quality, or of the soft hairs with which they are covered, they are neglected by cattle. The genus is readily known by the spikelets being two-flowered and the florets dissimilar, the lower one hermaphrodite and beardless, and the upper male only with an awn at the back of the larger pale. The pales harden upon the grain. There are two British species, woolly soft grass or meadow soft grass (*H. lanatus*) and creeping-rooted soft grass (*H. mollis*), which are both perennial, growing about 2 feet high when in flower, and equally covered with soft dry hairs. The *Holcus lanatus* has a fibrous root, downy leaf-sheaths, the upper glume blunt, the awn smooth and curved like a fish-hook; while the *Holcus mollis* has a creeping root, nearly smooth leaf-sheaths, the upper glume acute, the awn straight and rough with short hairs. The former is a very common British grass, and is also prevalent throughout Europe. It is most profusely distributed on arable land of a poor, moorish, or peaty nature. The latter species is more circumscribed in its habitat, being almost restricted to light sandy soils. Its spreading roots form an agreeable food for horse and cattle, but more especially for pigs. Another species, *Holcus* (or *Hierochloe*) *borealis*, *odoratus*, or *repens*, is one of the few grasses possessed of an agreeable aromatic fragrance, and hence is grown in gardens. It often flowers before the end of April on short and almost leafless stems, which rarely produce perfect seeds, a barrier to its natural propagation which is amply compensated by its creeping roots.

HOLD, the whole interior cavity or belly of a ship, or all that part of her inside which is comprehended between the floor and the lower deck throughout her length; being the part of the interior in which the cargo is stored.

HOLDING, in Scots law, a term signifying the manner in which an estate is held of a superior. It is of three kinds—feu, blench, and burgage holding. In feu-holding the service due from the vassal to the superior consists in the annual payment of a certain sum of money or quantity of grain. In blench-holding the service required is merely nominal, consisting in the payment of a penny Scots, a hawk, a rose, or some such thing. Burgage-holding is the mode by which property within the boundaries of a royal burgh, upon which no other superior has any claim, is held of the crown. The service due in this case is that of watching and warding, and is now merely nominal. Besides the ordinary and stated services, the superior in every kind of holding formerly had in certain events other claims on the vassal, amounting in some cases to the forfeiture by the latter of his fee, and in other cases to some fixed payment. On account of the uncertainty of the event on which the superior's claim depends, such as the entry of an heir (relief), such claims are called *casualties*. Since the Conveyancing Act of 1874 casualties payable at uncertain times cannot be contracted for, but payments in lieu thereof at stated intervals are allowed. Casualties in investitures prior to that year may be redeemed by the vassal. In burgage-holding, since it is properly the burgh and not the individual proprietor that holds the land of the crown, the casualties depending on the entry or non-entry of an heir can never become due, since the burgh can never die, and the fee is always filled.

HOLDING OVER, in English law, the keeping possession of a property after the tenant's term has expired, by which he becomes tenant on the terms of the expired lease. The corresponding phrase in Scotch law is *tacit relocation*, which is equivalent to the renewal of a lease for another year, and so on till the landlord or the tenant terminates the lease in proper form.

HOLE, Richard, English writer, was born at Exeter in 1746, his father being a canon of the cathedral there. Educated at the Exeter grammar-school and Exeter College, Oxford, he took orders, and soon afterwards became curate of Sowton, near his native town. Appointed vicar of Buckerell in the same district in 1777, he became, in addition, rector of Faringdon fifteen years later. Some years afterwards he received the rectory of Inwardleigh, near Okehampton, which he held till his death at Exmouth on May 28, 1803. He began his literary career in 1772 by publishing a Poetical Translation of Fingal, together with an original ode, and nine years later his translation of the Homeric Hymn to Demeter appeared. Arthur, or the Northern Enchantment, was the title of a poem in seven books issued in 1789, with learned notes. Some of the pieces in Polwhele's Poems, chiefly by Gentlemen of Devonshire and Cornwall (1792), were by Hole. He also contributed to several periodicals. Other works by Hole are Remarks on the Arabian Nights' Entertainments (published 1797); Essay on the Character of Ulysses as delineated by Homer (1807); and a paraphrase in modern English verse of The Exmoor Courtship.

HOLIBUT, or Halibut (*Hippoglossus vulgaris*), a well known fish of the flat-fish or flounder family (Pleuronectidæ). The eyes are on the right side, the mouth is wide, and the body approaches nearer to the ordinary fish-form than in the turbot or the flounder. The teeth of the upper jaw are in a double series, and the lateral line is curved. It attains a length of from 3 to 6 feet, the weight of a large female being about 160 lbs., though much heavier specimens have been reported at various times. The colour above is brownish, that of the belly a pure white. The scales are very small. The food of the holibut consists of smaller flat-fish and some crustaceans. It is common on the British coasts, especially in the north, numbers being caught by trawling, and is much used as food, though it is far inferior to the turbot. Its flesh is white and firm, but dry and deficient in flavour. The Orkney Islands are an important centre of the holibut fishery in the United Kingdom. Large quantities of holibut are taken on the coasts of the Eastern United States, where it usually makes its appearance with the shad and herring. As the temperature increases, these fish change their ground, and migrate to the banks of Newfoundland. The Greenlanders preserve it for winter use by cutting it in strips and drying them in the air. There is another species of the genus characterized by a straight lateral line. It occurs chiefly near Greenland.

HOLIDAY, any day set apart as a religious or national festival. (See Festivals.) By 34 and 35 Vict. cap. xvii. certain days are fixed as bank-holidays for England and Scotland, and it is enacted that all business transactions which would have been valid on any such holiday shall be held as valid if performed on the day following. Thus, when a bill of exchange becomes due, or notice of dishonour falls to be given, on a bank-holiday, the bill is payable, or the notice stands good on the following day. The days fixed for England are Easter Monday, the Monday in Whitsun Week, the first Monday in August, and the 26th of December if a week-day. These are in addition to Christmas Day, Good Friday, and other holidays previously established. The days fixed as bank-holidays for Scotland are New-Year's Day, Good Friday, the first Monday of May, the first Monday of August, and Christmas Day;

and if either New Year's Day or Christmas Day falls on a Sunday, the Monday after is held as a holiday. The same act empowers the sovereign to appoint by proclamation a special day to be observed as a bank-holiday, and to alter by order in council any of the days settled by the act.

HOLINSHED, RAPHAEL (RALPH), an English chronicler of whom nothing more is known than that he was descended from a family originally belonging to Cheshire, that he lived in the age of Queen Elizabeth, and that he died about 1580. He is only known by his Chronicles of Englande, Scotlande, and Irelande, the first edition of which, known as the 'Shakspere edition,' because it is the one which is supposed to have been used by him in collecting material for his historical plays, was published in London in 1577, and the second edition, with numerous omissions, in 1587. These principally relate to the history of Lord Cobham and the Earl of Leicester during the reign of Elizabeth, to whom the passages in question appeared offensive. In the preparation of this work Holinshed had several collaborators, principally in the volume relating to Ireland, for which the description of the island was written by Richard Stainhurst; the first part of the chronicle was translated from the Latin of Giraldus Cambrensis by John Hooker *alias* Vowal of Exeter, and the latter part of the same, from 1509 to 1586, written by Stainhurst and Hooker, the intervening period being written by Holinshed himself. The description of the Island of Britain was written by William Harrison, and the description of Scotland translated from the Latin of Hector Boëce. Prefixed to the Chronicles is one of the most curious and interesting memorials existing of the manners and domestic history of the English in the sixteenth century. The castrations to the second edition of the Chronicles were printed and published separately in 1728. A new edition of the whole work, with the castrations inserted, was published at London in 1807–8 (six vols. 4to).

HOLKAR, a powerful Mahratta family, now in possession of the protected state of Indor in Hindustan. It was founded in the first half of the eighteenth century by a man of humble origin, a native of the town of Hol in the Deccan, from which circumstance the family name is derived. Having entered the army, he rose rapidly by his bravery and ability to the highest rank, married the cousin of the Rajah of the Mahrattas, took part in the invasion of Guzerat in 1721, and in recompense for his services received, about 1736, the western part of the province of Malwah, with the city of Indor for its capital. He died before 1770, and was succeeded after a short interval, during which his grandson held the throne, by his niece Aylah Bhyi, who conducted the internal administration of the kingdom with extraordinary success, for which she is still revered by the people of Indor. She intrusted the military power to Takaji Holkar, who died in 1797, two years after Aylah Bhyi, whom he had succeeded in the government of the country. On his death he left two legitimate and two illegitimate sons, and after a civil war one of the latter, Jeswunt Rao Holkar, succeeded in 1801 in making himself master of the kingdom. In 1804 and 1805 he carried on a vigorous war with the British, but was defeated and obliged to give up part of his territory. In 1811 he was succeeded by Mulhar Rao Holkar, who renewed the war with the British, but with no more success than his predecessor. He was totally defeated at Mehudpur in December, 1817, and in January, 1818, a British residency was established at Indor, and his state put under British protection. During the Indian mutiny Mulkerji Rao Holkar, who had succeeded to the dominions of the family in 1852, endeavoured to support the British, but owing to the mutinous disposition of his troops was able to render them no material assistance.

HOLLAND, or PARTS OF HOLLAND, a district of England, one of the three portions into which the county of Lincoln is divided. It occupies the south-east part of the county round the Wash, and consists almost entirely of low, marsh, and fen land, the marsh being the portion nearest to the sea, and the fen that which lies more inland. It is principally included within what is called the Great Level of the Fens, being defended from the sea and from the overflowing of the rivers by immense embankments.

HOLLAND, a fine and close kind of linen, so called from its first being manufactured in Holland.

HOLLAND, HENRY RICHARD VASSALL FOX, THIRD LORD, born in November, 1773, succeeded to the peerage by the death of his father when little over one year old; was educated first at Eton and afterwards at Oxford, and then made the tour of Europe. He returned to England in 1796, and the following year married a lady with whom he had previously had an intrigue, which led to her divorce from her former husband, and subjected him to an action of damages. In 1798 he took his place in the House of Lords, and as the nephew of Charles James Fox was at once acknowledged as a Whig leader. When that statesman came into office by the formation of a Whig ministry in 1806, Lord Holland was made a privy-councillor, and appointed one of the plenipotentiaries to settle the differences with the Americans in regard to neutral rights. On the death of his uncle he obtained a seat in the cabinet as lord privy-seal; but the following year having terminated the Whig ministry, he was thrown again into opposition, and without taking any prominent part in public debate, contented himself rather with formal protests against the measures which he disapproved, and with the influence which his connections and the hospitality of Holland House gave him with his party. In 1830, when the Whigs again came into power, Lord Holland became chancellor of the Duchy of Lancaster, with a seat in the cabinet. His attention, though much occupied with politics from the very commencement of his public life, was by no means absorbed by them, and he gave proof of his proficiency, particularly in Portuguese and Spanish literature, by publishing in 1806 the Life and Writings of Lope Felix de Vega (1806), and translations of three comedies from the Spanish (1807). Since his death on the 22d of October, 1840, a considerable sensation has been produced, not so much by the merits as by the contents of two posthumous works bearing his name, the one entitled Foreign Reminiscences (1850), and the other—which embodies the former, and may therefore be called a continuation of it—Memoirs of the Whig Party during my Time (1852).

HOLLAND, SIR HENRY, an eminent physician, born at Knutsford, Cheshire, October 27, 1788; died in London, October 27, 1873. He was educated for the medical profession at the University of Edinburgh, where he took the degree of M.D. in 1811. He spent the following two years in travelling in Eastern Europe, and on his return published Travels in the Ionian Islands, Albania, Thessaly, and Greece (1815). In January, 1816, he established himself in London as a physician, and he rapidly acquired a great reputation. In 1816 he was elected a fellow of the Royal Society, and in 1828 a fellow of the Royal College of Physicians. In 1840 he was appointed physician in ordinary to the prince consort, in 1852 physician in ordinary to the queen, and in 1853 was

created a baronet. He continued to practise with the greatest success in London to the end of his long life, varying, however, the exercise of his professional duties by indulging his life-long fondness for travel in frequent visits to America and the European continent. He was the author of numerous articles contributed to the Quarterly and Edinburgh reviews, besides a work entitled Medical Notes and Reflections (third edition, 1855); another on Mental Physiology (1853), which placed him in the first rank as an authority on mental derangement; and a volume of Essays on scientific subjects (1862).

HOLLAND, KINGDOM OF. See NETHERLANDS.

HOLLAND, NORTH (*Noordholland*), a province of the Kingdom of the Netherlands, the greater part of which consists of a peninsula in the north-west, connected with the mainland by an isthmus less than 3 miles in breadth. It includes also a few islands to the north, and a portion of the mainland bordering on Utrecht and South Holland on the south. The total area is 1070 square miles. The province of North Holland was formerly known as West Friesland. It lies very low, some portions of it, as Waterland, Kennemerland, and Purmerland, being at least partially below the level of the sea. A broad margin of downs or sand-hills, often 180 feet high, protects it from the sea on the west as far north as the Helder, where the peninsula terminates. Artificial dykes have been constructed where this natural embankment ceases. For administrative purposes the province is divided into the four districts of Amsterdam, Haarlem, Alkmaar, and Hoorn. The means of internal communication are abundant, the principal of which, besides the rivers (Vecht, Drecht, Amstel, Zaan, &c.), roads, and railways, is the Great North Holland Canal. Most of the lakes have now been drained. The largest of these was the Haarlemer Meer (part of which lay in the province of South Holland), covering 70 square miles. About one-half of the province is estimated to consist of clover, grass, and hay land. In addition to these, the chief agricultural products are wheat, rye, barley, oats, potatoes, pease, beans, &c. The province is poor in timber, the total area covered by woods amounting to no more than 24 square miles. On the other hand, the reeds and rushes, which grow abundantly in some districts, are of considerable importance. The keeping of bees receives a good deal of attention in some districts. Nurseries are numerous, especially in the neighbourhood of Haarlem, Alsmeer, and Naarden. Butter is largely produced and exported. The wool trade also is considerable in this province, the chief wool-markets being on the islands of Texel and Wieringen, and at the town of Wieringenward, opposite the latter island. The chief manufacturing industries are carried on at Amsterdam and Haarlem, and on the Zaan, where there are numerous paper-mills. The chief towns are Amsterdam, Alkmaar, Haarlem, Helder, and Zaandam. Two-thirds of the inhabitants of this province are Protestants, and more than one-fourth Roman Catholics; the remainder are chiefly Jews. In 1899 the population amounted to 968,105.

HOLLAND, SOUTH (*Zuidholland*), the most populous province in the Kingdom of the Netherlands, bounded on the north by North Holland, on the east by Utrecht and Gelderland, on the south by North Brabant and Zeeland, and on the west by the German Ocean. The southern part of the province is broken up into several islands. The area is 1155 square miles. Like North Holland, it is a flat and depressed tract, and it also is protected from the sea on the west by a margin of downs or sand-hills, extending to the mouth of the Maas on the south. For administrative purposes the province is divided into the six districts of 's Gravenhage, Leiden, Rotterdam, Dortrecht, Gorkum, and Briel. The chief river is the Rhine, with its numerous branches—the Leck, Linge, Merwede, Ijssel, Gouwe, and Rotte. The lakes were formerly numerous, but most of them are now drained. Besides the ordinary cereals and green crops, the chief agricultural productions are flax, hemp, and madder. The area of the hay and meadow land is above 600 square miles, or more than half the whole area of the province. The principal agricultural products are butter and cheese. Excellent vegetables are grown in the west, particularly around the Hague and Gouda, and great quantities are exported to England. Fruit-trees and bushes are carefully cultivated in the western part of the province, and their produce sent to all parts of the world. The manufacturing industry of the province is highly developed. The chief manufactures are those of bricks, gin (schiedam), and earthenware. Ship-building and the subsidiary arts are also carried on. The principal towns are Delft, Dortrecht (Dort), Gorinchem (Gorkum), Gouda, Leyden, Rotterdam, Schiedam, 's Gravenhage (the Hague), and Woerden. There is a university at Leyden, which boasts of a matchless museum of natural history. Nearly three-fourths of the inhabitants are Protestants (chiefly Calvinists and Mennonites), and nearly one-fourth Roman Catholics; the rest are mainly Jews. In 1899 the population amounted to 1,114,401.

HOLLAR, WENZEL (*Wenceslaus*), a Bohemian engraver, born in Prague in July, 1607, attracted, in 1636, the attention of Lord Arundel, the British ambassador to the German emperor, who took him in his suite to England. Here he practised his art with considerable fame and success, producing, among others, a set of twenty-eight plates, entitled Ornatus Muliebris Anglicanus, representing the dresses of Englishwomen of all ranks and conditions in full-length figures. Under the Commonwealth he joined the Earl of Arundel in Antwerp, and remained there for some years, during which he engraved Holbein's Dance of Death, and other works of the old masters. He was deprived by death of his patron in 1646, by which he was obliged to support himself by working for booksellers and printsellers, who paid him very miserably. In 1652 he returned to England in the hope of bettering his position, but had no better success here until the Restoration brought back some of his former friends. The great fire of London in 1666 was a special calamity for the artist, as it deprived him of all he possessed, and even for a time of the means of earning money by his engravings. In 1670 he was commissioned by the government to make a plan of the town and fortifications of Tangier, for which he received £100. He was nevertheless unable, even by the most strenuous exertions, to keep himself out of debt, and he died on the 28th March, 1677, in great poverty. His prints are highly esteemed for their delicate, firm, and spirited execution.

HOLLES, DENZIL, LORD, an eminent political character of the seventeenth century, the second son of Holles, the first earl of Clare, was born in 1599. In the Parliament of 1627 he took a leading part in favour of liberty with his characteristic ardour and courage. When the three resolutions of the Commons against Popery, Arminianism, and tonnage and poundage by the king's prerogative were drawn up, he was one of the two members who forcibly held the speaker in the chair until they were passed. For this conduct, refusing to give bail or sureties for his good behaviour, he was condemned to fine and imprisonment, the latter of which he endured in the Tower for upwards of twelve months. In 1640 he entered the Long Parliament, a determined foe to the court, and was placed at the head of the Presby-

terian party. As the Earl of Strafford was married to his sister, he did not take part in the prosecution of that minister, but he carried up the impeachment against Archbishop Laud. He was also one of the members, the imprudent attempt to seize whom, in the Parliament House, in 1642, formed the immediate cause of taking up arms. In the ensuing war the Parliament conferred on him the command of a regiment, and appointed him lieutenant of Bristol; but becoming aware of the designs of the leaders of the Independents, he endeavoured to frustrate them by promoting a treaty with the king. In 1644 he was one of the commissioners appointed to carry propositions of peace to Charles at Oxford; and in 1647 he made a motion for disbanding the army, but the party of the Independents was now too strong, and the attack was returned upon himself by an impeachment for high treason. He consulted his safety by retiring to France, whence he was allowed to return in 1648, when he resumed his seat in Parliament, and was one of the commissioners appointed to treat with the king in the Isle of Wight. He was soon after again obliged, by the violence of the times, to retreat to France, where he remained until the Restoration, which he zealously promoted. He was one of the members of the House of Commons who waited upon the king at the Hague; and Charles II., before his coronation, advanced him to the peerage by the title of Lord Holles of Isfield, in Sussex. In 1663 he was sent ambassador to France, and in 1667 was one of the English plenipotentiaries at Breda. Notwithstanding these employments he remained a zealous friend to liberty; and when the politics of the reign tended to make the king absolute, Lord Holles was a conspicuous leader of opposition. He is mentioned by Barillon, the French ambassador, as one of the noblemen who entered into negotiations with France to thwart the suspected measures of Charles against liberty at home; but it is at the same time intimated that he and Lord William Russell alone refused the money offered by Louis XIV. He died with a high character for honour, integrity, and patriotism in 1680. In 1699 were published Memoirs of Denzil Lord Holles, from 1641 to 1648 (4to); some of his letters and speeches have been published separately.

HOLLOW WARE, the trade term for all kinds of vessels made of cast or wrought iron, and used for cooking and other purposes. Vessels of this nature were formerly either blackened or left untouched; but now various methods of finishing them are in use. If they are not intended for cooking they are usually coated with zinc, but if they are intended for that purpose they usually receive either a coating of tin or enamel. The process of tinning was introduced about the end of the 18th century. Vessels intended to undergo this operation after being formed are softened by the process of annealing, and then made smooth in the inside by turning on a turning-lathe. Melted tin is then poured into the inside in small quantities, and spread over the surface by means of a cork, a little sal-ammoniac being added to make the tin adhere. Sometimes the process of smoothing the inside is omitted; but although in this case the articles are cheaper the other kind are altogether preferable, as they are easier to clean, and the tin coating is more durable. The composition of the enamel which is used to line hollow ware varies. The substances most commonly used for the purpose are quartz flint, washed sand, felspar, broken glass, broken pottery, borax, soda, saltpetre, carbonate of magnesia, and carbonate of ammonia. According to the ordinary process of application it is laid on with a brush in two coats; the first coat furnishing the body of the enamel, and the second the glaze. The greatest difficulty to be obviated in applying enamel to vessels intended for cooking arises from the fact that iron is more readily expansible by heat than any enamel, which makes the latter liable to chip off when heat is applied. To overcome this difficulty the French apply the enamel by laying on the ingredients in a cold state and then heating the vessel till these ingredients vitrify, when they are said to combine with a film of the iron and form an irremovable vitreous enamel. Wrought-iron hollow ware is either made by soldering separate pieces together, or by stamping a single piece into the shape required. The latter process is now largely used, and articles made by it have the advantage of being free from joints, which renders it easier to tin them and to keep them clean, and also makes them more durable. The enamel on wrought-iron hollow ware is not nearly so durable as that upon cast-iron ware.

HOLLY (*Ilex*), a genus of plants of the order Aquifoliaceæ, embracing a number of evergreen trees or shrubs. The common holly (*I. aquifolium*) is common in Britain and the Continent of Europe. It is a handsome, conical evergreen tree, growing to the height of 30 feet in a wild state, and sometimes considerably more when cultivated. Its leaves are dark-green, shining, and leathery, abundantly armed with prickles on the lower branches, but free from them on the upper, or on very old trees. The flowers are white, appearing in May; the fruit is red, ripening in September, and remaining on the tree all the winter. A good many varieties are known, distinguished by the shape and colour of the leaves, which are sometimes spotted or edged with yellow, &c. The American holly (*Ilex opaca*) is widely diffused throughout the United States, extending from about lat. 42° to the Gulf of Mexico, and beyond the Mississippi to the border of the desert plains which skirt the base of the Rocky Mountains. It sometimes attains the height of 80 feet, with a trunk 4 feet in diameter It is so similar to the European species that some make it only a variety. The chief distinction between them is that the foliage of the American species is less glossy and its berries less bright. The wood of both species is very hard, susceptible of a fine polish, and more capable of receiving a black colour than almost any other. It is much used for veneering and cabinet work, and is a good wood for turning, for the cogs of wheels, and other purposes. From its retaining its foliage and fruit during the winter, the holly is a very desirable tree for shrubberies and ornamental planting. As a fence it is very serviceable; and when formed into hedges it admits of being cropped, and retains its foliage through the severest winters. Its growth is slow, but its duration is longer than that of most other trees. The bark yields a strong mucilaginous substance, from which birdlime is made. Among the Romans it was customary to send boughs of holly to friends, with new-year's gifts, as emblematical of good wishes; and in England it is used to decorate houses at Christmas. The *I. glabra* is another species of holly, inhabiting the coast regions of the United States. Its leaves are sometimes used for tea, and they furnished the 'black drink' which used to hold an important place in Indian ceremonies. The *maté* or Paraguay tea-plant is a species of holly (*I. Paraguayensis*). The leaves are used for tea, and are found on analysis to contain *theine*, the active principle of tea. The hollies are remarkable for their medicinal properties. The leaves and bark of the common holly are employed in intermittent fever; its berries cause vomiting and purging.

HOLLYHOCK (*Althæa rosea*), a malvaceous plant, a native of the East, and cultivated in gardens for the sake of its spikes of large and beautiful flowers. The root is biennial, and shoots up one or several up-

right stems, which attain the height of from 5 to 8 feet. The flowers are rose-coloured, and situated in the axils of the leaves. From cultivation many varieties have arisen bearing flowers single or double, white, yellow, red, or even almost black. It is a hardy plant, but latterly has fallen greatly out of cultivation owing to the ravages of a kind of fungus which attacks and kills it.

HOLMES, Oliver Wendell, one of the foremost American writers, was born at Cambridge, Mass., 29th August, 1809, being a son of the Rev. Abdiel Holmes, author of Annals of America. He graduated at Harvard in 1829, and was something of an author even in his student days, but the first piece which made him widely known was a poetical protest against the breaking up of the old American man-of-war *Constitution*, published in 1830. After studying law for a short time he devoted himself to medicine, carrying on his studies both in America and Europe, more especially at Paris, and devoting some part of his time to the writing of poetry, both humorous and serious. His first volume of poems appeared in 1836, the same year in which he took the degree of M.D. He was for a short time professor of anatomy and physiology at Dartmouth College; then gave himself up to private practice in Boston; and in 1847 became professor of anatomy and physiology at Harvard, a post which he held till 1882. He made various contributions to the literature of medicine, but it is in literature of a lighter kind that his name has become so well known. His most original work is The Autocrat of the Breakfast-Table, which first appeared in the Atlantic Monthly (established in 1857), and was published separately in 1859. This professes to be the table-talk of the 'Autocrat' (who lives in an American boarding-house), and the plan gives the author scope for touching on topics of the most varied character, in a vein at times serious, at times humorous or witty, but always striking and original, while poems of high excellence are also interspersed. The Professor at the Breakfast-Table and The Poet at the Breakfast-Table are two works of a similar character, and in their way only less successful than the Autocrat. Two rather remarkable novels also proceeded from Holmes's pen: Elsie Venner, a Romance of Destiny, and The Guardian Angel. Among collective volumes of his poems are those with the titles Songs in Many Keys; Songs of Many Seasons; The Iron Gate; and Before the Curfew. Among his prose works are Mechanism in Thought and Morals; Memoirs of Motley and Emerson; A Mortal Antipathy; and Our Hundred Days in Europe, a bright record of a short visit made in 1886, on which occasion the universities of Oxford, Cambridge, and Edinburgh all conferred honorary degrees on the writer, whose name was now as well known in Europe as in America. He died rather suddenly October 8th, 1894, retaining his faculties to the last.

HOLOGRAPH. In Scots law a holograph deed, that is, one written entirely by the granter's own hand, is valid without witnesses, but in that case does not prove its own date. A deed is presumed to be holograph until the contrary is proved, if it is stated in the deed itself to be so, and even where such is not stated to be the case it may be proved either by a comparison of the handwriting of the deed with the known handwriting of the granter, or by the evidence of a witness who saw the deed written. The same rule as to the validity of an unattested holograph will is recognized in French law; but in English law every deed, whether holograph or not, must have the names of one and in some cases two witnesses attached to it to render it valid.

HOLOTHURIA. The type of an order of Echinoderms, the *Holothurioidea*, or sea-cucumbers. All the members of this group are more or less vermiform in appearance, and further differ from the star-fishes and sea-urchins on the one hand in having the apertures of the intestinal canal at opposite ends of the body, and on the other in having only a few calcareous plates scattered through the integument. The ambulacral apparatus is present, but its five rows may be so arranged that one interspace becomes a kind of sole on which the animal creeps. The 'stone canal,' or canal of the ambulacral system, hangs free in the body. The mouth is surrounded by prehensile tentacles, and has not even rudiments of Aristotle's lantern. Respiration is effected by two or four gills, which, opening into the cloaca posteriorly, ramify through the body; but, as in *Synapta*, where these structures and the cloaca are wanting, the function may be carried on by the skin, the intestinal wall, and the tentacles. The larva becomes a cylindrical pupa surrounded by four or five ciliated rings, and thus resembles the larva of a worm. Within the pupal body the intestinal canal, its peritoneal covering, and its muscular bands are developed, and the pupal integument is retained throughout life. The Holothurians of the Pacific furnish the trepang or *bêche de mer*, a nutritious commodity in great favour with the Chinese and Polynesians. The bodies after evisceration, a process which the animal when captured often goes through spontaneously, are dried in the sun. The trepang owes its popularity, at least in some countries, to its supposed aphrodisiac properties, this being assumed because of the great fertility of the order. (See illustrations at Mollusca.)

HOLSTEIN. See Schleswig-Holstein.

HOLY ALLIANCE, a league proposed by Alexander I., emperor of Russia, September 26, 1815, after the defeat of Napoleon at Waterloo had cleared the way for the execution of his desire of establishing a settled peace in Europe. Alexander, Francis of Austria, and Frederick William III. of Prussia, signed with their own hands, and without the countersign of a minister, the act establishing this alliance, which is said to have been sent to the two latter in the handwriting of the first. It was not wholly published till February 2, 1816, when the text was given in full in the Frankfort Journal. It consisted of a declaration, that, in accordance with the precepts of the gospel of Jesus Christ, the principles of justice, charity, and peace should be the basis of their internal administration, and of their international relations, and that the happiness and religious welfare of their subjects should be their great object. Its real aim, however, was to maintain the power and influence of the existing dynasties. It was also stipulated that the three sovereigns should invite others to become members of the Holy Alliance. In Russia and Germany its principles were not discussed except in a spirit of eulogy, but they were uncompromisingly condemned in Britain by many of her foremost statesmen. On February 4, 1823, both Lansdowne and Brougham openly condemned its doctrines in their places in Parliament. Sir James Mackintosh said of the doctrine of legitimacy, in the sense in which it was used by the Holy Alliance, 'Sophistry lent her colours to the most extravagant pretensions of tyranny.' The events of 1848 broke up the Holy Alliance. It had previously lost much of its authority from the death of Alexander, and the French revolution of 1830. By a special article of the treaty the members of the Bonaparte family were declared incapable of occupying any European throne.

HOLY COAT OF TREVES, a relic preserved with extraordinary veneration in the cathedral of the ancient archiepiscopal city of Treves, on the Moselle, and said to be the identical seamless coat worn by our Saviour at his crucifixion, and for which the

soldiers cast lots. It was the gift of the Empress Helena, by whom it was discovered in her visit to Palestine in the fourth century. During the Middle Ages it attracted crowds of pilgrims, whose liberality enriched both the shrine and town. It was exhibited only once in a century, and was then carefully concealed in a place known only to a few. After having passed out of sight for several centuries it was rediscovered in 1196, and exhibited with much solemnity. A similar exhibition took place in 1512, when Pope Leo X. removed the restriction on the frequency of its exhibition, and ordered that it should be submitted to public inspection every seven years. The Reformation interfered with the observance of this religious festival. In 1841 the existence of the relic was considered doubtful; but in 1844 Archbishop Arnoldi announced a fresh celebration, which was attended by great numbers, and miraculous cures were asserted to have been wrought by the relic. Opposition, however, arose to the repetition of such scenes, and Johann Ronge, a German priest, denounced a resuscitation of the superstitions of the Middle Ages. He soon was at the head of a large number of Roman Catholics like-minded with himself, but the opposition resulted in nothing. In August and September, 1891, the coat was again exhibited to immense multitudes, and cures are said to have again taken place. The coat is of a brownish material, either linen or cotton, has sleeves about a foot long, and is said to measure, from the collar to the lowermost edge, 5 feet 2 inches.

HOLY GHOST. See GHOST (HOLY).

HOLYHEAD (Welsh, *Caer-Gybi*, 'The fortress of Cybi'), an island, with a seaport town of the same name, in North Wales, in the county of Anglesey. The island is about 7 miles long and 5 miles broad at the widest part, and is situated off the west side of Anglesey. It is connected with the mainland by a causeway, with a railway and a carriage road, which crosses the Lasenwan Sands, and is carried by a bridge over a portion of the sea. The northern extremity of the island consists of a huge headland of serpentine, presenting in some parts immense perpendicular precipices, in others magnificent caverns excavated by the action of the waves. North-west of the head are two rocks, called the North Stack and the South Stack, the latter having a lighthouse 197 feet high. The South Stack proves a great attraction to visitors, from the wildness and grandeur of the surrounding scenery. It is connected with the head by a handsome suspension bridge, extending over a chasm 90 feet wide, through which the sea roars and boils with great impetuosity. This bridge is approached from the height above by 365 steps, winding downwards in a zigzag track. The town is on the north-east side of the island. It is built in terraces, has two handsome churches, many fine nonconformist chapels, and a fine town-hall. From its advantageous situation Holyhead has been selected as the principal station of the post-office packets for conveying the mails to Dublin, 69 miles distant. There is a harbour of refuge about 400 acres in area, and another harbour, leased to the London and North-Western Railway Company. Beside the latter is a triumphal arch of Anglesey marble erected to commemorate the landing of George IV. in 1821. The harbour of refuge (Victoria Harbour) is formed by a massive breakwater which is 7860 feet in length, and has a lighthouse at the extremity, the whole cost, including some minor works, being £1,500,000. The harbour works were commenced in 1848 and completed in August, 1873, when the Prince of Wales visited Holyhead and publicly declared the Harbour of Refuge open. The London and North-Western Railway has an extensive terminus at Holyhead (the station being close to the harbour), and a large number of express boats plying between this place and Dublin and Greenore. A submarine electric telegraph was laid from Holyhead to Howth on June 1, 1852. Pop. in 1891, 8745; in 1901, 10,072.

HOLY ISLAND, or *Lindisfarne*, an island off the north-east coast of England, belonging to Northumberland, from which at the nearest point it is barely a mile distant, being connected by a stretch of sand. Posts have been erected at short intervals on the sands as a guide to persons travelling to the island, which can be reached on foot three hours or more before or after high water. The island is of an irregular form, about 2¼ miles in length, and about 1½ mile in breadth at the broadest part; the north-west diminishing to ½ mile. The north-western part of the island consists chiefly of barren soil and sand-hills, and is overrun with rabbits. The south-eastern end terminates in a perpendicular rock 60 feet high, crowned by a small fort or castle. The cultivable soil is fertile, producing excellent crops of corn, turnips, &c. Limestone and iron ore abound, and coal also has been met with. On the west coast are some curious caves, the largest extending 50 yards inwards from the entrance. Here is also the small but finely-situated village of Lindisfarne, about 3 miles from the mainland, now much resorted to by summer visitants. The inhabitants are chiefly engaged in fishing and many crabs and lobsters are here obtained. Close by the village is a small harbour.

The chief object of interest is the celebrated ruined Benedictine priory church of Lindisfarne, 'a solemn, huge, and dark-red pile' built in 1093 on the site of the monastery founded by Aidan, Bishop of Lindisfarne, in 635. Though frequently plundered for the erection of houses in the village, it is still magnificent, and is now secured from further dilapidation by its proprietor. The length of the church is about 138 feet, and its breadth 36 feet; the style of architecture somewhat resembles that of Durham Cathedral. The west end with a doorway, much of the north side of the nave, and a few other parts are all that remain. As a result of various excavations the plan of the original monastery has been restored. The exterior ornaments of the building being of a light sandy stone are much wasted. Pop. in 1900, 405.

HOLY LAND. See PALESTINE.

HOLY OFFICE. See INQUISITION.

HOLY PLACES OF JERUSALEM, a term meant to apply more particularly to that group of localities of which the Church of the Holy Sepulchre is the centre, and some of the other more celebrated objects are the Garden of Gethsemane, the Church of the Ascension, the Tomb of the Virgin, &c., all connected with the life and passion of our Saviour. The Church of the Holy Sepulchre, situated in the western half of the city, was dedicated by the Empress Helena in 335, burned by the Persians in 614, and has undergone several more or less complete destructions, rebuildings, and enlargements. It was partly burned so late as 1808. It forms a clumsy assemblage of buildings, a large number of chapels, shrines, &c., some forty in number, being here crowded together, the most prominent external features being a large and a small dome, and a truncated square tower. Under the great dome stands the little church containing the Holy Sepulchre, and richly decorated. A marble slab is shown as the Stone of Unction, the body of our Lord being said to have been anointed on it previous to being placed in the tomb. Seven Christian

sects are represented in the group of buildings, Greeks, Latins, Armenians, Syrians, Copts, &c., all having chapels, &c., here. What is called the Mount of Calvary is also in this quarter. The street approaching this is the *Via Dolorosa*, 'Dolorous Way,' because along it our Lord is said to have passed from the Hall of Judgment to Calvary. Such has always been the tradition held regarding the site of the sacred tomb, though some have maintained that the Mosque of Omar, in the eastern half of the city, covers the true site of the sepulchre; but all recent explorations have tended to support the traditional view.

The guardianship of the Holy Places was regulated by treaty between France and the Porte in 1740, and there have more than once political complications arisen out of this question sufficient not only to threaten but to break the peace of the world. A riot occurred at Jerusalem in 1757 from jealousy on this matter, and in the same year the guardianship was assigned by imperial edict to the Greek Church. In 1810 there was a French and Russian intervention, but negotiations were broken off in 1821, on account of the Greek revolution. In June, 1850, the French government, representing the Latin Christians, demanded a strict execution of the Treaty of 1740. On 9th February, 1852, the validity of the Latin claims was acknowledged by the Porte, but in the same month, on the remonstrance of Russia, the privileges of the Greeks were ratified by firman. This affair led to the Crimean war See CRIMEA.

HOLYROOD, PALACE AND ABBEY OF, in Edinburgh, at the eastern extremity of the old town. The abbey church, founded in 1128 by David I., was used as the royal cemetery. It is now mostly in ruin. The palace is a large quadrangular building of hewn stone, with a court within, surrounded by a piazza. It contains a gallery 150 feet long, in which are portraits of all the Scottish kings, most of them imaginary. It is now used at the election of the sixteen peers of Scotland to represent their order in Parliament. In the north-west tower the bed-chamber of the unfortunate Mary, with the remains of her crimson damask bed, is still to be seen, and an adjoining cabinet, from which Rizzio was dragged and murdered in her presence. A large portion of the palace was repaired for the Bourbon princes, who resided here after the first French revolution. It was afterwards occupied by the Duke of Hamilton, hereditary keeper of the palace, and again became the residence of the Bourbons in 1830. The occasional visits of Queen Victoria made it once more *de facto* a royal palace. See EDINBURGH.

HOLY WATER, in the Greek and Roman Catholic Churches, water which has been consecrated by prayers, exorcism, and other ceremonies, to sprinkle the faithful and things used for the church. Some antiquaries think that the use of holy or lustral water was borrowed from the Jews. 'By this benediction,' says the Dictionnaire de Théologie (a Catholic work), 'the church implores God to purify those who use it from sin, to avert the temptations of the enemy of salvation and the snares of this world. In the apostolic constitutions the holy water is called a means of expiating sins, and putting the evil spirit to flight.' Constit. Apost. viii. 29, '*ad fugandos dæmones, morbos expellendos, insidias profligandas.*' It is contained in a particular kind of vases, probably in imitation of the brazen sea of the Jews, at the doors of churches, and also within them at certain places, from which the Catholics sprinkle themselves before prayer. Holy water is also often found in the chambers of the Catholics, and is used before prayer, particularly before going to bed. The Roman Catholic Church seems to consider holy water not only symbolical of the purity of the soul, but in certain cases as effectual in exorcism. The Protestants renounced the use of holy water, probably from a fear that it would be considered, like amulets or relics, as something efficacious in itself, without the repentance commanded by the church. Roman Catholics, however, expressly disclaim any such belief. In Addis and Arnold's Catholic Dictionary it is remarked: 'The reader will observe that we do not attribute to holy water any virtue of its own. It is efficacious simply because the Church's prayers take effect at the time it is used'. At a very early period vessels were placed at the doors of churches for washing or sprinkling the hands, and the custom of blessing the water for this purpose must also have been very early; but the mingling of salt with the water was probably introduced considerably later.

HOLY WEEK, or PASSION WEEK, is that which immediately precedes Easter, and is devoted especially to commemorate the passion of our Lord. The name Passion Week rather refers to the days following and exclusive of Palm Sunday, since this day, strictly speaking, does not commemorate any incident of Christ's passion, but his triumphant entry into Jerusalem. The three chief days of the week are Maundy Thursday (or Holy Thursday), Good Friday, and Holy Saturday, the most sacred of all being Good Friday. The observance of Holy Week is of very early origin, and it was known as Great Week, Silent Week, Penitential Week, &c. It seems to have been very generally observed in the third century; and in the East the whole week from midnight on Palm Sunday to cockcrow on Easter, was kept as far as possible as a strict fast. Total abstinence was enjoined on Friday and Saturday, and there were some, it is said, who fasted the whole week, all work being laid aside, and public business suspended. In the ancient Church of Rome, when any of the ordinary church festivals falls on this week, it is not observed till after Easter. In Rome it used to be observed with much greater solemnity and penitential rigour than now; for the shops are kept open, concerts and other amusements are given, though the theatres are closed. The churches exhibit the chief external differences, the altars, crucifixes, and pictures being generally put in mourning, while instrumental music is suspended. Maundy or Holy Thursday, from *mandatum*, the word that commences one of the services of the day, was a day on which an abnegation of personal dignity was exercised, and when great ecclesiastical and lay dignitaries condescended to the menial office of washing the feet of the poor. The washing of the feet of poor men is still practised in Roman Catholic churches; and the Pope washes the feet of thirteen poor persons, all of whom are priests. In Austria the emperor keeps up the old rite of feet-washing with much ceremony. This day specially commemorates the institution of the Eucharist. On Holy Saturday 'new fire' struck from a flint is blessed, and from this is lighted the paschal candle, regarded as a symbol of Christ risen from the dead. The water of the baptismal font is also blessed, and after the water for baptism has been exorcised, some of it is sprinkled on the people. In Rome formerly all the fires were lighted anew from the holy fire, but this custom has been discontinued. Five grains of incense are fixed in the paschal candle to commemorate the wounds of Christ and the spices with which he was anointed for the tomb. On Holy Saturday catechumens were baptised, and candidates for the office of the ministry were ordained. For Good Friday, see FRIDAY (GOOD).

HOLYWELL, a market town and parliamentary borough, North Wales, in Flintshire, situated on a declivity near the southern shore of the estuary of the Dee, 17 miles S.W. Liverpool, with a station on

the Chester and Holyhead Railway, 2 miles north of the town, and close on the estuary. It has one principal street and several smaller; the former tolerably straight, the latter the reverse. The houses are chiefly of brick. The public buildings are noways remarkable. A *hospice* has been founded here by the Roman Catholics for the accommodation of 'pilgrims' who seek for a cure to their maladies by bathing in St Winifred's Well. This celebrated well, which discharges 20 tons of water per minute, is at the foot of a hill in the north end of the town, under spacious crypts which support a very ancient chapel or hall. About £4000 has recently been spent in the erection of baths, &c. The town has some trade in timber, building materials, leather, &c. In the immediate vicinity are mines of coal and lead, and quarries of limestone and freestone; the parish contains also extensive collieries, lead, silver, and copper works; manufactories of woollen goods, paper, zinc, &c. Holywell is a contributory parliamentary borough to Flint. Pop in 1891, 3018; in 1901, 2652.

HOMAGE, a term originally applied to the service or show of respect due from the vassal to his feudal superior. The word is formed directly from *homo*, Old French *home* (man), as the form of rendering homage commenced with the words in Norman French, 'I become your man.' Homage was the most honourable service of reverence that a free tenant could do to his lord. When a tenant performed it he was ungirt, and his head uncovered, the lord sitting. The tenant then knelt before him, and held his hands extended and joined between the hands of his lord, and repeated the formula of service, which acknowledged the superiority of the lord, as regarded the vassal, to all except 'our sovereign lord the king.' But since tenures were abolished the word has in English law no substantial legal meaning, except as to copyholds to denote the kind of acknowledgment made by a tenant to the lord of the manor. *Ancestral homage* was where a tenant held lands of his lord by homage, himself and his ancestors having held the same land of the same lord, and of his ancestors, immemorially, and having done to them homage. One bound to do homage was a *homager;* and *homagium reddere*, to renounce homage, was the expression used when a vassal made a solemn declaration of disowning and defying his lord. The word homage is not used in Scotch law.

HOMBURG-VOR-DER-HÖHE, often called simply Homburg, a town of Prussia, in the province of Hesse-Nassau, government of Wiesbaden, beautifully situated on a gentle rising ground, half-surrounded by projections of the Taunus Hills, 9 miles N.N.W. Frankfort. It is well and regularly built, contains the palace of the former landgraves of Hesse-Homburg, a gloomy-looking structure, with a conspicuous tower, now used as a Prussian royal residence, three churches, a synagogue, orphan and ordinary hospital, and mineral springs, with a Kurhaus or bathing establishment, to which gaming-tables were formerly attached. The waters are of two classes, those of three springs being purgative, and used for complaints of the stomach, liver, kidneys, &c.; those of the remaining two contain iron, and are used as a tonic. Pop. (1900), 9635.

HOME, Henry (Lord Kames), a Scottish judge, eminent for his writings on various subjects, was descended from a noble family. He was born at Kames, in Berwickshire, in 1696, and received his education from a private tutor at home. In 1712 he was bound to a writer of the signet, but, ambitious of becoming an advocate, he zealously supplied the defects of his education, mainly by private study, and fitted himself for the bar, to which he was called in 1724. He soon acquired reputation by a number of publications on the civil and Scottish law, the first of which, consisting of Remarkable Decisions in the Court of Session from 1716 to 1728, appeared in 1728. This was followed in 1732 by Essays on Several Subjects in Law. During the troubles in 1745 and 1746 he sought shelter in retirement, the fruits of which appeared in 1747 in his Essays upon Several Subjects concerning British Antiquities. In 1757 appeared his work The Statute Law of Scotland, abridged, with Historical Notes; in 1766 and 1780 Additional Decisions of the Court of Session; and in 1777 his Elucidations respecting the Common and Statute Law in Scotland. In 1752 he became a judge of session, and assumed, according to the custom of Scotland, the title of Lord Kames; and in 1763 was made one of the lords of justiciary. From his youth he had a great turn for metaphysical disquisition, and maintained a correspondence with Bishops Berkeley and Butler, Dr. Clarke, and other eminent reasoners. In 1752 he published Essays on the Principles of Morality and Natural Religion, in which he advocates the doctrine of philosophical necessity. His Introduction to the Art of Thinking (12mo,1761) is useful to young persons. In 1762 he published his Elements of Criticism (three vols. 8vo), in which, discarding all arbitrary rules of literary composition, he endeavours to establish a new theory on the principles of human nature. On this work his fame now chiefly rests. Its chief defect is an unnecessary multiplication of original tastes or principles. He followed this elaborate work in 1773 with two quarto vols., entitled Sketches of the History of Man, which is ingenious and entertaining, but of little or no scientific value. In 1776, at the age of eighty, he published the Gentleman Farmer; being an Attempt to Improve Agriculture, by subjecting it to the Test of Rational Principles, 8vo; and in 1781 he wrote his last work, Loose Thoughts on Education, being then in his eighty-fifth year. He died 27th Dec. 1782, at the age of eighty-six. A work of much interest is A. F. Tytler's (Lord Woodhouselee) Memoirs of the Life and Writings of the Hon. Henry Home, of Kames; with a Supplement (London, 1814, three vols. 8vo).

HOME, John, a dramatic writer, was born at Leith on the 21st September, 1722. He was educated at Edinburgh for the church, and was licensed to preach 4th April, 1745. In the autumn of the same year he took up arms on the royal side, and was made prisoner at the battle of Falkirk, but contrived to escape, and was not long after appointed to the parish of Athelstaneford, vacant by the death of Blair, author of the Grave. Here he composed his tragedy of Agis, which was refused by the London managers. His Douglas being also refused by Garrick, the author had it performed at Edinburgh in 1756, himself and several of his clerical brethren being present. For this departure from the usages of the Church of Scotland the author was threatened with ecclesiastical censures, and in consequence resigned his living, and ever after acted and appeared as a layman. He retired into England, where he obtained the protection of the Earl of Bute, and received a considerable pension, which enabled him to pass the remainder of his life in comparative affluence. As a persecuted man he was complimented on this occasion by David Hume, who, in a strain of high panegyric, addressed to him his Four Dissertations. His Douglas became a stock piece. Several other dramatic attempts by him completely failed. The Siege of Aquileia, the Fatal Discovery, Alonzo, and Alfred, had not even temporary success. They are now not only never read, but are absolutely forgotten, a fate which their mediocrity deserves. His History of the Rebellion of 1745–46 (4to) also dis-

appointed public expectation. He died in 1808, at the advanced age of eighty-five.

HOMER (Greek, *Homēros*), the greatest name in Greek literature, and the greatest epic poet of all time. The several old biographies of him extant give us little or no information that can be relied on. Even when we inquire as to the period in which he lived and flourished we are met with nothing but uncertainty and conjecture, no less a diversity than 500 years (from B.C. 1184–684) occurring to stagger us. The same uncertainty meets us as to his birthplace. The commonest form of the tradition is that seven cities contended for the honour of having produced him: Smyrna, Colophon, Chios, Argos, Athens, Rhodes, and Salamis. But on a careful examination of all the passages of the ancient writers in which the place of his nativity is indicated, we find seventeen or nineteen claiming him as their countryman; these claims, however, vanish on being stringently tested. The most probable opinion is that he was a native of some locality on the sea-board of Asia Minor, as his descriptions of the sea and all that belongs to navigation and seafaring are vivid and picturesque in the extreme. If he was in his later years blind he could not always have been so, for no peculiarity of form or colour escapes him, and he is one of the best and most truthful of scene-painters. His genealogy is surrounded with as much obscurity as the other incidents of his life. His father was said to be Mæon, hence his own patronymic *Mæonides*, and another, *Melesigenes*, is said to have been applied to him from a reputed nativity on the river Meles, not far from Smyrna. The derivation of the name Homer as indicating blindness on the part of its possessor is to be regarded as purely fanciful. On one circumstance of his life there was, till lately, no diversity of opinion, the belief that he was a wandering singer, or minstrel. But there could be no truth in the supposition that if he were a minstrel he would also be a beggar. The Greek minstrels were much respected, and welcome wherever they came—in the palaces of princes, and the assemblies of citizens, for whatever purpose these were convoked. Especially to the more prominent citizens their presence would be welcome, as they were able to confer immortality, if not on themselves, at least on their ancestors.

The poems attributed to Homer with least hesitation are the Iliad and Odyssey; few or none believe him to be the author of the Batrachomyomachia, Hymns, and Epigrams. The Batrachomyomachia (Battle of the Frogs and Mice), a mock-heroic poem, is merely a successful attempt to travesty the Iliad and Odyssey; and is unmistakably, from its contents, language, and the customs which it illustrates, of a much later age than the other Homeric poems. The hymns are probably only fragments of ancient Cyclic poems, or preludes of rhapsodies. Those whose opinion is of any value on this question assign to them a much later age than the two great epics, and are at one on their non-Homeric origin. The epigrams are, beyond dispute, of a different authorship from the Iliad and Odyssey.

The entire system of Homeric criticism was revolutionized in 1795 by F. A. Wolf in his Prolegomena to Homer. He asserted that the Iliad and Odyssey were not two complete independent poems, but originally a series of songs of different poets, celebrating single exploits of heroes, and first connected as wholes by Pisistratus. His ideas have since been not so much refuted as modified, and the position he took as a critic has, by provoking opposition and examination, done much to fix firmly our knowledge of how much can be known about Homer, and how much cannot now be ascertained with reasonable and desirable exactness. His first position was that the poems were not committed originally to writing—probably a correct view. His second, a corollary from this, was that the only possible mode of then publishing poems was by oral recitation. And then he asserted that as the Cyclic poems had little poetical merit, and almost no unity, the plot being simply a chronological narration of events, so the Homeric poems owed their present state of excellence and their reputation to the fact that, though there is no essential unity in them, Aristotle's ingenuity derived from them the laws of epic poetry, precisely because the several poems that compose them happened to fit into each other. The Iliad begins with the wrath of Achilles, but this ceases naturally on the death of Patroclus, and the new wrath is of a different kind. This objection is met successfully by K. O. Müller in his History of Greek Literature, in which he also vindicates triumphantly the unity of the Odyssey, a poem as an intellectual effort, and an inspiration of genius, even more surprising than that of the better-known Iliad. To believe that chance and compilation could more easily give birth to this wonderful production than the mind of a single man is one of those strange idiosyncrasies that are produced by the efforts of an ingenious man to support a favourite theory. No competent critic will deny that both the Iliad and Odyssey have suffered extensions and interpolations, but the inference deducible from this admission is just the opposite of what Wolf would wish us to draw. The correct inference is that these excrescences have only obscured and not destroyed the original unity, and that they were to be expected in a poem so long preserved by oral tradition.

The Rhapsodists and Pisistratus are credited with having brought these poems into their present form both by composition and compilation. Many of the Rhapsodists must have had genius and taste, and, therefore, were both fitted and tempted to try to improve particular passages, and to adapt their recitation to the occasion. We have also good authority for believing that to the labours of Pisistratus, assisted by competent critics and scholars, is owing the first complete and critical text of Homer, though, probably to flatter the pride of the Athenians, and to suit the political purposes of Pisistratus, some passages were interpolated. But the text would be too well known to the Greek race for any serious tampering with its purity and integrity to be attempted. That the subject-matter of the poems was a tradition resting on and preserving a knowledge of real events seems highly probable.

That Homer was a real personage seems to be the most reasonable view, for it is more difficult to believe in the existence of several poets of equal eminence, and either contemporary or following each other at no long intervals, than of one. That he gathered and gave form to the floating traditions of war, travel, and adventure that make up the two great epics, is the most likely supposition that is open to us. The Cyclic poems were once believed to be genuine productions of Homer, a faith which has been forced to collapse before our greater knowledge of the literature and antiquities of Greece. The hymns have long ceased to be attributed to him; the only reason that they ever were reckoned as his being the circumstance that they were recited by the Rhapsodists along with the genuine poems. They exhibit immense diversity of language and tone, and, according to Müller, 'contain fragments from every century from the time of Homer to the Persian war.' The Alexandrian critics never believed in their genuineness, and consequently never made a regular collection of them. Five of them are well known to Greek students, one of them particularly, that to the Delian Apollo, written by a Homerid who styles himself the blind

poet who lived in rocky Chios, a description which is the original of the familiar line—

'The blind old man of Scio's rocky isle'—

was deemed even by Thucydides to be an undoubted production of Homer. The Margites, a poem regarded by Aristotle as the source of comedy, was once erroneously attributed to Homer, as well as the previously-mentioned Batrachomyomachia. Even in ancient times many who admitted the Homeric origin of the Iliad rejected the Odyssey as the work of Homer. These were called *Chorizontes*, or *Separaters*. Longinus attempted to dispose of their objections and reasonings by referring the Odyssey to the poet's old age, and the Iliad to his youth. This theory was long held; and there seems every reason to accept the former poem as a subsequent production to the latter from many considerations, especially the superior character of its gods, and because social life is more refined, and art more advanced.

That the Homeric epics arose on Asiatic soil and had as their basis poetic legends brought by immigrants from Northern Greece is now a common view. Prof. Bury thinks that 'it was perhaps in the eleventh century, at Smyrna, or some other Æolian town, that the nucleus of the Iliad was composed on the basis of those older lays, by a poet whom we may call the first Homer, though it is not probable that he was the poet who truly bore that name. He sang in the Achæan, or, as it came to be called, the Æolian tongue. His poem was the Wrath of Achilles and the Death of Hector, and it forms only the smaller part of the Iliad. It was not till the ninth century that the Iliad really came into being. Then a poet of supreme genius arose, and it may be that he was the singer whose name was actually Homer . . . . He composed his poetry in rugged Chios . . . . He took in hand the older poem of the wrath of Achilles and expanded it into the shape and compass of the greater part of the Iliad . . . . His work was thoroughly artificial, conscious art, as the greatest poetry always is; and it is probable that he committed the Iliad to writing.' The Odyssey, he thinks, may have been worked up into a large poem from old lays of the doings of Ulysses, not earlier than the eighth century.

Spontaneity, simplicity, directness, dignity; a steady onward march of events; clear discrimination of character; description sufficient to place the whole picture before us, are prominent notes of the Homeric poems. Homer's heroes may be moved by the strongest passions; the representation of them is always calm. What the poet relates finds its way to every feeling heart, but he himself never shows his feelings, neither inclination nor dislike. Totally lost in his subject, you never perceive his individuality. Though the poet is himself a Greek, he speaks impartially of the Trojans. There is nothing in the poems which make us impatient for the *dénouement*. A uniform development, in constant progress, is the character of the Homeric epic. Herder therefore says of him: 'The truth and wisdom with which he unites all the subjects of his world in a living picture, the firmness of every stroke in all the personages of this immortal picture, the divine freedom with which he contemplates the characters, and paints their virtues and vices, their successes and disasters—this is what renders Homer unique, and worthy of immortality.' In Shakspere this impartiality and absence of individuality is at least equally great.

In what we have already said we have indicated what we consider the chief beauty of Homer. Few of his characters are of an elevated stamp. What, for instance, is the greatness of his chief hero, Achilles? It is the poetical faithfulness, the calmness and devotion of the poet, together with the beauty of his language, which render Homer great. If it were only for the chaste and yet powerful use of the noblest idiom ever spoken, so harmonious, finely organized and expressive, the pages of the Ionian epic would amply repay perusal. If the Homeric poems had always been considered in a simple and unprejudiced manner, free from the influence of pedantic theories and exaggerations, they would have had fewer pretended admirers, but more who truly relished them.

Germany possesses the best translation of Homer, by the great scholar J. H. Voss. In some respects Chapman's is the best translation in English. The English version of Pope is rather a paraphrase than a translation, but the beauty of its diction has made it a standard English classic. Cowper's version is much more faithful, but inferior in beauty of language. Among modern translators Worsley and Way are perhaps the best. Among prose translations the best is that of the Iliad by Leaf, Myers and Lang, and that of the Odyssey by Butcher and Lang. So much has been written for the explanation of Homer, that a mere enumeration of the titles of the works would fill a volume. Even on the medicine, mineralogy, and the general stock of knowledge contained in Homer, works are not wanting.

HOME RULE. See IRELAND.

HOME-SICKNESS, in medicine, *Nostalgia*. The natural feeling of grief at a separation from the paternal home and native soil becomes, in men of great sensibility, who go to a different climate (especially from a mountainous to a level country), and are surrounded by different scenery, without active occupation, a real disease. It shows itself by a deep melancholy, under which the whole nervous system in a short time suffers. The mind of the patient is filled with thoughts of his country, and with associations which serve to recall it. The desire of seeing it, and despair of gratifying the desire, engross him. The result of the mental condition thus produced shows itself in a series of symptoms, practically the same as those of melancholia. The bodily functions participate in the depression of the nervous system. There is loss of appetite, and other symptoms of the impairment of the digestive functions arise. Sleeplessness is a marked and distressing symptom; and the combined effect of this and the digestive disturbance is to induce gradual emaciation, pallor, and increasing weakness. Sudden death sometimes puts an end to this situation; but more commonly, if it is impossible to overcome the disease, death occurs as a result of prostration. A return to his home is the most effectual remedy. The confidence that this will happen has cured many; but when this is impossible, agreeable occupation is a better remedy than medicine, combined with outdoor exercise, abundance of nourishing food, attention to the regularity of the bowels, and remedies to induce sleep.

HOMICIDE is either justifiable, excusable, or felonious. Of the first sort are such cases as arise from unavoidable necessity or accident, without any imputation of blame or negligence in the party killing. So where a crime is punishable capitally according to the laws, the judge is bound to condemn the criminal to death, and the sheriff or other executive officer to carry the sentence into effect in the manner prescribed by the sentence of condemnation. But the judge must have jurisdiction of the offence, and be duly commissioned; and the executive officer must be empowered to carry the sentence into effect, and must perform the execution in the manner prescribed by law, otherwise the execution of the criminal will make the judge or the officer, as the case may be, guilty of criminal homicide. So, too, where

an officer of justice is resisted in the execution of his office, in his attempt to arrest a person in a criminal, or, as is maintained, even in a civil case, he is not obliged to give back, but may repel force with force; and if the person resisting is unavoidably killed, the homicide is justifiable, for few men would quietly submit to arrest if, in case of resistance, the officer was obliged to give back. It is, however, laid down as law that if a felony be committed, and the felon attempts to flee from justice, it is the duty of every man to use his best endeavours to prevent an escape; and if in the fresh pursuit the party be killed where he cannot be taken alive, it will be deemed a justifiable homicide. The same rule applies to cases of an attempt on the part of a felon to break away and escape after he has been arrested, and is on the way to jail. So if a party has been indicted for felony, and will not permit himself to be arrested, the officer having a warrant for his arrest may lawfully kill him if he cannot be taken alive. But this is to be understood only of officers, and not of private persons. Magistrates and officers authorized to suppress and disperse mobs are justified by the common law in taking the requisite measures and using the requisite force for this purpose, though it extend to the killing of some of the rioters. The law arms every member of the community with the power of life and death for the prevention of atrocious felonies accompanied with violence and personal danger to others, as in case of an attempt to murder or rob, or commit burglary or arson, the person making the attempt may, by the common law, if he cannot be otherwise prevented, be killed on the spot, and the law will not recognize the act as a crime. In cases of this sort, in order to justify the homicide, it must appear that there were good grounds for a suspicion that the person killed had a felonious intent. A woman is justifiable in killing one who attempts to ravish her, and the husband or father may be justified in killing a man who attempts a rape on his wife or daughter.

The cases already mentioned of justifiable homicide are those in which the public authority and laws are directly concerned. The laws of society, however, leave every individual a portion of that right of personal defence with which he is invested by those of nature. If one may interpose to prevent an atrocious crime against society, where he is not himself in any personal danger, the laws will, *a fortiori*, permit him to defend himself against attacks upon his own person. Murder is the killing of a person who is under the protection of the laws, with malice prepense, either express or implied. Malice is the distinguishing characteristic of murder, and may be either *aforethought*, or *expressed*, or *implied*. It is not necessary in order to constitute the crime of murder that the slayer should have the direct intention of killing. If the act be done with a wicked, depraved, malignant spirit, a heart regardless of social duty, and deliberately bent upon mischief, it is characterized by what the law denominates malice, though it may not result from any enmity or grudge against the particular victim. So if a man wantonly discharges a gun among a multitude of people, whereby any one is killed, the act will be done with that depravity of disposition which the law considers malice. Murder can be committed only by a free agent, for the crime presupposes a will, motive, or disposition on the part of the perpetrator. An idiot or insane person cannot commit this crime. But drunkenness is in general no excuse for homicide, though the act be done under its immediate influence.

The manner of killing is not material. Whether it be by sword, poison, beating, imprisonment, starvation, or exposure to the inclemency of the atmosphere, it will be equally murder. This crime may be committed by mere advice and encouragement. As to the person on whom a murder may be committed, the English law-books say it must be one 'in the peace of the king,' that is, a person entitled to the protection of the laws, as is one of the public enemy, if he is in the country, and not participating in the war. An infant unborn is within the protection of the law, and it is laid down that if, in consequence of poison given or wounds inflicted before the birth of a child which is afterwards born alive, it dies soon after its birth, the act is murder.

The act of suicide is considered by the law to be murder, and the person making away with himself is accordingly styled a *felo de se* or *self-felon;* and the laws of Great Britain long attempted to punish this crime by directing that the body of a suicide should be ignominiously buried. But this was only punishing the surviving relatives and friends of the deceased for his offence; and hence the old laws, inflicting punishment upon the living by the ignominious sepulture of suicides, were very rarely put into execution.

The lines of distinction between felonious and excusable or justifiable homicide, and between manslaughter and murder, are in many cases nice and difficult to define with precision. But in general the accused has the advantage of any uncertainty or obscurity that may hang over his case, since the presumptions of law are usually in his favour. The characteristic distinction laid down in the books between murder and manslaughter is the absence of malice in the latter. Sudden provocation may be an excuse for striking another without the intention to give a deadly blow; and though death ensue, the party may not be guilty of murder. One circumstance, showing the degree of malice, or rather showing its presence or absence, is the kind of weapon used in giving a wound on a sudden provocation; and another circumstance of importance is the fact of the weapon's being already in the hand or not, for going to seek a weapon gives time for deliberation. The ground of excuse of homicide, in case of provocation merely, is the supposed sudden passion, some influence of which the law concedes to the frailty of human nature. But the excuse of self-defence goes still further; and where a man is attacked, so that his own life is endangered, or in such way that he may reasonably suppose it to be so, he may repel the attack with mortal weapons. One of the most frequent cases of manslaughter was that occasioned by single combat, and on account of the firm hold which the point of honour had taken of the civilized nations of the west, was long among the most difficult subjects of legislation. (See DUEL.) In Scottish law the term *culpable*, as applied to homicide, implies that, though accidental, it may have proceeded from carelessness, or that, though proceeding from an unlawful act, or done with an intention to harm, it was not with an intention to kill. Even where the intention was to kill, if the act was committed on a sudden from resentment excited by real and great injuries, but without any previous malice or hatred to the deceased, the homicide was *culpable*. The crime of murder in its most aggravated degree is punished with death in most parts of the civilized world.

HOMILDON, BATTLE OF. In 1402 the Earl of March, who had transferred his allegiance to England, defeated at Nisbet Moor a small body of his countrymen who were engaged in a raid into England. In the autumn of the same year a considerable Scottish army marched into England, commanded by Archibald, earl of Douglas, not so much to avenge the affair of Nisbet Moor as to inflict serious injury on the enemy, and to acquire military renown. He had marched as far as Durham, and, satisfied with

his success, was returning home with a rich harvest of booty, when he heard at Wooler that Hotspur and his rival and feudal enemy the apostate March were advancing to meet them with a numerous force. Douglas drew up his forces on Homildon Hill, near Wooler. Hotspur wished to charge at once, but his impetuosity was restrained by March, and the bowmen were set to play on the compact mass of Scots, which they did with deadly effect. Douglas should have charged the archers with cavalry, an arm with which he was amply supplied, but he seemed to have lost his head, and allowed his soldiers to be slaughtered without resistance. His own mail was pierced in five places, though none of his wounds proved mortal. Sir John Swinton, a gallant young knight, by exhorting his countrymen to charge the enemy, acquired and has retained a brilliant reputation in Scottish history. He dashed on the English with a few followers, but being too few to effect their purpose, they were all speedily slain. England's victory was complete, and many eminent Scots were taken or killed. The victory was gained entirely by the bow, in accordance with the advice of March; while the unrestrained attack of Hotspur might have given the victory to the Scots, whose discipline and arms availed best for hand-to-hand encounter.

HOMILIARIUM, a collection of homilies for the use of the clergy. Anciently the supply of sermons among the clergy was very scanty, and a system of interchange was carried on among the preachers even of distant countries. But the demand was in excess of the supply, and the quality in many instances was but indifferent. Charlemagne therefore, among his measures of ecclesiastical reform, had a compilation of homilies made under the supervision of the deacon Paul Warnefried in the end of the eighth century. Homilies were included for all the Sundays and festivals of the year, and the clergy were commanded by their synods to translate them for the use of their flocks. These translations continued in use till the sixteenth century. Two editions are known to church historians—those of Speyer in 1482, and of Cologne in 1557. There was an ancient Gallican homiliarium, and the Venerable Beda's fifty homilies were in common use with the Western clergy. The collection ascribed to Alcuin was probably but a modification of Charlemagne's compilation. A collection of Anglo-Saxon homilies of the tenth century (The Blickling Homilies) has been published by the Early English Text Society under the editorship of Dr. R. Morris. A series of metrical homilies has also been published: A Collection of English Metrical Homilies, from Manuscripts of the Fourteenth Century; with Introduction, by John Small.

HOMILY (Greek, *homilia*, intercourse) signifies originally familiar discourse, but as an ecclesiastical term it means a discourse or sermon read or pronounced to an audience on some subject of religion; a discourse pronounced in the church by the minister to the congregation. Discourses read in the Christian churches took this denomination to intimate that they were not harangues like those of profane orators. The ancient homily was also sometimes simply a conversation, the prelate talking to the people and interrogating them, and they in turn talking to and interrogating him. This familiar and popular form of illustrating Scripture truth was borrowed by the Christian priesthood from the practice of the synagogue. The difference between the homily and the sermon was the entire absence of oratorical display from the former, and the elucidation of the Scriptural text in natural order, without throwing the exposition into the form of an essay. Moral reflections and exhortations were introduced where they were apposite. In modern use this restrictive definition is not rigidly adhered to, a homily differing but little in popular acceptation from an ordinary sermon, the idea of simplicity, however, being always attached to it.

The earliest existing examples of the homily proper are those of Origen in the third century. In the schools of Alexandria and Antioch this form of discourse was sedulously cultivated, and Clement of Alexandria, Dionysius, and Gregory Thaumaturgus are among the names most eminent in this department. It was in later centuries, however, and in the hands of Athanasius, Gregory of Nyssa, and Gregory of Nazianzus, Basil, Cyril of Jerusalem, and Cyril of Alexandria, and especially of Chrysostom that the homily reached its highest excellence. Numerous editions of the homilies of Chrysostom were published in England, among others a Latin version of two of them by Sir John Cheke, the reviver of Greek erudition in England, in 1543, in 4to, and a beautiful edition in Greek in 12mo was published at Oxford in 1586 by John Harmar. Thomas Chaloner, Sir John Cheke, and Thomas Tupset translated favourite homilies into English, all in the sixteenth century. The foreign editions are very numerous. Augustine and Gregory the Great were among the western composers of homilies. Later still Beda, several of the popes, and foreign ecclesiastics still adhered to the homiletic form of exposition as the most suitable to impress the truths of Scripture with efficacy on the popular mind. See preceding article.

In the Church of England there were two books of homilies that were long authoritative, and are still sometimes appealed to to settle disputes as to what the Anglican doctrine is in points on which they bear. But they have no binding authority. The first book of homilies was published in 1547, it is said, by Cranmer, with the title Certain Sermons or Homilies appointed by the King's Majesty to be declared and read by all Persons, Vicars or Curates, every Sunday in their Churches, where they have Cure. The second book was published in 1562, at the same time with the Articles, it is said by Jewell, but this admits of doubt. In 1747 these were revived in Germany by Count Zinzendorf. There were twenty-one of them, and they are enumerated in the thirty-fifth article. They are not now read in churches.

That particular branch of literature which treats of the composition of homilies is termed *homiletics*. No early formal treatise on the subject exists, though it has been touched on by Augustine, Rabanus Maurus, and Isodore of Seville. In Hunibert's De Eruditione Concionatorum and Borromeo's Instructiones Pastorum the subject is treated with more fulness, directness, and method. In the theological curriculum, both of Roman Catholics and Protestants, homiletics occupies a not unimportant place. The object of this is to make theology practical, and to teach aspirants after Christian pastorship to adapt their discourses to the capacities and wants of their hearers. It is sometimes called *pastoral* theology.

HOMŒOPATHY, the name of a system of medicine introduced by Samuel Hahnemann at the close of the eighteenth century, attracting much attention in Germany, and afterwards in other countries also. The name expresses the essential character of the system, which consists in this, that such remedies should be employed against any disease as, in a healthy person, would produce symptoms similar to those of the actual disease. The fundamental principle of this system is therefore *similia similibus curantur*—'likes are cured by likes.' To find such medicines against any given disease experiments are made

on healthy persons in order to determine the effect on them. In the conviction that every disease carries with it a great susceptibility for the proper medicine, and that the power of medicine increases by minute division, the homœopathist gives but one drug at a time, and does not administer another dose or a new medicine until the former has taken effect. At the same time a strict diet is prescribed that the operation of the medicine may not be disturbed. Homœopathy directs the attention chiefly to the symptoms of the disease, which are followed up and observed with much greater accuracy than formerly. Disease is considered by it as only an aggregate of symptoms; and therefore the business of the physician is to extinguish the symptoms. The disciples of this system care little about the customary names and divisions of diseases; they only regard the particular pains and debilities of which the varieties of sickness are composed. The proximate causes of diseases therefore are little regarded, though the more remote causes are studied, at least in relation to diet. Every disease is considered as requiring a specific remedy. Homœopathy is thus in opposition to the Hippocratic system, which has existed under various forms for twenty-two centuries; and it has been exposed to numerous attacks on this account. We will mention some of the points in dispute.

Homœopathy objects to the Hippocratic system that it acts on the maxim *contraria contrariis curantur*, and therefore effects merely a palliative cure. This reproach is unjust, because the judicious physician endeavours to restore the diseased organs by the influence of the healthy organs, and the merest empiric alone attempts to cure by absolute *contraries*. The Hippocratic medicine does not even reject the homœopathic principle, as the treatment of nervous diseases proves. Secondly, the homœopathists accuse their opponents of directing their efforts against what cannot be known, the proximate cause of the disease; while, in turn, the homœopathist may be reproached with attaching himself merely to the superficial, external appearance of the disease, and with a pedantic minuteness in regard to those symptoms which disease assumes in a given case. Thirdly, the homœopathist accuses the others of administering remedies of which they do not know the effects; to which it may be replied that the effect of a medicine becomes perfectly known only through a patient, never by a healthy person. Fourthly, the minuteness of the dose prescribed by the homœopathists is objected to by other physicians, who, however, should not forget that they constantly order a solution of 1 grain of tartar-emetic in 8 oz. of water. On the whole the homœopathic system has as yet made comparatively little progress in Britain, chiefly because it has been so generally opposed by the adherents of the older system. In London and elsewhere homœopathic hospitals, dispensaries, &c., do exist, but homœopathy does not hold the position that it holds in America for example. Homœopathists, however, maintain that their system has been justified by the results of experience, and assert that this has been clearly shown in the case of epidemics of cholera, yellow fever, typhoid fever, &c. They also allege that the system has in many cases modified the practice of adherents of the older system, who have, without acknowledgment, followed their lead in the use of certain medicines. Of course it is only to that department of medical science that deals with the use of medicines that the homœopathic treatment belongs.

HOMOGENEOUS LIGHT. When a beam of ordinary white light falls on a prism it is found to be composed of an enormous number of different and when a screen is placed behind the prism the light that has passed through the prism is seen spread out upon the screen, giving the well-known prismatic spectrum. (See SPECTRUM.) Now if a narrow slit is cut in the screen at right angles to the length of the spectrum, at some particular part of it, say in the yellow region, the light falling on this portion of the screen will pass through the slit. If a beam of yellow light, obtained in this way, is allowed to fall on a second prism, it is not found to be resolved into a new series of colours like the white light; it passes through the second prism unaltered except in the direction of the ray. Such a beam is said to be homogeneous; because it is not resolvable into several other colours, and the whole of the light is thus *of the same kind*. Homogeneous light, that is light that cannot be broken up or decomposed by prismatic *dispersion*, may be obtained from certain sources. Thus the light from the flame of burning thallium is almost pure green; that from sodium is almost pure, consisting of two colours of yellow so slightly different that it requires a very good spectroscope to detect any difference between them. Lithium gives almost pure red light, though the spectroscope detects faint blue light mixed with the red.

HOMOLOGATION, a Scotch law-term, signifying an act by which a person approves of a deed, the effect of which act is, to render that deed, though itself defective, binding on the person so homologating it. All informal or defective deeds may be homologated; as, for instance, where a deed has been executed by a person capable of giving consent, though the deed be defective at the time through the want of the consent of those whose concurrence the law requires, if that consent is afterwards given the validity of the deed is established. Homologation may be inferred from an act clearly and expressly implying a knowledge and approbation of the deed. The paying of interest or the performance of an obligation coming under the deed will constitute homologation. The effect of homologation as against the person homologating is to render the deed as binding on him and his heirs as if it had been originally valid.

HOMOLOGOUS. Homologous quantities or magnitudes in geometry are such as correspond to each other, as the antecedents and consequents in proportionals. In similar figures homologous sides are those which occupy corresponding positions with respect to the equal angles.

HOMOLOGOUS BODIES are those compounds of carbon which differ from each other in composition by CH_2, or any multiple thereof. Such substances exhibit a regular gradation of chemical and physical properties. Thus in the homologous series of the *fatty acids* (which see), the first members of the series are limpid liquids of low boiling-points. As we ascend the acids get more and more viscid, their boiling-points likewise gradually rising. The chemical activity of homologous bodies seems to be inversely as the complexity of their composition, those fatty acids which are most complex being at the same time possessed of least chemical energy.

HOMOLOGY, the identity of any two structures as regards their origin and relations, whatever be their functions, similarity of function constituting *analogy*. Thus the wings of birds and insects are analogous, their functions are the same, but neither in structure nor origin have they the slightest resemblance. On the other hand, the wing of the bird is homologous with the pectoral fin of the fish, and with the whole upper limb of man. The functions of these three organs are very unlike, but they arise from the same part of the skeleton, and consist of essentially the

The vertebræ with their processes are homologous to each other, this being *serial homology* or *homotypy*. *Polar* or *antagonistic homology* is illustrated by the similarity of endowment possessed by opposite ends of continuous structures, as of the intestinal canal. To homology it is an indispensable condition that community of plan should exist among the animals compared, and this cannot, on the hypothesis of evolution, exist without community of descent. But not all homologous structures can be thus explained, the relationships being often very remote. It has therefore been proposed to distinguish those homologies where community of descent is obvious as *homogenetic*, while those which do not so readily admit of this interpretation, but which are possibly due to the similarity of result which would follow the action of similar conditions on tissues identical or closely similar in composition, would be *homoplastic*. Homomorphism might be substituted for these phrases, since the identical form which it suggests is not associated with any theory of its origin.

HOMO NOVUS (*Latin*, a new man); in ancient Rome, a person of plebeian birth, and the first of his family that held a curule office. He was the founder of his family's nobility, and as such could have no *imagines* of his ancestors. Neither could he have any of his own, but the *jus imaginum* belonged to his children. These *imagines* were figures of wax placed in the *atrium* of the house.

HOMOOUSIAN (Greek *homos*, the same, and *ousia*, substance) and HOMOIOUSIAN (Greek *homoios*, like, and *ousia*, substance), two terms that created much discussion and acrimony between the orthodox and the Arian parties in the great controversy that arose in the fourth century about the nature of Christ's person. The Council of Nice adopted the word *homoousian* to express that the Son was of the same substance with the Father, while those followers of Arius who wished to offend the Catholic party as little as possible adopted the term *homoiousian*, as a sort of middle and reconciling theory, to express that the Son, though not of the *same*, was yet of a *similar* substance with the Father. The doctrine of Arius himself was not only that the Son was subordinate to the Father, but that he was totally unlike him, being a mere created being. Both the Arians and the semi-Arians were at one as to the rejection of *homoousian*, and argued that the use of the term was not only an error in the existing controversy, but that the use of it had been expressly forbidden by the Council of Antioch in A.D. 269. But the term *ousia* had entirely different significations in the Councils of Antioch and Nice; in the former it was condemned as meaning personality, to reprobrate the doctrine of the Sabellians; while in the latter its meaning was restricted to substance or nature.

HOMOTYPY, another term for serial homology, or the identity of structures serial to each other along an axis. See HOMOLOGY.

HOMS. See HEMS.

HONAN, a large and populous city, China, in the province of same name, on an affluent of the Hoang-ho, and considered by the Chinese to occupy the centre of the empire. It is surrounded by mountains; its environs and suburbs are adorned with gardens; it gave China the first emperor of the Song dynasty, and under the name of Toung-king, played a conspicuous part in the former revolutions of the country. The province lies between lat. 31° 30′ and 37° N.; lon. 110° 5′ and 116° 35′ E.; area, 65,104 square miles; bounded N. by provinces Shansee, Chihle, and Shantung; E. by Kiangsi and Nganhwei; S. by Houpe; and W. by Shense. It is generally level, but is traversed in a south-eastern direction by a range of low hills, and is watered by the Hoang-ho and its affluents. The soil is fertile, carefully cultivated, and produces more food than supplies the province; likewise cotton, hemp, flax, and silk. The forests in the west supply timber; and mines yield tutenag or Chinese copper, cinnabar, mica, &c. Honan suffered severely from the inundation of the Hoang-ho in 1887; capital, Kai-fung. Pop. 22,117,036.

HONDO, the name given by the Japanese to the principal island in their empire. In many geographical works Nippon or Niphon is the distinctive appellation of this island, but by the Japanese themselves that is the name applied to the whole country. The area of this island of Hondo is 87,425 sq. miles, and the pop. (1899), 33,327,935.

HONDURAS, an independent republican state of Central America; lat. 13° to 16° N.; lon 83° 20′ to 89° 39′ W.; bounded on the N. and E. by the Caribbean Sea; on the W. Guatemala; on the S. Salvador, the Bay of Fonseca, and Nicaragua; S.E. Nicaragua; area, 43,000 square miles. Its surface is irregular, being traversed by numerous mountain-ranges in all directions, but generally of moderate elevation. The valleys between are numerous and fertile, and there is one lake about 18 miles long by 10 miles broad, near the centre of the state. Its mineral wealth is very considerable, but was turned to much better account formerly than now; it comprises gold, silver, lead, and copper; the two latter found in a variety of combinations, and the two former frequently combined with each other; also opals, emeralds, asbestos, and cinnabar. There are some considerable rivers in the state, the largest of which are the Chamelicon, Ulua, and Aguan, all flowing to the Caribbean Sea, and the Choluteca, an affluent of the Pacific. The climate is, upon the whole, extremely good and salubrious, especially in the interior parts, but it inclines to a temperature rather high; particularly close on the northern coast, and the shores of the Pacific, where deposits of mud, acted upon by a tropical sun, with a heat often of 120°, produce miasma, clouds of mosquitoes and sand-flies, and almost every other description of annoying insects. There are some extensive forests abounding in fine timber, such as mahogany, cedar, &c. The principal cultivated productions are bananas and other fruits, sugar, tobacco, coffee, some wheat, rice, &c. Numbers of cattle are reared. Since 1880 the capital has been Tegucigalpa, situated near the centre of the state, with a railway to the Pacific. The principal ports are Puerto Cortez, and Truxillo on the Caribbean coast, and Amapala on the Pacific (Gulf of Fonseca); exports, £600,000. The constitution of the state gives the legislative power to a congress of forty-six deputies. The executive authority is in the hands of the president, who is elected for four years. The resources of the country are but slightly developed, and the finances are in a very disordered state; debt over £19,000,000. Pop. in 1900, 587,500.

HONDURAS, BAY OF, a wide inlet of the Caribbean Sea, mostly between lat. 16° and 18° N.; and lon. 84° and 80° 50′ W.; having on the south Mosquitia and Honduras, and on the west British Honduras and Yucatan. Along its shores are the islands of Bonaca, Ruatan, Utila, Turneff, and numerous islets and reefs called cays. It is divided into several smaller bays, of which that of St. Thomas, the innermost in the Gulf of Amatique, is spacious and deep. Several considerable rivers fall into the bay, namely, the Belize, Dulce, Motagua, Chamelicon, and Ulua.

HONDURAS, BRITISH, or BELIZE, a British territory, on the east coast of Central America. It lies mainly between lat. 16° and 18° 30′ N.; and lon. 88° and 89° W., having north and west, Yucatan; west and

south, Guatemala; and east, the Bay of Honduras; length, north to south, 175 miles; breadth, east to west, about 90 miles, but part of the south-west boundary line, towards Guatemala, is quite undetermined. The area amounts to 7562 square miles. Excepting the river Hondo, which forms the Yucatan frontier, the only rivers of consequence are the Belize, which traverses the territory south-west to north-east, dividing it into two nearly equal parts, and the New River, which, rising in the New River Lake, flows in a course nearly parallel to the Belize till it reaches the Caribbean Sea, a few miles south from the mouth of the Hondo. The country north of the Belize River, and traversed by the New River, is low and level; towards the shore, swampy, and interspersed with several lakes. East of the New River, however, is a range of hills stretching north-east to south-west and joining on to the mountains of Guatemala. South of the Belize River the country, though also swampy on the coast, rises inland much more rapidly, and may be generally described as mountainous. It is intersected by a ridge parallel to that west of the New River, and also joining on with the mountains of Guatemala, the eastern part, both north and south of this ridge, being covered by its lateral branches. The mountains, and the wide valleys between them, are covered with extensive forests of the finest timber, including cedars, pines, ironwood, logwood, braziletto, mahogany, and cabbage and silk cotton trees. The chief products are mahogany and logwood. The climate, especially during the wet season, is considered by some more healthy than any of the West India Islands; though the low, swampy northern portions can scarcely fail to exhale pestilential vapours. The mean annual temperature is 80°, though the heat is seldom oppressive from the beginning of July to the beginning of April, being tempered by refreshing sea-breezes; but during the other three months it is excessive, though mitigated occasionally by violent thunder-storms. The most rainy months are July, August, and September. The cultivable portion of the soil is extremely fertile, producing readily all kinds of tropical produce, of which sugar and coffee may be mentioned; and among fruits, bananas, pine-apples, mangoes, oranges, cocoa-nuts, plantains, &c. Rice is cultivated and to some extent exported, and cotton and indigo might likewise be raised. Sarsaparilla and india-rubber are collected in certain districts. The wild animals are those usual in such regions of America—ounces, panthers, tapirs, deer, peccaries, agoutis, armadilloes, and monkeys. Manatis and alligators frequent the lagoons; birds, aquatic and land, abound; fish, turtle, lobsters, and shell-fish are plentiful, and of excellent quality. The value of the total exports in 1902, consisting chiefly of mahogany, logwood, fruit (especially bananas), and sugar, was over £285,000.

Honduras is a crown colony, the government being administered by a governor, who is assisted by an executive council of three official and two unofficial members, and a legislative council of three official and five unofficial members. The capital is Belize. Honduras was transferred by Spain to England by treaty in 1670, but at different times its occupation was contested by the Spaniards till 1783, since which period it has remained quietly in the possession of Great Britain. The population is composed chiefly of negroes, who were first introduced as slaves. With exception of a few Caribs, who fled into it as a place of refuge, there appear to have been no native tribes in the territory. The revenue in 1899 was about £52,000, the expenditure £54,000. Pop. (1891), 31,471, including about 500 whites; in 1901, 37,479.

HONE, the name given to several varieties of slaty stones employed in whetting knives, razors, or other edge-tools. The best-known varieties are the Ayr stone, so called from being found in the water of Ayr, in Scotland; the Charnley Forest stone, found in Charnwood Forest, near Mount Sorrel, in Leicestershire; the German razor hone, obtained from slate rocks near Ratisbon, where it occurs in the shape of a thin yellow vein, and regarded throughout Europe as superior to all whetstones for the finer descriptions of cutlery; and the Turkey oil-stone, which differs from the others in not having a slaty structure, and is brought for sale to Smyrna from the interior of Asia. This last has been regarded as the best of all whetstones, possessing in an eminent degree the property of abrading the hardest steel, and being at the same time so compact in its texture as to resist the pressure necessary for sharpening a graver or similar small instrument. It occurs both white and black, though nearly with similar qualities.

HONE, WILLIAM, an author who, after acquiring notoriety as the author and publisher of some political and profane parodies, turned his talents to better account by the publication of really useful works, was born at Bath on June 3, 1780. His father, who acted occasionally as a Dissenting preacher, brought him up with a strictness which produced the opposite effect of that intended; and young Hone, shortly after quitting the paternal control for a writer's office, became deeply imbued with infidelity. Having quitted the law, and married in 1800, he turned printseller and bookseller, setting up at the same time a circulating library; but devoted so much of his time to politics and other pursuits that he was unsuccessful in business. In 1811 he obtained the appointment of bookseller's trade auctioneer. But having no genius for business, he again fell into difficulties, and after endeavouring to eke out a maintenance by honest literary labour, took to the writing of parodies, one of which, entitled The House that Jack Built, had an immense sale, going through no fewer than fifty editions. Another, in which there was more profaneness than wit, subjected him to a government prosecution. He was so fortunate, however, as not only to obtain an acquittal, having conducted his own trial successfully, but to be rewarded by a subscription, which gave him the means of recommencing business in more commodious premises than he had hitherto occupied. It was not long before misfortune again overtook him, though he had now disconnected himself from discreditable publications, and begun the publication of a work of real utility, entitled the Every-day Book, which he afterwards rendered more complete by sequels entitled the Table Book and the Year Book. These two last books were begun and completed in the King's Bench Prison, into which his debts had conducted him. To relieve him from his difficulties a second subscription was raised for him, and employed in putting him into the Grasshopper Coffee-house in Gracechurch Street. It proved a bad speculation, and he was once more in danger of being thrown upon the world, with a family of ten children depending upon him for support. Happily for himself he had by this time renounced his infidelity, and was anxious to make some reparation for the mischief he had done when zealously propagating it. His wish in this respect was to some extent gratified. He had formed some acquaintances among members of the Independent connection, and had united himself to an Independent church; and the celebrated Independent preacher Thomas Binney, having satisfied himself by personal acquaintance with Hone that his religious profession was not a sham but a great reality, induced him to try his powers in the pulpit, and he preached frequently with acceptance at the Weigh-house Chapel, Eastcheap. He was

afterwards sub-editor of the Patriot newspaper, and employed himself in other literary labours, till repeated attacks of paralysis unfitted him for mental exertion. The last days of his life proved the sincerity of his religious profession, and he died on Nov. 6, 1842, aged sixty-three. His last publication was an edition of Strutt's Sports and Pastimes of the English (1838). That Hone's character was much misconceived may be gathered from the fact that among his admirers were Sir Walter Scott, Lamb, Southey, Wilson, Horace Smith, and others.

HONEY, a well-known substance similar to sugar in its properties, prepared by bees from the nectar found in many flowers, and deposited in the cells of the honey-comb. Honey differs much in colour and in consistence. The best is clear and transparent, and solidifies when kept for some time into a granular, white mass. Some varieties of it are dark-yellow or brownish in colour. That made in mountainous countries is more highly flavoured than that of low grounds. The honey made in the spring is more esteemed than that gathered in the summer; that of the summer more than that of the autumn. *Virgin* honey is that which flows from the combs without pressure. *Yellow* honey is obtained by pressure from all sorts of honey-combs, old as well as new. The combs are broken, and heated with a little water in basins or pots, being kept constantly stirring; they are then put into bags of thin linen cloth, and these into a press to squeeze out the honey. The wax stays behind in the bag, excepting some particles which pass through with the honey. The specific gravity of honey is about 1·44.

About 800 or 900 tons of honey are annually imported into Britain, chiefly from North and South America, the West Indies, Portugal, France, and Greece. The 'Narbonne honey' of France owes its peculiar delicious flavour to the rosemary and other allied labiate flowers on which the bees feed; as a table delicacy the Grecian honey, however, stands in highest estimation. Honey is collected and sold in considerable quantities in Britain, bee-keeping having much increased in recent years. It is frequently adulterated with treacle, which may be detected by the colour and odour, and with farina, flour, &c., in which case the mixture will not form a nearly clear solution with cold water. Starch-sugar is a common adulterant, which may be detected by its property of increasing the dextro-rotatory power of the honey. Other adulterants, as gelatine and glycerine, are not so easy of detection.

Honey is used in preserves and confectionery, and, in its pure state, to put upon bread; also as a demulcent medicine against hoarseness, catarrhs, &c., and externally as a softening application to promote suppuration. It is used in its clarified state to sweeten certain medicines. It is more aperient and detergent than sugar, and is particularly serviceable in promoting expectoration in disorders of the breast, and as an ingredient in cooling and detergent gargles. For these and other similar purposes it is sometimes mixed with vinegar in the proportion of 2 lbs. of clarified honey to 1 pint of the acetic acid, boiled down to a proper consistence over a slow fire, and thus forms the oxymel simple of the shops. It is also impregnated with the virtues of different vegetables by boiling it in the same manner with their juice or infusions till the watery parts have exhaled. It is the basis of several compositions in pharmacy, though in this way it is less used than formerly. It is also used in making mead, as it readily enters into the vinous fermentation. When collected from poisonous plants, as the *Azalea Pontica*, &c., it partakes of the qualities of the plants. The inferior qualities of honey, and what remains when it is purified, can be used in the preparation of brandy, vinegar, &c.

Honey, as may be easily imagined, was one of the first articles of human nourishment. It is mentioned, in Genesis xliii. 11, as one of the articles that Jacob sent with his sons to Egypt as a present to their brother Joseph, then known to them only as the governor of Egypt. Aristotle, Celsus, Pliny, Ælian, and probably the ancients in general, did not know where honey originally came from; they thought it was a dew which fell from heaven. Pliny does not decide whether it issued from the heavens in general or from the stars, or was a juice produced by the purification of the air, and which afterwards was collected by the bees. The juice of the flowers, they believed, produced only the wax. Hence we find the honey flowing from the trees in great abundance in the descriptions which the poets give of the golden age. In the Bible we find mention made of bees'-honey and of grape-honey. In all the ancient works on agriculture we find much importance attached to honey and the care of bees. The ancients also ascribed medicinal powers to honey. In their domestic concerns they used it as we do sugar, and made of it and good old wine a mixture very much liked. This was distributed among the soldiers when they returned in triumph.

The sugar contained in honey consists principally of dextrose, levulose, and also some cane-sugar. The proportion of the cane-sugar decreases with the age of the honey, being gradually transformed by the action of a ferment in the honey into inverted sugar. When honey undergoes fermentation, as in making mead, the whole of its sugar is transformed into alcohol. Other substances present in honey are wax, colouring substances, phosphoric acid, aromatic and nitrogenous bodies, and sometimes mannitol. Rather less than one-fifth the weight of honey represents water. See also next article.

HONEY-COMB, a waxen structure full of cells, framed by the bees to deposit their honey and eggs in. The construction of the honey-comb seems one of the most surprising of the works of insects, and the materials of which it is composed, which, though evidently collected from the flowers of plants, yet do not, that we know of, exist in them in that form, have given great cause of speculation. The wax is secreted by the peculiar organization of the insect in the form of small and thin oval scales in the incisures or folds of the abdomen. The regular structure of the comb is also equally wonderful. The comb is composed of a number of cells, most of them exactly hexagonal, constructed with geometrical accuracy, and arranged in two layers placed end to end, the openings of the different layers being in opposite directions. The comb is placed vertically; the cells, therefore, are horizontal. The distance of the different cakes of comb from each other is sufficient for two bees to pass readily between them, and they are here and there pierced with passages affording a communication between all parts of the hive. The construction of the cells is such as to afford the greatest possible number in a given space with the least possible expenditure of material. The base of each cell is composed of three rhomboidal pieces, placed so as to form a pyramidal concavity. Thus, the base of a cell on one side of the comb is composed of part of the bases of three on the other. The angles of the base are found by the most accurate geometrical calculation to be those by which the least possible expense is required to produce a given degree of strength. The sides of the cells are thinner than the finest paper, and yet they are so strengthened by their disposition that they are able to resist all the

motions of the bee within them. The effect of their thrusting their bodies into the cells would be the bursting of those cells at the top were not these well guarded. But to prevent this the creatures extend a cord or roll of wax round the verge of every cell, in such a manner that it is scarce possible they should split in that particular part. This cord or roll is at least three times as thick as the sides of the cell, and is even much thicker and stronger at the angles of the cells than elsewhere, so that the aperture of each cell is not regularly hexagonal, though its inner cavity be perfectly so. The cells which have served or are to serve for the habitation of the larvæ of the neuters and of the male bees are often made also at other times the receptacles of honey; but though these are indifferently made to serve either use, there are others destined only to receive honey. The celerity with which a swarm of bees, received into a hive where they find themselves lodged to their minds, bring their works of the comb to perfection is amazing. There are vast numbers at work all at once; and that they may not incommode one another, they do not work upon the first comb till it is finished, but when the foundation of that is laid, they go to work upon another, so that there are often the beginnings of three or four stories made at once, and so many divisions allotted to the carrying on the work of each.

HONEY-DEW, a sweet clammy varnish, of an unpleasant odour, common in hot weather on the leaves of trees and herbaceous plants. Some assert that it is an exudation from the leaves, caused by the puncture of aphides, and others that the presence of the plant-louse is merely accidental, the honey-dew being its favourite food. But it is probable that the production of it is due to more than one cause. It is clear that aphides are capable of producing the phenomenon by wounding the leaves, and that they exude from their own bodies a sweet substance, which can form a sweet clammy glaze upon the subjacent leaves. It is equally certain that honey-dew occurs on plants where no aphides can be detected, and that in very hot and dry weather it is sometimes produced from all adjacent trees indiscriminately, though no insect is present. Though the fact of the production from their bodies of a sweet fluid is undoubted, it has not yet been proved that this fluid naturally runs from them in quantities sufficient to produce such considerable effects, even were its chemical identity with the exudation from the leaves established. Liebig's notion was that honey-dew depended on the want of a due proportion between the quantity of azotized and that of the unazotized substances which are supplied to them as nutriment. Some scale insects, as well as aphides, cause the production of this substance, occasionally in this country, but to a much greater degree under the tropics. It is probable that honey-dew is not generally injurious to plants, as its presence depends on an over-supply of nutriment; but a secondary effect is often detrimental both to health and beauty. For unless it is washed off by rain or otherwise, every passing impurity in the air settles upon it, and it becomes a nidus for certain kinds of moulds which cover the plant with a dense felt-like coat, stopping respiration, and ultimately causing death. Honey-dew is sometimes produced so abundantly that its collection becomes profitable. In early times it was supposed to be dew from the clouds.

HONEY-EATER, the name given to a number of birds forming the family Meliphagidæ, order Insessores, tribe Tenuirostres. Honey-eaters form a very numerous group of birds, all feeding, as their name imports, on honey and the sweet juices of flowers, though occasionally varying their diet with insects and other small living beings. They are natives of Australia and the adjacent islands. They have long curved sharp bills, with tongues terminating in a pencil of delicate filaments, to enable them the better to extract the juices of flowers. Of the several varieties may be mentioned the New Holland Honey-eater, the White-pinioned Honey-eater, and the Garrulous Honey-eater, so called on account of its singularly talkative propensities. The Poë Bird is ranked with this group, as also the Brush Wattle Bird of Australia, and the Yellow Wattle Honey-eater (*Anthochæra inauris*). There are many other species, but their habits are all so similar that it is superfluous to mention them. They are all graceful in their forms, and pleasing in the colour of their plumage, and are nearly allied to the sun-bird and the humming-bird. The Australian colonists name one of the most splendid species the rifleman or rifle bird, while a species, quaint and rather grotesque, is named the friar bird, because of its bare, oddly shaped head. It is possessed of even more than the usual loquacity of the family. None of them is remarkable for its powers of song, but the poë or parson bird, whose native notes are very fine, and its powers of mimicry scarcely inferior to those of the mocking-bird. It learns to speak with remarkable distinctness and fluency, and is a very desirable inhabitant of an aviary. The poë, whose scientific name is *Prosthemadera Novæ Zealandiæ*, receives the name of parson bird from two small tufts of white feathers below its throat, which are supposed to resemble the 'bands' of a minister. In giving utterance to its varied notes also, it often gesticulates with its head much in the way practised by some preachers in addressing an audience. It bears confinement very well, and is often kept in cages both by the colonists and the Maoris. Its colour is generally greenish above, and blackish brown beneath.

HONEY-LOCUST, Sweet Locust, or Black Locust (*Gleditschia triacanthos*), a lofty and beautiful tree belonging to the United States, and occurring in rich woods from Pennsylvania to Virginia, Illinois, and southwestward. It belongs to the natural order Leguminosæ. The leaves are pinnated, divided into numerous small leaflets, and the foliage has a light and very elegant appearance; the flowers are greenish and inconspicuous, and are succeeded by long, often twisted pods, containing the large brown seeds, enveloped in a pulp, which is extremely sweet. This tree is especially remarkable for its formidable thorns, often triple or compound, and growing to the length of several inches, on which account it has been recommended for hedges. The *G. monosperma*, a tree inferior in dimensions to the preceding, and distinguished by its oval, one-seeded, pulpless pods, grows in swamps in Illinois and southwestward. The wood is inferior in quality.

HONEYSUCKLE, or Woodbine, the *Lonicera* of Linnæus, belongs to the natural order Caprifoliaceæ. The common honeysuckle, *L. periclymenum*, with distinct leaves and red berries, is indigenous in Great Britain; but two others have been naturalized, viz. *L. caprifolium*, distinguished by its upper leaves being united (connate) and perfoliate, and by its smooth orange-coloured berries; and *L. xylosteum*, an erect shrub, with small, yellowish, scentless flowers, and scarlet berries. The honeysuckle family is represented in the North American flora by nine different species, amongst which are *L. sempervirens*, the trumpet honeysuckle; *L. grata*, American woodbine; *L. flava*, yellow honeysuckle, &c.

HONFLEUR, a seaport town of France, in the department of Calvados, agreeably situated on the left shore of the estuary of the Seine, 7 miles S.S. Havre. It is a poorly built and dirty place, but considerable improvements have recently been made, and the

entrance of the port protected by two long stone jetties. It has manufactures of lace, ship-biscuits, casks, and mineral acids, rope-works, tanneries, and building yards. The trade has been greatly injured by the rise of Havre. The chief exports are corn, dairy and other produce. Eggs, fruit, and vegetables are exported to England. On the hill above the town is the chapel of Notre Dame de Grace, much frequented by sailors, and filled with their votive offerings. Honfleur was long in possession of the English, and makes a considerable figure in their French wars. Sir Sydney Smith was taken prisoner here in 1796, while leading off a vessel which he had captured. Pop. in 1901, 9610.

HONG-KONG, or HIANG KIANG (The Fragrant or Flowing Streams), a small island off the S.E. coast of China, in the province of Quang-Tong, now belonging to the British. It is situated at the mouth of the estuary that leads to Canton, from which it is distant, south-east, 75 miles; and from Macao 40 miles east. It is about 10 miles in length and 7½ miles in breadth, and is separated from the mainland by a strait, which at Lymoon or Ly-ee-moon Pass is only about a quarter of a mile wide. To the colony belongs also a peninsular extension of the mainland opposite, known as Kowloon. The coast of Hong-Kong is indented by numerous bays, of which the most considerable are on the south-east side of the island, which they form into two peninsulas. The general appearance of the island is somewhat picturesque and curious, but, on the whole, rugged and bare, being composed mostly of granite rocks that rise from the sea to heights of 1000 and 2000 feet, and so abruptly as to leave hardly any level space. There are no trees of any size on the island, except those that have been planted in recent times, and few valleys of any extent. Some rank vegetation here and there, with a little herbage and brushwood growing in the intervals between the masses of granite or on the margins of the streams, form almost the only vegetable productions. Good water, however, is abundant, and some of the cascades are sufficiently picturesque. The climate, at one time considered very unhealthy, is now believed to be quite as well suited to European constitutions as that of any of the British eastern tropical possessions. On the north side of the island, and situated on a magnificent bay, capable of accommodating any number of vessels, affording excellent anchorage and deep water close inshore, is the thriving town of Victoria, where the great bulk of the population is centred. This bay presents a lively and busy scene, being crowded with shipping of every nation, and with dense masses of junks, boats, and other Chinese craft. The town stretches for about 4 miles along the shore, and also ascends the hillside and the faces of the ravines above. It is generally well-built, with wide streets and handsome terraces, and there is a massive sea-wall along the sea-front. The many newly erected houses of sightly exterior, stuccoed, and with green verandahs; the increase of vegetation upon the public roads and around the private houses; the construction of the government gardens, and of water-works and gas-works, and an elegant drinking fountain, give an improved appearance to the city, assist its sanitary condition, and add to the comfort of the inhabitants. Among buildings of more or less note in Victoria are a cathedral, a bishop's palace, a government house, a court-house, an exchange, a city-hall, hospitals, barracks, schools (government and other); while handsome residences of the merchants are scattered about the town and its elevated suburbs, and are also numerous in Kowloon. The schools include Victoria College, a central government school for boys, a number of other government schools free and undenominational, many free schools connected with the various missionary societies, and a medical college for Chinese. English, Portuguese, and three dialects of Chinese are taught in the schools. The roads in the island are mostly for foot-passengers only. In Victoria there are cable-tramways and omnibuses, but the common mode of conveyance is by chairs carried by porters. The position of the colony of Hong-Kong is peculiar; it is merely a great commercial entrepot, itself producing little either in the way of natural products or manufactured goods; but so admirable is its situation that it has become a centre of distribution and collection for China and other neighbouring regions, and is a place frequented by great ocean mail steamers from all parts of the world, such as those of the P. and O. Company, the Messageries Maritimes, the North German Lloyd and the Austrian Lloyd, the Canadian Pacific line to Vancouver, lines to the Australian Colonies, San Francisco, Portland, &c. There is daily communication with Canton and Macao. The port is well provided with docks and repairing slips for vessels. The prosperity of the colony is largely owing to the great numbers of Chinese who resort to this port for the purposes of trade, with no intention of becoming permanently British subjects. Hong-Kong is a free port, and there are no returns of its total trade, the chief articles of which consist of cottons and opium as imports, tea and silk as exports. An estimate gives the total imports at £20,000,000, the total exports at £25,000,000. The foreign commerce, that is the commerce beyond China, is chiefly carried on with Singapore, Japan, Great Britain, Australia, the United States, and Germany. In 1902 the imports direct from Britain were £2,274,217; exports to Britain, £610,398. The shipping entered in 1899 amounted to 6,720,769 tons, a large proportion being British. The local banking and insurance business is very large.

Hong-Kong was ceded to Great Britain by the Treaty of Canton in 1841, and again by the Treaty of Nanking in 1842. The Kowloon portion of the colony became British in 1861. In 1898 Britain secured a lease for 99 years of a further portion of the mainland, with the neighbouring waters and the island of Lan Tao, the leased area amounting to about 400 square miles. The government of the colony is vested in a governor, an executive council of six officials and two others, and a legislative council of seven officials and five others. An effective police has been established, consisting partly of Europeans, the rest being Sikhs and Chinese. There is an imperial garrison of about 3500 men, and a small volunteer artillery force. Hong-Kong is the headquarters of the British squadron in Chinese waters, there being a naval dockyard and victualling yard, and a coaling station; the town and harbour are protected by strong batteries. The revenue (amounting to about £600,000) is raised chiefly by municipal rates, and by opium and other licenses. The currency consists of bank-notes, silver dollars, and other coins, accounts being kept in dollars and cents. The population on the first occupation of the island by the British was only 5000. In 1891 it numbered 221,441, 212,896 being coloured (chiefly Chinese), and 8545 whites, many of them Portuguese; in 1901 it was 288,975.

HONITON, a municipal borough and market town of England, in the county of Devon, on the left bank of the Otter, 17 miles E.N.E. Exeter. It consists principally of one spacious street, nearly one mile in length; well paved and lighted, and amply supplied with water. The chief branch of manufacture here is lace-making, which is again reviving after a long period of gradual decline. This

branch of industry was introduced by the Lollards during the reign of Elizabeth. The butter of Honiton is also much esteemed, and large quantities of it are sent weekly to the metropolis. Coarse pottery-ware, bricks, tiles, malt, leather, scythe-stones, &c., are made. Honiton was given by William at the Conquest to the Earl of Montague; and in the reign of Henry I. the manor was granted to Richard de Rivers, from whom it descended to the Courtenays, earls of Devon. It was a borough by prescription, and returned two members to the House of Commons from the 28th of Edward I. to 1867, when it was disfranchised by the Scotch Reform Act. Pop. in 1891, 3216; in 1901, 3271.

HONOLULU, the capital and principal seaport of the Sandwich Islands, on the south side of the island of Oahu. It has broad streets paved with lava and lined with shade trees, and many of the houses are inclosed within small gardens of exotic and indigenous ornamental plants. It is mostly built in the European style; has some fine public buildings, numerous churches (including an Anglican cathedral), many schools, hotels, banks, hospitals, water-works, museum, &c.; periodicals in English, Hawaiian, and other tongues; electric lighting, telephones, cabs, and other features of modern civilization. The mouth of the harbour is formed by an inlet through a coral reef. The basin inside is capable of containing between seventy and eighty ships, well protected in all weathers. Honolulu is a rapidly improving place, the chief commercial centre of the Sandwich Islands, and under American rule is becoming more and more Americanized. The exports in 1901 (almost wholly sugar) amounted to £5,784,300. Pop. (1901), 39,305.

HONORIUS, the name of several popes.

Honorius I. was elected pope in 625. He favoured the heresy of the Monothelites, which, while recognizing the twofold nature of Christ, declared he had but one will, a doctrine which was condemned by the sixth Council of Constantinople. He died in 638. He was anathematized by the council that condemned the heresy.

Honorius II., elected pope in 1124, was at the time of his election Bishop of Velletri. A part of the bishops and cardinals had previously invested Cardinal Thibaut with the papal dignity; but both candidates having resigned Honorius was re-elected. He died 1130.

Honorius III. was raised to the Papal chair, 1216, on the death of Innocent III. Immediately on his election he wrote to the King of Jerusalem to assure him of his support; to the bishops of France, to encourage pilgrims, and to the Emperor of Constantinople to promise him assistance against the schismatics. John, king of England, had left to his successor, Henry III., the burden of a war with the French Prince Louis, who laid claim to the English throne, and had been encouraged in his pretensions by Innocent. Honorius reconciled the barons with Henry, and obliged Louis to renounce his pretensions. The pope then turned his attention to the Crusades, and crowned Frederick II. emperor of Germany, on condition that he would go to Palestine within two years. In France he instigated Philip Augustus and Louis VIII. to support the war against the Albigenses. He died in 1227, and was succeeded by Gregory IX.

Honorius IV. was elected pope in 1285. He supported the French king, Philip the Bold, in the war against Peter of Arragon. He died in 1287.

HONORIUS, Flavius, son of Theodosius the Great, born, according to the best authorities, in 384 A.D. On the death of his father in 395 the empire was divided into two parts, Honorius receiving the western half, with Rome as his capital; but being only ten years old was put under the guardianship of Stilicho, whose daughter he married in 398. The principal events of his reign are the adoption of rigorous measures against paganism in 399; the devastation of Northern Italy by Alaric in 400–403; another irruption of barbarians under Rhadagaisus, 405–406. Both invasions were repelled by the energetic soldier and able minister Stilicho, who, however, fell under the displeasure of his weak and indolent master, and was assassinated at Ravenna in 408. Taking advantage of the death of the defender of Rome, Alaric marched upon the city and plundered it in 410, while Honorius shut himself up in the city of Ravenna. Some of the finest provinces of the empire, Spain, Gaul, and Pannonia, were lost in this reign. Honorius died in 423 without issue.

HONOUR, in law, is used especially for the more noble sort of seigniories, on which other inferior lordships or manors depend by performance of some customs or services to those who are lords of them. Before the statute 18 Edward I. the king's greater barons, who had a large extent of territory holden under the crown, frequently granted out smaller manors to inferior persons, to be holden of themselves, which therefore now continue to be held under a superior lord, who is called in such cases the *lord paramount* over all these manors; and his seigniory is frequently termed an *honour*, not a manor, especially if it has belonged to an ancient feudal baron, or been at any time in the hands of the crown. When the king grants an honour with appurtenances it is superior to a manor with appurtenances; for to an honour, by common intendment, appertain franchises, and by reason of those liberties and franchises it is called an *honour*.

HONOUR, Maids of, ladies in the service of European queens, whose business it is to attend the queen when she appears in public. In England they are eight in number.

HONOURABLE, Right Honourable, and Most Honourable, titles given in the United Kingdom to peers, their families, and certain public functionaries. The title honourable is conferred on the younger sons of earls, all the children of viscounts and barons, lords of session, the supreme judges of England and Ireland, members of Parliament, maids of honour, &c. The title right honourable is bestowed on all peers and peeresses below the rank of marquis and marchioness; on the younger sons of dukes and marquises, and their wives; on all the daughters of dukes, marquises, and earls; on privy-councillors, the Lord-mayors of London, Dublin, and York, the Lord-advocate of Scotland, the Lord-provost of Edinburgh. Marquises and marchionesses are entitled to the prefix most honourable. In America the governors of states, judges, members of Congress, and others holding offices of dignity and trust, are styled honourable.

HONOURS, Military, the compliments paid by troops to royalty, officers of rank, &c., or such as are given at funerals to all grades of the army.

HONOURS OF WAR are stipulated terms which are granted to a garrison surrendering, in consideration of a brave defence, or from some other cause. In some instances the vanquished are allowed to march out with all their arms, drums beating, and colours flying; in others they will only be permitted to advance silently to the front of their works, there to pile arms, and then to retire to their lines as prisoners of war; or again, they may be permitted to deposit their arms and stores at some special spot, and then return to their own territory on parole of not serving during the war against the victors or their allies.

HONTHEIM, JOHANN NICOLAUS VON, descended from an ancient and noble family in Trèves, was born in 1701, and educated by the Jesuits. He studied law, became afterwards a clergyman, travelled to Rome, and made himself acquainted with the policy and abuses of the ecclesiastical government. On his return he was appointed by the Elector of Trèves counsellor of the consistorium, and soon afterwards professor of the civil law. In 1748 he was made suffragan of the archbishopric. Between 1750 and 1760 he wrote a history of Trèves in Latin; and in 1762, under the assumed name of Justinus Febronius, a bold work which procured him much reputation, On the Condition of the Church and the Lawful Power of the Pope. This was likewise in Latin. Though he was an ardent Catholic, and dedicated the work to the pope, yet the usurpations of the Romish see are here attacked with so much boldness that the author was persecuted, and the work prohibited by the court of Rome. He died in 1790 at Montquintin, much esteemed for his piety and benevolence.

HOOD, ROBIN, the hero of several old ballads and traditionary tales, which generally represent him as the chief of a band of outlaws who inhabited the forest of Sherwood in Nottinghamshire, and also the woodlands of Barnsdale in the adjoining West Riding of Yorkshire. They supported themselves by levying toll on the wealthy, and more especially on ecclesiastics, and by hunting the deer of the forest. Robin Hood carefully avoided all attacks on the poor and on women, and is said to have adopted the levelling principle of robbing the rich and avaricious, and giving to the poor a generous share of the spoil. The principal members of his band were his lieutenant Little John, his chaplain Friar Tuck, together with William Scadlock, George-a-Greene, Much, the miller's son, and his sylvan mistress Maid Marian. Some legends inform us that he was none other than the Earl of Huntingdon, who, from misfortune or his own mismanagement, was compelled to lead a predatory life; that he was born at Locksley in Nottinghamshire in 1160, and that after having successfully conducted his operations for a long course of years, he at last, in his eighty-seventh year, felt the infirmities of age coming upon him, and was induced to enter the convent of Kirklees in Yorkshire, to procure medical assistance. The prioress (by some described as a relation) is said to have accomplished his death by opening an artery and leaving him to die from loss of blood. This is said to have occurred in 1247. He is represented as being most skilful with the longbow and quarterstaff, and generally victorious in any personal encounter. The sceptical tendency of modern investigation has induced several eminent antiquarians to throw considerable doubt upon the existence of Robin Hood. It has been maintained by Wright in Great Britain, and Grimm in Germany, that the bold outlaw is a poetical myth, or one among the personages of the early Teutonic mythology. On the other hand, it is stated that there is sufficient evidence to prove that such a personage did actually exist. The earliest authentic mention we find of him is in the Vision of Piers Ploughman, written between 1355 and 1365. About 1495 Wynkyn de Worde published a poem of considerable length, entitled Lytell Geste of Robyn Hood. Some of the incidents in that poem are held by the Rev. Joseph Hunter to be in some measure similar to what he can prove by documentary evidence to have happened to one Robyn Hod, a vadlet or porteur, for sixteen months in the service of King Edward II. Mr. Hunter conjectures that Robin Hood was one of the yeomen who joined the discontented barons under the Earl of Lancaster, and were ruined by the failure of their enterprise. Thierry in his History of the Norman Conquest has represented him as the chief of a body of Saxons, who, in their fastnesses, defied for long the authority of the Norman conquerors. Another writer declares the band to be a remnant of the followers of Sir Simon de Montfort, earl of Leicester, who was slain at the battle of Evesham. The statement that he was the Earl of Huntingdon rests mainly on an epitaph manufactured in later times, and on one or two obscure expressions found in some ancient authors. Dr. Stukeley has built up a regular genealogy of the hero; but he appears to have been cleverly duped, or to have derived it from his own imagination.

HOOD, SAMUEL, VISCOUNT, a British admiral, son of the vicar of Butleigh in Somerset, was born in 1724. He entered the navy in 1741, and five years after was promoted to a lieutenancy. After seeing much service and reaching the rank of captain he was appointed commissioner of Portsmouth dockyard in 1778, and soon after created a baronet. In 1780 he was made a rear-admiral, and was then sent to act with Rodney in the West Indies, where he rendered brilliant services against Count de Grasse in the famous defeat of that officer by Admiral Rodney, April 12, 1782. His services on this occasion were rewarded with an Irish peerage, with the title of Baron Hood of Catherington. In 1784 he was chosen member of Parliament for Westminster; but he vacated his seat in 1788 on obtaining the appointment of a lord of the admiralty. In 1793 he commanded against the French in the Mediterranean, when he signalized himself by the taking of Toulon, and afterwards Corsica; in reward of which achievements he was made a viscount and governor of Greenwich Hospital. He died at Bath in 1816.—His brother Alexander, Viscount Bridport, (1727-1814) was also a distinguished naval commander.

HOOD, THOMAS, an English poet and humorist, born in 1799 at London, where his father, a Scotsman, was a bookseller. On leaving school he entered a mercantile house, but, losing his health, was sent to live with a female relative at Dundee. Here, while only fifteen or sixteen years of age, he wrote some articles for a Dundee newspaper and magazine. Having recovered his health he returned to London in 1818, and began to study the art of engraving under an uncle. In 1821 he became subeditor of the London Magazine, and from that time appears to have resolved on devoting himself entirely to a literary life. In 1826 he published Whims and Oddities, selected for the most part from his articles in the London Magazine. This was followed by National Tales in prose, and a volume of serious poetry, which, though favourably received, did not obtain much popularity. In 1830 he started the Comic Annual, which, during the eight years of its existence, occupied his principal attention, and was made the vehicle of many of his most remarkable productions. At the same time his pen was diligently employed on other subjects, and he published The Epping Hunt, a comic poem, ridiculing Cockney sportsmen; the powerful poem called Eugene Aram's Dream, inserted in the Gem, of which he was for a short time editor; and Tylney Hall, a novel, which, though defective in its plan and structure, abounds in fine strokes of wit and humour. His health had begun to fail, and in consequence he lived on the Continent from 1835 to 1840. He continued his Comic Annual during his residence at Coblentz and Ostend, and in the year

1838 he published Hood's Own. His continental experiences also furnished the materials for his work entitled Up the Rhine, published in 1839, consisting of a series of imaginary letters after the manner of Smollett's Humphrey Clinker. The whimsical cuts inserted in the work, as well as its combination of good sense and humour, made it very popular. Shortly after his return, though still in indifferent health, he undertook the editorship of the New Monthly Magazine, and continued it till 1843. His principal contribution to it was the famous tragi-comic story in verse of Miss Kilmansegg. His last periodical, entitled Hood's Magazine, was commenced in 1844. It contains some of his best productions, though several of them were written after his health had completely given way, and while he was propped up by pillows in bed. He died in 1845, after suffering so severely that he was repeatedly heard to exclaim, 'I cannot die, I cannot die.' He had the satisfaction of knowing that the pension of £100 conferred upon him on his last illness by Sir Robert Peel was to be transferred to his wife. Hood is unrivalled as a punster, and seems to have been almost equal master of the comic and the pathetic. In the latter style his Song of the Shirt is universally known, and as a burst of poetry and indignation is not surpassed by anything in the English language. Though his peculiar vein of humour must have exposed him to strong temptations, it is infinitely to his honour that all his writings are in a good spirit, and are never at variance either with decency or good morals.

HOODED SNAKE. See COBRA DA CAPELLO.

HOOFT, PIETER CORNELISZOON, a Dutch historian and poet, born in 1581 at Amsterdam. He translated Tacitus, published a life of Henry IV. of France in Latin, a History of the Low Countries from the Abdication of the Emperor Charles V. to the Year 1598 (two vols. fol.); besides a variety of miscellaneous works, consisting of epigrams, comedies, &c. The Nederlandsche Historien is considered one of the classics of Dutch literature, and is still of considerable historical value; and his Minnedighte are replete with Anacreontic playfulness, naiveté, and elegance. Louis XIII. made him a knight of the order of St. Michael. He died in 1647.

HOOGEVEEN, a town of Holland, prov. Drenthe, on the canal from Meppel, with thriving industries. Pop. 11,700.

HOOGHLY RIVER. See HUGLI.

HOOK, THEODORE EDWARD, born at London in 1788, was the son of James Hook, a musical composer of some celebrity, and was attending school at Harrow in 1802, when, on his mother's death, he was removed from it, and employed occasionally by his father in writing songs and composing airs for Vauxhall. Meanwhile his elder brother had taken his degrees at Oxford, and seeing the dangers to which Theodore's employment exposed him, persuaded his father to send him also to the university. Before actual residence a course of reading was prescribed to him, and he returned to London to commence it, but instead of doing so employed himself in composing an operatic farce entitled The Soldier's Return. It was performed in 1805, and with such success as to make him abandon all thoughts of the university. This piece was followed by a series of others, sometimes at the rate of two or three a year, up to 1811. The life he led in London was of the gayest sort; he became the delight of the green-room and the idol of evening parties. He indulged pretty freely in reckless practical jokes, and the famous Berners Street hoax of 1809, by which that locality was for a day crowded with the carriages of the nobility, coal waggons, furniture vans, and hosts of tradesmen, all convened by the supposed invitation and orders of a lady residing there, is said to have him for its originator. At this time he had become famous as an improvisatore and a mimic, and having been invited to exhibit these talents before the prince regent, was rewarded shortly after in 1812 with the appointment of accountant-general and treasurer to the Island of Mauritius, with a salary and allowances amounting to nearly £2000 per annum. These offices he held till 1818, when the discovery of a large deficiency in the military chest caused him to be sent home under arrest. The extent of his guilt seems to have been gross carelessness, and there appear to have been no good grounds for a criminal prosecution, but the threat of a civil prosecution was kept suspended over him, and he was thrown upon the world penniless. To maintain himself he resumed the literary labours which he had abandoned when the ill-judged appointment was conferred upon him, and at last became editor of a newly-established paper called the John Bull, which partly by its talent and partly by its virulence obtained a large circulation, and yielded him a large income. In 1824 he published his *first* series of Sayings and Doings, followed by a *second* in 1825, and a *third* in 1828. His other principal works are Life of Sir David Baird, and a series of novels, among which may be mentioned Love and Pride, Jack Brag, Gilbert Gurney, Gurney Married, Precepts and Practice, Fathers and Sons. The four last appeared originally in the New Monthly Magazine, of which he became editor in 1836, and one of them, Gilbert Gurney, derives particular interest from containing in a modified form his own autobiography. Amid all these labours he managed to keep up an extensive intercourse with society, and indulged in expenditure to which his means were inadequate. Over-exertion both of body and mind was followed by its usual consequences. His constitution, originally excellent, was completely broken up, and after two months' confinement to his house he died in 1841, in his fifty-third year. Much of Hook's talent was, though great, of an ephemeral description, and his writings were composed with too much rapidity to carry down their author's name with distinction to any distant period.

HOOKAH. See PIPE (TOBACCO).

HOOKE, NATHANIEL, celebrated for an elaborate Roman history. The time and place of his birth is unknown. The first fact known of him is given in a letter from himself to Lord Oxford, in which he describes himself as ruined by the South Sea Scheme. He was recommended to Sarah, duchess of Marlborough, to aid her in drawing up her memoirs, for which service she presented him with £5000, although she afterwards quarrelled with him for endeavouring to make her a Catholic. His zeal for his religion was very great, if not orthodox, he being greatly attached to the mysticism and quietism of the school of Fénelon. He was a friend of Pope, and it was he who brought the priest to confess the poet on his death-bed, much to Bolingbroke's disgust. Hooke's great work, his Roman History from the Earliest Period to the Accession of Octavius, is comprised in four vols. 4to, published in 1738, 1745, 1764, and 1771. It is a performance of great accuracy and critical acumen, the style of which is clear and perspicuous, without being eloquent or masterly. Another work of his upon Roman affairs was Observations on Four Pieces upon the Roman Senate (1758, 4to), in which he discusses the opinion of Vertot, Middleton, and Chapman, with some severity in respect to the two latter. He also translated Ramsay's Travels of Cyrus. He died July 19, 1763.

HOOKE, ROBERT, an English mathematician and natural philosopher, was born in the Isle of Wight

in 1635. He was entered of Christ Church College, Oxford, in 1653. In 1658 or 1659 he invented the balance spring of watches; at least the prior discovery of it is usually assigned to Hooke by the English, while foreigners ascribe it to Christian Huyghens. In 1663 he was nominated one of the first fellows of the Royal Society, and was afterwards a member of the council. In 1664 he was made Cutlerian professor of mechanics to the Royal Society; and he afterwards became professor of geometry at Gresham College. The next year he published his Micrographia, or Philosophical Descriptions of Minute Bodies. In 1666, having produced a plan for rebuilding the city of London, which had been destroyed by fire, he received the appointment of city surveyor, an appointment that turned out very profitable. In 1673 he proposed a Theory of the Variation of the Mariner's Compass. His death took place in March, 1703. He published a great number of papers in the Philosophical Transactions, besides which he was the author of Cutlerian Lectures, a volume of Posthumous Tracts (printed in 1705), and Philosophical Experiments and Observations (published by Dr. Derham in 1726). Besides the invention already mentioned, many others, along with several important discoveries, have been ascribed to him with some show of justice, as, an escapement for maintaining the vibration of a pendulum, in 1656; barometer or weather-glass, 1657; the double-barrelled air-pump and the conical pendulum, 1660; the engine for cutting clock and watch wheels, and the chief phenomena of capillary attraction, 1663; the method of supplying air to a diving-bell, and the number of vibrations of a musical string, 1665; a quadrant by reflection, 1667; &c. Dr. Hooke was a man of undoubted talents, but of a very unamiable disposition. His quarrels with other men of science were generally managed in a way by no means creditable to his character.

HOOKER, Richard, a celebrated divine and theological writer of the sixteenth century, was born about 1553 at the village of Heavitree, near Exeter. His avidity for learning procured him the patronage of Bishop Jewel, who in 1567 sent him to Oxford, where he obtained the place of one of the clerks of Corpus Christi College. He was elected a scholar of his college in 1573, and in 1577 was chosen a fellow of Christ Church. In 1579 his skill in the oriental languages procured him the appointment of deputy professor of Hebrew; and in 1581 he took holy orders, and was shortly after made preacher at St. Paul's Cross, in London. He lodged at a dwelling appropriated to the preachers, which was under the charge of a Mrs. Churchman, a managing mother, whose attentions gained the confidence of the young, guileless divine, and induced him to marry, without sufficient consideration, her shrewish daughter, Joan, who, in the words of Walton, brought him neither beauty nor portion. The description of the visit of Edwin Sandys and George Cranmer, two of Hooker's old pupils, who found him tending some sheep by order of his wife, and who were also deprived of his company in the after-part of the day by Richard being called to rock the cradle, is one of the most characteristic sketches of old Izaak. In 1584 he was presented to the rectory of Drayton Beauchamp, in Buckinghamshire. The following year he was appointed by Archbishop Whitgift Master of the Temple for life. Here he became engaged on a controversy on church discipline and some points of doctrine with his colleague Walter Travers, whose sympathies were strongly puritanical. To this controversy we owe his celebrated work Of the Laws of Ecclesiastical Polity. The first four books were printed in 1594. The ensuing year he was presented by Queen Elizabeth to the living of Bishop's Bourne, in Kent, where he passed the remainder of his life. The fifth book of his great work appeared in 1597; the last three were not published till after his death in 1600. The Ecclesiastical Polity, written in defence of the Church of England, is no less remarkable for learning and extent of research than for the richness and purity of its style, which entitles its author to be regarded as one of the classics of the Elizabethan age. The best edition is that of Keble (3 vols., Oxford, 1836), which has been re-issued in a revised form by Dean Church and Canon Paget (3 vols., 1888). Hooker was also the author of some tracts and sermons.

HOOKER, Thomas, an eminent divine, was born at Markfield, Leicestershire, in 1586. He became a fellow of Emmanuel College, Cambridge, and a lecturer in Chelmsford, Essex, but was obliged to give up his ministry in consequence of his refusal to conform to all the rites of the Established Church. He then kept a school; but being still persecuted by the spiritual court he went over in 1630 to Holland, and in 1633 embarked for Boston, in America, where he arrived September 4th of that year. The following October he was ordained pastor of the church in Newtown; but in June, 1636, he removed with his whole congregation to the banks of the Connecticut River, and may be termed the founder of the colony of that name, and especially of the town of Hartford. Whenever he visited Boston, which he did frequently, he attracted great crowds by the force of his preaching. He died July 7, 1647. He published many volumes of sermons, and various polemical works. His principal production is the Survey of the Sum of Church Discipline—a work of great merit and research. Mr. Hooker was particularly noted for his power in argument.

HOOKER, Sir William Jackson, one of the most distinguished British botanists of modern times, was born at Norwich in 1785. He was attracted to the study of botany at an early age, and for the purpose of collecting plants visited Scotland and the Scottish islands, France, Switzerland, and Iceland. An account of his journey in the last-named country was given in his Tour in Iceland, which was published in 1811, and was so successful that a second edition was called for in 1813. In 1815 he married the daughter of Dawson Turner of Yarmouth. His investigations on the British Jungermanniæ and Mosses led to his appointment to the chair of botany in the University of Glasgow, a position which he filled with great success for twenty years. In 1836 he was knighted by King William IV. as an acknowledgment of his services to science, and in 1841 was appointed director of the Royal Gardens at Kew, a post which he held up to the time of his death, which took place 12th August, 1865. Under his management these gardens increased from 11 acres to 270, most artistically laid out, and containing hot-houses and conservatories far superior to anything of the kind on the Continent, and including museums filled with objects derived from the vegetable kingdom, botanical libraries, and a most extensive and excellently arranged herbarium. Among his most numerous works are The British Flora, Flora Boreali-Americana, Illustrations of the Genera of Ferns, Icones Plantarum, British Ferns, &c.

HOOLE, John, born in London in 1727, was the son of a watchmaker. At the age of seventeen he became a clerk of the East India House. In 1758 he began to translate Tasso's Jerusalem Delivered, and published the translation in 1763. In 1767 he published a translation of six dramas of Metastasio in two vols.; and the next year brought out his own tragedy of Cyrus, which did not succeed. Timanthes,

in 1770, and Cleone, in 1775, were equally unsuccessful, being the whole of his dramatic efforts. In 1773 he published the first volume of his Orlando Furioso, and concluded it in 1783, when it appeared complete in five vols. 8vo. He afterwards connected the narrative of the Orlando in twenty-four books, and disposed the stories in a regular series. In 1792 he translated Tasso's Rinaldo, and ended his literary labours with a more complete collection of dramas from Metastasio. Mr. Hoole is smooth, but prosaic and monotonous, in his versification. He died in 1803.

HOOPER, JOHN, an English reformer and martyr, born in 1495, in Somersetshire, was educated at Oxford, and joined the order of Cistercian monks, but becoming dissatisfied with monastic rules, returned to the university, and embraced the principles of the Reformation. In 1539, to avoid the persecution consequent on refusing to sign the new articles of faith put forth by Henry VIII., he withdrew to the Continent, and settled in Zürich, where he lived on intimate terms with Bullinger. On the accession of Edward VI., in 1547, he came over to London, and both by his service and active part in the religious transactions of the period contributed greatly to the progress of the Reformation. In 1550 he was nominated Bishop of Gloucester, but in consequence of puritanical objections to the ceremonies of consecration, declined induction till they were dispensed with by special authority. On the accession of Mary, in 1553, he was one of the first victims fixed upon, and being imprisoned in the Fleet, ostensibly on the false and frivolous charge of being a debtor to the queen, was treated with great severity. The true charge was afterwards divulged, and in 1555 he was required formally to recant his opinions. This he refused to do, and on the 9th February of the same year he was burned at the stake near his own cathedral. His works consist chiefly of a Godly Confession and Protestation of the Christian Faith, Lectures on the Creed, Sermons on the Book of Jonah, Annotations on the Thirteenth Chapter of the Romans, and expositions of several psalms.

HOOPING-COUGH or WHOOPING-COUGH, a disease characterized by a cough, occurring in paroxysms, and consisting of a rapid series of expirations followed by a prolonged inspiration. The latter is attended by a peculiar whoop, or shrill crowing sound, due to partial closure of the glottis by spasm and the rush of air through the narrowed orifice. The fit of coughing usually ends in the expulsion of some viscid phlegm or in vomiting. The spasms recur at longer or shorter intervals, in severe cases, several times an hour, determined by the irritation of mucus in the windpipe and larynx. The slightest emotional excitement will also usually determine the occurrence of a paroxysm. It is evidently due to a poison acting as an irritant to the pneumo-gastric nerve. It is contagious. Children are most commonly the subjects of this disease, and it seems to depend on a specific contagion, which affects them, as a rule, but once in their life. The hooping-cough usually comes on with a difficulty of breathing, some degree of thirst, a quick pulse, and other slight febrile symptoms, which are succeeded by a hoarseness, cough, and difficulty of expectoration. These symptoms continue, perhaps, for a fortnight or more, at the end of which time the disease puts on its peculiar and characteristic form, and is now evident, as the cough becomes convulsive, and is attended with the sound which has been called the *whoop*. On the first coming on of the disease there is little or no expectoration; or if any, it consists only of thin mucus; and, as long as this is the case, the fits of coughing are frequent, and of considerable duration; but, on the expectoration becoming free and copious, the fits of coughing are less frequent, as well as of shorter duration. The disease having arrived at its height, usually continues for some weeks longer, and at length goes off gradually. In some cases the cough continues for a lengthened period, and readily recurs with slight cold. In ordinary cases the duration of the disease is from six to eight weeks. The disease is infectious from the beginning, before the whoop is developed, and the infectious character continues for six or eight weeks. The period of incubation, that is the time from the receipt of infection and the commencement of symptoms, is about fourteen days. When complicated by bronchitis or pneumonia it is often a fatal disease; otherwise it is seldom fatal, except to very young children. Indeed, it is the most fatal disease of the first year of life, the fatality being largely due to the occurrence of bronchitis. The danger seems, indeed, always to be in proportion to the youth of the person.

HOOPOE (*Upupa*). The hoopoe is the type of a large family closely allied to the bee-eaters (*Merops*) and the king-fishers, while it also has points in common with the hornbills and humming-birds. The family is characterized by having a long, slender bill, curved throughout, and sharp at the tip; the mandibles have the surfaces of contact flat; the tongue is very short; wings moderate; tarsi short and stout, and the two outer toes united at the base (syndactyle). The sub-family of hoopoes proper, Upupinæ, have an erectile crest on the head; bill keeled at the base; wings long, and tail with ten feathers. The sub-family Irrisores have no crest, tail with twelve feathers; outer toes longer than the inner, and united at the base with the middle one. The European hoopoe (*U. epops*, Linn.) is about 12 inches long; the feathers of the crest are pale cinnamon-red, tipped with black, a wedge of white separating these two tints over the posterior half of the crest; upper surface ashy-brown, with black and white bands on the back. The wings are black, the coverts having white bars; chin white, throat and breast pale fawn; abdomen white, with black streaks and dashes. This bird has a very wide range, from Burmah to the British Islands and Africa. In Southern India it is only a winter visitor, returning northwards in summer. It is a ground-feeder, preying chiefly on insects; it nests in cavities of trees or walls. It defends itself by the fetid secretion of the uropygal glands, which is most offensive during breeding time. The Indian hoopoe is a smaller bird, with darker crest, and no, or only inconspicuous, white spots on the wings. The Irrisores are African species, of gregarious tastes, and in habit similar to the woodpeckers, climbing like them in search of insects. The hoopoe utters a loud double or treble *hoop*, whence its name. See illustration at ORNITHOLOGY.

HOORN, a seaport, Holland, on a small bay of the Zuider-see, 20 miles N.N.E. of Amsterdam. It was formerly one of the most flourishing towns in Holland, and was surrounded by fortifications, but promenades have taken the place of those works. The principal streets, four in number, are spacious, and meet in a central square, and numerous canals, communicating with the harbour, traverse the town in different directions. The principal buildings are the Grootekerk, or great church, and several other churches, Calvinistic, Lutheran, and Roman Catholic; an old and neat town-house, and a large pile of offices, once belonging to the East India Company. The trade is extensive, especially in cheese. Hoorn is the birth-place of the navigator Schouten, who first doubled the cape at the southern extremity of South America, and called it after his native town Hoorn, now corrupted into Horn. Pop. 10,200.

HOP (*Humulus lupulus*). This well-known and useful plant, belonging to the natural order Urticaceæ, is a native of Europe. In many of the settled parts of the United States it occurs wild, but has been introduced from Europe. It belongs to the same family with the hemp and nettle. The root is perennial, giving out several herbaceous, rough, twining stems, which bear opposite three to five lobed leaves; the fertile flowers are green; the fruit is a catkin, with concave scales each enveloping a single seed. The plant is cultivated for the sake of the catkins, which are employed to communicate to beer its aromatic bitter. The young shoots, however, are sometimes boiled and eaten like asparagus; the fibres of the old stems make good cords; and it is, besides, employed in medicine as a tonic, sudorific, and sedative. The cultivation of the hop is more carefully attended to in England than in any other country. A light and somewhat substantial soil should be selected. The time of planting is in the autumn, and that of harvesting about six weeks or two months after the flowers are expanded; if the fruit is suffered to get too ripe, it loses many of its good qualities. Other low plants may be cultivated in the intervals between the hop-poles. The hops, on being gathered, should be taken immediately to the kiln for drying, and afterwards packed in bags, the closer the better will they preserve their smell and flavour. The whole process, from the time of planting to the preparation for the purposes of commerce, requires much experience and many precautions. The crops even are excessively variable, often in a tenfold proportion in different seasons and situations. The excellence of hops is tested by the clammy feeling of the powder contained in the catkins.

The use of hop catkins and their special value in brewing depends upon a peculiar bitter substance which they contain, called *lupulin*. Lupulin, which is a yellow powder, is contained in the hop catkins to the extent of about 10 to 12 per cent. by weight; besides a bitter principle, it contains a volatile oil, to which doubtless is due the peculiarly soothing effect of hops. The bitter principle, which forms from 8 to 12 per cent. of the lupulin, when pure appears as a white or yellowish white inodourous powder, possessed of the characteristic taste of hops. Hops are remarkable for their exhaustive effect on the soil; thus the plants grown on an acre of ground abstract about 87 lbs. of mineral constituents from the soil, including 12 to 13 oz. of phosphoric acid and 17 lbs. of potash. Hops may be preserved in ice for many months and still retain all the properties of young fresh plants.

HOPE, Thomas, a distinguished writer and art patron, was born in London about 1770. He was descended from a family of opulent merchants of Amsterdam. He devoted much of his time while still quite young to extensive travels in various parts of Europe, Asia, and Africa, and, after retiring from business, purchased two spacious mansions, one in Duchess Street, London, and the other, Deepdene, in the neighbourhood of Dorking. These residences soon became famous as choice galleries of the finest specimens of art, ancient and modern. He died 3d February, 1831. His principal works are: Household Furniture and Internal Decorations (atlas folio, 1807), a work which completely revolutionized the public taste on the subject; The Costume of the Ancients (two vols. royal 8vo, 1809); Anastasius, or Memoirs of a Modern Greek (three vols. 8vo, 1819), a novel displaying a vivid imagination, remarkable descriptive powers, a classical taste, and a minute accuracy in the accounts of eastern climes and manners. The authorship was generally ascribed to Byron, who declared he would have given his two most approved poems to have been the author of Anastasius. Hope also wrote an Essay on the Origin and Prospects of Man (three vols. 8vo, 1831), a rather heterodox, but eloquent work; and An Historical Essay on Architecture (two vols. 8vo, 1835).

HOP-FLEA (*Haltica concinna*), a coleopterous insect analogous to, but rather larger than the turnip-fly. In spring the hop plantations are often so severely attacked by this creature that the crop is diminished more than a half. The fleas eat up the young shoots as fast as they appear above ground, and will sometimes arrest all apparent vegetation for a month or more, and even after the hop stems have grown 8 or 9 inches long, they will devour every leaf and head, leaving an appearance as of the hops having been scorched by fire. The plant should be covered with 4 or 5 inches of fine earth; this secures it from attack for several days and gives it the advantage of growing more rapidly, as the stems come through the earth at a later period when the weather is warmer. If the plants have been greatly retarded by a severe attack, they should be liberally stimulated with guano when they begin to grow.

HOP-FLY (*Aphis humuli*), a species of plant-louse very destructive to the hop. The winged female is green with a black head and bands and spots of black on the body, the legs and wings are long. They generally make their first appearance about the middle of May; fresh detachments often following up their first incursion throughout the summer. A few winged females are first observed, and wingless myriads are to be seen by the middle of June. The insects on their first arrival immediately suck the under side of the upper small leaves of the stem, and there deposit their young on the most succulent part of the plant. Lady-birds and other insects render important service by destroying great numbers of these insects; they are extremely susceptible to atmospherical and electrical changes, myriads perishing on a night from an alteration of the weather. The fly is the great dread of the hop-farmer, and no means have been found of arresting its ravages.

HÔPITAL, Guillaume Françoise Antoine de l'. See L'Hôpital, Guillaume Françoise Antoine de.

HÔPITAL, Michel de l'. See L'Hôpital, Michel de.

HOPKINS, Samuel, D.D., an American divine, and founder of the sect called *Hopkinsians*, was born September 17, 1721, in Waterbury, Connecticut, and graduated at Yale College in 1741. Soon afterwards he engaged in theological studies at Northampton, Massachusetts, under the superintendence of Jonathan Edwards, and in 1743 was ordained at Housatonic, now Great Barrington, Massachusetts, where he continued until 1769, when he removed to Newport, Rhode Island, in consequence of the diminution of his congregation and the want of support. When he had resided for some time in this place, the people became dissatisfied with his sentiments, and resolved in a meeting to intimate to him their disinclination to his continuance amongst them. On the ensuing Sunday he preached to them a farewell discourse, which was so interesting and impressive, that they besought him to remain. He did so until his death, December 20, 1803. Dr. Hopkins was a pious and zealous man, with considerable talents, and almost incredible powers of application. He is said to have been sometimes engaged during 18 hours of the day in his studies. He published numerous sermons, besides various other works, the principal of which are a Dialogue, showing it to be the Duty and Interest of the American States to emancipate all their African Slaves (1776); a System of Doctrines contained in Divine Revelation, explained and de-

fended, to which is added a Treatise on the Millennium (two vols. 8vo, 1793), and a sketch of his own life. His theological opinions, which are in part those of Jonathan Edwards, have given birth to the most earnest controversy.

HORA CANONICA, HORA REGULARIS, or simply HORA, is applied, in the Roman Catholic Church, to the appointed hours at which certain hymns and devotions, which themselves also receive the name of *Horæ* or *Hours*, are performed in monasteries. These horæ, consisting of psalms and passages from the Old and New Testament, responses, antiphonies, &c., are contained in the Breviary, arranged according to the festivals and other days, and are recited or uttered aloud. The rules and observances of different orders contain particular arrangements as to the performances of the horæ. They however form an essential part of the choral service, which contains eight canonical hours. 1. Matins, now usually performed on the previous evening by anticipation, but at an earlier period used most commonly about midnight; 2. Lauds, before day-break; 3. Primes, at six o'clock ('the first hour'); 4. Terces, at nine o'clock (the third hour); 5. Sexts, at noon (the sixth hour); 6. Nones, at three P.M. (the ninth hour); 7. Vespers, in the early evening; and 8. The Completorium or Compline.

HORACE. See HORATIUS FLACCUS.

HORÆ (Latin: Greek form *Hôrai*, Hours), in classical mythology, the goddesses of the order of nature. In Homer they are the ministers of Zeus, the guardians of the gate of Olympus, and rulers of the clouds and weather. In Hesiod they are the daughters of Zeus and Themis (justice), who provide not only the fruits in their season, but give to a state good laws, justice, and peace. They are usually mentioned in connection with the graces and the nymphs as attendants on the Olympian deities, adorned with wreaths of flowers, and bringing blessings to men. Their number was indefinite; in Athens two only were worshipped, Thallo and Carpo, the Horæ of spring and harvest. The Hora of spring accompanies Persephonē every year on her ascent from the lower world, and the expression, 'the chamber of the Horæ opens,' is equivalent to 'spring is coming.' The attributes of spring, flowers, fragrance, and freshness are transferred to the Horæ; they adorned Aphrodite as she rose from the sea, and made a garland of flowers for Pandora. In works of art the Horæ are represented as blooming maidens carrying the different products of the season.

HORAPOLLO. We have a work in Greek, called Hieroglyphica, under the name of Horapollo, pretended to have been translated from the Egyptian by a certain Philip, of whom nothing is known. The work is divided into two books, and is of some value to the students of hieroglyphics, as it refers to the same forms still seen on Egyptian monuments, and shows that the author must have known the monuments well and studied them carefully. The second book is inferior to the first, and seems to be disfigured by later interpolations, probably by the translator. By many authorities the book is supposed to have been written about the fifth century and translated as late as the fifteenth. The work was first printed by Aldus, Venice (folio, 1505). The best critical edition is by Conrad Leemans (Amsterdam, 1835, 8vo)

HORATII. The Horatii were three Roman brothers, who, according to tradition, under the reign of Tullus Hostilius, and at his suggestion, engaged the same number of Alban brothers (the Curiatii), in order to decide the contest between the two nations. Dionysius of Halicarnassus relates that they were the sons of two sisters, and born at the same time. A sister of the Horatii was betrothed to one of the Curiatii; but both sides forgot their private relations in the service of their country. Tullus, having received the consent of the Horatii, which their father approved, in the presence of the Roman army solemnly consecrated the brothers, and devoted them to the protection of the gods. The same was done also on the side of the Albans. The field of battle was then marked out by both sides, on a large plain, after they had sworn, on the common altar of sacrifice, that the country of the conquered should submit to that of the conquerors. The champions then stepped forth into the place marked out for the contest. The combat was furious; two of the Romans soon fell; the Albans gave a shout of joy; the Romans encouraged the surviving Horatius. The contest was unequal, but art compensated for the inferiority of strength. Horatius saw his antagonists faint with the loss of blood. He himself remained unwounded. In order therefore to separate them from one another, he feigned flight, and, while they pursued him as well as their wounds would permit, at unequal distances, he suddenly turned back, slew one after the other, and thus decided the sovereignty of his country over the Albans. He was conducted back to the city amidst the rejoicings of the Romans, adorned with the spoils of the slain. There he saw, in the crowd, his sister in tears for the death of her betrothed, one of the Curiatii. She uttered with loud lamentations the name of her lover, whose military cloak, which she herself had wrought for him, hung, a bloody trophy, over the shoulders of her brother. Provoked that her lamentations for her lover should mingle with the rejoicings of the nation on his victory, the brother plunged his dagger into her breast. For this deed he was condemned by the duumviri to be scourged and then hanged. Horatius appealed to his peers, the burghers or populus; and his father pronounced him guiltless, otherwise he would have punished him by the right which paternity gave a father. The people could not endure the tears of the old father, who, but a short time before surrounded by his children, was now about to be deprived, by a shameful death, of the last of his sons. The deliverer of his country was absolved from the pain of death; nevertheless, he was obliged, in order to satisfy the law and atone for the murder, to march, with his head covered, under a beam placed across the street (as if under the yoke), which was considered by the Romans as an ignominious punishment. In the war which shortly followed the combat of the brothers, Horatius was entrusted by King Tullus with the destruction of Alba.

HORATIUS COCLES. When the Etrurian king Porsenna, to whom the banished Tarquins had fled, advanced against Rome (B.C. 507), tradition relates that a hero of this name, along with Spurius Lartius and Titus Herminius, held the Sublician bridge over the Tiber against the enemy, while the Romans were breaking it down behind them. When the work was nearly finished Horatius sent back his two companions, and continued to defend the bridge until the crashing of the falling timbers and the shouts of the Romans announced the completion of the work. Though enfeebled by wounds, he then plunged into the stream with his armour, and, in the midst of the darts of the enemy, reached the opposite bank of the Tiber in safety. The nation rewarded him with a monument and as much land as he could plough round in one day. His fellow citizens hailed him as the saviour of his country, and deprived themselves of food when famine was raging so that he might not want. He is said to have been a relation of the Horatii, and to have received the surname of *Cocles*, from the circumstance of having lost an eye in battle.

HORATIUS FLACCUS, QUINTUS, the greatest of Latin lyric poets, was born near Venusia, a city lying on the borders of Lucania and Apulia, December 8, B.C. 65. His father was a freedman who had been manumitted before the poet's birth, and was by occupation a collector of taxes, from the proceeds of which office he had saved enough to purchase the farm where the poet was born. He determined to give his son the best education he could, possibly discerning already signs of genius in him, and for this purpose he removed with his son, then probably about twelve years old, to Rome. Though not rich he caused him to be taught the liberal arts, supported him in the same manner as youths of the best families lived, and was himself a watchful guardian of his morals and an example of virtue, as the grateful son informs us in his Satires (i. 6, 66–92). He was instructed in the Greek and Latin languages, the text-books being Homer for the former and Livius Andronicus for the latter. One of his teachers was Orbilius Pupillus, whose liberal use of the rod has been mentioned by Horace in the eleventh epistle of his second book. At the age of eighteen years he went to Athens to continue his studies, Athens being then a sort of finishing school or university for the Roman youth. During his stay in this city the most important changes were taking place in Rome. Julius Cæsar was assassinated; Brutus came to Athens to prepare for the war which was to follow, and received into his army the Roman youth who studied there. Among these was Horace, who followed Brutus to Macedonia, while at Rome, M. Lepidus, M. Antony, and Octavius Cæsar declared themselves triumvirs of the republic for five years, and divided the provinces among themselves. Horace was legionary tribune in the army of Brutus, and fought in the last battle for the freedom of Rome, at Philippi in Macedonia (B.C. 42). Brutus and Cassius fell; Horace saved his life by flight. He himself playfully mentions his flight, and his throwing away his shield (Od. ii. 7, Ep. ii. 2, 46), which has caused some to accuse him of disgraceful cowardice; but it was surely little to his discredit to flee with the other remnants of an utterly shattered army. Liberty of return was granted to the vanquished, and Horace availed himself of the opportunity, and from this time took no direct part in public affairs. His father was now dead; his paternal estate was confiscated; poverty, as he himself says (Epistles, book ii. epistle 11, 49 et seq.), compelled him to make verses. Whether this expression was meant literally, as many believe, is uncertain, as he had a moderate support from the station of clerk to the quæstor, a situation which he had been able to purchase. But he could not have employed his leisure hours in a nobler manner than in the exercise of the talent which nature had so richly bestowed upon him; nor could he have chosen a better way to soothe those feelings which, in contemplating the occurrences of his time, must often have powerfully disturbed his inmost soul. The talent which he displayed procured him the friendship of two eminent poets, Virgil and Varius, and to them he was indebted for his first acquaintance with Mæcenas, a refined man of the world, who, without leaving his private station, was the friend and confidant of Augustus Cæsar, and who expended his wealth willingly for the encouragement of literature and the arts. Nine months after, Mæcenas received Horace into the circle of his intimate friends, and, after some years, presented him with the Sabine estate, which Horace so often mentions in his poems. The situation of this farm was in the valley of Ustica, within view of the mountain Lucretilis, part of which is now called Mount Gennaro, and near the Digentia about 15 miles from Tibur (Tivoli). It was sufficient to maintain him in ease and comfort during the rest of his life. He had also a cottage at Tibur, and at Rome or one or other of his country residences the latter part of his life was spent. If the poet did not acquire a still more splendid fortune, the fault lay in himself. He was at length introduced to Augustus, and though he came to be on a footing of great familiarity with him, and has sung his praises in several of his poems, he never sought favours at his hands. According to Suetonius he declined a proposal which Augustus made to him through Mæcenas, to enter his service and undertake the management of his private correspondence, under the pretence of ill health. This refusal did not alienate the favour of the emperor however, with whom, as with many others of the most distinguished men at Rome, Horace continued to live on terms of mutual esteem and friendship. He died 17th November, B.C. 8, the same year as his friend and patron Mæcenas, near whose tomb in the Esquiline he was buried. Almost all his poems addressed to Mæcenas celebrate love and freedom, and express indifference to that happiness which depends on the will of another, and contentedness in a situation in which he found himself rich above his wishes. He did not, however, make a parade of rusticity, or deem a strict morose manner of life necessary to virtue; he rather displayed a genuine urbanity, which finds a tone adapted to every circumstance. He has left us four books of odes; a book of epodes, so called, which differ from the odes not only in metre, the second verse being always shorter than the first, but also in the sentiment, which would rather rank them among the satires, in which he took Archilochus as a pattern; two books of satires, and two books of epistles, one of which (that addressed to the Pisos) is often cited as a separate work, under the title of Ars Poetica.

In appreciating Horace as a lyric poet it must not be forgotten that he was the first among the Romans who formed the Roman language for lyric poetry, and applied it with no small labour to the difficult Greek metres. Uninterrupted study and perseverance only could have effected so masterly a structure of the verse. It is said, indeed, and it cannot be denied, that the greater part of the odes of Horace are only imitations or translations of Greek lyrists—Archilochus, Alcæus, Stesichorus, Sappho, and others. Many have made use of this objection to detract from the poetical fame of Horace. But, granting that originality cannot be attributed to Horace as a lyric poet, no one can deny it to him as a satirist. As didactic satire in general was a Roman invention, so it was Horace who, following Ennius, Pacuvius, and Lucilius, by whom its form and object had been defined, gave it a tone and polish of his own. The satires of Horace, among which may be included his epistles, since they differ little from the others, except in their title, and in being addressed to an individual, have more or less a comic character, and are to be judged from this point of view. Horace does not expose vices so much as follies, which he places in a ridiculous light: he sees more folly than vice in the world, and even declares himself not exempt from a portion of it. Nevertheless he seeks to amend follies as far as possible, because he considers them pernicious. To prejudices and errors he opposes his philosophy, which, so far from imbittering, or even forbidding the enjoyments of life, only exhorts to a prudent vigilance, and teaches all the virtues, without which happiness is impossible. The easy, agreeable manner in which he philosophizes without appearing to do it, the salt with which he seasons his thoughts, the delicacy and ease with which he expresses himself, afford the most agreeable entertainment. We know not which most to admire,

his accurate knowledge of the human heart and of the different classes of men, his love of truth, candour, and ingenuousness, the agreeable tone, the urbanity which, in seriousness or derision, never forsakes him, the delicacy with which he presents the ridiculous without bringing it out in bold relief, or his skill in delineating characters. His descriptions are still as true to life and nature as ever, and we cannot imagine a time when the poems of Horace will cease to be read and admired.

Among the earlier commentators on Horace are Acron, Porphyrion, and the scholiast of Cruquius; among his later editors and commentators we will only mention Bentley, Orelli (4th edition, Berlin, 1885–90), Meineke (1874), Haupt (1881), L. Müller (3rd edition, 1898), Kiessling (2nd edition, 1886–98), Keller and Häussner (2nd edition, 1892), and Dillenburger (7th edition, 1881); and among modern English editors Macleane and Wickham. Among English translations the spirited one by Sir Theodore Martin deserves special notice (2 vols., 1881).

HORBURY, a town of England, in Yorkshire (W. Riding), 3 miles west-south-west of Wakefield, a seat of the woollen manufacture, worsted, flannel, yarn, and cloths being here made. Horbury Bridge, on the Calder, is an adjacent village also carrying on the woollen manufacture; and Horbury Junction is likewise a busy place. Pop. (1901), 6736.

HÖRDE, a town of Prussian Westphalia, on the Emsche, 2 miles south-east from Dortmund. In the neighbourhood are productive iron and coal mines, and in the town itself are extensive tin and iron works. The place has recently increased with great rapidity. Pop. (1900), 25,126.

HOREB (Arabic, *Jebel Mûsa*, Mountain of Moses), a mountain in the northern part of Arabia, of the same ridge as Mount Sinai, which lies not far distant from it, memorable in the history of Moses. The monks on Mount Sinai still point out the rock on Horeb from which water issued at the blow of Moses. A small party of Hussites called the mountain between Ledetz and Lipniza, in Bohemia, where they assembled, *Horeb*, and themselves *Horebites*.

HOREHOUND (*Marrubium vulgare*), a labiate plant with whitish, cottony leaves and stem; flowers small, nearly white, in crowded whorls, possessing an aromatic smell and bitter flavour. It is a popular remedy for coughs and asthma. *Ballota nigra*, another British plant of the same natural order, is known as *black horehound*.

HORGEN, a village of Switzerland, beautifully situated on the south-west shore of the lake, and 9 miles S.S.W. of the town of Zürich. It is well built, and has a beautiful parish church with an elegant spire, manufactures of silk goods, and a harbour with a considerable lake trade. Horgen is also an important railway-station. The vine is cultivated in the neighbourheod. Pop. (1900), 6914.

HORIZON. Standing on the deck of a ship, we are able to see all round to a certain distance. At a higher level we have a greater range of vision; but in all cases we are stopped somewhere. We can see but a certain amount of the earth's surface all round. This is owing to the spherical figure of the earth. The earth's globular form prevents our having from any point a view of more than a certain easily-calculable area. To our view the sky and the sea appear to meet in a certain line, which is a circle, and is called the line of the *visible* or *sensible horizon*; and the plane that contains this circle is called the plane of the sensible horizon. The term horizon is, however, used indifferently for the plane and for its circular rim. In astronomy the horizon of any place means a plane parallel to the plane of the sensible horizon, but passing through the centre of the earth. The plane of the astronomical horizon thus divides the celestial sphere into two equal parts, and hence the line in which this plane cuts the celestial sphere is a great circle. The plane of the horizon divides the visible from the invisible hemisphere. With regard to the moon and the nearer planets, there is a difference in this respect between the sensible horizon and the astronomical horizon. But for the fixed stars there is no appreciable difference, for although the two planes just defined are separated by a distance of 4000 miles, the radius of the earth, yet this distance is quite imperceptible in comparison with the distance of the nearest of the fixed stars.

The plane of the horizon is of great importance in astronomical observations, and in particular in observations at sea for the purpose of determining the latitude of the place. For example, the altitude of the pole-star above the horizon is equal to the latitude of the place of observation; and from the altitudes of other stars, particularly of the sun, above the horizon, the latitude of the place of observation is always calculated. Whenever it is possible the altitude of the sun or a star above the visible horizon is measured by means of the sextant, for the purpose of determining the latitude.

When the line of the real sea horizon is not visible on account of the proximity of land, or for any other reason, an *artificial horizon*, as it is called, is employed for astronomical observations. This is no real horizon, and only deserves its name from being a substitute for a horizon. The artificial horizon consists generally of a basin of mercury, and the following is the use of it. In determining the latitude of a place, the altitude of the sun or some known star above the real horizon is observed by means of the sextant; but if the real horizon is invisible, the observation that is made is the angle between the sun or star and the image of the sun or star in the basin of mercury, and it is easily seen that half this angle is the altitude of the object above the real horizon. The artificial horizon is thus made a substitute for the real horizon.

HORN, the term for hard and pointed appendages of the head, as in deer, cattle, &c. In strictness nothing should be called horn which is not derived from the epidermis or outer layer of the integument, whether on the trunk, hoofs, or head; while the term a horn or horns may be applied to any projection from the head. Horn is a tough, flexible, semitransparent substance, which may be developed morbidly as a corn, or naturally, as in the callosities on the legs of a horse, the breast of a camel, and the hips of a monkey. Or again, it may be developed in connection with important functions, as when it forms the 'shell' of the tortoise, the nails, claws, and hoofs of animals, the beak of bird and turtle, &c. Horn is distinguished from bone in being softened very completely by heat, either applied immediately or through the medium of water, so as to be readily bent to any shape, and to adhere to other pieces of horn in the same state. It contains but a small portion of gelatine, and in this it differs from bone, which contains a great deal. Horns consist chiefly of condensed albumen, combined with a small and varying portion of gelatine, with a small part of phosphate of lime. With some animals the horn is an instrument of defence; with others, not. In some species of animals the males only have horns, as, for instance, the stag or red-deer. Female sheep seldom have horns. The female goats have horns, but they are always smaller than those of the male. In cattle the horn is particularly well developed. The bull generally has a shorter, denser, firmer horn than the cow. There are, however, hornless cattle. In the case of most horned animals the horns are not entirely developed

until they have become capable of continuing their species.

Horns may be divided into three kinds: 1, those of the rhinoceros; of the ox, antelope, goat, and sheep; of Owen's chameleon, and other lizards; 2, of the camelopard or giraffe; 3, of the deer kind. The horns of the rhinoceros are composed entirely of a horny substance. They are situated not upon the head, but on the snout, and are, in fact, huge nails developed on processes of the true skin. They are like nails, fibrous in texture. They are not deciduous; but increase from the root or base in proportion as they wear. Similar structures belong to many of the ruminating quadrupeds, and some birds have similar processes on their heads. The horns of cattle consist of three parts—an osseous core or flint, a vascular investment, and the external sheath. The bone is a process of the *os frontis*. As it elongates the skin becomes callous by thickening of the epidermic covering, when the osseous process is found to be clothed in a real case of horn. The horny case grows from the roots, and the increase in each year is marked by a circular groove near the root of the horn. They are not shed, save by the prong-horned antelope (*Antilocapra*), which is also exceptional in having the horns branched. Only one ruminant (*Antilope quadricornis*) has two pairs of horns. The second sort are the short straight processes on the head of the camelopard, which are at first distinct ossifications, but become united to the os frontis by anchylosis, and terminate in a convex knob; the stem is covered with the skin, but the bulb on the end sustains a number of short strong hairs. Those of the third kind are peculiar to the deer genus. They are composed entirely of bone, and are shed and reproduced annually. They first appear like two small knobs under the skin. These develop their different branches in succession, still covered with the skin, and a delicate, soft hair, forming together what has been called their *velvet coat*, which is extremely vascular. When the horn is completely formed the velvet coat becomes dry, and is rubbed off by the deer. The growth of the 'burr' or bony ring a little above the base obliterates the blood-vessels which supplied the velvet, and the horn, now deprived of nourishment, dies, and is shed. (See DEER.) The horns of the deer, or, as they should be called, the antlers, are homologous with the osseous core of the horns of the other ruminant quadrupeds. The horns of the rhinoceros and those of the deer are the two extremes in these organs. The one wants the osseous basis, the other the horny covering. Those of the camelopard and ox exhibit examples of the intermediate structure. Instances are given of horses, cats, and particularly hares, found with horns. The human body sometimes produces horny protuberances on various parts.

The horns of animals, literally speaking, formed the most ancient drinking cups. Pindar, Æschylus, and Xenophon make mention of them as being appropriated to this purpose. Philip of Macedon is said to have made use of one. It is from this ancient usage that the general name of *horns* has been given to a species of drinking cup, as after the actual employment of the animal substance had been discontinued the shape remained in use. The horns of victims sacrificed to the gods were gilt, and suspended in the temples, more especially in those of Apollo and Diana. From the most remote times the altars of the heathen divinities were likewise embellished with horns, and such as fled thither to seek an asylum embraced them. Originally the horns were doubtless symbolical of power and dignity, since they are the principal feature of gracefulness in some animals, and instrument of strength in others. Hence these ornaments have been frequently bestowed on pictorial representations of gods and heroes; ancient medals frequently present the figures of Serapis, of Ammon, of Bacchus, and of Isis with these additions. The Kings of Macedon were actually in the habit of wearing the horns of a ram in their casques, and the same thing is asserted of various other princes and chieftains.

Horn Manufactures. The valuable properties of horn, its toughness, flexibility, and transparency, render it susceptible of being employed for many ornamental purposes. The principal are those of the ox, buffalo, sheep, and goat: from the osseous nature of deer-horns they have a very limited application, chiefly for the handles of knives. The horns of the other animals mentioned can be softened by heat, cut into sheets of various thickness, which sheets may be soldered so as to form plates of large dimensions, and polished and dyed so as to imitate the much more expensive tortoise-shell. When horn is wanted in sheets it must be steeped in water for about fifteen days in summer, and a month in winter, to separate the pith from the kernel; after it is soaked it must be well shaken and rubbed to get off the pith; then it must be put for half an hour into boiling water, taken out, and the surface sawed even lengthways. It must again be put into boiling water to soften it, and then may be split into sheets with a small iron chisel. These sheets must be again softened in boiling water, and scraped with a sharp instrument to reduce the unevenness of surface. The pieces are then pressed between hot iron plates, and if it is wanted to join them the edges of two or more are brought together between polished copper plates, and these screwed tightly together with a hand-vice and plunged into boiling water, and then into cold water, and the edges will be found firmly welded together. The clippings of horn may be welded together in the same manner, and made into snuff-boxes, powder horns, handles for umbrellas, knives, forks, &c. As horn has the valuable property of taking on and retaining a sharp impression from a die many highly ornamental articles may be turned out. Combs are made from the flattened sheets, and out of the solid parts of buffalo horns beautiful carvings are made. When it is wished to colour the horn in imitation of tortoise-shell metallic solutions are employed. For red a solution of gold in aqua regia; for black a solution of silver in nitric acid; and for brown a hot solution of mercury in nitric acid, or a paste of red-lead made with a solution of potash. The more common vegetable dye-stuffs will also colour it, but not so brightly and so permanently as the metallic materials.

Composition of Horn. Horny tissue or epidermose may be obtained from those animal structures of which it forms the basis, by exhausting the divided particles with boiling alcohol. The residue is still very impure, but the analyses of it as obtained from different animal tissues show that it is in all essentially the same substance. Epidermose may be obtained from hair, horn, skin, nails, hoofs, wool, quills, feathers, lining membrane of eggs, whalebone, or from the scales of the turtle, &c. It contains about 50 per cent. of carbon, 6·5 per cent. of hydrogen, about 17 per cent. of nitrogen, together with 3 to 5 per cent. of sulphur, the remainder being made up of oxygen. By digestion in a Papin's machine horny tissue gradually dissolves; it does not gelatinize on cooling, in which respect it differs from bone. The cellular structure of horn may be very well seen by treating it with a strong solution of caustic potash or soda.

HORN, a musical instrument, originally formed, as the name denotes, from the horn of an animal.

The name includes a large family of wind-instruments, many of which have fallen into disuse. The hunting-horn (the *cor de chasse* of the French, the *Waldhorn* of the Germans), a brass or copper tube gradually expanding into a bell-shaped mouth, and bent into a semicircle, was long the chief form extant. Within a century, however, the instrument has been so greatly improved as to rank at present among the first in the orchestra. The French horn, or now, par excellence, *the horn* (Italian, *corno*), consists of a metallic tube of about 10 feet in length, very narrow at top, bent into rings, and gradually widening towards the end whence the sound issues, called the *bell*, or in French the *pavillon*. It is blown through a cup-shaped mouth-piece of brass or silver, and the sounds are regulated by the player's lips, the pressure of his breath, and by the insertion of the hand in the bell of the instrument. As a simple tube, unprovided with holes, as the flute, &c., the horn yields only the generating note, or tonic and its aliquot parts or harmonics, and of course would be confined to one key; but by means of *shanks* or *crooks* the tube can be lengthened, and therefore transposed into any key. By the insertion of the hand into the bell, which has the effect of flattening a note, the sounds awanting are produced. The compass of the instrument is three octaves. Music for the horn is always written on the key of C, an octave higher than it is played, with the key of the composition marked at the beginning of each movement: thus 'corni (or horns) in D' directs the performer which crook he must use to play the notes in the key indicated. In order to procure clear and distinct tones all throughout (the insertion of the hand producing stuffed or muffled sounds) pistons were added to the horn by Stoelzel; but the cornet à piston is inferior to the parent instrument in purity of tone. Great improvements have been made in the instrument by C. J. Sax of Paris, whose Saxhorn gives a greater volume of sound than the old instrument. The *bugle-horn* is a tube of 3 feet 10 inches in length bent into small compass. It is usually provided with keys, and has a range of two octaves, and notes commencing with the upper B of the bass clef.

HORN, CAPE. See CAPE HORN.

HORN, HOORNE, or HORNES, PHILIP II., DE MONTMORENCY-NIVELLE, COUNT VAN, a Flemish soldier and statesman, was born in 1518. His father was a descendant of the French family of Montmorency, and on the mother's side he was related to Lamoral Egmont, with whose fate his own was destined to be linked. His mother becoming a widow when he was about eight years of age, was married again to John, Count van Horn, one of the wealthiest nobles of the Netherlands, who, having no children of his own, left his estates to his wife's children on condition that they should assume his name. Philip was thus at the outset of his career one of the most influential of his order, and subsequently received from Charles V. and Philip II. several important trusts and distinctions, including the appointments of governor of Geldern and Zutphen, admiral of the Flemish fleet, and councillor of state. He fought with reputation at the battles of St. Quentin and Gravelines, and in 1559 accompanied Philip II. to Spain, where he is supposed to have received information of the designs of the Spanish court against the Netherlands, and to have communicated them to the Prince of Orange. Returning in two years to the Netherlands he joined Orange and Egmont in resisting the aggressive policy of Philip; yet continued loyal to the crown, and indisposed to accept the doctrine of resistance broached by the Prince of Orange. He was, however, suspected of disaffection by the Spanish court, and upon the arrival of Alva in Brussels he was enticed along with Egmont to that city, and arrested 9th Sept. 1567, on a charge of high treason. Ceaseless but vain efforts were made to obtain for him a fair trial, and appeals for clemency on his behalf were made by potentates in all parts of the Continent. He was executed in June, 1568, and met his death with perfect composure, though he could not help protesting indignantly at the injustice of the sentence, which, he said, was a poor requital for twenty-eight years of faithful service to his sovereign.

HORNBEAM (*Carpinus Betulus*, natural order Cupuliferæ), a species of tree common in Britain, which has barren flowers in a cylindrical catkin; fertile flowers in a lax catkin; nuts in pairs; a small tree growing in woods and hedges, often in a damp tenacious soil. It forms a principal part of the ancient forests on the north and east sides of London. The wood is white, tough, and hard, and burns like a candle. It is used in turnery, for cogs of wheels, &c. The inner bark yields a yellow dye. The American hornbeam (*Carpinus Americana*) is a small tree rarely attaining the height of 30 feet, sparingly diffused over the whole of the United States. The wood is fine-grained, tenacious, and very compact; but is little used on account of its inferior size.

HORN-BILLS. This remarkable group of birds is entirely confined to Southern Asia and Africa. The feature to which their popular name is due is in the typical species a horn-like excrescence at the base of the upper mandible, but the genera may be arranged so as to show a regular sequence; thus the Javan *Rhyticeros* has simply thickened ridges on the base of the mandible; the African *Toccus* has the upper edge of the mandible sharply compressed; the Philippine *Anorrhinus* has a crest marked off with a furrow; the Malaccan *Rhinoplax* has a vertically placed helmet-like elevation; the Abyssinian *Bucorvus* (Abba Gumba of Bruce) has a high projection truncated in front; in *Eurycerus* a broad rounded process projects backwards; the horn of *Berenicornis* is depressed and long. The typical genus *Buceros* shows several modifications: in all the horn is separated by a deep furrow from the bill, but in the Sumatran species, the Rhinoceros Hornbill, the tip arches upwards; in the Philippine (*B. plunicornis*) the upper surface is a flat disc; in the South Asian (*B. bicornis*) it ends in a divided tip; and in the Sumatran (*B. monoceros*) the tip bends down. The skeleton of these birds is extremely pneumatic, all the bones containing air derived from the lungs, whose cavity communicates with an extended system of air canals. Wallace and Livingstone describe the remarkable habit of some species, namely, that the male plasters up the female during incubation in the hollow of a tree, and feeds her through a small aperture left for the purpose. The hornbills are of arboreal habit, and feed on fruits, which they toss up and catch after detaching them; but in captivity they take small reptiles, and the Abyssinian species even attacks snakes.

HORNBLENDE, or AMPHIBOLE, is one of the most abundant and widely diffused substances in the mineral kingdom, next to quartz, feldspar, and mica, and is very remarkable on account of the various forms and compositions of its crystals and crystalline particles, and of its exceedingly diversified colours, thus giving rise to almost numberless varieties, many of which have obtained distinct appellations. The primitive form of the species is an oblique rhombic prism of 124° 30′ and 55° 30′, in which the terminal planes are inclined to the obtuse lateral edges, under angles of 105° and 75°. The former planes are easily developed, by cleavage from its crystals and crystalline masses; but the latter have never been obtained

in this way, having been inferred from calculation. The crystals of hornblende are generally long, and destitute of regular terminations; they are often deeply striated longitudinally, and much disposed to intersect each other, sometimes in such a manner as to give rise to a sheaf-like or to a stellular composition. Perfectly regular, implanted crystals do occur occasionally; and these present, for the most part, the following shapes: six-sided prisms, from the truncation of the acute lateral edges of the prism, acuminated by four planes, corresponding either to the lateral edges or to the lateral faces of the prism; the same with an acumination of three planes; the same with dihedral summits; and the primitive form with dihedral terminations, of which the faces correspond to acute edges of the prism. The massive varieties frequently offer a granular structure, in which the individuals are of various sizes, and strongly coherent, often with a tendency to a slaty fracture; more commonly, however, the composition of massive varieties is columnar, the individuals being sometimes very long, parallel, or diverging, and, when delicate, producing a silky lustre. The lustre of hornblende is vitreous, inclining to pearly, upon the faces of cleavage, in the varieties possessing pale colours. Colour, various shades of green, often inclining to brown, white, and black, with every intermediate shade; nearly transparent in some varieties, in others opaque, brittle; hardness about the same with feldspar; specific gravity, 3·00. Three varieties, on being analysed, gave the following results:—

	A white Variety.	A green Variety.	A black Variety.
Silica	60·3	46 26	45·69
Magnesia	24·2	19·03	18·79
Lime	13·66	13·96	13·85
Alumina	0·26	11·48	12·18
Protoxide of iron	0·15	3·42	7·22
do. of manganese	0·00	9·36	0·22
Fluoric acid	0·94	1·60	1·50
Water and foreign substances	0·16	1·04	0·00

The true chemical composition of this mineral is scarcely yet known. Most of the analyses agree with the supposition that it is a metasilicate of the general formula $M_2 SiO_3$—M representing generally the metals calcium, magnesium, iron, and sodium. The part played by the alumina, which is sometimes present in large quantities, has not been thoroughly explained. It is supposed to replace part of the silica; oxide of iron sometimes exists in the state of magnetic oxide (Fe_3O_4).

Of those varieties of the present species which have obtained distinct names, and which, in some systems of mineralogy, have even been regarded as forming separate species, the following are the most remarkable, viz. hornblende, tremolite, actinolite, and certain kinds of asbestos. Hornblende differs from the rest principally by its dark, blackish, or greenish colours, and is divided into three sub-varieties, basaltic hornblende, common hornblende, and hornblende slate. The first consists of black and perfectly-cleavable crystals, which are always found imbedded in basaltic or volcanic rocks; the second refers to imbedded crystals of various colours, but always of dark shades, and in which cleavage is less easily obtained; it includes, besides, all massive, granular or columnar varieties, except such as are black, easily cleavable, and of a shining lustre, which have been distinguished by the name of carinthin. Hornblende slate comprehends such varieties as consist of minute and closely-aggregated particles, united in such a manner as to produce a slaty fracture. Tremolite consists of the pale green, gray, bluish, and white varieties, and has been subdivided into common, glassy, asbestiform, and granular tremolite. The first occurs in crystals, rarely with perfect terminations, and in massive varieties; the second in columnar compositions, or coarsely fibrous, with a high degree of transparency; the third refers to very thin or capillary crystals, and the fourth consists of granular particles. The varieties of actinolite differ from those of tremolite by their deep (often grass-green colours. The asbestiform tremolite and asbestiform actinolite form a passage into asbestos, which term is applied not only to minute columnar and variously interwoven individuals of this species, but to those also of augite or pyroxene, and may be said to denote rather a peculiar stage of aggregation in these species than the substance of a distinct mineral. (See ASBESTOS.) The best crystals of basaltic hornblende come from near Teysing and Teplitz, in Bohemia. Common hornblende abounds at Arendal, and other places in Norway and Sweden; a light greenish variety, imbedded in granular limestone at Pargas, in Finland, has received the name of pargasite. The varieties of actinolite and tremolite abound in numerous places in Europe; the former occurring in talcose slate, and the latter in limestone and dolomite rocks. In America this species is also widely disseminated.

HORN-BOOK is a copy of the alphabet, large and small, with perhaps several rows of monosyllables and a copy of the Lord's Prayer, set in a frame and covered with a thin plate of horn, to prevent the paper from being thumbed to pieces by the children who were made to study it. Down to the age of George II. the horn-book was the primer of our ancestors. Generally there was a handle to hold it by, through which a hole was made for a string whereby it was strung to the girdle of the scholar.

HORNCASTLE, a market town, England, in the county of Lincoln, 21 miles east of the city of that name, near the confluence of the rivers Bain and Waring. The chief buildings and institutions are St. Mary's Church, restored in 1860; a grammar-school, founded in the reign of Queen Elizabeth; court-house; butter-market; corn-exchange; and the mechanics' institute, with a library. There is a considerable trade in corn and wool. There are three annual fairs, that held in August being one of the largest horse-fairs in the United Kingdom. The town gives name to a parl. division of the county. There are remains of a Roman fortification; ancient coins and other antiquities are found in the neighbourhood. Pop. in 1891, 4374; in 1901, 4038.

HORNER, FRANCIS, an able politician and political economist, born at Edinburgh on the 12th of August, 1778. After attending the high-school and university there, he studied for the Scottish bar, but exchanging it for the English bar, took up his residence in London in 1803. He had early, with his friends Jeffrey and Brougham, declared his preference for Whig principles, and in 1806, when Mr. Fox came into office, obtained through ministerial influence a seat in Parliament. He sat at first for the borough of St. Ives, and afterwards successively for that of Wendover and St. Mawes. Though not an orator, he was so clear and forcible a reasoner as to command the attention of the house, particularly on all questions relating to political economy. He particularly distinguished himself on the bullion question, and had a large share in drawing up the celebrated bullion report. In consequence of a pulmonary complaint he set out in 1816 with the intention of spending the winter in the south of Europe. The remedy proved too late, and he died at Pisa on the 8th of February, 1817. He was one of the projectors of the Edinburgh Review, and wrote many articles for it. His statue in Westminster Abbey is one of Chantrey's best works.

HORNET (*Vespa crabro*), a kind of wasps, distinguished from others by their larger size, which is

from 14 to 16 lines long. The feelers, clypeus, and head, as well as the front, edge, and middle of the thorax, and the underside of the lower part of the body, are of a brownish red; the lower rings of the body are yellow, but the fore-edge is black, and has two or three points projecting outwards. The hornets form their nest of a kind of paper-work in hollow trees and walls, and are able with their sting to inflict a very painful wound, usually accompanied with considerable swelling. Hornets do much injury to trees, particularly ashes, by eating away the bark. They also devour much fruit, and live partly on other insects. According to a recent statement, it has been discovered that inoculation with hornet poison confers immunity against viper bites.

HORN OF PLENTY. See CORNUCOPIÆ.

HORNPIPE, a dance, whose name is probably derived from the instrument that was played during its performance. This instrument, once common in Wales, where it was called *pib-corn*, consisted of a wooden tube with holes, having a reed at the mouthpiece and the other end made of horn. The dance, a lively *pas seul*, appears to have been formerly danced to triple-time music, but that now performed to it is in duple time.

HORN SILVER, a name for native chloride of silver. See SILVER.

HORNSTONE. See QUARTZ.

HORN-WORK, in fortification, a work with one front only, thrown out for the purpose of either occupying rising ground, barring a defile, covering a bridge-head, or protecting buildings. The front of a horn-work consists of two demi-bastions connected by a curtain.

HOROLOGY. See CLOCK-WORK and WATCH.

HOROSCOPE, an astrological term applied to a sort of diagram or scheme of the position of the celestial bodies at the time of a person's birth, for the purpose of predicting his future. It is also used for a scheme or figure of the position of the heavenly bodies at any time. The heavens were divided by astrologers for this purpose into twelve parts, called *houses*, to each of which was assigned its particular virtue or influence. The *ascendant* was that part of the heavens which was rising in the east at the moment; this is the first house, or house of life, and contained the five degrees immediately above the horizon, and the twenty-five beneath it. The second was the house of riches, &c.; the seventh, or angle of the west, the house of marriage; the eighth, the house of death; and so on.

HORROX, or HORROCKS, JEREMIAH, an English astronomer, was born at Toxteth, near Liverpool, about 1617, and educated at Emmanuel College, Cambridge. He accurately observed the transit of Venus over the sun's disk, November 24, 1639. He died January 3, 1641, only a few days after he had finished his treatise entitled Venus in Sole visa. Other productions of his pen, left in an imperfect state, were collected and published by Dr. Wallis in 1672 under the title of Opera Posthuma. Horrox seems to have been the first who ever predicted or observed the passage of Venus over the sun's disk, from which he deduced many useful observations, though not aware of the full importance of that important phenomenon. Newton, who always spoke of Horrox as a mathematical genius of the highest order, showed that the theory of lunar motions propounded by the latter was a direct consequence of his own gravitation theory.

HORSA. See HENGIST.

HORSE (*Equus caballus*, Linn.), a beautiful and useful ungulate quadruped, of the odd-toed group (Perissodactyla), type of the family Equidæ, which includes the animals formerly classed in the order of Solipedes, and is thus described: a single toe on each foot included in a broad hoof; six cutting teeth or *nippers* in each jaw, two very small tusks usually in the male alone; grinders with a flat crown, presenting when worn different figures, formed by the enamelled plates of the interior; stomach small and simple, intestines very large; a valve at the cardiac orifice, the cœcum or blind gut of considerable dimensions; neither gall-bladder nor clavicles. The horse family (Equidæ) may be divided as follows: *a*. Tail with long hair throughout; callosities on the four limbs; 1. The horse. *b*. Long hair only at tip of tail; callosities only on the fore limbs; 2. The ass. 3. The African ass. 4. The onager or wild ass of Western Asia. (This and the preceding are probably the original of the domestic ass.) 5. The Tibetan wild ass (kiang, dziggetai). 6. The zebra. 7. The quagga. Arabia produces the most beautiful breed of horses, which are also swift, courageous, and enduring. The Arabians select the most promising for breeding, and cherish and cultivate the race with a degree of kindness which can scarcely be surpassed. It used to be believed that Arabia is the original country of the horse, since there, instead of crossing the breed, the utmost care is taken to keep it pure; but this is very doubtful. The Arabian breed of horses has been diffused in Barbary, Egypt, and Persia, and Arabian blood has also been introduced into western Europe. Large herds of wild horses are sometimes seen in the southern parts of Siberia, and in the deserts of Central Asia, and it has been supposed by many that these represent the original of the domestic horse, while others regard them as horses that have escaped from domestication and again become wild. The true wild Asiatic horse is the *tarpan*, which has the head thick and short, the neck long and slim, the ears long and pointed, the mane short and rather erect; though in certain respects reminding one of the wild ass, the tail is bushy throughout. Another wild horse, discovered by the Russian traveller Przevalsky, differs from the true horse in having a short erect mane, no forelock, and the long hairs of the tail beginning half-way down. Sir William Flower suggests that this variety may be a hybrid between the tarpan and the kiang. In the Pampas of South America there are immense troops of wild horses, which are descended from those carried thither by the Spanish conquerors. These herds occupy a tract of country chiefly between the river Negro and the country of the Patagonians, and are sometimes in herds of 10,000. Among these herds, each stallion appropriates as many mares as he can, which he keeps collected and protects, so that every large troop consists of many distinct families. Horses in a wild state may now be met with also in parts of N. America and Australia. Some believe that both horse and ass have descended from a single stock, which was probably dun-coloured and marked with stripes, these stripes still appearing in the longitudinal back stripe and shoulder stripes of the ass, and in the similar stripes sometimes seen also in horses.

Probably the horse was first domesticated in Asia, but the earliest record of its use as a domestic animal is found in Egyptian pictorial representations of about 1900 B.C. For long the horse was used only in war, its use as a draught-animal having been introduced at a comparatively recent period. The thoroughbred race-horses of England have been produced by long and careful selection, assisted by the introduction of foreign blood. In 1689 the Byerly Turk was brought from the Levant, and in the early eighteenth century the Darley Arabian, ancestor of the celebrated Eclipse, was introduced.

About 1724 the Godolphin Arabian followed, and from these three all the present thoroughbreds are descended.

Of the various modes of judging of a horse's age, the best is from a careful inspection of the teeth. These, when the series is complete, number forty-four, namely six incisors, two canines (tusks), eight premolars, and six molars in either jaw. The permanent teeth are preceded by the milk-teeth, which are only twenty-four in number, and all make their appearance before the end of the first year. It is not till about the end of the fifth year that the last of the permanent teeth appear, and up till this period the age of the horse may be easily known by the condition of the teeth. Beyond this stage indications of age are chiefly obtained from the wearing and consequent appearance of the incisors. These, which are somewhat hollowed in the middle and have a black mark in the cavities, at five years old scarcely rise above the gums; at six their hollow pits begin to fill up, and turn to a brown spot like the eye of a garden bean; and before eight years the mark generally disappears. A horse's age is also indicated by the tusks, which till six continue sharp at the points, but at ten appear long and blunted. But artful dealers and jockeys have a method of burning and staining horses' teeth, which may deceive the unwary, and this method is called *bishoping* in their cant language. Between the canine teeth and the molars there is a gap which receives the bit. At the age of two years the horse is in a condition to propagate. The mare is generally in heat from the latter end of March till the beginning of June, but her most violent ardours only continue fifteen or twenty days. She carries her young eleven months and some days, continues to breed till the age of sixteen or eighteen years, and lives on an average between twenty and thirty years. The foal is capable of taking solid food at four months, and may be weaned at six or seven. In its fourth year the fore-feet may be shod, and the hind-feet six months after. The horse is, strictly speaking, an herbivorous animal, and is more scrupulous in the choice of his food than most other domestic quadrupeds, in the meadow rejecting several plants which the ox devours with pleasure. In Sweden it has been calculated that he eats 262 kinds of herbs and rejects 212. Marshy pastures are not friendly to his constitution, and he is apt to indulge too greedily in succulent herbage, particularly in clover and lucerne. He is fond of salt, bread, and malt liquors; and what is extraordinary, the horses of South America are said sometimes even to eat animal food. He sleeps four or six hours out of the twenty-four, and frequently in a standing posture. He is apt to be easily startled at loud or unpleasant sounds, and at the sight of unexpected objects, especially at the dead body of one of his own species. If properly treated he may live to the age of forty years. Wonderful instances are related of his extraordinary sagacity and affection, of his social and gregarious disposition, his love of home and his master, and his wonderful docility.

In England the breeding of horses has reached a degree of perfection which is hardly known elsewhere, and the fleetness of English horses is scarcely credible. Thus, the celebrated Flying Childers of the eighteenth century ran 4 miles in six minutes and forty-eight seconds, carrying at the same time a weight of 9 stone 2 lbs. Modern racers are superior to those of former times, first-class horses being said to be able to cover a furlong in 13½ seconds. The utmost speed of an English trotter is considered to be a mile in somewhat less than three minutes; but some American trotting horses have considerably surpassed this, the distance having been done in 2 minutes 8¾ seconds.

The hunters of England do not form so well-marked a class as the thoroughbreds already referred to. The best of them have been obtained from the race-horses by crossing with heavier native horses. The London dray-horses are rather remarkable for mass and weight than for hardiness or vivacity. The *Shire* horse of the English midlands is a draught-horse of a black colour, with white on the feet, forehead, and a few other parts. It is strongly built, and has hairy limbs, but it is very slow. The *Suffolk punches*, as they are called, excel in drawing dead pulls. They are of a dun colour, and are believed to have been originally introduced from Normandy. The Clydesdale horses are celebrated as perhaps the best draught-horses in Britain. They are larger than the Suffolk punch, and the neck is somewhat longer; they possess all the essential points for heavy draught, and are besides extremely docile. In colour they vary a good deal, being either black, brown, or gray. They are not so high as the shire horse, but their body is longer. The principal markets at which they are sold are those of Lanark, Carnwath, Rutherglen, and Glasgow. Their quick step adds greatly to their value. The mountain ponies of Wales and Scotland are small, but extremely hardy, durable, and sure-footed. The *Shelties* of Shetland, though only from 9 to 11 hands in height, brave the rigours of these northern climes, and are excellently calculated for the rugged fastnesses of their native land. They have long, dense coats, and are usually of a brown colour. In the Orkneys a larger kind of pony is found, and in several other parts of Britain there are characteristic forms. Of foreign horses, one of the best-known breeds is the French *Percheron* cart-horse, which, though of great value, is less heavy and strong than British draught-horses. The Brabançon has similar characteristics.

Of English horses before the Conquest we know very little, but from that period we may probably date the beginning of important improvements in the breeds. Various sovereigns are recorded as having introduced foreign horses, and Edward III. and some later monarchs prohibited the exportation of British horses. Henry VIII. sought to prevent indiscriminate and detrimental crossing, and Elizabeth forbade the sale of horses to Scotchmen. The Stuarts introduced oriental blood, and in William III.'s reign the first of the three Eastern ancestors of the thoroughbreds was brought to England. During the age of chivalry the breeds of horses most in repute were those of Normandy and Flanders, from their great size and strength. When gunpowder was invented, however, and the heavy coats of mail were laid aside, this description of horse was consigned to the waggoner, and sedulous attention paid to animals of a lighter and more active character.

The ailments with which the horse is liable to be assailed as a domestic animal are rather numerous, the chief being connected with the lungs, stomach, and alimentary canal, legs, feet, and joints, and often requiring the attention of the veterinary surgeon. Glanders is a deadly disease communicable to man.

The staple diet on which horses are kept is oats and hay, with beans added for horses subjected to heavy work; as they are heating, however, beans should only be given sparingly and occasionally. As a substitute for, or an addition to the regular food, bran, linseed, and carrots are used. Bran is a laxative, and should be given only in the form of a mash at the end of a day's hard work. Carrots carefully cleaned may, like beans, be given now and then in small quantities; they keep the blood in good order, checking the febrile symptoms induced by

the dry provender horses usually subsist on. Oats should be bruised, and are best divided into four feeds, and beans, when supplied, should be given at mid-day and evening. The heaviest cart-horses, after they reach the age of four years, are often fed up for the market with oil-cake, grains, and other fattening food, besides oats. Horses should have access to water at all hours of the day and night, and a constant fresh supply should be kept up. If thus left to themselves, horses will be found to drink less than when watered at stated times, with the result that they will be in better condition. Should this plan not be adopted, horses should be watered in ordinary cases four times a day. The stable should be well lighted; the drainage and ventilation should be as perfect as may be, the manure and litter constantly removed, and a moderate temperature (about 55° Fahr.) maintained.

The relations of the horse have lately been curiously elucidated by discoveries in America. It appears that the earliest member of the family *Equidæ* is *Orohippus*, Marsh, in which there are four digits or toes in the anterior limb, and no preorbital depression as in the fossil *Hipparion* and *Anchitherium*. This animal was about the size of a fox. In *Miohippus* (Marsh), from the miocene of Oregon, there are only three digits, and the animal was larger than a sheep. *Anchitherium* is represented in the same deposits by species about the size of a sheep, or smaller; in these the lobes of the upper molars are more connected than in *Miohippus*. *Protohippus*, Leidy (*Equus parvulus*, Marsh), from the pliocene beds of Nebraska, was about 2½ feet high. *Eohippus* (Marsh), about the size of an ass, is also found in the Nebraska pliocene sands; in it the lateral digits are reduced to splint-bones, as in the horse. Other genera have been found, the extinct *Equus fraternus* (Leidy) being almost, if not wholly, identical with *E. caballus* (Linn.) of Europe. So far as research has hitherto gone the living horses are linked to the earliest types by a larger number of intermediate forms in America than Europe. Of course the succession is not by direct lineal descent; but in America the variations of the common stock seem to have been more numerous than in Europe. It is remarkable that, closely as the latest horse of America resembles that of Europe, the New World is entirely indebted for its living horses to the Old World. The gradual diminution in the number of toes, and union of the separate pillars of the grinders into a complex pattern, going alongside of elongation of the limbs, so as to give increased speed, justifies the anticipation that a cretaceous animal may yet be found in which there were five toes on each hoof, and the complex tooth pattern of the horse was represented by a series of distinct pillars. See also HORSEMANSHIP, HORSE-RACING.

HORSE-CHESTNUT (*Æsculus Hippocastanum*), an ornamental tree growing to a large size, with an erect trunk and pyramidal head. The leaves are large, digitate in form, and of a deep-green colour, and singularly interesting and beautiful in their vernation and development. The flowers are white, spotted with red and yellow, and disposed in a superb thyrsus or dense panicle. It belongs to the natural order Sapindaceæ, and is indigenous to the mountains of Greece, being found also in Persia, Northern India, and elsewhere, while the genus is also represented by several species in America, especially North America. It appears to have been introduced into Britain in the sixteenth century. The fruit is a prickly capsule, containing one or two large seeds somewhat resembling chestnuts, but possessing a bitter and disagreeable flavour. Cattle are said to be fond of it. For their use it is first soaked in lime-water or an alkaline solution, which deprives it of its bitterness; it is then washed, and boiled to a paste. In Turkey it is ground and mixed with provender for horses. It has been made into starch, and forms a paste or size which is preferred by bookbinders, shoemakers, &c., to that made from flour. The powder, snuffed up, excites sneezing, and has been used with benefit in affections of the eyes. This tree is easily raised, and grows with great rapidity, the whole length of its spring shoots being complete in about three weeks from the first opening of the buds. It is often planted so as to form avenues, and some of these in England consist of trees of great size. A scarlet-flowered species or variety is well known. The timber is soft and of little value.

HORSE-FLY. See GAD-FLY.

HORSE-GUARDS, a building opposite Whitehall, London, so called because the horse-guards usually do duty here. In this building is the office of the commander-in-chief of the British army. See also GUARDS.

HORSEMANSHIP, the art of mounting, riding, and managing horses. Horses are ridden for several distinct purposes and under very different circumstances, and there are consequently different styles of horsemanship, adapted to different types of horses, and requiring different qualities in the riders. The horsemanship of the hunting-field, for instance, is widely removed in many respects from that of ordinary road riding, and still more from that of the circus, whilst military riding has special characters entitling it to separate consideration. For most kinds of riding the saddle and the bridle are essential. The saddle in most general use is that of the well-known English type. It consists of a so-called 'tree' or frame covered with leather, and is firmly held in place on the horse's back by girths passing under the body. The front projection of the saddle is called the 'pommel' and the back one the 'cantle'. The side flaps are often furnished with pads for supporting the knees and giving greater security to the the rider. The stirrups hang from the saddle on either side. The side-saddle used by ladies is provided with a special 'leaping-horn' or 'leaping-head' for greater security. Of the two kinds of bit in use the snaffle is much less severe than the curb. The former consists essentially of two pieces of steel linked together endwise, and having a ring on each of the outer ends, while the curb or bit is formed of two pieces of steel, known as the 'cheeks', joined together by an unlinked mouthpiece with a central arch called the 'port'. In mounting, a person should stand beside the horse's left shoulder and face towards the tail. Having taken the reins in the left hand, he should grasp the mane with that hand also, then place the left foot in the near stirrup, and, taking hold of the cantle of the saddle with the right hand, swing himself into the proper position in the saddle mainly by the spring of the right leg and the pressure of his hands. Ladies require assistance in mounting. The feet should be placed home in the stirrups. The rider should sit well forward in the saddle, and when necessary throw his weight back by moving the body from the hips, not by shifting his seat. He should ride mainly by balance, but proper grip with the legs is indispensable to a good rider. Too great dependence on grip, however, will soon tire the muscles concerned in maintaining it. The body should be kept erect and easy, and the whole attitude should be as graceful as possible. The feet are now usually kept parallel to the sides of the animal, with the heels somewhat depressed. Both hands and legs are used in

guiding and controlling the horse, and the action of both should become as automatic as possible. The foot and the calf of the leg are used by good riders to assist and supplement the action of the reins in collecting and stimulating the horse and in causing him to turn. Spurs are best avoided by beginners. The reins should be held fairly long, and in ordinary riding they should be held in both hands. The hands and the legs must co-operate in managing the horse, and their action must be free from all hesitancy and ambiguity. On this point an eminent French authority says: 'It is by the co-ordination of the hands and the legs that the different gaits are determined, regulated, changed, or stopped. It is by equal weights that equilibrium is maintained, and it is by means of different weights that an object is made to incline more to one side than to the other. When any body is subjected to a resistance from one side, it tends to move towards the opposite side. This reasoning will enable us to explain the action of the legs on the horse's body, and also that of the bridle and the bit on the neck and mouth. In one respect the action of the hand is totally opposed to that of the legs, since the hand serves to stop or pull back, while the legs urge forward. In order to manage a horse one must know these different effects, that they may not be produced in a contradictory manner. The agreement or co-ordination, properly understood, of the hands and legs includes the whole art of horsemanship, and the good rider is known by the precision and accuracy with which he secures it.'

Seven different gaits or modes of progression have been distinguished in the movements of domesticated horses. Some of these, such as the walk and the gallop, are certainly natural, but others are probably not found in truly wild horses. In all but the walk the feet are entirely off the ground for shorter or longer intervals, and in all of them the body is supported during most of the time on two feet. In some, the support is momentarily on three legs, and at times only one foot may be on the ground. In no gait are two feet raised from the ground or brought down to it at exactly the same instant. In an ordinary walk the horse is always supported on two feet at least, but at times three are on the ground at once. The order in which the feet strike the ground may be thus stated: right hind, right fore, left hind, left fore. Four sounds are therefore heard during each stride, but the intervals are unequal. The weight of the animal is supported alternately by a lateral pair (a hind-foot and a fore-foot on the same side) and by a diagonal pair (a hind-foot and the opposite fore-foot). In ambling, the pairing is lateral throughout, and two sounds are heard during each stride. Each of these sounds, however, is double, since the two feet on one side do not strike the ground at quite the same moment. The pace or rack is only a faster amble, with possibly some unimportant differences. In the trot the pairing is diagonal throughout, and two double hoof-sounds, as in the amble, are heard during each stride. In the gallop, springing movements come into play, and the legs may be regarded as doubly paired. The hind-legs are paired with the fore-legs, and at the same time there is a diagonal pairing. Three sounds may be distinguished, caused by the striking of the hind-feet, the right fore-foot, and the left fore-foot respectively. The canter is a slower gallop, and the run a faster one. In order of speed, from the slowest to the fastest, the gaits may be arranged thus: walk, amble, pace, trot, canter, gallop, run; but some of the gaits, it should be remembered, can be employed within a considerable range of speed. In general, however, some of the above gaits are naturally associated with slow or medium speeds, whilst the others are quite as naturally connected with higher speeds. The length of stride varies in the different gaits, the order in this respect being much the same as that given above for speed. Six feet is about an average walking stride, and ten feet may be regarded as normal in ambling. A pacing horse will stride about four yards, and a galloping one may make a stride of about fifteen feet. In trotting, the stride may be anything from that of an amble to that of a gallop, and in running, twenty feet may be attained. In walking, the rate may be four miles an hour or slightly faster. Good trotters cover a mile in less than two and a half minutes, and twenty miles can be trotted in less than an hour. The fastest running record for a mile is rather under a minute and three-quarters. The gaits of horses have been thoroughly studied by means of instantaneous photographs.

The obstacles encountered by riders in the hunting-field are all included under the generic term 'fences'. In order to clear such obstacles easily and safely the horseman must manage his horse properly while approaching them, and must sit properly while they are being taken. One writer gives these as the points to be attended to in respect of seat in jumping: 'to sit well down in the saddle; to lean the head and shoulders back; to draw the feet back, so as to avoid, on landing, the shock that is likely to be transmitted from the stirrup-irons to the body through the legs; and to grip tightly with the knees'. With most horses it is best to take fences as slowly as possible, and the writer already referred to advises the horseman not to interfere with the horse during the last forty yards in coming up to a fence. Water jumps are the most troublesome of all. Some horses persistently refuse to take them, and only a few will clear a stream ten or twelve feet wide.

The above remarks refer mainly to ordinary riding, but there are several other well-marked styles requiring somewhat different knowledge and training on the part of the rider. Rough-riding, in the sense of riding unbroken horses, is especially common in Australia and America, and may be said to require a special form of saddle, since with an ordinary saddle the rider would be unable to keep his seat. Military riding requires more varied experience and knowledge than almost any other kind, for it is in reality a combination of styles, with some special features belonging to its particular purpose. High-school riding includes ordinary circus horsemanship, and is the form in which the horseman's control of the horse is most complete and most direct. The following modern works on the subject may be mentioned: Hayes, Riding on the Flat and Across Country (1881); the Horsewoman (1891); Illustrated Horse-breaking (1889); and the article 'Riding' in the Encyclopædia of Sport (1898); E. L. Anderson, Modern Horsemanship (1884) and other works; H. G. English, Art of Riding (1890); Captain Kerr, Practical Horsemanship (1891), and Riding for Ladies (1891); Captain Weir, Riding (Badminton Library, 1891); Duplessis, L'Équitation en France (1892).

HORSENS, a seaport in Denmark, on the east coast of Jutland, at the head of a fiord of same name, at the mouth of the Bygholm. It is an old place, but is well built; and has manufactures of woollen stuffs and of wooden wares, ship-yards, machine-works, foundries, tobacco-works, &c. The chief Danish convict prison is here. Pop. in 1901, 22,232.

HORSE-POWER, a term used in stating the rate at which a machine is capable of doing work. A machine is said to work at one-horse power when it

performs 33,000 foot-pounds of work per minute; a machine of twenty horse-power would do 20 × 33,000 or 660,000 foot-pounds of work per minute. The name horse-power is founded on an over-estimate of what a horse really can perform. The performance of a horse depends very much on the nature of the work; but even under favourable circumstances 33,000 foot-pounds per minute is at least 10 per cent. too high.

HORSE-RACING. This sport is of ancient origin, having been practised among the Greeks and Romans. It was introduced into the Olympic games in the 33d Olympiad (648 B.C.) From Greece it was introduced into Rome, where it gained a place as one of the games of the circus. The horses were usually ridden bareback (at least during the republican period in Rome), and the rider frequently held by the bridle another horse besides the one on which he was mounted. The jockeys, who were called by the Romans *cursores*, were characterized, like their modern successors, by the bright and diverse colour of their dress, and frequently, as at the present day, received immense rewards from their patrons. The institution of horse-races in England, where the sport has become a great national pastime, belongs to a very remote period. The first regular horse-races, however, did not take place till the reign of James I. The prize then consisted of a gold or silver bell, whence we have the expression 'to bear away the bell' still in use with regard to the winner of a prize. The successors of James I. down to Queen Anne were all more or less attached to the sport. In the reign of the latter, in 1711, the York Plates were founded, and about that date the passion for betting on the turf began to be pretty general. Under George I., the successor of Queen Anne, horse-racing became more and more flourishing, and the sport continued to grow in importance during the remainder of the century. The two most celebrated horses of that period were Flying Childers (foaled in 1715) and Eclipse (foaled in 1764), which long had the reputation of being the fleetest horses that ever ran. From the latter are descended many of the first-class thoroughbreds of the present day; but the descendants of the former are comparatively few in number, as his proprietor, the Duke of Devonshire, reserved him for his own stud. None of the English sovereigns was more devoted to horse-racing than George IV. He was himself a distinguished sportsman. Between 1784 and 1792, while yet Prince of Wales, he gained 185 prizes, including the Derby of 1788. Horse-racing was introduced into France from England, and during the reign of Louis XIV., and still more during that of Louis XV., was pursued with the utmost enthusiasm. The revolution put an end to it for a time, but the sport was revived by Napoleon, who saw that it tended to the improvement of the breed of horses, and on the 31st of August, 1805, issued a decree requiring horse-races to be established in all the departments of the empire which excelled in the rearing of horses. The incessant wars which were waged during the ensuing years entirely or almost entirely prevented this decree from being carried out, and it was not till 1827 that this institution again rose into importance in France. Horse-races, mostly upon the English model, have also been introduced into nearly all the other countries on the Continent.

The principal varieties of horse-racing are flat-racing, or racing on level ground; steeple-chasing, or racing over ground not specially prepared for the purpose; hurdle-racing, in which the horses have to leap over obstacles purposely placed in the way; and match trotting. This last kind of race is a very favourite one in America, where the best trotting horses are to be found, but in this country it is not much practised. Formerly all races were what is called weight-for-age races, that is, all the horses entered to compete were of the same age and bore equal weights, or if in certain cases there was an inequality in point of age there was also a fixed difference in the weight carried. But it was found that when races were conducted on this plan the best horses came to be known, and the inferior ones withdrew, not venturing to compete with them, so that the race resulted in a walk-over. Hence arose the practice of handicapping, that is, of adjusting as nearly as possible the weight to be carried to the previously ascertained powers of the horse, so as to reduce the chances of all the horses entered to an exact equality. Since the introduction of this practice handicap races have become a very favourite sport, alike among horse proprietors, professional bettors or book-makers, and the general public, although weight-for-age races are far from being obsolete, and still form some of the leading events in the sporting calendar. The principal weight-for-age race for two-year-olds is the Middle Park Plate, and for the three-year-olds the principal for both colts and fillies are the Two Thousand Guineas, the Derby, and St. Leger, and for fillies only the One Thousand Guineas and Oaks. The most important handicap races are the Great Northampton Stakes, the City and Suburban and Metropolitan Stakes at Epsom, the Northumberland Plate, the Goodwood Stakes, the Ascot Stakes, the Ebor Handicap (run at York), the Great Yorkshire Stakes (run at Doncaster), the Liverpool Spring, Summer, and Autumn Cups, the Cesarewitch, Cambridgeshire, and Newmarket Handicaps (run at Newmarket). The chief racing meetings are those at Epsom, Newmarket, Ascot in Berkshire, Doncaster, Goodwood, Liverpool, Manchester, and Leicester. Those at Newmarket are the oldest of all, dating from the reign of Charles II. The Ascot races are considered the most fashionable, being largely attended by the aristocracy, and sometimes honoured with the presence of royalty. The Goodwood races, which are held in the Duke of Richmond's park in Sussex, are also a favourite rendezvous of the aristocracy. But the most popular meeting throughout the year is the Epsom, which owes its popularity partly to the proximity of Epsom to London and partly also to its being the meeting at which the Derby and the Oaks are run. At the Oaks the ladies are the chief bettors, and the bets are not thousands of pounds but dozens of Paris gloves. The principal racing meetings in France are those held in spring and autumn at Chantilly and the Bois de Boulogne. The conditions under which the most of the races are run are the following. Every horse that takes part in a race must be entered as a yearling, that is before the close of the year in which it is foaled, for a horse's age is always reckoned from the 1st of January of the year in which its birth takes place. On being entered a certain sum is paid by the owner, which is called a forfeit, because it is forfeited if the horse is afterwards withdrawn, or, in the language of the turf, 'scratched,' as the great majority of the horses entered as yearlings are. These forfeits form the great bulk of the prizes run for. If the horse entered as a yearling actually appears in the race a further sum is paid by the owner, and the total of these sums added to the forfeits make up the stake.

The training of a race-horse begins with its second year, and is a slow process, requiring great care and attention. During the period of training the horse is under the charge of a stable-boy in the trainer's establishment, who dresses him, looks after him in

the stable, and rides him. In the first part of the training the exercise to which it is subjected is comparatively gentle, but in the latter part a gallop of half or three quarters of a mile is taken every other day, and it is occasionally made to undergo long sweats. In training it is usually led by an old horse, who teaches it to gallop. Before a race takes place the powers of the horse are put to the test by its being made to run over about half a mile against an older horse, which is weighted to make up for the difference in age. The breeding of thoroughbred horses, that is, of horses which can trace an unbroken pedigree through the best sires and the best dams, is when well conducted a very profitable business. The prices given for stallions are sometimes enormous. In 1900, when the Duke of Westminster's racing stud was sold off, the average price reached the high level of 3707 guineas, and the record world's price of £37,500 was brought by Flying Fox, which had won the Derby the year before. Before this, Ormonde, another Derby winner, had fetched 30,000 guineas. The large sums now given for the use of stallions in breeding studs are the cause of our race-horses being withdrawn much earlier than they used to be from the turf, for as soon as they have acquired a reputation the owner of a good race-horse can make much larger sums by hiring it out for breeding purposes than he could by entering it for races. The pedigrees of all thoroughbred horses are registered in the stud-book, so that if any particular animal is omitted in that register the inference is that its pedigree is not without some blemish more or less remote. The effects of a careful system of breeding in improving the quality of horses are very marked in at least one respect, that of fleetness. Some are of opinion that the aim of breeders being only to produce horses of great swiftness the horses of the present day are inferior to their ancestors in strength and endurance. This, however, is denied by others, while it is unquestionable that no pure Arabian horse can be compared in point of speed with a thoroughbred. In size and shape, too, the horses of the present day surpass those of former times, the average height of a thoroughbred now being 15 hands 3 inches, while formerly it seldom reached 15 hands.

The prevalence of the practice of betting in connection with horse-racing is a fact so well known that it is needless to enlarge upon it, although it will be of interest to some to explain in what manner it is conducted. Bettors are divided into two classes —the backers of horses, and the book-makers, or professional bettors, who form the betting ring, and make a living by betting against horses according to a methodical plan. Backers of horses may be again divided into those who have special information about the qualities of the horses which are to engage in a race, which enables them to back a particular horse with a certain amount of confidence; and those who have no such means of information, and accordingly back horses pretty much at random. The former class, if their information is good, have a very fair chance of success in their speculations, and the horse that wins any great race usually brings in to his owner vast sums in payment of bets, compared with which the stakes, considerable as they often are, are insignificant; but the latter class are pretty certain in the long-run to lose. By the method adopted by the professional bettor the element of chance is as far as possible removed from his transactions, so that he can calculate, with a reasonable prospect of having his calculations verified, on making more or less profit as the result of a season's engagements. Instead of backing any particular horse, the professional bettor lays the same sum against every horse that takes the field, or a certain number of them, and in doing so he has usually to give odds, which are greater or less according to the estimate formed of the chance of success which each of the horses has on which the odds are given. In this way, while in the event of the race being won (as is usually the case) by any of the horses entered in the betting-book of a professional bettor, the latter has always a certain fixed sum (say £1000) to pay, he receives from the backers of the losers sums which vary in proportion to the odds given. Thus, if a book-maker is making a £1000 book, and the odds against some horse is 4 to 1, he will, if that horse wins, have to pay £1000, while, if it loses, he will receive £250. It usually depends upon which horse it is that wins a race whether the book-maker gains or loses. If the first favourite wins it is evidently the worst thing that could happen for the book-maker, for as he is bound to receive the sum of the amounts to which all the horses except one have been backed, the largest deduction must be made from his total receipts on account of the first favourite. For example, if the sum of the amounts to which the horses in a particular race have been backed in some professional bettor's book is £1300, and if the odds against the first favourite were 5 to 2 (or £1000 to £400), then the total sum received by the book-maker, in the event of the race being gained by the first favourite, would amount to £1300—£400, or £900, so that he would suffer a loss of £100; while if a horse had won that had long odds against him (say 200 to 1, or £1000 to £5), his total receipts would amount to £1295, and his gains to £295. Very frequently the receipts of the book-maker are augmented by sums paid on account of horses which have been backed and never run at all. Sometimes, although not often, the odds are given upon and not against a particular horse, as was the case with Macgregor, the first favourite at the Derby of 1870, when the odds were 9 to 4 in his favour. The break-down of Macgregor on this occasion brought immense profits to the betting ring. Books may also be made up on the principle of betting against any particular horse getting a place among the first three. The odds in this case are usually one-fourth of the odds given against the same horse winning. Another mode of betting is that called sweepstakes, in which a number of persons join in contributing a certain stake, after which each of those taking part in the sweepstakes has a horse assigned to him (usually by lot), which he backs, and the backer of the winning horse gains the whole stakes. If there are more persons taking part in the sweepstakes than there are horses running some of them must draw blanks, in which case of course their stakes are at once lost.—Horses have been sometimes sent over from America to compete on the English race-courses, but only with moderate success. Their chief victory has been that of Iroquois in the Derby of 1881.

Flat-racing in Britain is carried on under rules and regulations laid down by the Jockey Club, a body instituted in 1750, and whose membership includes the leaders of the sporting world. A similar body, the National Hunt Committee, superintends all steeple-chasing and hurdle-racing events; while the rules of betting are nominally under the control of the committee of Tattersall's Subscription Rooms, London. The stewards of the Jockey Club have power to grant and to withdraw licenses to racing officials, jockeys, and race-courses; to fix the dates on which all meetings shall be held; to make inquiry into and deal with all matters relating to racing; and to warn any person off Newmarket Heath, which means also exclusion from other race-courses. At every regular race-meeting there must be at least two stewards, with a clerk of the course, a handi-

capper, a stake-holder, a clerk of the scales (since the jockeys of course must be carefully weighed), a starter, and a judge, each of these officials being licensed by the club.

HORSE-RADISH (*Cochlearia Armoracia*), a cruciferous plant inhabiting the temperate parts of Europe, in moist situations. The stem is herbaceous, growing to the height of 2 or 3 feet, bearing small white flowers. The radical leaves are large, oval-oblong, and somewhat resemble those of the common dock. The root is cylindrical, penetrating very deeply into the ground, and, when fresh, forms a well known condiment, possessing a pungent taste and odour. It is also employed medicinally, as a stomachic, diaphoretic, and diuretic, and externally as a rubefacient.

HORSE-SHOEING. In performing this operation all that is necessary by way of preparation is to pare down the crust or outside rim of the hoof with a drawing-knife, and to remove any ragged portions that may be seen on the frog. The bars or continuations of the crust running inwards at a sharp angle from the heels should be left untouched, so as to aid in supporting the shoe at the heels. The shoe should be broad enough to fit the crust accurately all round without any overlapping, which is apt to cause it to be torn off on heavy ground, and is more likely to cut the opposite limb. In front the shoe ought to be hollowed out slightly on the ground surface and a little turned up, so as to render it more comfortable and to diminish the chance of tripping. The inside edge or rim of the hinder shoe should be rounded off or bevelled to prevent cutting by overreach, that is to prevent the wounding of the fore-foot by the hind-foot striking against it, which often occurs in leaping. For horses engaged in light work five nails are enough, three on the outside and two on the inside, but for draught-horses seven or eight are required. Draught-horses should also have moderate tips and heels on their shoes to prevent them from slipping when straining their muscles in pulling. When the soles of horses are weak or bruised they may be protected by leather or waterproof pads, but these should not be used longer than necessary.

Horse-shoes do not appear to have been known to the ancients, as we find no mention of them in any Greek or Roman writer. Xenophon, Vegetius, and others mention various processes for hardening the hoofs so as to make them stronger, but say nothing of any protection like the horse-shoe. Suetonius states in his life of Nero that that emperor on short journeys was drawn by mules shod with silver and sometimes with gold shoes, but these seem to have been intended merely as ornaments. In Japan it has long been the practice to preserve horses' hoofs by means of straw coverings, which can be renewed at a small cost when they are worn out. The superstition with regard to horse-shoes that they afford a protection against witches was formerly very widespread, and is still almost too well known to require any mention.

HORSE-TAIL. See EQUISETUM.

HORSE-TAIL, among the Turks and certain other orientals, is, or rather was, used as a standard, the tail of the yak being similarly employed. It was also a sign of distinction for the commanders, the number of horse-tails carried before them mounted on a staff or pole being in proportion to their rank. Thus the sultan had seven horse-tails in war, the grand vizier five, and the pashas three, two, or one. Its origin may be naturally explained from the use of the horse-tail as a military ornament.

HORSFORTH, an urban district or town of England, in Yorkshire (W. Riding), about 5 miles north-west of Leeds. There is a modern church in early English style, and various other places of worship, a mechanics' institute, and a temperance hall. Woollen goods are extensively manufactured. Pop. (1901), 7785.

HORSHAM, a town of England, in Sussex, on a branch of the Arun, and on the London and Brighton Railway, 37 miles S.S.W. of London. It consists of two principal streets, crossing at right angles, one of them lined with a double row of trees, and has a handsome parish church with a lofty spire, a town-hall, county police station, free grammar and other schools. Christ's Hospital was recently transferred here from London. Horsham was a parliamentary borough up till 1885. Pop. in 1901, 9446.

HORSLEY, SAMUEL, a learned dignitary of the Church of England, was born in London, in October, 1733. He was educated at Cambridge, where he took the degree of LL.B. in 1758. The same year he became curate to his father, and in 1759 rector of Newington Butts. In 1767 he was chosen a fellow of the Royal Society, of which he was appointed secretary in 1773. After several charges he was appointed in 1788 Bishop of St. David's, from which he was translated to Rochester in 1793, receiving at the same time the deanery of Westminster; and finally to St. Asaph in 1802, when he resigned his deanery. He died at Brighton, October 4, 1806. Dr. Horsley was the greatest theological controversialist of his day, and is best known on account of his controversy with Priestley on the faith of the primitive Christians respecting the nature of Christ. The controversy was waged in 1783, and the tracts of Horsley in this controversy were published in 1812. Bishop Horsley may at least claim the praise of consistency of conduct as an enemy of innovation; and he was probably honest and sincere, if not wholly disinterested, in his denunciations against religious and political heresy and heretics. Besides the controversial tracts already noticed, he was the author of Critical Disquisitions on the Eighteenth Chapter of Isaiah (4to); Hosea, a New Translation with Notes (4to); a Translation of the Psalms with Critical and Explanatory Notes (two vols.); Biblical Criticism, or the first fourteen Historical Books of the Old Testament (four vols. 8vo); sermons; charges; one or two treatises on subjects of classical scholarship; and papers in the Philosophical Transactions. Dr. Horsley also applied himself a good deal to the study of mathematics, but his performances in this department do not secure him a very high rank. His most ambitious attempt was an edition of Sir Isaac Newton's works, which was published between 1779 and 1785, but which is condemned by Professor Playfair as a complete failure.

HORTA, a town in the Island of Fayal, one of the Azores, on the shores of a small bay between two rocky headlands. It has numerous fortifications in a ruinous state, and consists of narrow but clean streets, lined with houses built of a gray trachyte, and generally only of one story. It has also a tolerable harbour, and exports wine, oranges, and grain. Pop. about 10,000.

HORTENSIUS, QUINTUS, the celebrated orator, and the rival of Cicero, was born B.C. 114, held many military and civil offices, and was elected consul for the year 69 B.C. In the previous year he had been engaged to defend Verres during the famous prosecution in which Cicero acted for the accusers; but as Cicero brought so overwhelming a load of testimony against the accused, the latter did not venture to await the decision of the judges. Hortensius was never called upon to speak. Hortensius continued to be the opponent as well as the rival of Cicero till the period of the Catilinarian conspiracy (63 B.C.), when Cicero, in order to crush the conspirators, saw himself constrained to join the party of the senate to

which Hortensius belonged. After that date the two orators generally appeared on the same side in private cases, while Hortensius for the most part kept aloof from all political rivalries. In the affair of Clodius, however, Hortensius gave Cicero his active support, and was so zealous in his proceedings against the former, that he was in imminent danger of being assassinated by the Clodian party. In the private cases in which both Hortensius and Cicero were professionally engaged on the same side, Hortensius always allowed his rival to speak last, which was equivalent to acknowledging his superior abilities as an orator. Hortensius was of so easy a temper that he seems to have quite got rid of any feeling of jealousy on account of Cicero's superior oratorical powers, although Cicero during his whole life seems scarcely to have been able to master that feeling with regard to Hortensius, and on some occasions could not even help expressing to his friends a distrust of the conduct and motives of his rival which was wholly unjustified. Hortensius died after April, B.C. 50, which is the last occasion on which he is known to have appeared in the quality of a counsel. He was rich, and loved luxury and splendour. His speeches are all lost. The ancients commend the eloquence of Hortensius as flowery, full of ornament, and approaching the Asiatic style. He was elegant and acute in the conception and distribution of his matter, and succeeded by sudden effect. His delivery was graceful, and his voice good. See CICERO.

HORTICULTURE (from *hortus*, garden, and *colere*, to till) includes, in its most extensive signification, the cultivation of esculent vegetables, fruits, and ornamental plants.

The cultivation of esculent vegetables is called kitchen gardening. The kitchen garden is an indispensable appendage to every rural establishment. In its simplest form it is the nucleus of all others. Containing small compartments for the culture of esculent vegetables, fruits, and ornamental plants, these may be gradually extended, until the whole estate assumes the imposing aspect of picturesque or landscape scenery. Many of the most valuable products of agriculture were first introduced and their qualities tested in the garden.

The practice of horticulture as applied to the cultivation of ornamental plants is as old as the oldest civilization of which anything is known. The bards, scholars, and philosophers of the classic ages have transmitted descriptions of the gardens of the ancients, from those in which Homer places the palace of Alcinous and the cottage of Laertes, to the splendid villas of Pliny and Lucullus. Among the ancient Greek writers, Hesiod, Theophrastus, Xenophon, and Ælian treated of gardens to a certain extent; and works of those who wrote after the seat of government was removed to Constantinople were collected under the title of Geoponica, and have been translated by Owen. Among the Latins, Varro was the first author, to whom succeeded Cato, Pliny the Elder, Columella, and Palladius. Passages are to be found relative to the subject in Martial, Vergil, and Horace; but Pliny's Natural History, and Columella's Book on Gardens, contain the most correct information on Roman horticulture. For several centuries after the overthrow of the Roman Empire in the West by the northern barbarians horticulture was almost confined in Christian Europe to the monasteries. Among the Arabs in Spain there is no doubt that great attention was paid to the art, and that numerous flourishing gardens were to be seen in the Empire of Cordova, as afterwards in that of Granada. In another part of Europe a temporary impulse was given to the formation of gardens by a capitulary of Charlemagne requiring gardens to be made throughout his whole dominions, and even mentioning the flowers which were to be cultivated in them. Walafried Strabo, who wrote shortly after the time of Charlemagne, is the author of a Latin poem which gives an account of the gardening of the time. The practice of horticulture does not appear to have been again revived outside of the monasteries in Christian Europe until the tenth century, when it began to be fostered in Italy by Alfonso d'Este, who is recorded to have founded several botanical gardens, and whose example was followed in Pisa, Ferrara, Venice, Padua, and elsewhere. In the same century the earliest botanical gardens were established in France, Germany, and Holland. Among the earliest in France were those founded at Le Mans by Belon, on his return from his travels, about the middle of the sixteenth century, and by Henry IV. at Montpellier at a later date. The first established in Germany were those at Breslau, Basel, and Strasburg, and the oldest in Holland is that of Leyden. At first the plants to be seen in such botanic gardens could only be native plants, or such as flourished in a climate corresponding to that of the country where the garden in which they were grown was situated. The re-invention of green-houses (which were known to the Romans) was of great importance to horticulture, as enabling botanists to preserve exotic plants in gardens the climate of which was naturally unsuited for them. The credit of this re-invention is ascribed to Solomon de Caus, who was gardener to the elector palatine at the beginning of the seventeenth century; but it was not till a century later (1717) that the use of glass roofs for green-houses was suggested, which had the effect of increasing still further the range of plants which could be cultivated in European gardens; for the first green-houses used in modern times having opaque roofs could only be used for the preservation during the winter of such flowers as could bear a European spring and summer but were killed by severe cold, while in green-houses with glass roofs exotic plants could be kept permanently at the temperature suited to them. Another important improvement in the construction of green-houses is the substitution of curved glass roofs in iron frames, which cause much less loss of light than the straight roofs.

In the present state of horticulture England is perhaps in some respects ahead of all other countries. Nowhere is the taste for gardening more general. The eye is continually struck with cottages embowered amidst fruit-trees, shrubs, and flowers, while a neat compartment of esculent vegetables supplies much of the food for the inmates. Much also has been done for the promotion of horticulture as a science. The London Horticultural Society, instituted in consequence of the efforts of Knight, Wedgwood, and Sir Joseph Banks in 1804, was the first of the kind ever set on foot, and similar institutions are now very numerous in Great Britain. England can also boast of having been the first to possess an experimental garden, the one now located at Chiswick, where it was removed in 1822, having been founded in 1817. The gardens at Kew, near London, contain a collection of exotic plants which is unrivalled in any other country. For devotion to horticulture Belgium stands next to England if not even above it. Ghent may be described as the floral capital of that country. There every one is a horticulturist either from taste or by profession. It was in this town that in 1809 the idea of holding annual flower-shows, which has been adopted elsewhere, and has been of so great benefit to the art of horticulture, originated. The Belgian florists are especially remarkable for the extreme care which they bestow on the practical part of the art. The utmost attention

is paid to order and cleanliness. Everything which can poison the atmosphere or offend the eye is scrupulously removed. The glass of the hot-houses is constantly being cleaned, and the walls brushed, and the utmost industry is employed in ridding the plants of destructive insects and noxious parasites. Holland also has long been distinguished for her excellence in gardening, both as applied to fruits and flowers. Some of the finest fruits of our gardens were produced by the indefatigable experimentalists of that country. In France the taste for gardening is not so general as it is in the countries just mentioned, but if the state of horticulture in Paris were taken as representative of its condition throughout the rest of the country, she would hold a high rank. A horticultural society was established in Paris in 1826, and has now a very large membership. In the various provinces where horticultural societies have not been founded, those of agriculture or of the sciences and arts have departments expressly devoted to that interesting pursuit; and in 1827 a practical and theoretical institution was founded at Fromont by the Chevalier Soulange Bodin, for educating gardeners and introducing improvements in every department of horticulture. The nursery of the Luxembourg at Paris long supplied a great part of Europe with fruit-trees; and the flower-garden of St. Cloud, and that of Trianon, also became famous. The Jardin des Plantes (Paris) is the principal botanical garden in France, and is unquestionably one of the most scientific and best managed establishments in Europe. In Germany the chief botanical gardens are those of Munich and Berlin, and in Austria that of Vienna. That of Berlin is especially famous. The art of gardening in Russia, in common with other useful pursuits, owed much to Peter the Great. In Poland gardening was practised earlier than in Russia. In Warsaw there is a very remarkable garden, laid out by King Augustus II. (elector of Saxony) in 1721, and hence called the Saxon garden. The rest of Europe was indebted to Spain for the introduction of many plants from America. Seeds were brought from thence in the reign of Ferdinand VI. for the royal garden of Madrid, whence their produce was distributed. The oldest and most extensive gardens now to be found in Spain are of Moorish origin. The floating gardens or *chinampas* of Mexico, and the similar gardens in some parts of China, are gardens of a peculiar character. In Britain and several other European countries, especially France, Germany, Holland, and Belgium, as also in North America, horticulture has become of great economic importance, and the mere love of flowers and gardening has given rise to great establishments, such as nurseries, seed-farms, flower-farms, &c., while the trade in garden plants, flower-seeds and bulbs, and cut flowers has become very large, both as between different parts of the same country and between different countries. For instance, tons of early spring flowers are sent to London from the Scilly Islands each season.

After this historical and geographical sketch on the subject of horticulture, it remains to us to add something on the practice of the art. The practical objects of the cultivator of vegetable substances are—

1. To collect useful and ornamental plants from all quarters of the world.

2. To adapt the soil, moisture, heat, and general culture suitable to such plants, so that they may vegetate to the full extent of their powers.

3. By artificial means, such as blanching and other processes, to change the nature and juices of plants, whereby they are rendered more esculent.

4. To produce new sorts or varieties of natural species by engrafting, building, and other processes.

On the first of these heads it is necessary to say nothing. The soil which covers the surface of the earth is composed of various inorganic matters, with a greater or less proportion of vegetable remains. Some soils, indeed, are almost entirely composed of vegetable remains, and constitute the rich dark mould, which is esteemed the most fertile for the growth of vegetables. Some plants, however, thrive best in one kind of soil, and some in another. The object of the horticulturist is to adapt his soil for the particular kinds of plants he wishes to rear in perfection. Hence the preparation of artificial soils. It is doubted by many whether the pure earths afford any nourishment to plants; at all events they enter but very sparingly into their composition. They serve, however, as a medium by which water, carbon, and some of the gases are conveyed into their juices, and also as a convenient means by which the fibrous or bulbous roots are attached to and held firm and stationary in the ground. The true nourishment of plants is water and decomposing organic matter, whether vegetable or animal. The constituent parts of the soil which give tenacity and coherence, are the minutely divided particles, and they possess this power in the greatest degree if they be aluminous.

If the siliceous or sandy particles are in excess, however, sterility is the consequence. Neither must the soil be too much comminuted; a certain proportion of coarser particles seems to be requisite. No one ingredient should be in excess in any fertile soil, not even an excess of organic matters: so that the best soil for general purposes is that where an equable admixture of the general ingredients is present, with a portion of the particles in a state of minute comminution.

Much of the fertility of soils depends upon their power of absorbing moisture from the air. When this power is great the plant is supplied with moisture in dry seasons, and the effects of evaporation during the sunshine is compensated by the absorption of moisture at night. Stiff clayey soils which absorb a great proportion of rain water are not, however, the best suited for absorbing it in dry weather, as the surface becomes hard and separates into deep fissures, which assist the evaporating effects from the interior. The best absorbing soils are those in which there is a due admixture of sand, clay, and lime, with animal or vegetable matter, and of a loose and light texture, freely permeable to the air and moisture. Carbonate of lime, and animal and vegetable matter, are highly useful in this respect to soils; they impart an absorbent power without giving the soil too great tenacity. The absorbent power of soils ought to be adapted to the climate. In moist climates a sandy light soil will be more productive than a deep clayey one, and the contrary. The subsoil also has a considerable effect in modifying the quantity of moisture. Shallow soils, situated on rocky ground, soon lose their moisture, while deep clay subsoils retain it for a long time. Some soils absorb heat much more quickly and copiously than others, and also retain their heat longer. Black and brown mould has this property, while lighter clays and chalky soils are less absorbent of heat, the former giving it out again sooner than the latter. Marshy soils, exposed to inundations and to continual evaporation, are colder and more ungenial than dry lands. The elevation above the sea level has also a very great effect on the temperature and on the growth of plants. Digging, ploughing, and pulverizing the soil, and exposing the surface to the action of the summer sun and the winter's frost, are highly useful operations, by which the tenacity of stiff soils is overcome, weeds and insects are destroyed, and a quantity of air is admitted into its particles. Nutritive matter is frequently

supplied to plants in the form of manure. Manures are either organic or inorganic, the former including vegetable and animal manures. The principal vegetable manures include all green succulent plants, which contain saccharine and mucilaginous matter, rape and linseed cake, malt dust, sea-weeds, peat earth (which requires, however, an admixture of dung), tanner's spent bark (also requiring dung), &c. Animal manures in general require no chemical preparation to fit them for the soil. The chief thing to look to in employing them is to blend them with the earthy constituents in a proper state of division, and to prevent their too rapid decomposition. The chief are fish, bones, horn, hair, urine, blood, and dung. Perhaps the most valuable of such manures is guano, which, as is well known, consists of the dung of certain birds. The chief inorganic manures are lime, gypsum, common salt, and soot. See HOT-BED.

After the soil is properly dry and pulverized the seeds are deposited, and this should always be done in dry weather, for a dry soil is especially requisite for covering in the seeds. Small seeds are sown in greater or less quantity, according to the kind. Some are planted singly, as beans, potatoes; and the depth at which they are covered in much depends upon the kinds of plants. Some seeds require a mere sprinkling of earth, others have to be covered up with 1, 2, or 3 inches of mould, especially if planted at times when frost occurs. In general, however, as germination requires air and heat, the seeds should not be more than covered with the soil.

Watering is often necessary as a means of nourishment to growing plants, especially as a support to newly transplanted vegetables, and for cleaning the leaves and destroying insects. Water should never be thrown over the leaves of plants when the sun shines. Indeed, watering should always be practised either in the evening or the morning, as during sunny days the sudden evaporation of water causes a chill which is fatal to vegetation.

For an account of the processes of budding and grafting see these articles. Another mode of propagation is that by means of cuttings. This process is exceedingly simple and easy in the case of many trees, as the willows and poplars; but requires some management in the heaths, myrtles, and other shrubs. Cuttings are to be chosen from the side shoots of plants, especially those which show a tendency to droop towards the ground, and the proper time for doing this is when the sap is in full motion. The cuttings should contain a portion of last year's wood, or of wood so far formed, and after it has assumed its proper brown colour. Cuttings from herbaceous plants are chiefly taken from the low growths, but they will also succeed occasionally from the flower stems. The cuttings should be prepared, so as that the lower end terminates in a joint or bud where the leaves spring out, and the upper leaves should be left on the branch. In plants difficult to strike, it is a general practice before cutting them off from the parent plant, to cut a ring round the bark, and after remaining on the parent branch for a short time, till a callus is formed, they are cut off below the ring and inserted into earth. Tender cuttings, when planted in pots, should be placed near the sides, not in the middle, with their lower ends touching the bottom of the pot, or resting in sand or gravel. In this way they readily strike, whereas, if planted in the loam in the middle, they will fail. The cuttings should not be inserted to a great depth, and a moderate degree of heat, moisture, and light is preferable to any excess. A glass frame or hand-bell cover promotes their striking very considerably, by tending to promote an equilibrium of atmosphere and temperature. The degree of heat necessary depends upon the nature of the plants. In general, cuttings during the process of striking require less heat than the vigorous parent plant. Cuttings of deciduous hardy trees taken off in autumn should not be put into heat until spring, but should be kept dormant like the parent trees. The subject of landscape-gardening will be found treated under its proper heading.

HORTUS SICCUS. See HERBARIUM.

HORUS, the Latinized form of an Egyptian divinity, whose proper name Har signifies the 'day,' or the 'sun's path.' Several Egyptian deities are known by this name, the principal of whom are Haroeris or the elder Horus, and Horus, the son of Isis (Har-si-hesi), who was the most celebrated of all. These were often confounded together especially by Greek and Roman writers. The elder Horus was the son of Seb (identified by the Greeks with Kronos) and Nu (Rhea) and brother of Osiris. The other Horus is mentioned by Herodotus as the son of Osiris and Isis, and the brother of Bubastis (identified with Artemis). He was identified by the Greeks with their Apollo, probably because he was credited with a knowledge of medicine and the gift of prophecy, and was worshipped as the god of the sun. During the war of Set (Typhon) with Osiris, Horus, then an infant, was kept concealed on the floating island of Chemmis or Buto, where he was brought up. When he was grown up he avenged his father's death by vanquishing Set, whence he became known as Har-net-atf (Horus the avenger of his father). After this Horus reigned over Lower and Set over Upper Egypt until by the death of the latter Horus became ruler over the whole. Both the elder and younger Horus were regarded as symbols of the sun. The hawk and the sparrow were sacred to him, and he is frequently represented with a hawk's head. He was often identified with Harpocrates, another Egyptian deity, also a son of Isis, who is represented as a sickly child enveloped in long clothes, and with a finger on his mouth, which was falsely taken by the Romans as indicative of silence, but was in reality merely a sign of his childish state. He symbolized the winter sun. The worship of Horus was general throughout Egypt, and was also introduced into Rome.

HORUS APOLLO. See HORAPOLLO.

HORWICH, a town of England, in Lancashire, about 5 miles west by north of Bolton. There is a modern church, and various other places of worship; cotton-mills, quarries, collieries, &c.; and the works of the Lancashire and Yorkshire Railway Company. Pop. (1891), 12,850; (1901), 15,084.

HOSANNA, a word composed of two Hebrew words, occurring in Ps. cxviii. 25, signifying 'save, pray'. The psalm was sung on joyful occasions, and particularly at the feast of Tabernacles, which was the solemnity observed with the greatest demonstrations of joy. Verses 25 and 26 were sung with loud acclamation; and the feast itself was sometimes called the Hosanna. The phrase was also used as a solemn salutation, and was addressed as such to kings and heroes. So also we have it used towards Christ (Mat. xxi. 9).

HOSEA, the first in order among the minor prophets of the Old Testament, but more probably the third in order of time. Nothing is known of his life, except what can be gathered from the introduction to his prophecies, namely, that he was the son of Beeri, and that his ministry belonged to the reigns of Uzziah, Jotham, Ahaz, and Hezekiah, kings of Judah, beginning probably about the end of the reign of Jeroboam II., king of Israel. His prophecies are addressed almost equally to both kingdoms. His book was admitted into the canon after the Babylonish captivity. He has represented, in the three

first chapters of his book, the guilty violation of their covenant with God by an allegory, very common among the Hebrew poets, of a marriage covenant which the wife has violated, referring to the covenant which God had concluded with the Israelites. The remaining chapters treat of the same subject, under different figures, with reproaches, exhortations, and threats; he predicts the approaching exile of his countrymen, and the consoling promise of the final return of an improved people forms the conclusion of this prophetical book. He is remarkable for his laconic style, hastening from image to image, and from reflection to reflection. The stream of a powerfully excited fancy forces him irresistibly onward. Hence he does not exhibit the roundness, grace, and harmony which characterize the other prophets. His interruptions are frequent and abrupt, his images are often very incomplete, and his expressions are not unfrequently what an over-refined modern taste would describe as rude, and even coarse. Still, on account of his marked originality, the depth and truth of his sentiments, and the strength of his language, he will always maintain a distinguished rank among the Hebrew poets.

HOSIERY, a word properly applied only to the making of hose or stockings, but used as a general term for all kinds of knitted articles, including drawers, petticoats, night-dresses, &c., and fancy articles such as head-dresses, hoods, shawls, neckerchiefs, cravats, besides other articles. The materials used for the purpose are cotton, linen, and wool, the last of which is sometimes mixed with cotton or silk. Silk is also frequently used alone. Nearly all articles of hosiery, except some fancy articles, are now made by a knitting-frame of some kind or other, hand-knitting with a needle being now almost entirely obsolete. The knitting-frame was invented in 1589 by William Lee of Calverton in Nottinghamshire. The hosiery machines now in use are of three different kinds: the warp machine, which turns out flat webs which have to be sewed together both behind and at the foot; and the circular and rotary machines, both of which, with some differences in the method of working, produce cylindrical webs. In the first form of circular or rotary machine the webs were all of one uniform diameter, and the stockings had to be shaped to the leg by stretching them on a board and ironing them in that position to preserve the shape; but improvements have been introduced having the effect of making the cylindrical web wider at the calf and narrower at the ankle in the process of manufacture. Since 1841 the Jacquard loom has also been employed in the manufacture of articles of hosiery. Nottinghamshire is still the chief seat of the hosiery manufactures in England, but it is also carried on extensively in Leicestershire, Lincolnshire, Derbyshire, and other counties. In Scotland the chief seat of this manufacture is Hawick, where there is a large production of Cheviot wool stockings, drawers, and vests. On the Continent by far the most important manufactures of hosiery are in the Kingdom of Saxony, especially at Chemnitz.

HOSPICE signifies either a little convent belonging to a religious order, occupied by a few monks, and destined to receive and entertain travelling monks, or houses in uninhabited mountains, erected for the purpose of receiving travellers who have lost their way or are exhausted by fatigue. The most famous of these are the one on the Great St. Bernard, which came into the possession of the priests of the canton of Valais in 1825, and that on Mount St. Gothard, which existed as early as the thirteenth century.

HOSPITAL. A hospital, according to the most general use of the word, is any building appropriated for the reception of any class of persons who are unable to supply their own wants, and are more or less dependent upon public help to have those wants supplied. Hence hospitals are of various kinds, according to the nature of the wants they supply, and the class of persons for whom they are intended. A large number of hospitals are medical; others are for the reception of incurables; others for the aged and infirm; others for the education of children of people in reduced circumstances; others for the reception of the wounded in battle, and so on.

Among the ancients there were no institutions resembling the hospital of our own day. The constitution of the family, the universal prevalence in civilized countries of the practice of slavery, and the laws of hospitality regulating the relations between host and guest, were all so many circumstances which excluded the idea of the creation of such benevolent institutions as it is the province of this article to treat of. In ancient Rome the system of patronage secured to free men fallen into poverty the assistance of the rich of whom they were the clients; and the slaves attached to a family, in the Roman sense of the word, were cared for in case of wounds or sickness in the *valetudinaria* belonging to all houses of any importance. The only institutions in ancient times which at all corresponded to our hospitals were the public halls which existed in some towns, and in which strangers were lodged and fed, and the people found shelter during the winter. During the first centuries of the Christian era the practice of private charity sufficed to supply all the wants of the infirm and indigent, but in course of time this resource was found no longer sufficient, and it was found necessary to devise some means of making up for its insufficiency. Hence arose the earliest kind of hospital. The first establishments of this nature are believed to belong to the fourth century, and the emperor Constantine, St. Basil, and St. Chrysostom, patriarch of Constantinople, all of whom lived at that time, are mentioned among those who encouraged their formation. In the first instance, however, the primary object of these establishments was to afford a shelter to strangers and travellers, and it was only occasionally that the sick and infirm were admitted. As Christianity spread, the bishops were charged by the canons of the councils with the care of the poor of their dioceses; and under their care numerous hospitals arose specially intended for the reception of the sick and infirm, which were placed under the direction of the priests, and supported by private contributions. When it came to be found that these private contributions were not enough to meet the expenses of the hospitals, especially since a large part of them was diverted for the maintenance of the priests in charge, an edict was passed by the Council of Orleans, about the beginning of the sixth century, requiring that a part of the revenues of the clergy and the monastic orders should be set apart for charitable institutions, and that the funds required for the support of the indigent and the relief of the sick should be supplied as far as possible by the bishops. Subsequent councils confirmed or modified this edict. At the same time benevolent-minded members of the laity established a considerable number of hospitals; but it was an easier matter to found than to support them, and there are proofs enough come down to us of the insufficiency of the resources of the most of these charitable institutions. One of the earliest hospitals of which we have any satisfactory information was that established by the emperor Valens at Cæsarea about the end of the fourth century, and which was conducted on a very large scale. The Arabs in Spain, at an early period of their occupation of that country, following the example of the Christians, founded a magnificent

hospital at Cordova, to which the sick came from all parts of the Peninsula, and where physicians were trained, who did a vast deal to advance the study of medicine. The Arabs have also the credit of having founded the first lunatic asylum in Europe, which was erected in the city of Granada. In Catholic countries the hospitals are generally attended by nuns, sisters of mercy, &c., of whom even Voltaire says that there is nothing nobler than the sight of delicate females sacrificing beauty, youth, often rank and wealth, to devote themselves to the relief of human miseries under the most revolting forms.

Most of the large towns and counties throughout the British Islands have hospitals of one kind or another, and there is no city in the world where a greater number or a greater variety of hospitals are to be seen than in London. The majority of hospitals everywhere are medical, often called infirmaries. Such institutions serve a double purpose, inasmuch as they not only afford the best medical advice and treatment to the poor, who would otherwise be unable to obtain it, but also supply the best means of giving instruction in medicine and surgery, as in them students have the opportunity of witnessing cases of nearly every variety of disease, and observing how they are treated by the most skilled physicians. For this reason a good infirmary or medical hospital is an indispensable adjunct to every school of medicine and surgery, and there are usually professors specially appointed to expound to the students the nature of the diseases under which the infirmary patients are labouring, and the method of treatment adopted with regard to them. Besides the general medical hospitals for the reception of poor patients suffering under various kinds of illnesses and injuries, there are others intended only for particular classes of patients, such as hospitals for diseases of the skin, throat, and eye, for the paralysed and epileptic, for consumption, fistula, stone, fever hospitals, small-pox hospitals, lying-in-hospitals, hospitals for women, &c. &c. The following are the chief general medical hospitals in London:—

	Founded		Founded
St. Bartholomew's	1547	North London or University College	1833
St. Thomas's	1553	Metropolitan	1836
Westminster	1719	Middlesex	1836
Guy's	1721	King's College	1839
St. George's	1733	St. Mary's	1851
London	1740	Great Northern	1856
Charing Cross	1818	West London	1856
Royal Free	1828		

(Further information relating to some of these will be found in special articles.) Hospitals are generally supported by endowments, legacies, voluntary contributions, and sometimes by other means. Where connected with a medical school, part of their support is derived from fees paid by students. In many cities of the United Kingdom it is a regular practice to have a collection on some Sunday in the year in the churches or meeting-places of all denominations for the medical hospital or hospitals. In the year 1873 this practice was introduced into London, the 15th of June of that year being fixed as the first Hospital Sunday. On that day a sum of £25,743 was realized by church collections, while ten years later, in 1883, the sum amounted to £32,248; in 1903, to about £65,000. There is also a Metropolitan Hospital Saturday fund, collections for which are made in streets and workshops. The Prince of Wales's Hospital Fund, started in 1897, is a permanent fund largely supported by subscriptions and donations of the wealthy.

The following is the mode in which medical hospitals are most usually regulated:—There are several large wards, each containing several beds. At the head of each bed is a small cupboard or shelf, for containing the bottles, cups, and medicines belonging to the patients. There are also a few smaller bed-chambers for the reception of particular cases, which it may be judged advisable to keep separate from the others. Each hospital has a matron, house surgeon, and apothecary resident within its walls; and sometimes there is also a resident chaplain and secretary. The duties of the matron consist in regulating the night and day nurses, and the washing and laundry department, as well as the purchase of the necessary supplies of provisions, and keeping a general superintendence over the kitchen and messes of the sick. The resident surgeon performs all the minor operations, and takes care of all casualties and accidents in the absence of the principal surgeons. He and the apothecary keep a set of books in which they enter in writing all the details of their respective duties. The apothecary takes care of the pharmacy, and prepares all the medicines prescribed from time to time by the surgeons and physicians. There is a well-lighted room set apart for the performance of operations, and a dead-room for the reception of corpses previous to interment. The dressing of the sores, &c., of the infirm is performed by the young hospital pupils, under the directions of the surgeons. The nurses relieve each other day and night in a regular manner. Particular wards are set aside for the reception of persons labouring under various and peculiar denominations of disease, and their distribution is regulated by the house surgeon, under the control of the physicians and surgeons. Every large hospital has a pathological department under the direction of the pathologist, whose duty includes that of performing the post-mortem examinations, and determining and recording the changes produced by disease in the various tissues and organs. Connected with this department there is usually a museum, where are preserved illustrations of diseased organs of special interest. There is usually a garden or airing-ground, where the convalescents may walk about. The greatest attention is paid to cleanliness and ventilation. Contagious diseases are now always placed in distinct buildings. The chaplain is instructed to read prayers daily to the sick, and to administer the sacrament and consolations of religion to those whose minds are prepared to receive them. All patients who are disorderly or disobedient are discharged. The general management and control of the house is vested generally in a committee of subscribers, who meet once a week or fortnight and receive reports of vacant beds, deaths, and other casualties. There are generally two days in the week set apart for discharging and receiving patients; but accidents are received at all times and at all hours. Patients often bring with them letters of recommendation from annual subscribers or governors, by the form of which the person recommending binds himself to remove the patients if required, or, should they die, to be answerable for the expenses of their funerals.

In recent times there has been considerable discussion as to the best method of constructing medical hospitals. It was objected to the plan of constructing large edifices for the purpose, that the benefit they conferred was greatly diminished by the risk of being attacked by hospital fever, but modern science has obviated almost all danger of this kind. Sir James Y. Simpson of Edinburgh went the length of maintaining that the only way to remove this risk was to build hospitals in the form of temporary detached huts, which should be frequently taken down and replaced by new ones; that at least all staircases and other means of communication between the wards should be outside the building. As a means of removing, at least partially, the evils

connected with the present system of hospital construction, some new hospitals are being built in detached parts, which are each reserved for a separate class of diseases. The pavilion system of construction, which is now being to some extent adopted in England and Germany and to a greater extent in France and America, deserves a short notice. According to this system the wards should be separated from the administrative part of the establishment, and should be arranged in pavilions of one story where practicable, but never more than of two. The pavilions may radiate from a central rotunda, branch off at right angles to a central corridor, or be arranged *en echelon* in a triangle, according to the locality, direction of the prevailing winds, &c., but should always surround the administrative blocks. Each pavilion should be about 115 feet long, by 25 feet broad, and 14 to 15 feet high (greater dimensions being necessary in warm climates); the beds in each pavilion should never exceed 32 in number, and each should have a clear floor space of 80 to 100 feet. The Royal Infirmary of Edinburgh, the Herbert Hospital of Woolwich, and the New York Hospital are among the best examples of the pavilion style.

Military and Naval Hospitals. — Establishments for the reception and care of sick and wounded soldiers and seamen have been in existence in all civilized countries for a long period. The chief military hospitals in Britain are the Royal Victoria at Netley, and the Herbert at Woolwich, both being general hospitals, besides the station hospitals with a fixed staff at the head-quarters of the various military districts. The chief naval hospitals of Britain are those of Haslar at Portsmouth (the largest in the country and capable of accommodating 1500 patients), the Royal at Plymouth, and the Melville at Chatham, besides those at the chief naval stations abroad, such as Malta, Halifax, Bermudas, Jamaica, the Cape, Hong-Kong, &c. The patients in naval and military hospitals are subject to certain stoppages of pay, unless wounded in action, but should disease be the result of misconduct the whole pay is stopped. The sum annually paid by government for medical establishments and services averages about £300,000 for the army and £70,000 for the navy. In France, Germany, Austria, and other European countries great attention is paid to military hospitals, the administration of which is usually in the hands of the medical department. In the United States, the army being small and mostly engaged in frontier work, permanent and costly structures are not necessary, their place being generally taken by post hospitals consisting of a series of wooden huts or other temporary erections to hold from 10 to 25 beds, and not designed to last for more than 10 or 12 years. Two large permanent establishments, however, exist, namely, the hospital for cadets at West Point, and the Barnes Hospital near Washington. In connection with the marine service there are hospitals at many of the ports, whether sea, river, or lake; the hospitals on the pavilion system at Chicago and San Francisco being worthy of special mention. Connected with the armies of all nations in time of war are general hospitals established at the base of operations, and field hospitals which follow the main bodies of the troops during the progress of the campaign.

There are two institutions which, though not exactly of the nature of medical hospitals, may yet be mentioned here as subsidiary to such establishments. These are dispensaries in which, upon order obtained from the proper authorities, medicines are made up and dispensed free of charge to those who are unable to pay for them; and schools for the training of nurses. There is a very important school for this purpose in connection with St. Thomas' Hospital in London. It was founded at the suggestion of Miss Nightingale with a sum of £50,000 which had been collected as a testimonial for her in recognition of her self-denying labours in attendance on the wounded in the Crimean war, and which she refused to receive except on condition that it should be applied to this purpose. Convalescent homes and hospitals for incurables may be regarded as supplementary to medical hospitals properly so called. The former are intended for those whose cure has been effected in the infirmary, but who have not yet acquired sufficient strength to be out of danger of a relapse if they should resume their ordinary occupations. These homes are therefore built by the sea-side, or in some healthy locality, where the patient, after leaving the infirmary, is rapidly reinvigorated by a stay of two or three weeks. The other class of hospitals mentioned are intended, as the name indicates, for those who are suffering from diseases for which there is no possibility of cure. The oldest hospital of this kind in London is the Royal Hospital at Putney Heath, which was founded in 1850. It contains 137 inmates, and gives a pension of £20 to 277 others. Besides those at present existing in London and elsewhere, a proposal has been made to build another out of London on a larger scale than any hitherto erected, to be called the National Hospital for Incurables.

After medical hospitals of all kinds, the next most numerous are perhaps those intended for the education of children of parents in reduced circumstances. The most celebrated of these is Christ's Hospital in London, usually known as the Blue-coat School. (See Christ's Hospital.) For its size, no city was, till recently, so largely provided with this kind of hospital as Edinburgh, and the buildings are still among the leading ornaments of the city. Within a recent period, however, in consequence of a strong feeling that had grown up against these institutions on account of the evil effects which were attributed to their monastic system, and on account of their alleged pauperizing tendency, many of them have been remodelled and converted into public schools, the foundationers formerly supported and educated within the walls of the hospitals being now boarded out in families of the city. Hospitals for the education of children are commonly supported by endowments. Another numerous class of hospitals are those for the reception of aged men and women, to which the alms-houses of England belong. Many of these are reserved for decayed members of particular professions. The Charterhouse in London is a famous hospital for decayed gentlemen; Chelsea Hospital is one for old and disabled British soldiers. Of this kind also was the Greenwich Hospital for seamen belonging to the royal navy, but in 1865 the inmates of that hospital (except the bedridden) were removed from the building, with additions to their pensions to enable them to maintain themselves among their own friends, and the hospital converted into an infirmary for seamen. Among the other kinds of non-medical hospitals the only ones which it is necessary to mention here are foundling hospitals and orphan hospitals. The earliest foundling hospital in Europe was founded at Milan in 787. (For an account of one or two of the best-known hospitals of this kind see Foundling.) The first orphan hospital established in Europe is said to have been founded by Alexius I., emperor of the East, at Constantinople in 1090. On the subject of hospitals for the insane, see Lunatic Asylums.

In France, hospitals, though at the present day not so general as in Britain, seem to have existed at an earlier period than there, and there still exist in that country some of the oldest, largest, and most widely-known charitable institutions of this nature

The oldest of which there is any mention is that of Lyons, which is said to have been founded by Childebert, the son of Clovis, in conjunction with his wife Ultrogothe, in 542. It has been several times reconstructed and considerably enlarged, and now bears the name of Hôtel Dieu de Lyon. Hôtel Dieu is also the name of the most ancient hospital in Paris. The earliest period at which it is known to have existed is the reign of Louis the Debonnair, about the beginning of the ninth century, when it was called Saint-Christophe. The Hôtel des Invalides, founded in 1671 by Louis XIV., is destined for military veterans. The Hôpital général, founded by the same monarch in 1656, and reorganized in 1800, is intended to contain mendicants, as well as to furnish assistance from its revenues to the very poor. In the eleventh and twelfth centuries, in consequence of the introduction of leprosy into Europe from the East by the Crusaders and of St. Anthony's fire, the number of hospitals increased very largely in France.

HOSPITAL FEVER is a malignant form of typhus fever so called from its being at one time frequently met with in hospitals, especially those of large size. See TYPHUS FEVER.

HOSPITALLERS, as the name imports, are charitable brotherhoods who devote themselves to tend the sick in hospitals. These foundations belong to different times and countries, and the brethren are bound by the vows of poverty, chastity, and obedience common to the several religious orders of the Roman Catholic Church, in addition to the vow for the special work which gives them their designation. They have always originated in the presence of an unforeseen need, or of some destructive plague, which ordinary agencies were unequal to cope with. The Order of Hospitallers had two grand divisions:—first, of those who devoted themselves exclusively to charitable services; and second, of those who formed military brotherhoods under this name. The latter had numerous subdivisions, as the Knights Hospitallers of the Order of Constantine; of Our Lady Della Scala; of Our Lady of Mount Carmel; of St. John of Jerusalem (see JOHN, ST., KNIGHTS OF); &c. These orders held it their duty to provide lodging and entertainment for persons engaged in pilgrimages, and to find them protection against all assailants. The Knights of St. John acquired great wealth and influence, and received great privileges, which they often abused. Being driven from Palestine they settled in Cyprus (1291) and in Rhodes (1309). When Rhodes was captured by Solyman II. in 1522, they dispersed, and were settled in Malta by Charles V. (1530), and were again dispersed on the capture of Malta by Napoleon I. (1798). The Knights Hospitallers settled in England in the twelfth century. They followed the rule of St. Austin, and wore a black habit with a white cross upon it. There are also sisterhoods of this order, as that of the Order of the Mercy of Jesus, founded at Gentilly in 1648 by Claude Sonnius. Their duty was to care for the children of the town and the neighbouring villages. In 1655 these religious sisters founded an hospital for sick females, married and unmarried, and in 1704 another establishment of the same kind at St. Maudé.

HOST (Latin, *hostia*, a victim). *Hostia* means, in the Latin of the Christian church, Jesus Christ, in so far as he sacrificed himself for men; and *hostia*, or *host*, is also used for the bread (or wafer) and wine in the eucharist, as containing the body and blood of Christ, among those Christian sects who believe in the presence of Christ in the bread and wine. As the wafer alone is given to laymen in the Catholic Church, as containing both the body and blood of the Redeemer, the term *host* is usually applied to the consecrated wafer. The term derives its significance from the doctrine that the eucharist is a 'sacrifice' in the strict sense of the term. Common bread was originally used at the Lord's Supper; but bread baked particularly and solely for this purpose, large, round *oblatæ*, came into use in the fourth century, which it was customary to break after consecration into as many pieces as there were communicants. The hosts, or smaller wafers, were introduced into the Latin Church in the twelfth century. The Greek and other oriental churches use for the eucharist leavened bread, whilst the Roman Catholics use unleavened wafers, which custom was followed by the Lutherans. It is well known that the Calvinists on the Continent, not believing in transubstantiation or consubstantiation, prefer unleavened bread to the wafers. This bread has been adopted in Prussia in the new ritual for the united Lutherans and Calvinists; yet any person preferring the wafer may have it, as at the end of the celebration of the Lord's Supper it is offered to them. The Protestants in Britain and America use common leavened bread. For the elevation of the host, see ELEVATION, and for more information see MASS.

HOSTAGE (French, *ôtage;* Latin, *obses;* Low Latin, *obstagius*), a person left as pledge or surety for the performance of the articles or conditions of a treaty. The taking or giving of hostages is now scarcely known in the relations of modern communities, but was formerly almost universal, and many questions in the law of nations arose out of the practice. When a town capitulated it was customary both for victors and vanquished mutually to exchange certain officers of importance as pledges that the terms agreed on should be faithfully carried out. If the stipulated terms were observed the hostages were returned on each side, but if the terms were violated or evaded the hostages might be put to death. Writers on international law have discussed how far the rights of conquerors extend over hostages, what circumstances may release them from their obligation, and what effect their escape will produce on the treaty proposed by the contracting parties. In modern civilized warfare hostages are not usually interchanged, and the circumstances would be indeed exceptional that would be deemed sufficiently grave to call for the execution of a hostage.

HOSTILIUS. See TULLUS HOSTILIUS.

HOT-BED, in gardening, a bed artificially prepared to bring forward various kinds of plants which require more than the natural heat of the country and season, but to cultivate which the hot-house is not necessary. Plants, having little or no power to generate heat, are dependent for warmth on the media which surround them. The production of a soil hotter than the surrounding air, and that shall not prove injurious to vegetation, is what is sought for in hot-beds. The heat, which must be constant and gentle, is produced by fermentation. In our climate melons, cucumbers, ornamental plants for borders, and vegetables wished to be prematurely fit for the table, are raised in these beds. The fermenting substances employed are fresh stable dung, tanners' bark, leaves of trees, grass, and the herbaceous parts of plants generally, for which are sometimes substituted the waste of flax, cotton, or woollen factories. But stable dung is in most general use. In preparing manure for hot-beds the object is to modify the excessive heat generated in the first process of fermentation, and it is expedient to prepare the materials beforehand that the heat may not be too great. They should be turned over frequently, and water supplied or withheld according as the fermentation is too tardy or the reverse. Fermentation is always most rapid in summer, and if the materials are spread abroad during frost it is totally impeded. In this latitude

a hot-bed should slope towards the south. The fermenting substance, being covered with a layer of earth, is surmounted with a frame about a foot less in length and breadth than the bed, and furnished with a movable glass sash or sashes, according to the size. These beds are not of a fixed thickness, but vary according to the purpose intended and the degree of heat required. As a great deal of heat is lost in the process of fermentation, various plans have been devised to turn it to some account; and when it declines beyond the degree necessary to produce the object intended, *linings* of the same material as the hot-bed are added to the sides of it. The sashes should be made as tight as possible, to prevent the warm air within from escaping, or the cold air without from penetrating; and during the heat of the day they should be partially removed, to permit ventilation and the escape of vapour. The slope of the frame will not only make the bed receive the full rays of the sun at his meridian, but will furnish a proper declivity to carry off the wet.

HOT-HOUSE. See GREENHOUSE.

HOTTENTOTS, a peculiar African race, the aboriginal occupants of the south end of that continent, at and near the Cape of Good Hope. Their limits may be said to have been the river Orange on the north and north-east and the Kei on the east; but their eastern boundary appears to have been fluctuating. On the north-west they passed the Orange, and advanced north and north-east far into the interior. The name now given to the whole race was that of the tribe in the immediate vicinity of the Cape of Good Hope, with which the Dutch settlers first became acquainted. The origin of the name is unknown. It is not certain what are the affinities of their language, which is characterized by curious sounds known as *clicks*. They are, when young, of remarkable symmetry; but their faces are ugly, and this ugliness increases with age. The complexion is a pale olive, the cheek-bones project, the chin is narrow and pointed, and the face consequently is triangular. The lips are thick, the nose flat, the nostrils wide, the ears large and lobeless, the hair woolly, and the beard scanty. The women in early life are often models of proportion, and their gait by no means deficient in grace. Their bloom, however, is transient, for, marrying at twelve or thirteen, after the first child they lose their grace and proportion, and soon become hideous. Both sexes are distinguished by excessive incurvation of the spine. When the Dutch first settled at the Cape the Hottentots were a numerous nation, of pastoral and partially nomadic habits, and occupied a territory of 100,000 square miles. They had abundance of horned cattle and sheep; and it is supposed that the seven tribes into which they were divided made up together a population of at least 200,000. At the present day this race is nearly extinct within the wide territory which formerly belonged to it. Constantly harassed and hunted down by the Boers, who confessedly sought their extermination, their only chance of escape was to engage in the service of their persecutors. But this domestication was fatal to the purity of the breed; and of those classed as Hottentots within the limits of the colony the greater majority are people of mixed race.

But connected with this once great and now utterly decayed trunk are certain offshoots and collateral stems which call for notice. Among these must be mentioned the Griquas, a half-breed race, descended from Hottentot mothers and Dutch fathers, living chiefly to the north of the Orange River, in Griqualand West, on both sides of the Vaal. They are in a semi-civilized condition, possess considerable numbers of cattle and sheep, and practise agriculture to some extent. They may amount to about 20,000. Others of the Griquas inhabit Griqualand East, in the north-east of Cape Colony. The Koras or Korannas (shoe-wearers), south of the Kalahari Desert, still remain a favourable specimen of the Hottentot race. They are taller, stronger, and more cleanly than some of the other tribes. Most of them possess cattle; those who do not, soon degenerate into Bushmen. On the eastern frontier of the colony are still some remnants of the Gona or Gonaqua tribe; but they have nowhere preserved their ancient usages and purity of blood, but are much mixed with the Amakosa Kafirs. The Namas, who are the purest type of Hottentots now existing, dwell in Namaqualand, in German South-west Africa. The Bushmen are also of Hottentot race. Their proper country is between the Roggeveld Mountains and the river Orange; but they are to be found wherever the absence of a stronger population permits their increase. (See BUSHMEN.) On the western side of Africa, in lat. 21° to 23°, are the Damaras, of whom those called Hill Damaras are of Hottentot race. The Namas are a pastoral people almost exclusively, being in this respect distinguished not only from the Bantus and Negroes, but also from the closely-allied Bushmen. They wear a sheepskin covering known as a *kaross* and an ornamented apron called an *okhubib*, and they are accustomed to rub their bodies with a mixture of grease and a red powder. Their dwellings are low, rude huts, surrounded by fences. Many of them have been Christianized. The Hottentots generally are very indolent and lethargic.

HOUGHTON-LE-SPRING, a picturesque town of England, in the county of Durham, 6 miles s.s.w. of Sunderland. It has a fine large venerable church, besides several other places of worship; a town-hall, church institute with library, old grammar-school, alms-houses, &c. Many of the inhabitants are employed in the neighbouring coal-mines. There are also limestone quarries and breweries. This town now gives name to one of the eight parl. divs. of Durham. Pop. in 1891, 6476; in 1901, 7858.

HOUND (*Canis sagax*, Linn.), a name given generally to hunting dogs, but restricted by scientific writers to such as hunt by scent, a definition which excludes the greyhound. It is difficult to determine from what stock the English hound has originally sprung. The bloodhound is a large, powerful variety, with a thin, loose skin, and very long ears. His height is about 2 feet, and he has a noble expression, and a shy, affectionate nature. The beagle is a smaller hound, with large, pendulous ears, a strong muscular body and legs, and is usually black-and-tan or white-and-tan in colour. The otter-hound is a rough-haired large dog, built like a foxhound, and the Welsh hound is a sort of wiry-haired foxhound. The deerhound and greyhound are of very similar appearance, characterized by the slender, muscular body, the bright, keen eyes, the small ears, and longish neck and legs. Other sorts of hound are the whippet, a cross between the greyhound and a terrier, the Irish wolfhound, the borzoi or Russian wolfhound, and the great Dane. The foxhound is one of the best-known hounds, and the harrier is a smaller foxhound. At the present day, when the word hound is used by itself, or a pack of hounds is spoken of, it is the foxhound that is generally to be understood. The foxhound is entirely the result of breeding, and the animal of the present day is a very perfect instrument for the sport for which he is intended, being highly remarkable for speed and also for power of endurance. The foxhound is generally from 22 to 24 inches high, and rather strongly built; colour, white with black and tan spots;

head rather large and deep; legs muscular, the fore-leg short from knee to foot, the hind-leg similar, but long from hip to hock. Hounds are distinguished not only by their fineness of scent, but by docility and sagacity, and a good hound knows when to 'give tongue' and when to be silent. The breed of hounds is preserved in purity with the most scrupulous care. Fox-hunting is a specially English sport, and has been introduced by Englishmen into various countries, although other animals may have to be hunted instead of the fox. In England itself the foxhound is used also as a staghound. Fox-hunting is a privileged pursuit, no one being challenged for trespass when engaged in it except there be wilful mischief, though it is tacitly understood that all who take part in it, actively or as spectators, shall do the least damage possible.

HOUNSLOW, a town of England, in Middlesex, 9½ miles from Hyde Park Corner, on the edge of Hounslow Heath. The church, erected on the site of an old priory, is a brick edifice, adorned with stone cupolas in the Italian style; there is another church erected in the early English style in 1874, besides several other places of worship, a town-hall, with a library and reading-room, and two railway-stations. The adjoining heath, notorious for the robberies committed on it in former times, is now entirely inclosed, and is the site of large cavalry barracks and extensive powder-mills. Pop. (1901), 11,377.

HOUPE (North of the Lakes), a central province, China, between lat. 29° and 33° N.; lon. 108° 35′ and 116° E.; bounded north by Honan, east by Nganhoei and Kiangsee, south by Hoonan, and west by Sechuen and Shense. It is intersected by the Han-kiang and the Yang-tse-kiang, and its surface, particularly towards the south, is dotted with numerous lakes. It is considered one of the most fertile parts of the empire; produces bread-stuffs, silk, cotton, tea, fish, and timber; and manufactures cloth, paper, and wax. With Honan it formerly constituted one province, named Hukwang. Provincial capital, Woo-Changfoo. Pop. 39,412,940.

HOUR, the twenty-fourth part of a day (see DAY). In most countries the hours are counted from midnight, and twelve hours are twice reckoned. But in some parts of Italy twenty-fours are counted, beginning with sunset, so that noon and midnight are every day at different hours. Each hour is divided into sixty minutes, and each minute into sixty seconds. Many nations are totally unacquainted with the division of the day into twenty-four equal parts; with others the hours of the (natural) day are longer or shorter than those of the night. (See DAY and SIDEREAL TIME.) The fixed stars complete their apparent revolution round the earth in twenty-four hours of sidereal time, and therefore pass through 360 degrees in twenty-four hours, or 15 degrees in one hour. If we suppose two observers 15 degrees of longitude distant from each other, one of them has any fixed star one hour of sidereal time later in his meridian than the other. Meridians are called *horary circles* or *hour circles* in dialling. A *horary angle* is that angle which any hour-circle makes with the meridian of the observer. If, for instance, it is 10 o'clock A.M. according to the sun-dial at the place of observation, and the sun is therefore two hours distant from the meridian, its hour-circle makes an angle of 30 degrees with the meridian. See DIAL.

HOUR-GLASS, a species of chronometer or instrument for measuring time. It consists usually of two hollow bulbs placed one above the other, and having a narrow neck of communication. Dry sand is introduced in quantity sufficient nearly to fill one of the bulbs, and fine enough to pass freely through the orifice of the connecting neck. The quantity of sand is adjusted to the time which the glass has been constructed to indicate. In the case of an hour-glass the sand in the upper bulb takes an hour to pass into the lower bulb; and so on for any other definite division of time. This instrument is always subject to slight error in its indications of time, owing to the expansion and contraction of the glass by changes of temperature, and by the variations of dryness in the sand. Such instruments are not therefore perfectly reliable; but their intention is nothing more than to indicate time roughly, as in the common and well-known egg-boiler. The hour-glass was commonly used in churches during the sixteenth and seventeenth centuries to regulate the length of the sermon, and in some places it continued in use down to the beginning of the nineteenth century. Hour-glass stands of exquisite workmanship are still to be seen in several English churches, one of these being in Stoke d'Abernon church, Surrey.

HOURIS, virgins who, in Mohammed's paradise, are one of the rewards of the blest. According to the description of the Koran they surpass in their dazzling beauty both pearls and rubies; they are subject to no impurity, and reserve the languishing glances of their dark black eyes for individual admirers. They dwell in green gardens beautiful beyond description, among lotus and acacia trees, with fruits in abundance, near flowing streams, where they are to be found in bowers lying upon green cushions and the most beautiful tapestry, and flourishing in perpetual youth. The very meanest of the faithful will have seventy-two houris. Mohammed has omitted nothing to render his paradise delightful to the voluptuous inhabitants of the East. A paradise for women is also provided, abounding in pleasures of every kind. A further hope is held out to affectionate wives, for it is left optional with their husbands to take back their wives in the place of the houris. It is affirmed, however, by some that the descriptions of the houris in the Koran are allegorical, and designed merely to convey an idea of the transcendant beatitude of the saints; and that the wiser Mohammedans attach a higher than a mere literal interpretation to the presence of these black-eyed virgins in paradise.

HOURS. See HORÆ.

HOUSE. English and Scottish law do not regard the house or domicile in precisely the same light. The common expression, 'an Englishman's house is his castle,' is in most instances true. Except in criminal cases an Englishman can hold his house against all comers. No bailiff can break open his door to arrest him, or seize his goods for debt, nor can any court give him this power. As long, therefore, as an Englishman who chooses to hold his house can subsist, so long is he secure. The usual plan is to blockade him, and prevent supplies from entering the citadel; and if this can be done he must at last surrender. When the bailiff once gains admittance he cannot be expelled. Scottish law confers no such right on the householder. The Scottish debtor may bolt himself within, but the court can give the messenger permission to force the door, and arrest or distrain as may be wished. This right of entry granted by the court is popularly known as the 'king's keys'. But the house is no protection either in England or Scotland where there has been a criminal offence. Breaking into a house by night with the intent to rob is *burglary;* in Scotland the same offence is called *housebreaking.* The offence known in Scotland as *hamesucken* consists in feloniously assaulting a person in his own house. To constitute the crime the house must be that in which the person resides. A shop, whether adjoining to the house or not, is not reckoned a man's house. A man may defend his house against trespassers and

thieves attempting forcible entrance, even to the killing of the intruder, if it can be shown that he has used no greater force than was absolutely necessary.

HOUSE-BREAKING. See BURGLARY.

HOUSE-BURNING. See ARSON.

HOUSE-FLY. See FLY.

HOUSEHOLD TROOPS. See GUARDS.

HOUSELEEK (*Sempervivum tectorum*), a succulent plant of the natural order Crassulaceæ, having the leaves, which are all radical, disposed somewhat in the form of a double rose. The stem rises to the height of 8 or 10 inches, and bears a few purplish flowers, which have twelve or fifteen petals. It grows in the clefts of rocks, on old walls, and the roofs of cottages. The other species of *Sempervivum*, nearly thirty in number, are all natives of Madeira, the Canaries, and the Mediterranean shores.

HOUSE OF COMMONS. See BRITAIN; also PARLIAMENT.

HOUSE OF CORRECTION, a prison for idle and disorderly persons, not under the charge of the sheriff, but governed by a keeper. Originally vagrants, trespassers, and convicted persons were detained in these houses that they might be compelled to work. They were also called *bridewells*. The distinction between such prisons and other prisons was abolished in 1865.

HOUSE OF LORDS. See BRITAIN; also PARLIAMENT.

HOUSSAS, or HAUSSAS, a people of Africa, in Central Soudan, chiefly inhabiting the region between the Niger on the west and Bornu on the east, the Sahara on the north and the Benué on the south. This country, now included in Northern Nigeria, is extremely fertile, and cultivated with a skill little inferior to that of Europeans. It fell under the rule of the Fellatahs (see FELLATAHS), who subjected the native inhabitants the Haussana or Haussas, a race intermediate between the negroes and the Berbers, but generally ranked with the latter. They are described as intelligent, lively, social, and very industrious. They are expert weavers as well as agriculturists, and manufacture large quantities of cotton cloths, with which they supply Fezzan. They are also well acquainted with tanning and working in iron. Their language is the richest, most sonorous, and most flexible of all the Soudan, and has become the general medium of commercial intercourse in Central Africa. Their religion is the Mohammedan. Where the country is not cleared for cultivation it is covered with forest-trees, especially mimosas and acacias, and there is rarely a spot without vegetation. Among the chief towns of the region are Sokoto, Katsena, and Kano. These towns carry on an extensive trade with the countries of North-west Africa, particularly Fezzan and Tripoli. The Haussas have been made use of as soldiers by the British, and as such have done good service.

HOUSTON, a city of the United States, in Texas, capital of Harris county, at the head of steamboat navigation on Buffalo Bayou, which is here crossed by seven iron bridges, 55 miles north-west of Galveston. It stands in an excellent grazing district, and is a very important railway centre. Among the most important of its industrial establishments are oil-mills, cotton-presses, machine-shops, railway works, breweries, and furniture works. Its easy communication with Galveston and the Gulf of Mexico by steamer, and its railway connections, make it an important commercial city, with a large trade in cotton, grain, &c. It contains numerous churches and schools, some for the white, and others for the coloured population; a city-hall and market-house; a masonic temple; public libraries, &c. It was once the capital of Texas. Pop. in 1880, 16,513; in 1890, 27,557; in 1900, 44,633.

HOVE, the western portion of Brighton, forming a separate municipality but included in the parl. borough. Pop. (1891), 28,335; (1901), 36,542.

HOVEDEN, or HOWDEN, ROGER DE, an English historian, probably a native of Hoveden or Howden, in Yorkshire. The dates of his birth and death are unknown, but he flourished in the reign of Henry II., under whom he was a clerk. He was also a lawyer, and was employed by Henry to visit certain monasteries when their abbots or priors died, and the revenues of the respective foundations fell into the king's hands. After the death of Henry he applied himself to the compilation of English history, and wrote Annals in Latin, commencing at 732, the period at which Bede finished, and bringing down affairs to 1201. His style is defective, but he is highly esteemed for his diligence and fidelity, and, according to Leland, surpasses all the writers of his class who preceded him. But the Recueil des Histoires des Gaules asserts that he was chiefly a copyist of Henry of Huntingdon, Simeon of Durham, and Benedictus Abbas. Such was his authority that Edward I. caused a diligent search to be made in all the libraries for copies of Hoveden's Annals, in order to ascertain the homage due from the crown of Scotland. The portion dealing with the period 1192–1201 is the most original and valuable. This work was published in Sir Henry Savile's Collection of Ancient English Historians (1596–1601, folio), and an edition in 4 vols., 1868–71, has been published in the series of the Master of the Rolls, edited by Bishop Stubbs, who contributes a valuable preface. A translation by H. T. Riley was published in Bohn's Antiq. Lib. 1853.

HOWARD, the patrician house that has been for centuries at the head of the English nobility. The highest title in the family, the dukedom of Norfolk, dates from the middle of the fifteenth century. Though there is a tradition that the name is of Saxon origin, and derived perhaps from the title of an eminent office held under the crown before the Conquest, the first of the family of whom anything is certainly known is Sir William Howard, who was chief-justice of the common pleas under Edward I. and Edward II. His grandson, Sir John Howard, was named admiral and captain of the navy in the North in 1335, and again in 1347, in which year he assisted at the siege of Calais. He possessed extensive property in Norfolk, and was also sheriff of the county. His grandson, Sir Robert Howard, by marrying the co-heiress of the Mowbrays, dukes of Norfolk, greatly increased the family possessions and enhanced the family importance. Their only son, Sir John Howard, one of the leading supporters of the house of York, distinguished himself in the wars with France in 1452–53, and in 1462 was appointed Constable of Norwich Castle. He was also constituted sheriff of the two counties of Norfolk and Suffolk. In 1468 he became treasurer of the royal household, and in 1470 he was created Baron Howard, and made captain-general of the royal forces at sea. In 1472 he was installed a Knight of the Garter, and ten years later he was appointed Constable of the Tower. Adhering to the fortunes of Richard III. he was in 1483 created Duke of Norfolk, and elevated to the high dignity of Earl-marshal of England, a distinction still belonging to the family. Almost simultaneously with these honours were added those of High-steward of England and admiral for life, but two years after he was killed at the battle of Bosworth Field, and his blood and honours were attainted by Parliament, Nov. 1485. A like attainder was decreed against his son Thomas, who had been created Earl of Surrey by Richard at

the same time that his father had been raised to the dukedom, but after an imprisonment of three years in the Tower, being restored to his title and possessions, he manifested high military talent, and distinguished himself in several expeditions against the Scots, and more especially by his signal defeat of James IV. of Scotland at Flodden in 1513. His son Thomas, third duke of Norfolk, early obtained distinction by his talents, both as a naval and military commander, becoming in 1513 High-admiral of England. In 1521 he was sent to Ireland as lord-lieutenant, where he suppressed a dangerous insurrection under O'Neal. He was afterwards a leading member of the king's council, and was considered as the head of the Roman Catholic party, though he acted with so much prudence as to retain the favour of his capricious sovereign till near the close of his long reign. But in spite of all his services at home, and against the Scots and the French, the suspicious jealousy of Henry at last condemned him, on slight grounds, to suffer the death of a traitor. The 29th January, 1547, was appointed for his execution, but the king's death the preceding night procured him a respite. He was reinstated in his rank and property by Queen Mary, and died in August, 1554. By his marriage with a daughter of Edward IV. he became the father of the ill-fated and accomplished Henry Howard, earl of Surrey, the best English poet of his age.

The date of Henry Howard's birth is uncertain, but it is supposed to have been about 1516. In 1532 he was present at the interview between Henry VIII. and Francis I. at Calais. In 1542 he served under his father as lieutenant-general of the army sent against Scotland, and in 1544 he accompanied the troops with which the king invaded France, and was field-marshal of the army before Boulogne. On the surrender of that place in 1546 he was made captain-general and commander of the garrison left for its defence; but the same year, being defeated by the French in an attempt to intercept a convoy, he was superseded in his command by Seymour, earl of Hertford. The short remainder of his life was clouded by misfortunes; for on his return to England, conscious of his former services, and smarting under what he conceived to be unmerited disgrace, he is said to have dropped some reflections on the king and council, which, being reported to his majesty by the earl's enemies, proved the cause of his ruin. He had quartered in his escutcheon the royal arms of Edward the Confessor, to which he had a hereditary right, and is said to have aspired to the hand of the Princess Mary. On these and other charges of a more frivolous nature he was, together with his father, committed to the Tower in Dec. 1546, and, Jan. 13, was tried at Guildhall, before a common jury, by whom he was obsequiously found guilty of high treason. Six days after he suffered the sentence of the law by decapitation on Tower Hill. Dr. Heylin, in his Church History, calls him 'the chief ornament of the nation;' Lord Orford styles him 'an almost classic author;' and Sir Egerton Brydges says that he 'was a man of learning, a genius, and a hero, who united all the gallantry and unbroken spirit of a rude age with all the elegance and grace of a polished era.' His works, which mark an era in English literature, consist of songs and sonnets (in a collection published in London in 1557, of which there were several reprints in the sixteenth century); the second and fourth books of Vergil's Æneid, translated into blank verse (London, 1557, 12mo); a translation of Ecclesiastes, and some of the Psalms; Satires on the Citizens of London; a translation from Boccaccio; and some smaller pieces. Surrey is the earliest writer of English blank verse, some beautiful examples of which are to be found in his versions from Vergil. He is also the leader of the second school of English poets who admired and imitated the Italian models, and as such Spenser and Milton owe him much.

Thomas, fourth duke of Norfolk, entertained the project of marrying Mary Queen of Scots. But his intention being discovered he was committed to the Tower, and released only after nearly a year's imprisonment. He again renewed his correspondence with the Scottish queen, and being again discovered, he was re-committed to the Tower, 4th September, 1571; convicted of high-treason 16th January, 1572; and beheaded on June 2 of the same year. The attainder was reversed and the family honours restored partly by James I. and partly by Charles II. The ducal house of Norfolk has thrown out many branches which have enjoyed, or still enjoy, the earldoms of Carlisle, Suffolk, Berkshire, Northampton, Arundel, Wicklow, Norwich, and Effingham, and the baronies of Bindon, Howard de Walden, Howard of Castle Rising, and Howard of Glossop. Many other individuals connected with this noble family have been distinguished for their abilities, their services, or their misfortunes, as Lord Howard of Effingham, who defeated the Spanish Armada in 1588; Catherine Howard, one of the ill-fated consorts of Henry VIII.; and Sir Thomas Howard, who died in the Tower a prisoner, for having aspired to the hand of the Lady Margaret Douglas, daughter of Margaret, queen-dowager of Scotland, and niece of Henry VIII. 'The blood of the Howards' has become proverbial, as expressive of ancient lineage combined with high rank.

HOWARD, JOHN, the celebrated philanthropist, was born at Enfield or Hackney about 1726. His father, a wealthy London tradesman, bound him apprentice to a wholesale grocer in the metropolis; but dying when his son was about sixteen years of age, young Howard, who was of infirm health, purchased the remaining term of his indentures, and indulged his taste by making a tour in France and Italy. Returning home still in a state of ill health he took lodgings at Stoke-Newington; and on his recovery he married his landlady, an elderly widow twenty-seven years his senior, out of gratitude for her care in nursing him. She died in 1755, about three years after the marriage, and Mr. Howard undertook a voyage to Lisbon to view the effects of the recent earthquake. The vessel in which he embarked being captured, he was consigned to a French prison. The hardships he suffered and witnessed previously to his release first roused his attention to the subject of his future researches. When he reached England he was induced to lay before the commissioners of the Sick and Hurt Office the information he had gained, and his communication was well received. In 1773 he served in the office of sheriff for the county of Bedford, when the subject of prison discipline came under his notice; and finding that many abuses existed in the management of jails, he resolved to devote his time to the investigation of the means of correcting them. With this view he visited most of the English county jails and houses of correction, and in March, 1774, he laid the result of his inquiries before the House of Commons, for which he received a vote of thanks. In 1775 and 1776 he visited many of the continental prisons, as well as those of Scotland and Ireland; and the substance of his investigations appeared in a work he published in 1777, entitled the State of the Prisons in England and Wales, with Preliminary Observations, and an Account of some Foreign Prisons (4to). In 1778 he repeated his visit to the Continent, and extended his tour into Italy In 1781 and 1782 he made a tour through the northern parts of Europe, including Denmark, Sweden, Russia

and Poland. In 1783 he visited Spain and Portugal, and again surveyed the prisons of his own country. At the same time was published a complete edition of his State of the Prisons, with all the supplementary matter.

A new subject now engaged his attention, namely, the management of lazarettos, and the means of preventing the communication of the plague and other contagious diseases. In order to obtain accurate information he went to Smyrna, where he knew that the plague prevailed, for the purpose of proceeding to Venice with a foul bill of health, that he might be subjected to all the regulations of quarantine in the lazaretto, and thus become experimentally acquainted with them. In 1789 he published an Account of the Principal Lazarettos in Europe, with various papers relative to the Plague, together with farther Observations on some Foreign Prisons and Hospitals, with additional Remarks on the Present State of those of Great Britain and Ireland (4to). At the end of this work he announced an intention of revisiting Russia and European Turkey, and extending his travels into Asia. In pursuance of this plan he set off from London in the summer of 1789, and proceeded through Germany to St. Petersburg and Moscow. Prisons and hospitals were everywhere thrown open for his inspection as a friendly monitor and public benefactor. He had taken up his residence at Cherson, in the south of Russia, where a malignant fever prevailed, and having visited a patient labouring under the contagious disease, he received the infection, and died, Jan. 20, 1790. He was interred in the vicinity of Cherson, and every respect was shown to his memory by the Russian authorities. A cenotaph is erected in St. Paul's cathedral, exhibiting his statue in a Roman garb, executed by Bacon.

HOWE, Elias, an American inventor, was born in Spencer, Massachusetts, in 1819. In 1836 he began to learn the trade of a machinist, and, possessing remarkable inventive powers, he applied himself to construct a sewing-machine, of which the model was completed and the patent issued September 10, 1846. Though a patent was taken out in England the inventor realized nothing from it. After constructing a few machines in the United States, he visited England in 1847 and remained till 1849. He returned to Boston in a state of destitution, and was compelled to resume working as a common tradesman. For several years he was involved in expensive and harassing lawsuits to establish his right to reap the benefits of his own ingenuity, but in 1854 the principal infringers of his patent arranged to manufacture sewing-machines under licenses granted by him. He died at Brooklyn, 3d October, 1867. Immense numbers of the Howe sewing-machine are now manufactured, both in America and in Great Britain.

HOWE, John, a celebrated nonconformist divine, sometimes called the *Platonic Puritan*, born at Loughborough in Leicestershire, 17th May, 1630, accompanied his father to Ireland on his ejection from the church of Loughborough, in consequence of his puritanical principles, but on the breaking out of the Irish rebellion returned and settled in Lancashire. He afterwards studied both at Cambridge and Oxford, and having taken orders, was appointed minister of Great Torrington in Devonshire in 1654. Cromwell appointed him his domestic chaplain in 1656, and he took up his residence at Whitehall; but his theology appears to have been too rational for the Protector, who was offended at the freedom with which, in one of his sermons, he inveighed against the fanatical notions of divine impulses and special impressions in answer to prayer. Howe however retained his situation during the life of Cromwell, and was still in possession of it when his son Richard was deposed. On the act of uniformity in 1662 he preached privately for some time in Devonshire. In 1671 he went to Ireland as chaplain to Lord Massarene, and was permitted to preach regularly in the church of Antrim. In 1675 he succeeded Dr. Seaman as minister of a congregation in London, and was generally respected, even by those who disrelished his puritanism, for his moral worth and his great abilities both as a preacher and theological writer. In 1685 he proceeded with Lord Wharton to Holland, and was introduced to the Prince of Orange, afterwards William III. In 1686 he became one of the preachers to the English church at Utrecht, but when James II. published the 'declaration for liberty of conscience' he returned to England, and continued to officiate in London till his death in 1705. His works, generally admired for solidity, depth, and fervid eloquence, consist both of polemical and practical treatises. Several of the latter, more especially the Vanity of this Mortal Life, the Blessedness of the Righteous, the Living Temple, &c., have often been reprinted, and are still in very general circulation. His works were published in 1724, two vols. folio, with a life by Dr. Calamy the younger. More than one edition has been published since, and in 1836 his life, with an analysis of his writings, was published at London by Henry Rogers. He is unquestionably the greatest of all the Puritan divines.

HOWE, Richard, Earl Howe, a celebrated English admiral, was the second son of Emanuel Scrope, second Viscount Howe, and was born in 1725. After having received the rudiments of a liberal education at Eton, his strong predilection for the sea induced his father to place him, at the age of fourteen, in quality of a midshipman on board the *Severn*, in which ship he sailed with Anson for the Pacific, and continued going through the usual gradations of the service under that admiral till 1745, when, though only twenty years of age, he obtained the command of the *Baltimore* sloop of war, in which he took part in the siege of Fort William, during the last Jacobite rebellion. In 1756 he served in the Channel fleet. In 1758 he reduced Cherbourg, and in the same year succeeded to the title of Viscount Howe. In 1759 he defeated a French squadron under De Conflans, and for two years he occupied a seat at the board of admiralty. In 1770 he sailed as commander-in-chief to the Mediterranean with the rank of rear-admiral of the blue; and he latterly became admiral of the fleet (1796), after being vice-admiral of England. In 1776, as commander-in-chief in North America, he acted against the revolted colonists, and against D'Estaing, who commanded a superior French fleet. He returned in 1778 discontented with the government, and was not in active service till 1782, when he became commander in the Channel and was made a British peer. In this year he sailed to the relief of Gibraltar, which he effected in spite of the combined fleets of the enemy. From 1783 till 1788 he was first lord of the admiralty, and was then created Earl Howe. On the outbreak of war with France in 1793 he took the command of the British fleet, and bringing the enemy to an action on June 1, 1794, he obtained over them a decisive victory, for which he received the thanks of Parliament. The rank of general of marines, and the vacant garter, both conferred on this successful commander in the course of the next year, were the consummation of his honours. In 1797 Lord Howe exerted himself with great success to quell the mutiny among the seamen at Portsmouth. His death took place August 5, 1799, at the age of seventy-four. His name is one of the highest among the great sea-captains of Britain.

HOWEL THE GOOD, or Hywel Dda, a Cambrian prince, famous as a legislator in the tenth cen-

tary, succeeded his father, Cadell, as ruler of part of Wales about 910, and is often called King of Wales. He assembled a kind of national convention of the heads of tribes and learned clergymen and laymen, by whose co-operation a collection of laws was prepared, which are still extant, though not in the original form. Howel went to Rome in 928 and got the pope's sanction for them, and died in 950.

HOWITT, WILLIAM and MARY, two well-known names in recent English literature. William was born in Derbyshire in 1792. He showed such a precocious bias to literature that he published verses by the time that he was thirteen years old. In 1821 he married Mary Botham of Uttoxeter (born in 1799), who wrote both by herself and in conjunction with her husband. Their first conjunct work, a volume of poems, entitled The Forest Minstrel, was published in 1823, and in 1827 appeared The Desolation of Eyam. The best lines in these works are understood to have been by Mrs. Howitt, Howitt himself having no very high poetic gift. In 1871, however, he published a volume of verse with the title, The Mad War Planet and other Poems. William and Mary Howitt settled first in Staffordshire. In 1823 they made a pedestrian tour in Scotland, and then removed to Nottingham, where they resided till 1837. In 1840 they visited Germany, where they resided for three years. Howitt was in Australia from 1852 to 1854, and then with his family lived at Highgate and elsewhere. They repaired to Italy in 1870, and William Howitt died at Rome, March 3, 1879. Mary Howitt also died at Rome, Jan. 30, 1888. Results of their residence in Germany were given in The Student Life of Germany (1841), and The Rural and Domestic Life of Germany (1842), which, being translated into German, acquired a very flattering popularity. While residing at Heidelberg their attention was directed to the literature of the North, and Mrs. Howitt set herself to translate the tales of Frederika Bremer into English, while William published her Life in Dalecarlia (1845). Their most ambitious work is The Literature and Romance of the North (1852). Howitt's most charming works are those in which English history and life are treated of in connection with English scenery The earliest of the works of this class was the Book of the Seasons (1831), which acquired great popularity; Rural Life in England (1838) was also well received. Favourable examples, in addition to these, are: Visits to Remarkable Places (1840), Homes and Haunts of the British Poets (1847), The Year Book of the Country (1850), and The Northern Heights of London (1869). In conjunction with his wife he published volumes on The Ruined Abbeys and Castles of Great Britain. Other works by him are: Colonization and Christianity (1838); The Boy's Country Book (1839); Madame Dorrington of the Dene (1851); Land, Labour, and Gold in Victoria (1855); History of the Supernatural (1863).

HOWITZER, a short piece of ordnance, midway between the gun and the mortar. Howitzers and mortars fire large-capacity shell with a very curved trajectory in order to get at objects behind cover, which are protected from high-velocity guns by reason of their comparatively flat trajectory. The destructive effect of a common shell against earthworks or masonry, when burst correctly, is due more to the amount of its bursting charge than to its velocity. One heavy bursting charge can produce results greater than any number of lighter ones. These considerations lead to the use of light short pieces of comparatively large calibre, about 12 calibres in length firing long shell—even up to 4½ calibres in length—with low velocities due to small charges in the powder-chamber. The British 6-inch breech-loading mobile siege howitzer (see GUN, Pl. I.) fires a 4½-calibre forged-steel common shell, weighing 122 lbs., including a 19-lb. lyddite bursting charge, and the missile has a muzzle velocity of 777 feet per second due to 1 lb. 14 oz. cordite. On the other hand, the British 6-inch breech-loading gun has a 100-lb. shell, and a 10-lb. lyddite bursting charge with a velocity of 2500 feet per second, due to 20 lbs. of cordite. The weight of the howitzer is 30 cwts., that of the gun is 7 tons, while their lengths are 94 inches and 279 inches respectively. The Creusot 6-inch howitzer (Pl. II.) is 16 calibres long and therefore approaches to a short gun. It fires an 88-lb. shell with a muzzle velocity of 984 feet per second. The Skoda 24-centimetre 9·4-inch mortar or short howitzer (Pl. I.), 9 calibres long, fires with a charge of 5 lbs. a 281-lb. shell which has a bursting charge of 44 lbs. high explosive, or 34 lbs. charcoal powder. The maximum range is 8350 yards. The velocity is 984 feet per second. The weights of the above typical howitzers are 30, 20, and 40 cwts. respectively. A study of their data shows the points of importance aimed at in each design. With low velocities, the shells, having less chance to ricochet, penetrate deep into the surface. A 180-lb. shell, 28 inches long, filled with 26 lbs. of powder and fired at an elevation of 29° from an 8-inch rifled muzzle-loading howitzer with a bore 92 inches long, has penetrated 19 feet of clay. It is interesting to compare with such a shell, the spherical shell of the obsolete 8-inch smooth-bore mortar, weight 47 lbs., bursting charge 2 lbs. 9 ozs. only. Howitzers are inaccurate at long ranges, the bores being not long enough to rotate their shells properly, which, being of low velocity, fly so slowly that the varying air currents have more time to influence them.

HOWLER MONKEY (*Mycetes*), a genus of South American monkeys which derives its popular name from the remarkable loudness of its voice. This power of voice is owing to special features of its hyoid bone and laryngeal connections, this bone being enormously dilated so as become a huge bony chamber with thin walls. Both sexes are provided with a beard, but that of the male is larger than that of the female. Sexual differences of colour occur. The females and the young of *M. caraya* are grayish yellow; the adult male is black. The same resemblance of females and young is found in *M. seniculus*. *M. caraya* is found in Paraguay and in the western parts of Brazil. *M. seniculus* is met with in Brazil, Guiana, and Colombia. They live in trees, and are generally found in companies. See plate at APES.

HOWTH, a fishing village in Ireland, county of Dublin, extending along the north side of the Hill of Howth, 9 miles E.N.E. of Dublin. The peninsula on which the town stands, called the Hill of Howth, forms the northern inclosure of Dublin Bay, and is a very striking and remarkable object. It is about 2 miles in length by 1½ mile in breadth, and terminates towards the sea in a rocky elevation of 563 feet in height. Pop. (1891), 652.

HÖXTER, a town of Prussia, in Westphalia, in government of and 40 miles S.S.E. of Minden, on the left bank of the Weser, here crossed by a stone bridge 500 feet long. Pop. (1900), 7625.

HOY, an island of Scotland, the second largest of the Orkneys, about 14 miles long by 6 miles broad, in some parts tolerably fertile, but generally mountainous and covered with heath. It rises to the height of 1564 feet, and has sea-cliffs more than 1100 feet high. Near its south-eastern extremity is the well-known harbour of Long Hope, said to be

the finest in the Orkneys. One of the curiosities of the island is the Dwarfie Stone, a huge block of sandstone with a kind of apartment hollowed out in one end of it by iron tools, of which the marks are still visible. A lofty pillar of rock in the sea on the north-west of the island is called the Old Man of Hoy. Pop. (1891), 1320; (1901), 1216.

HOYLAND NETHER, a town of Yorkshire (W. Riding), about 6 miles south-east of Barnsley, with coal-mines, brick-works, &c. Pop. (1901), 12,464.

HUAMANGA. See GUAMANGA.

HUBER, FRANÇOIS, a Swiss naturalist, born 2nd July, 1750, at Geneva; died 22nd December, 1831, at Lausanne. He lost his sight completely, but the aid of his wife, with that of an intelligent domestic, who acted as his reader and amanuensis, enabled him to make numerous important observations on the habits of bees. In 1796 appeared, in the form of letters, his Nouvelles Observations sur les Abeilles (English translation, London, 1806), mainly a republication of his Lettres à Ch. Bonnet, 1792. In his Mémoire sur l'Influence de l'Air et de diverses Substances gazeuses dans la Germination de différentes Plantes, he relates the observations which he made in company with Sennebier. Huber was also intimately connected with Charles Bonstetten. He instructed his own son Pierre in natural science, and from him derived important aid in his studies. This son afterwards made some observations on ants, which were published under the title Essai sur l'Histoire et les Mœurs des Fourmis Indigènes (Paris, 1806), and translated into English (London, 1820).

HUBERT, ST., the Apostle of Ardennes, a saint of the Roman Catholic Church, the patron of huntsmen. The legend says that he was a son of Bertrand, duke of Guienne, at the court of Pepin d'Heristal, and a keen hunter, and that being once engaged in the chase on Good Friday, in the forest of Ardennes, a stag appeared to him having a shining crucifix between its antlers, and he heard a warning voice. He was converted, entered the church, and became a zealous disciple of Bishop Lambert, whom he succeeded as Bishop of Maestricht and Liége. He worked many miracles, and is said to have died in 727 or 730. His body, which was at first deposited in the church of St. Peter at Liége, was in 817 conveyed to the Benedictine convent of Andain, in the Ardennes, which received the name *St. Hubert's of Ardennes*. November 3rd is the day of the saint, and was formerly celebrated at many courts by a solemn chase.

HUBERTSBURG, HUBERTUSBURG, formerly a Saxon hunting seat in the circle of Leipzig, now enlarged and divided into portions used respectively as lunatic asylums for men and women, hospitals, &c. Here the Peace of Hubertsburg, which put an end to the Seven Years' War, was signed between Prussia, the emperor, and Saxony, February 15, 1763. Peace had been concluded at Paris between Great Britain, France, Spain, and Portugal, February 10, 1763. The Peace of Hubertsburg placed the Prussian monarchy among the first powers in Europe. The empress-queen Maria Theresa renounced all claims to the provinces of Silesia and Glatz, which had been ceded to Prussia by the Peace of Breslau and Berlin in 1742. Frederick II. restored to the Elector of Saxony, who was King of Poland, his electorate. The Peace of Dresden (1745), was confirmed, and the German Empire was expressly included in the Treaty of Hubertsburg.

HUC, ÉVARISTE RÉGIS, a celebrated French missionary and traveller, was born at Toulouse, 1st August, 1813. After studying theology in his native city, about 1837 he entered the order of the Lazarist Fathers, and was ordained priest in Paris in February, 1838. In 1839 he went to China as a missionary, and reached Macao about the month of August. Here for about eighteen months he prepared himself for his work in the Lazarist seminary, and then started for the interior of the empire. At Peking he perfected himself in the Chinese language. In 1844 he and Père Gabet, another Lazarist, were instructed by the vicar apostolic of Mongolia to explore the vicariate, to ascertain its extent and its missionary capabilities. Taking with them a single Chinese convert, they travelled along the Mongolian side of the great wall, their only guides being a map and a compass; and after suffering great hardships, they took up their abode for eight months in the celebrated Lamasery or Buddhist convent at Kounboun, where they applied themselves to the study of the Tibetan language. Under the escort of a Tibetan embassy on its return from Peking they reached Lhassa, 29th January, 1846. They were well received by the Grand Lama, but they had scarcely settled themselves to their self-imposed duties when Ke-shen, the Chinese resident, interposed on political grounds, and had sufficient influence to secure their expulsion from the country. In charge of an escort of Chinese soldiers they were carried first to Ching-tu-foo, and then to Canton, where they arrived in October, 1846, and in a few days they went to the Lazarist seminary at Macao. Huc remained here two or three years, and arranged his notes of travel for publication. His health having failed, he sailed for Europe in the beginning of 1849, and arrived at Toulouse, his native city, in the autumn of the same year. In 1850 he published at Paris, in two vols. 8vo, his Souvenirs d'un Voyage dans la Tartarie, le Thibet, et la Chine pendant les Années 1844, 1845, et 1846, which was translated into English by William Hazlitt the younger (London, 1852). L'Empire Chinois (two vols. 8vo, Paris, third edition, 1857) relates the adventures of the missionaries during their journey from Lhassa to Canton, and gives a general account of the manners, government, laws, and internal condition, of the Chinese Empire. In 1857 Huc published a valuable historical work on Christianity in China (Le Christianisme en Chine), which has also been translated into English (two vols. 8vo, London, 1857). During his wanderings Huc obtained much interesting information about people and places that had been previously almost unknown to Europeans, and his narratives were sometimes treated as unworthy of implicit credit, but later explorations in the same regions have fully confirmed the fidelity of his descriptions. The information conveyed may be of no great value in a scientific point of view, but it threw light on subjects then for the first time introduced to the notice of Europe. Huc died at Paris, March 26, 1860, aged forty-six.

HUDDERSFIELD, a flourishing manufacturing town, municipal, county, and parl. borough (one member), England, in Yorkshire (West Riding), 15 miles south of Bradford. It is situated on an acclivity rising gently from the Colne, and comprises about fifty principal streets, nearly all running at right angles to each other, well paved, drained, and carefully kept; houses remarkable for their uniformity, generally of a very superior description, and built of the best Yorkshire sandstone. Some of the places of worship are very handsome edifices. The other buildings of note are the town-hall, a rich classic building, the corporation offices, also a classic building, the fine Gothic market-hall, with clock-tower and spire, the infirmary (of the Doric order), the circular cloth-hall (of brick), the general railway-station, an elegant structure in the Roman Corin-

thian style, with a statue of Sir Robert Peel in front, the armoury or volunteer head-quarters, the police station, the guardians' offices, the Ramsden estate offices, the Victoria Hall of the temperance society, Huddersfield College, the technical college, a fine modern building, collegiate school, handsome banks, warehouses, &c. Huddersfield College, a higher-grade school under the school board, gives a general education in English, modern languages, classics, mathematics, natural science, economics, &c. The technical college has accommodation for 2500 students, there being both day and evening classes, and instruction being given in the handicrafts of the district as well as in the different branches of a liberal education. There are three public parks, of 21 acres, 26 acres, and 5 acres respectively. The principal manufactures carried on in the town and adjacent villages are woollens, consisting of broad and narrow cloths, serges, kerseymeres, cords, and a great variety of fancy goods, as tweeds, trouserings, mohairs, sealskins, angolas, &c. Goods are also made of silk and cotton or of certain admixtures, and there are foundries, engine-works, boiler-works, machine-works, chemical-works, dye-works, organ-works, &c. Pop. of the parl. bor. in 1891, 96,495; of mun. bor. 95,420; in 1901, 95,008.

HUDSON, a town and port, United States, in the state of and 116 miles north of New York, capital of Columbia county, on the left bank of the Hudson. It is very regularly built, all the streets, with the exception of two which follow the line of the river, intersecting each other at right angles, the main street being above 1 mile long. Its principal buildings are the court-house, surmounted by a dome; the city-hall and post-office, the academy, public libraries, &c. There are large iron-smelting works, foundries, breweries, &c. Pop. (1900), 11,699.

HUDSON, HENRY, an English naval discoverer, whose early history is unknown, but who may have been born about 1570. He sailed from London in 1607 in a small vessel for the purpose of discovering a north-east passage across the pole to the East Indies, instead of the circuitous route round the Cape of Good Hope. He had a crew of only ten men and a boy beside himself, and after proceeding beyond the 80th degree of latitude he returned to England. In a second voyage the next year he reached Nova Zembla, but could proceed no farther eastward. In 1609 he undertook a third voyage, under the patronage of the Dutch East India Company. Being unsuccessful in his attempts to find a north-east passage, he sailed for Davis' Strait, but struck the continent of America in 44° N. lat., and holding a southerly course, entered the mouth of the Hudson, which he ascended about 50 leagues in a boat. His last voyage was undertaken in 1610. He sailed on April 17, in a barque named the *Discovery*, with a crew of twenty-three men, and came within sight of Greenland, June 4. Proceeding westward, he reached, in lat. 60°, the strait bearing his name. Through this he advanced along the coast of Labrador, to which he gave the name of *Nova Britannia*, and at length entered the vast bay which is also called after him. He resolved to winter in the most southern part of it, in order that he might prosecute his discoveries farther in the following spring; and the crew drew up in a small creek, and endeavoured to sustain the severity of that dismal climate, in which attempt they endured extreme privations. Hudson, however, fitted up his shallop for further discoveries; but not being able to establish any communication with the natives, or to revictual his ship, with tears in his eyes he distributed his little remaining bread to his men, and prepared to return. Having a dissatisfied and mutinous crew, he imprudently uttered some threats of setting some of them on shore; upon which a body of them entered his cabin at night, tied his arms behind him, and put him in his own shallop at the west end of the straits, with his son John Hudson and seven of the most infirm of the crew. They were then turned adrift, and were never more heard of. A small part of the crew, after enduring incredible hardships, arrived at Plymouth in September, 1611. One of the conspirators having incautiously revealed Hudson's fate, an expedition was sent from England in quest of him, but no trace of him or of his companions was ever discovered. An account of his four voyages is contained in Purchas's Pilgrims. An excellent work, elucidative of Hudson's career and position as a discoverer, with the original documents, has been published by the Hakluyt Society (Henry Hudson, the Navigator, London, 1860).

HUDSON BAY, an extensive bay, or rather an inland sea, of North America, north of Canada, extending between lat. 51° and 64° N., and lon. 77° and 95° W.; length, north to south, about 800 miles; greatest breadth, about 600 miles; area, 400,000 square miles, including in this different gulfs, the principal of which is James' Bay on the south. Hudson Strait, a stretch of sea 460 miles long and 100 miles broad, connects it with the North Atlantic. Hudson Bay is navigable for about 4½ months in the summer (from middle of June to end of October), or perhaps longer, being more or less obstructed by drift-ice during the rest of the year. The main body of the bay is clear of islands, but Southampton and Mansfield Islands lie opposite Hudson Strait, and Agomska Island lies in James' Bay. The shores on the east are high and bold; but those on the west, especially towards the south, are low and level, and much of the land here is favourable for stock and dairy farming. Numerous rivers fall into the bay, the chief being the Nelson and Churchhill on the west. The Hudson Bay Company have several settlements and forts, especially on the west and south coasts. A railway is partly made from Winnipeg to the mouth of the Nelson, and a direct traffic route with Britain is expected to be opened up in this way. The centre of the continent could thus be reached in a shorter time than by any existing route, but for how long each year this route would be available is doubtful.

HUDSON BAY COMPANY. See FUR.

HUDSON (or NORTH), RIVER, one of the most important rivers in the United States. It rises, by two branches, in the northern part of the state of New York, among the Adirondacks. The eastern branch passes through Lake Schroon, and joins the western or main branch coming from the north-west, after a separate course of about 40 miles each. The united stream proceeds first south-east 15 miles to Hadley Falls, and then north-east 20 miles to Glen's Falls. From this point to its embouchure in New York Bay its direction is almost due south. Its whole course exceeds 350 miles. Its chief affluents are the Sacandaga and the Mohawk. The former it receives about 15 miles after its branches unite; the latter, and the more important of the two, 40 miles below Glen's Falls. The tide flows up to a little above Albany, to which, 145 miles above New York, the river is navigable for sloops and steamboats; to Hudson, 118 miles, it is navigable for the largest vessels. For a considerable part of its course, particularly at first, the banks of the Hudson are high, rocky, and precipitous; and the scenery along them is very picturesque. Much money has been expended in rendering the upper parts more navigable. The chief places on it are—New York, Jersey City, Poughkeepsie, Hudson, Albany, Troy, and Catskill.

HUÉ, the capitol of Anam, on the river Hué, which is here navigable for small craft, 10 miles from its mouth in the Gulf of Tonquin. It was fortified early in the nineteenth century in European style by French officers in the service of the King of Cochin-China. The circumference of the walls is upwards of 5 miles. The fortress is nearly square in form, and has a regular well-formed glacis, and a ditch 30 yards wide. Each angle is flanked with four bastions. On each face there are four stone arched gateways approached by stone bridges over the ditch. The internal area is laid out in wide and regular streets, crossing each other at right angles. The palace is situated within an inner strong fortification or citadel, inclosed with a double wall; and around this wall are the barracks. The fortress would require 50,000 men to garrison it against Europeans. France having acquired the protectorate of Anam, there is now a French political resident in Hué; and at Thuan-an, the port at the river mouth, there is a French garrison. Owing to the bar at its mouth the river admits only vessels of small draught. Pop. (with suburbs), estimated at 50,000.

HUE AND CRY, in English law, the pursuit of a felon or offender, with loud outcries or clamour to give an alarm. This procedure is taken by a person robbed, or otherwise injured, to pursue and get possession of the culprit's person. At common law a private person who has been robbed, or who knows that a felony is committed, is bound to raise hue and cry under pain of fine and imprisonment. The regular mode of raising hue and cry now is for the injured party to go to the nearest constable and declare the fact, and describe the offender and the way he has gone, on which the constable raises the town and searches for the offender. If he does not find him, he sends a like notice to the neighbouring towns. The term is also applied to a paper circulated by the secretary of state for the home department announcing the perpetration of offences.

HUELVA (anciently *Onoba*), a seaport town of Spain, capital of the province of same name, in Andalusia, 51 miles west by south of Seville. It has two large squares and several wide and well-built streets, but no buildings particularly deserving of notice. Its manufactures are ropes, sails, blocks, and other articles connected with ship-building, and the trade is chiefly in exporting copper pyrites, sulphur, and iron, also manganese, oranges, grapes, figs, wine, &c. Huelva is a rising port, its trade having been greatly increased by the working of the rich copper mines (especially the Tharsis and the Rio Tinto), 30 or 40 miles inland, and by the opening of the railways to these and to Seville. Over 500,000 tons of British shipping enter the port annually. Pop. 18,195.—Huelva province is mountainous in the north, where it is covered by ramifications of the Sierra Morena, but in the south is comparatively level, and is fertile. It is very rich in minerals. Area, 4122 square miles. Pop. (1900), 260,880.

HUESCA (ancient, *Osca*), a town, Spain, Arragon, capital of the province of same name, on the right bank of the Isuela, 35 miles north-east of Saragossa. It is partly surrounded by dilapidated walls, consists of several squares and spacious well-paved streets, is the see of a bishop, and has a magnificent Gothic cathedral, with some good paintings; a university, and an ancient palace of the kings of Arragon. The manufactures are soap, earthenware, bricks and tiles, &c. Pop. 10,160.—The province, bounded north by France, has an area of 5878 square miles, and a population of 244,867. It contains some summits of the Pyrenees covered with perpetual snow; in the south it possesses much fertile and comparatively level land; and throughout has extensive pastures.

HUET, Pierre Daniel, a French scholar, was born in Caen in 1630, and educated in the Jesuit's College there. Having distinguished himself by his attainments and character, he was appointed preceptor to the dauphin in conjunction with Bossuet, and he had the chief superintendence of the famous series of classics published for the use of the dauphin, and known as the Delphin editions. After the completion of his tutorship, having taken holy orders, he was made Abbot of Aulnai, and subsequently nominated Bishop of Soissons, which see he exchanged for that of Avranches. But after holding the episcopal office some time he abdicated the bishopric, contenting himself with the abbacy of Fontenai. He died January 26, 1721. He wrote books on theology, philosophy, and history, one of the most valuable being Histoire du Commerce et de la Navigation des Anciens. He also wrote memoirs of his own life in Latin.

HUGH CAPET. See Capet.

HUGLI or Hooghly, a river of Hindustan, in Bengal, the most westerly and important branch by which the Ganges enters the Bay of Bengal. It is 15 miles wide at its mouth, and is much encumbered by shoals, through which it requires great care to steer large ships. At Calcutta it is about a mile wide, and the tides are often violent and rapid, running at the rate of 7 miles per hour. During the south-west monsoons it exhibits the phenomenon called the bore. Ships drawing 26 feet ascend as far as Calcutta. Total course about 200 miles.

HUGLI, a town of Hindustan, in Bengal, on the right bank of the river of same name, 22 miles north from Calcutta, with which it is connected by rail. It contains a fine church built by the Jesuits during the Portuguese ascendency, and a government college, in which the English and oriental languages are taught. The town is said to have been founded by the Portuguese in 1537. A British factory was established here in 1676. Pop. (with Chinsura) (1901), 29,383.

HUGO, Victor Marie, a French poet and novelist, born February 26, 1802, at Besançon, where his father, then Major Hugo, was stationed in command of a brigade. His father having entered the service of Joseph Bonaparte, king of Italy, and afterwards of Spain, Victor's earlier years were partly spent in those countries. At the age of twelve he was already writing verses, and in 1823 his first novel, Han d'Islande, appeared, followed in 1825 by Bug Jargal. In 1828 a complete edition of his Odes et Ballades appeared. In these productions Hugo's anti-classical tendencies in style and treatment of his subject had been very visible, but the appearance of his drama Cromwell (1827), with its celebrated preface, gave the watchword to the anti-classical or romantic school. Cromwell was too long for representation, and it was only in 1830 that Hernani, over which the great contest between Classicists and Romanticists took place, was brought on the stage. Other dramas followed—Marion Delorme (1831), Le Roi s'amuse (1832), Lucrèce Borgia (1833), Marie Tudor (1833), Angelo (1835), Ruy Blas (1838), Les Burgraves (1843). During those years he had also published a novel, Notre Dame de Paris (1830), and several volumes of poetry, Les Feuilles d'Automne (1831), Les Chants du Crépuscule (1835), Les Voix Intérieures (1837), Les Rayons et Les Ombres (1840). The poetry of this period has a melody and grace superior perhaps to any that he afterwards wrote, but wants that deep and original sense of life which is characteristic of his later poems. During the same period he also wrote his critical essays on Mirabeau, Voltaire, and a number of articles for the Revue de Paris. In 1841, after having been four times previously rejected, he was elected a member of the

French Academy; made shortly afterwards a tour in the Rhineland, of which he wrote a brilliant and interesting account in Le Rhin, published in 1842. In 1845 he was made a peer of France by Louis Philippe. The revolution of 1848 threw Hugo into the thick of the political struggle. At first his votes were decidedly Conservative, but afterwards, whether from suspicion of Napoleon's designs or from other reasons, he became one of the chiefs of the democratic party. After the *coup d'état*, December 2, 1851, he was one of those who kept up the struggle in the streets against Napoleon to the last. He then fled to Brussels, where he published the first of his bitter satires on the founder of the Second Empire, Napoléon le Petit. In August, 1852, he went to live in Jersey, and finally settled in Guernsey. In the following year (1853) the famous volume of Les Châtiments, a wonderful mixture of satirical invective, lyrical passion, and pathos, appeared. It was in the comparative solitude and quietness of the Channel Islands that he wrote most of the great works of his later years, Les Contemplations (1856), La Légende des Siècles, 1st series (1859); Chansons des Rues et des Bois (1865), and his celebrated series of social novels, Les Misérables (1862), Les Travailleurs de la Mer (1866), and L'Homme qui Rit (1869). In 1870, after the fall of the Empire, Victor Hugo returned to Paris, where he spent the remaining years of a remarkably vigorous old age in occasional attendances at the senate, and in adding to the already long list of his literary works. Amongst these latest productions we may mention Quatre-vingt-treize (1873), L'Art d'être Grand-père (1877), L'Histoire d'un Crime (1877), Le Pape (1878), La Pitié Suprême (1879), Religions et Religion (1880), Les Quatre Vents de l'Esprit (1881), La Légende des Siècles (last series, 1883), Torquemada (1882). He died on May 22, 1885, being perhaps the greatest writer that France has yet produced, and certainly her greatest poet. But he had grave defects and limitations, the chief being an entire want of humour, a too frequent straining after effect through the abnormal and bizarre, an overweening belief in his own infallibility, and an ever-present conviction that he was a sort of sage, all of whose sayings might be regarded as priceless teachings, to be eagerly caught up by a listening world. An edition of his complete works in 40 vols. appeared at Paris in 1886. See Swinburne's Study (1886); Mabilleau's Victor Hugo (1893); Nichol's Victor Hugo, a Sketch of his Life and Work (1894); and Biré's Victor Hugo après 1852 (1894).

HUGUENOTS, a term applied to the Protestants of France in the period of the religious wars and persecutions (derived probably from the German *Eidgenossen*, confederates). In public documents they were styled *Ceux de la religion prétendue réformée* ('those of the religion claiming to be reformed'), or *Religionnaires*. The principles of Luther and Zwinglius had gained an entrance into France during the reign of Francis I. (1515–47). The doctrines of Calvin spread still more widely, although Francis endeavoured to suppress them by prohibiting Calvinistic books, and by penal laws, and, in some instances, by capital punishment. Under Henry II., the successor of Francis, these doctrines made greater progress the more violently they were persecuted. The opinions and influence of Queen Margaret of Navarre had no small share in this extension. The parties of the Bourbons and of the Guises, under the government of the weak Francis II., made use of this religious dispute in order to advance their own political ends. The Bourbons belonged to the Protestant party; and the Guises, in order to weaken, and, if possible, to destroy their rivals, continued the persecution of the heretics with fanatical fury. In every parliament there was a chamber established to examine and punish the Protestants, called by the people the *burning chamber* (*chambre ardente*, which see), because many convicted of heresy were burned. The estates of those who fled were sold, and their children who remained behind were exposed to the greatest sufferings. But probably the Protestants would not have thought of a rebellion had not a prince of the blood (in 1560) encouraged them to it by the promise of his assistance. This was Prince Louis of Condé, who gladly seized the opportunity to make himself formidable by the support of the Huguenots. It was determined that a number of the Calvinists should appear on an appointed day before the king at Blois to present a petition for the free exercise of their religion, and for the removal of the Guises; and, in case this request was denied, a chosen band of armed Protestants were to make themselves masters of the city of Blois, and compel the king to name the Prince of Condé regent of the realm. This plot was betrayed. The court left Blois, the military were summoned, and the greater number of the Protestants, who had armed themselves to carry the plan into effect, were executed or imprisoned. About 1200 expiated their offence with their lives. The Guises now desired to establish the inquisition, but instead it was ordered by the edict of Romorantin (1560) that all inquiries into the crime of heresy should be committed to the bishops, and that parliament should be prohibited from exercising any jurisdiction in matters of faith.

In the reign of the next king, Charles IX., during whose minority the queen mother, Catherine de' Medici, was at the head of the government, the contest between the parties became yet more violent, and it was only from motives of policy that the free exercise of their religion was secured to the Protestants by the queen, in order to preserve the balance between the parties, by the edict of January, 1562. The Protestants thereby gained new courage; but their adversaries, dissatisfied with this ordinance, and regardless of decency, disturbed the Huguenots in their religious services. On 1st March, 1562, a number of Protestants who had met in a barn at Vassy for worship were attacked, and many of them massacred, by the followers of the Duke of Guise. Upon this Condé hastened to Orleans, and called upon the Protestants to join him. The religious wars which followed desolated France almost to the end of the sixteenth century, and were only interrupted by occasional truces. The evils which these wars brought upon France are largely to be attributed to Catherine de' Medici. Queen Catherine, who exerted the most decided influence not only over the feeble Charles IX., but likewise over the contemptible Henry III., wished, in fact, for the extirpation of the Huguenots, but her intriguing policy induced her, much to the vexation of the opposite party, to favour the Protestants from time to time, and to grant them freedom of conscience. Both parties were therefore generally dissatisfied with the court, and followed their own leaders. A wild fanaticism seized the people. Heated with passion and religious hatred, it seemed to be their only object to acquire the superiority for their own creed by fire and sword. The French Protestants received assistance from Germany, Switzerland, and England, and, under Condé, Coligny, and other leaders, made a gallant fight for their faith, though suffering such defeats as those of Dreux, Jarnac, and Moncontour. At last Catherine tried a master-stroke of treachery—the massacre of St. Bar-

tholomew's (1572). For the events that led up to this see BARTHOLOMEW'S DAY, CATHERINE DE' MEDICI, CHARLES IX., HENRY III., and see also GUISE.

Shortly before the line of kings of the house of Valois had become extinct with Henry III., and the way was opened for the house of Bourbon, the head of which was the Protestant Henry, king of Navarre, the relations of the two parties became still more involved. The feeble king found himself compelled to unite with the King of Navarre against the common enemy, as the intrigues of the ambitious Guises, who openly aimed at the throne, had excited the people against him to such a degree that he was on the point of losing the crown. After the assassination of Henry III. the King of Navarre was obliged to maintain a severe struggle for the vacant throne; and not until he had, by the advice of Sully, embraced the Catholic religion (1593), did he enjoy quiet possession of the kingdom as Henry IV. Five years afterwards he secured to the Huguenots their civil rights by the edict of Nantes, which confirmed to them the free exercise of their religion, and gave them equal claims with the Catholics to all offices and dignities. They were also left in possession of the fortresses which had been ceded to them for their security. This edict afforded them the means of forming a kind of republic within the kingdom, and such a powerful party, which had for a long time been obliged to be distrustful of the government, could always offer to the restless nobility a rallying-point and a prospect of assistance.

Louis XIII., the weak and bigoted son of the liberal and magnanimous Henry IV., allowed himself to be influenced by his ambitious favourite De Luines, and his confessor against the Huguenots, who were able to offer a powerful resistance, as they had become very numerous in many provinces. But in the first religious war, which broke out in 1621, the Protestants lost the greatest part of their strong places through the faithlessness or cowardice of the governors. Some of these, however, and among the rest Rochelle, remained to them, when, disunited among themselves and weary of war, they concluded a peace. Rochelle enabled them to keep up a connection with England; and Richelieu, who aimed to make the royal power, which he exercised under the name of Louis, absolute, used every means to deprive the Protestants of this bulwark of their liberty, and thus destroy every remnant of a league which recalled the times when civil factions had so often weakened the royal power. Rochelle fell into the hands of Louis, after an obstinate defence in 1629; the Huguenots were obliged to surrender all their strongholds, and were thus left entirely at the mercy of the king. Freedom of conscience was indeed promised them, and Richelieu and his successor Mazarin did not disturb them in the enjoyment of it; but when Louis XIV. abandoned his voluptuous life for an affected devotion, he was led by his confessors and Madame de Maintenon to persecute the Protestants, for the purpose of bringing them back to the bosom of the true church. In 1681 he deprived them of most of their civil rights, and on the death of Colbert, who had generally opposed violent measures, he followed altogether the advice of his counsellors, who were in favour of persecution—his minister of war, Louvois, the chancellor Le Tellier, and the Jesuit La Chaise, his father confessor. Bodies of dragoons were sent into the southern provinces, where the Protestants were most numerous, to compel the unhappy inhabitants to abjure their faith. To prevent the emigration of the Protestants the frontiers were guarded with the utmost vigilance, yet more than 500,000 Huguenots fled to Switzerland, Germany, Holland, and England. Many who could not escape were obliged to renounce their faith. Lists of Protestants, who it was pretended had been converted, were sent to the king, and it was very easy for his flattering counsellors to persuade him that he had gained honour by having almost extirpated the Protestants in France. Under this erroneous supposition he revoked the Edict of Nantes, October 22, 1685. But he had still more than 500,000 Protestant subjects, and this unjust and unwise revocation robbed France of a great number of useful and rich inhabitants, whose industry, wealth, and skill found a welcome reception in foreign countries. But quiet was by no means restored in France. In the provinces between the Rhone and Garonne the Protestants were yet very numerous, and the neighbouring mountains of Cevennes afforded them shelter. There the Camisards (see CAMISARDS) maintained war for a long time, armed for the most part with clubs alone. After twenty years (1706) the government was finally obliged to come to terms with them; yet quiet was not perfectly restored. In the level country, especially at Nismes, a Protestant spirit still survived in secret; even the compassion of the Catholics was excited; and there were not wanting clergymen among the Huguenots who were kept concealed.

In the reign of Louis XV. new but less severe measures were adopted against the Protestants, and in 1746 they ventured to appear publicly in Languedoc and Dauphiny. By degrees many voices were raised in favour of religious toleration. Montesquieu led the way; but Voltaire, shocked by the unhappy fate of Jean Calas, effected still more by his Essay on Toleration in 1762. From this time Protestants were no longer disturbed, yet they did not dare to make pretensions to public offices. The revolution restored them all the civil rights, and they frequently laid out their hitherto secreted treasures in the purchase of the national domains. It was not therefore strange that at the restoration they appeared attached to the former government, which had granted them privileges that they were fearful of losing under the new. Although they did not offer any opposition to the new order of things, yet troubles took place, which were attended with bloodshed, at Nismes and the vicinity; but these were suppressed by the judicious measures of the government. The pastors of the recognized Protestant church, which includes both the Reformed and Lutherans, receive small salaries from the state; till 1872 they were not permitted to hold synods or general assemblies; all ecclesiastical affairs being managed by local consistories.

HUIA-BIRD (*Heteralocha acutirostris*), a bird of the starling family, inhabiting certain densely-wooded mountain ranges in New Zealand, and very singular from the fact that the male has a straight sharp conical bill, while the female has a long curved slender bill, quite different in appearance. Both have the plumage uniformly black, the tip of the tail white, and orange-coloured wattles at the angles of the mouth. They live chiefly on grubs, which may be found under the bark or in the substance of decaying trees, and while the male digs into the tree with repeated blows of his bill, like a woodpecker, the female inserts hers into holes and crevices less easy to open up, and draws out the larvæ within.

HULK, the name applied to old ships laid by as unfit for further sea-going service, and used as depots for coals, sailors, &c. The hulks near Woolwich consisted formerly of old ships, to which convicts were sent previously to their transportation.

HULL, KINGSTON-UPON-, a large river port, mun. and parl. borough, and city of England, and a county of itself, locally situated in the county of York (East Riding), on the north shore of the estuary

of the Humber, where it is joined by the Hull, 34 miles E.S.E. of York. It has excellent railway communication, no fewer than five railway companies running into the town. The city, which has been greatly enlarged and improved of late years, stands on a low and level tract of ground, about 20 miles from the mouth of the Humber (here about 2 miles wide), and stretches along the banks of the river, from the inundations of which it is secured by strong embankments. The houses are nearly all of brick, and are in general well built. Among the many handsome churches and chapels of the town we may mention the church of the Holy Trinity, the ancient parish church, a large cruciform structure in the florid Gothic style, with a fine tower. Among public buildings of note are the town-hall, a stately Italian edifice completed in 1866, the new exchange, of same date, also a fine building in the Italian style, the corn exchange, market-hall, post-office, the custom-house, Trinity House, dock offices, public rooms, royal institution (containing the rooms of the philosophical society, &c.), art gallery, technical schools, central library (quite a new building), Hymers college, grammar-school, railway-station and connected hotel, two theatres, the jail, royal infirmary, borough asylum, hospitals, crematorium, and dispensary. The town possesses three well-laid-out public parks. Among public monuments are a bronze equestrian statue of William III. in the market-place, a lofty fluted Doric column in memory of the philanthropist Wilberforce, who was a native of the town, and marble statues of Queen Victoria and the Prince Consort in one of the public parks. The industries of the town are rather varied. There are several ship-building yards, iron-foundries, machine-shops, and steam flour-mills; the other principal branches of industry comprehend seed-crushing, colour-making, paper-making, canvas, rope, and cable making, tobacco manufacturing, and oil boiling. Hull now ranks as the third port in the kingdom, and the extent of its ship accommodation, docks, quays, &c., is commensurate with this eminent position. The docks, basins, timber-ponds, &c., constructed successively since 1775 by the Hull Dock Company, have a total area of about 136 acres; and since 1880 the Hull, Barnsley, and West Riding Railway and Dock Company have also constructed docks. The docks are surrounded by broad quays and large warehouses, and are crowded with vessels from all parts of the world. There are also large graving-docks. The principal exports are machinery, coal, metal goods, and woollen and cotton goods, the total value in 1903 being £15,122,382 (besides £4,932,532 of foreign and colonial produce); imports—timber, corn, iron, wool, flax, hemp, tallow, hides, pitch, tar, rosin, bones, &c. — in 1903, £32,601,063. The vessels belonging to the port are 882 in number, with a tonnage of 241,635 tons. Hull has an extensive commerce with the Baltic, Mediterranean, America, &c., besides a large coasting trade. The government of Hull is vested in 16 aldermen and 48 councillors. The name of Kingston-upon-Hull was given to it by Edward I., who erected a fortress, and constituted it a chartered town and port. When Edward III. invaded France in 1359 Hull contributed 16 ships and 470 mariners. In the reign of Charles I. Hull was the first place to close its gates against the king, who shortly after besieged it, but without success. The town was afterwards besieged by the Marquis of Newcastle, and successfully defended by Lord Fairfax. At the close of the reign of James II., the town, fort, and garrison being in the hands of the Jacobite party, the place was surprised, and the Prince of Orange proclaimed king; the anniversary of which event is still kept as a holiday. Andrew Marvell was a native of the town. Hull sends three members to the House of Commons. Pop. in 1881 (mun. bor.), 154,240; (parl. bor.), 162,194; in 1891, 199,991 and 199,660; in 1901, county bor. 240,618; parl. bor. 239,876.

HULSEAN LECTURES, a series of discourses delivered annually at Cambridge, under a bequest by the Rev. John Hulse, who died in 1789, and conveyed by his will certain estates to the university, for the purpose, among others, of founding the office of a lecturer, who should each year deliver not less than four nor more than six sermons. The subject prescribed is the evidence of revealed religion, or the explanation of the most difficult texts or obscure parts of Holy Scripture. The persons eligible are Masters of Arts of the University of Cambridge. An annual prize of £40 is also directed by the same bequest to be given for the best dissertation on the Evidences of Christianity. Certain modifications of the regulations regarding both the Hulsean Lectures and prize were made in 1860. The Bampton Lectures are a similar course delivered annually at Oxford.

HUMANITARIANS, a term sometimes applied to the various classes of anti-Trinitarians, who regard Christ as a mere man. The earliest known author of the purely Humanitarian theory is Theodotus of Byzantium, who lived in the second century. A contemporary of his, Artemon, taught the same doctrine, and asserted that such had been the universal belief of Christians up till the beginning of the third century. These opinions must not be confounded with Arianism, which admits the pre-existence of Christ, and his pre-eminence among God's creatures.

HUMANITIES (Latin, *studia humaniora*, or *literæ humaniores*), a term used in European schools and colleges to signify polite literature, or grammar, rhetoric, and poetry, including the study of the ancient classics, in opposition to philosophy and science. It is sometimes used in a narrower sense for classical literature, and in the Scotch universities *humanity* signifies the Latin language and literature alone.

HUMBER, a large river, or rather estuary, on the east side of England, between the counties of York and Lincoln. At its western extremity it is joined by the Ouse, after the latter has been augmented by the Derwent and Aire; below Goole it receives the Don, lower down the Trent, and still lower the Hull from the opposite side. Its whole length, from the confluence of the Ouse to Spurn Head, on the North Sea, is about 35 miles; average breadth, 2 to 3 miles, expanding, however, towards its eastern extremity to 5 or 6 miles. Its general direction, from its western end to Hull, which is nearly in the centre of its length, is east by north, thence to Spurn Head south-south-east. The basin of the Humber comprises an area of 1178 square miles, or, including those of the Ouse and Trent, 9550 square miles. Hull is the principal port, and next to it are Goole and Grimsby. At Hull, spring-tides rise about 22 feet, and neaps about 13 feet; and as there is at all times a considerable depth of water in the fair-way of the channel, that port is accessible by very large vessels, the navigation from Spurn Head being safe and easy. Vessels drawing 15 and 17 feet may ascend to Goole, which is 22 miles farther inland. The sea has made extensive inroads on the shores of the Humber, many towns once of note on the estuary having been swept away, extensive sands, dry at low water, alone remaining in their stead.

HUMBLE-BEE. See BEE.

HUMBOLDT, FRIEDRICH HEINRICH ALEXANDER, FREIHERR VON, a distinguished traveller and naturalist, was born Sept. 14, 1769, at Berlin. His father,

whom he lost when he was not quite ten years of age, was chamberlain to the King of Prussia. He studied at the Universities of Frankfort-on-the-Oder, Berlin, and Göttingen; went to the commercial academy in Hamburg, and in 1790 travelled with G. Forster along the Rhine to Holland, France, and England. This journey gave rise to his Observations on the Basalt on the Rhine, which was published in 1793 at Brunswick. In 1791 he studied mining and botany at the mining school in Freiberg, where he enjoyed the private instructions of Werner, and the companionship of Freiesleben, Von Buch, and Andreas Del Rio. Here his acquirements, his attractive and instructive conversation, his wit, and goodness of heart gained him universal esteem and affection. In 1792 he was appointed assessor in the mining and smelting department, and soon afterwards removed to Baireuth, as overseer of the mines in Franconia. Here he introduced many improvements, among which was the establishment of the mining school at Steben; he likewise made valuable galvanic experiments, the results of which were published in Berlin, 1796, in two volumes. But in 1797 he gave up this office from a desire to travel. Owing to the disturbed state of the Continent, however, it was not easy for him to carry out his project. For some time he resided in various parts of Germany, particularly at Jena, where he became intimately acquainted with Goethe and Schiller. In 1797 he went, in company with his brother, Karl Wilhelm, a Prussian minister of state, and a gentleman named Fischer, to Paris, where he became acquainted with Aimé Bonpland, a pupil of the medical school and botanic garden in Paris. He then went to Madrid, and having obtained permission from the crown to travel through the Spanish colonies in America, he immediately sent for his friend Bonpland, and sailed with him from Corunna. They landed at Teneriffe, where they ascended to the crater of Pico, in order to analyze the atmospheric air, and to make geological observations. In July they arrived at Cumana in South America. For five years they were occupied incessantly in travelling through tracts of the earth rich in all that could interest the scientific observer, and till then never scientifically described. They explored the regions of South America watered by the Orinoco and the upper part of the Rio Negro, fully tracing the connection between the Orinoco and the Amazon; then returned to the coast and sailed for Cuba, where they remained some months. Leaving Cuba in 1801, they returned to the South American continent, sailed up the Magdalena as far as they could, pursued their route by land to Popayan and Quito, and thence as far south as Lima, crossing the Andes no fewer than five times in the course of their journey, and, besides other mountain ascents, climbing Chimborazo (23d June, 1802) to an elevation of 19,300 feet, being the highest point of the Andes then reached by man; from Lima they sailed to Guayaquil, and thence to Acapulco, on the west coast of Mexico (January, 1803). Some months were spent in examining the city of Mexico and the surrounding country, and in a visit to the United States; and in January, 1804, the travellers set sail for Europe, taking Cuba again on their way. On the 3d of August, 1804, they arrived at Bordeaux, bringing with them, as the result of their five years' labours, an immense mass of fresh knowledge in geography, geology, climatology, meteorology, botany, zoology, and every branch of natural science, as well as in ethnology and political statistics. Humboldt selected Paris as his residence, no other city offering so many aids to scientific study, or having so many distinguished savants, and remained there till March, 1805, arranging his collections and manuscripts, and experimenting with Gay-Lussac, in the laboratory of the polytechnic school, on the chemical elements of the atmosphere. He was accompanied by Gay-Lussac, who exerted a lasting influence on his chemical studies, in a visit to Rome and Naples, and also by Von Buch on his return through Switzerland to Berlin, where, after an absence of nine years, he arrived on the 16th Nov. 1805. As the condition of Germany made it impracticable to publish there his large scientific works, he was permitted by King Frederick William III., as one of the eight foreign members of the French Academy of Sciences, to remain in Paris, which was his residence, excepting brief periods of absence, from 1808 to 1827. There appeared his Voyage aux Régions équinoxiales du Nouveau Continent (three vols., with Atlas, 1809–25; German edition, six vols., Stuttgart 1825–32; new edition, edited by Hauff, four vols., 1859–60). When in 1810 his elder brother resigned the direction of educational affairs in Prussia to become ambassador at Vienna, the former post was urged upon Humboldt by Hardenberg; but he declined it, preferring his independence, especially as the publication of his astronomical, botanical, and zoological books was not far advanced. He had also already decided upon a second scientific expedition, through Upper India, the region of the Himalaya, and Thibet, in preparation for which he was diligently learning the Persian language under Sylvestre de Sacy and André de Nerciat. The political events between the Peace of Paris and the Congress of Aix-la-Chapelle gave him occasion for several excursions. He went to England in the suite of the King of Prussia in 1814; again in company with Arago, when his brother was appointed ambassador to London; and again in 1818 with Valenciennes from Paris to London, and from London to Aix-la-Chapelle, where the king and Hardenberg wished to have him near them during the congress. He also accompanied the king to the Congress of Verona, and thence to Rome and Naples; and in 1827, at the solicitation of the monarch, gave up his residence in Paris, and returned by way of London and Hamburg to Berlin, where on the following winter he delivered a series of public lectures on the cosmos. Under the patronage of the Czar Nicholas he undertook in 1829 an expedition to Northern Asia, to explore the Ural and Altai Mountains, the Chinese Dsoungaria, and the Caspian Sea. In this expedition he was accompanied by Ehrenberg and Gustav Rose. Their course lay through Moscow, Kazan, and the ruins of Old Bulghari to Ekaterinburg, the gold mines of the Ural, the platinum mines of Nijni Taghilsk, Bogoslovsk, Verhoturye, and Tobolsk, to Barnaul, Schlangenberg, and Ustkamengorsk, in the Altai region, and thence to the Chinese frontier. From the snow-covered Altai Mountains the travellers turned towards the southern part of the Ural range, and traversed the great steppe of Ischim, passed through Petropavlovsk, Omsk, Miask, the salt lake of Ilmen, Zlatousk, Taganay, Orenburg, Uralsk (the principal seat of the Uralian Cossacks), Saratov Dubovka, Tzaritzin, and the beautiful Moravian settlement of Sarepta, to Astrakhan and the Caspian Sea. They visited the Kalmuck chief Sered Jaab, and returned by Voronesh, Tula, and Moscow. The entire journey of over 10,000 miles was made in nine months; its results are given in Rose's Mineralogisch-geognostische Reise nach dem Ural, Altai und dem Kaspischen Meere (two vols. Berlin, 1837–42); and in Humboldt's Asie Centrale, Recherches sur les Chaines de Montagnes et la Climatologie comparée. It extended the knowledge of telluric magnetism, since in consequence of it the Russian Imperial Academy established a series of magnetic and meteorological stations from St. Petersburg to Pekin, which

was followed, on Humboldt's application to the Duke of Sussex, by the establishment of similar stations in the southern hemisphere by the British government. The convulsions of 1830 gave a more political direction to Humboldt's activity for several years. On the news of the French revolution, and the accession of Louis Philippe, he was selected, partly on account of his long intimacy with the house of Orleans, to convey to Paris the Prussian recognition of the new monarch, and to send political advices to Berlin. The latter office fell to him again in 1834–35, and he was called upon to fulfil it five times in the twelve following years, residing four or five months in Paris on each mission. To this period belongs the publication of his Examen critique de la Géographie du Nouveau Continent (five vols. Paris, 1835–38). He accompanied the King of Prussia in visits to Denmark, England, &c. (1841–45), and resided for several months in Paris in 1847–48, from which time he lived in Prussia, usually in Berlin, occupying a high position at the court until his death, 6th May, 1859. His last great work, Cosmos (four vols. Stuttgart, 1845–58), has been unanimously recognized as one of the most valuable contributions to science ever published. It explains the physical universe according to its dependencies and relations, grasps nature as a whole, moved and animated by internal forces, and by a comprehensive description shows the unity which prevails amid its variety. It has been translated into all languages in which a book of science is required, and has been without an equal in giving an impulse to natural studies. His Travels, Cosmos, and Views of Nature form nine vols. in Bohn's Scientific Library. See Bruhns' Alexander von Humboldt, Eine Wissenschaftliche Biographie (Eng. trans., 1873).

HUMBOLDT, KARL WILHELM, FREIHERR VON, brother of the preceding, was born at Potsdam in 1767, and, after a very careful education, studied law at Berlin, at Frankfort-on-the-Oder, and at Göttingen, and at the same time devoted equal attention to antiquities, æsthetics, and the philosophy of Kant. After returning from a tour through the west of Germany and Switzerland, he formed an intimate friendship with Forster and F. H. Jacobi. In 1789–90 he lived in Erfurt and Weimar, where a friendship commenced with Schiller, continued without interruption till the poet's death. In 1791 he married Caroline von Dacheröden, and lived for some time chiefly on her Thuringian estates, and afterwards in Jena, associating intimately with Schiller, and devoting himself to literary and scientific pursuits. A valuable memorial of his friendship with Schiller is the correspondence between them (Briefwechsel Zwischen Schiller und Wilhelm von Humboldt, Stuttgart and Tübingen, 1830) published by him after Schiller's death. After making numerous travels he lived from 1797–99 in Paris, and then resided for some time in Spain, from which he returned with rich literary collections. In 1801, at the request of the Prussian government, he accepted the situation of ministerial resident at Rome. From 1806–1808 he was here minister plenipotentiary, but, having little diplomatic business to discharge, divided his time between study and the liberal patronage of young students and artists. Having been called from Rome to fill the office of minister of the interior in connection with ecclesiastical and educational matters, he had a most important share in the educational progress which Prussia has since made; more especially is the erection of the Berlin University to be ascribed to him. He, however, exchanged this situation in 1810 for that of extraordinary ambassador and minister plenipotentiary to Vienna. Since this time Wilhelm Humboldt's name is closely interwoven with the most important events in the recent history of Prussia and Germany. He took an active part during the armistice of 1813 in the peace congress at Prague; in 1814 at the Congress of Chatillon, and the conclusion of the first Paris peace; in 1815 at the Congress of Vienna; and in 1816 at Frankfort-on-the-Main, in all matters connected with the German diet. He was afterwards appointed ambassador to London, and in 1818 attended the Congress of Aix-la-Chapelle. In 1819 he was an active member of the Prussian ministry, but gave in his resignation the same year, because in favour of a freer and more constitutional system than the Hardenberg ministry was disposed to follow. After 1819 he lived almost without interruption on his estate at Tegel, where, though freed from public functions, he continued his active habits of business and study till his death in 1835. His collected works, published at Berlin (seven vols. 1841–52), include poems, essays on subjects of taste, and in particular numerous valuable disquisitions in regard to the origin and progress of language.

HUME, DAVID, an eminent historian and philosopher, was born at Edinburgh on the 26th April, 1711. His father was a descendant of the noble family of Home, and the proprietor of the estate of Ninewells in Berwickshire, but not opulent, and the subject of this article being his youngest son, his fortune was very small. Losing his father in his infancy, he was brought up under the care of his mother, a woman of singular merit, daughter to Sir David Falconer, a judge of the Court of Session under the designation of Lord Newton. He was destined by his family for the law; but his passion for literature was so strong, that he could not confine himself to professional studies, and, as he observes in his memoirs, while his family fancied him to be poring over Voet and Vinnius, he was occupied with Cicero and Vergil. In 1734 he visited Bristol, with recommendations to some eminent merchants; but he was as little disposed to commerce as to law, and resolved to retire to some provincial town of France, with the intention of prosecuting his literary pursuits in privacy, and of supplying, by economy, his pecuniary deficiencies. He passed three years in France in a manner very accordant with his own inclinations. In 1737 he went to London, and the next year published his Treatise upon Human Nature, the entire neglect of which work proved a severe mortification. In 1741 and 1742 he published at Edinburgh his Essays Moral and Political, which, owing to their more popular form and elegance of style, were very favourably received. In 1745 he became companion or guardian to the imbecile young Marquis of Annandale. He remained in this situation for a year, and then stood candidate for the professorship of moral philosophy at Edinburgh; but, although strongly supported, he was excluded by the negative of the presbytery, owing to his known scepticism; and he was equally unsuccessful in obtaining the chair of logic in Glasgow. In 1746 he accompanied General St. Clair as his secretary, in an expedition designed against Canada, but which ended in an attack upon the French coast; and in 1747 attended the same officer in a military embassy to the courts of Vienna and Turin. Having been led to imagine that the neglect of his Treatise upon Human Nature originated from its too dry and systematic form, he cast the first part of the work anew, and caused it to be published while he was abroad, with the title of an Inquiry Concerning the Human Understanding. It, however attracted very little more notice than at first, and on his return the author retired to Scotland, where he resided two years. In 1751 he repaired to the metropolis, where, in the next year, he published his Political Discourses, which were at once well received In this little work he announced those principles o

political economy, comprehending the doctrine of free trade, which it fell to his friend Adam Smith more fully and comprehensively to develop. Nearly about the same time appeared his Inquiry concerning the Principles of Morals—a work that he himself deems 'incomparably his best,' but which met with but little attention. In 1752 he obtained the appointment of librarian to the faculty of Advocates at Edinburgh, which, by affording him the command of a large and curious collection of books, seems to have inspired him with the idea of becoming a historian. The History of England under the House of Stuart, of which a quarto volume appeared in 1754, to use his own language, was received 'with one cry of reproach, disapprobation, and even detestation.' He attributes this reception to his favourable treatment of Charles I. and Lord Strafford, but it was much more owing to his equally contemptuous mention of the opposing religious parties. The work was not only decried, but neglected; and had not a war broken out between the two countries, the author would have again retired to France. His constitutional equanimity, however, gradually prevailed, and he resolved to proceed in his task; in the meantime he published his Natural History of Religion, and other pieces, the first of which was answered by Warburton, in the name of Dr. Hurd. In 1756 he published the second volume of his history, which embraced the period from Charles II. to the Revolution, and was comparatively well received. He now resolved to take a wider range, and in 1759 published his History of the House of Tudor, which excited almost as much clamour against him as his first volume. His reputation as a historian, however, gradually increased, and he was encouraged to complete his work from the earliest period, which he accomplished, in two additional volumes, in 1761; and his History of England became thenceforth a standard book. Although free from the narrow partialities and prejudices which so frequently influence national historians, and enlarged and philosophical in his general views of events and characters, his researches into the origin and progress of the English constitution are wanting both in depth and accuracy. He has too sweepingly regarded the liberty of the country as of modern date, and the mere result of concessions from the sovereign, and has sometimes even coloured facts to support that conclusion. His predilection for the house of Stuart has also made him somewhat unfair to that of Tudor, and still more to the real patriotism of the motives of many of those who sought to curb the high pretensions and baleful extent of prerogative so imprudently claimed by that unhappy family. With every abatement, however, his reputation stands high, and, aided by his clear style,—which, although sometimes incorrect and exhibiting Gallicisms, is frequently eloquent, and always agreeable,—will probably remain so. The copy money received for his History, added to a considerable pension obtained from the crown by the interest of Lord Bute, finally secured him independence, and he was about to retire from his native country when he was invited by the Earl of Hertford, then proceeding as ambassador to Paris, to attend him, with a view of ultimately becoming the secretary of the embassy. He accordingly accompanied that nobleman to France, and received the expected appointment. He was also farther gratified by a most enthusiastic reception in the Parisian circles, in his character of historian and philosopher. He remained *chargé d'affaires* after the departure of Lord Hertford in 1765, and returned to England in 1766 accompanied by Jean Jacques Rousseau, to whom he behaved with a delicacy and generosity which that eccentric person repaid with his usual ingratitude and suspicion. Mr. Hume, in 1767, became under secretary of state under General Conway, which post he held until the resignation of that minister in 1768. He then finally retired to Edinburgh; and having by this time realized a thousand per annum, he drew round him a chosen set of suitable associates, among whom he lived, generally admired and respected. He died August 25, 1776. Dr. Adam Smith depicts him as charitable, generous, urbane, and possessed of a degree of gaiety and good humour which is seldom attendant on students so persevering as Mr. Hume. This temper even evinced itself on his death-bed, and it will be as difficult to deny the high personal moral claims of this writer, favoured as he was with the rare talent of self-command, as the vigour and acuteness of his intellect. A new edition of his Treatise on Human Nature, and his Essays, Moral, Political, and Literary (each in two vols.), was published in 1874, edited by T. H. Green and T. H. Grose.

HUME, Joseph, one of the most earnest, persevering, and successful of modern reformers, was born at Montrose in January, 1777. His father was the master of a small coaster, and his mother, early left a widow with a large family, took up a crockery shop, which enabled her, by the exercise of a rigid economy, to maintain and educate them. Joseph, after such schooling as his native place then afforded, was apprenticed at the age of thirteen to a surgeon and druggist, with whom he remained for three years, and then went to Edinburgh as a medical student. Having completed his studies, he was, in 1797, appointed marine assistant-surgeon in the service of the East India Company, and was soon on the fair way to fortune. The number of influential passengers with whom his official position brought him into friendly contact supplied him with patrons able and willing to advance his interests, and he was not the man to allow the prospect which thus opened to remain unimproved. Having qualified himself by a diligent study of the native languages for any situation that might offer, he is found, during the Mahratta war, filling the office of Persian interpreter in the army under Lord Lake. At the same time, while performing medical duties, he held several lucrative posts connected with the pay-office, prize agencies, and the commissariat. The result was, that in 1808, when he had been little more than ten years in the Company's service, and was only in his thirty-fifth year, he returned to Europe with a competent fortune. Shortly afterwards he made a considerable tour, visiting Egypt, as well as most of the countries in the south of Europe. In 1812 he obtained a seat in Parliament as member for the rotten borough of Weymouth and Melcombe Regis on paying a 'consideration,' and pledging himself to give Tory votes. The honour, such as it was, proved short-lived, for a dissolution took place in the course of a few months, and his connection with the constituency, or rather with the patron of the borough, terminated. Thus excluded from Parliament, Mr. Hume laboured to become an East India director. Meanwhile other objects of a more patriotic nature engaged his attention, and he began to attract notice by the active part which he took in promoting Lancasterian schools, savings'-banks, and other measures of social reform. His canvass for the direction, though it was unsuccessful, did not exclude him from an indirect share in Indian affairs, as a holder of East India stock, and had also a most important influence on his future life, by introducing him to the acquaintance of Mr. Burnley, a wealthy proprietor, whose daughter he afterwards married. In 1818 Mr. Hume was returned to Parliament as member for the Aberdeen district of burghs, one of which was his native town. His activity

as a reformer was now unbounded, and he was constantly on the floor of the house exposing abuses, and those changes, the adoption of which, though once regarded as revolutionary, have certainly purified both the House of Commons and the government, and brought both much more into unison with the wishes and intelligence of the country. It is on the part which he took in these changes, and the devotion of his life to the advocacy of them, that Mr. Hume's fame rests. He had no skill as a public speaker, and had the good sense never to aspire to oratory. His strength lay in his figures, the accuracy of which, considering the imperfect materials from which he was obliged to derive his information, was truly astonishing, and ultimately made the most zealous and interested of his opponents chary of encountering him. The frequency of his speeches, and the quantity of verbiage by which he often obscured his statements, were trying to the patience of his hearers, and attempts were made at the outset of his career to cough him down. It would not do. He kept his ground manfully, and had his reward, all parties, even those most opposed to him in politics, admitting the value of his services, and inviting him to persevere in his crusade against corruption. In 1830, on the dissolution occasioned by the introduction of the Reform Bill, he was returned unopposed for Middlesex. At the subsequent election, in 1837, a contest ensued, which threw him out by a small majority, and he returned in the somewhat humiliating position of a nominee of Daniel O'Connell, who made him member for the county of Kilkenny. Even this seat was wrested from him by a Conservative reaction in 1841, which also prevented his success as a candidate for Leeds, so that he remained without a seat till 1842, when he renewed his parliamentary connection with his native town, which, now that Aberdeen had obtained a member for itself, was become the head of the electoral district. This seat he ever after retained. His death took place at Burnley Hall, Norfolk, on the 20th of February, 1855.

HUMMEL, John Nepomuk, one of the most eminent performers and composers of modern times, born at Presburg in 1778, received his first education from his father, who in 1785, on obtaining the situation of chapel-director at Vienna, succeeded in interesting Mozart so much in the musical talents of his son that he took him into his own house and under his own training. As early as 1788 the young Hummel made musical tours with his father through Germany, England, and Holland. In 1795 he returned to Vienna, and, particularly under Albrechtsberger and Salieri, made great progress in composition. The results of his studies were various sonatas, rondos, and trios, which, though eclipsed by later performances, still maintain their existence. As chapel-master to Prince Esterhazy he found an opportunity of trying his powers in church and dramatic music. After resigning this situation in 1811 he devoted himself chiefly to instruction and composition. In 1816, after his appointment as chapel-master at Stuttgart, he first came publicly forward as a pianist, and produced universal astonishment both by his mastery of the instrument and an almost unexampled gift of improvisation. He afterwards became chapel-master at Weimar, where, though occasionally making extensive tours, chiefly to Russia and Great Britain, he continued till his death in 1837.

HUMMING-BIRD (*Trochilus*). These beautiful birds, which may be termed the gems of animated nature, are peculiar to America, and almost exclusively tropical. They are distinguished by their long and slender bill, and attenuated and retractile tongue, which is divided into two filaments from the middle to the tip, and sometimes set with recurved spines. They feed on honey, though they are also insectivorous. Their flight is extremely rapid, and whilst feeding they remain poised in the air by means of the horizontal motion of their wings, which produces a humming noise, whence their common name is derived. The genus *Trochilus* is very extensive. Only one species is found in the north-east part of the United States, the *T. colubris*, belonging to the subgenus *Trochilinæ*, or those having straight bills. This well known and splendid little bird arrives in Pennsylvania towards the end of April, and begins to build its nest early in May. This is usually fixed on the upper side of a horizontal branch, seldom above 10 feet from the ground. It is hemispherical, and about 1 inch in diameter, lined with vegetable down, and covered externally with lichen. The female lays two eggs of a white colour. The humming-bird is very fond of tubular flowers, particularly those of the trumpet vine. When he alights he always prefers the small dead twigs of a tree or bush, where he dresses and arranges his plumage with great dexterity. His only note is a single chirp, not louder than that of a cricket. The humming-bird is very irascible, two males scarcely ever meeting without a contest ensuing. They will also attack birds of a much larger size, as wrens or king-birds, and sometimes have contests for a favourite flower with the humble-bee. From the beauty of these birds many attempts have been made to domesticate them, but unsuccessfully, though they have been kept from three to four months with attention. They are exceedingly susceptible of cold, and droop and die when deprived of the animating influence of the sun's rays. There is every reason to believe that insects form no inconsiderable portion of their food. They begin to retire south in September, and in November take refuge for the winter in Florida. The common humming-bird is 3½ inches in length and 4¼ in extent. The whole back, upper part of the neck, sides under the wings, tail coverts, and two middle feathers of the tail, are of a rich golden green; the tail is forked, and, as well as the wings, of a deep brownish purple; the bill and eyes black; but what constitutes their chief ornament is the splendour of the feathers of the throat, which, when viewed in a proper light, rival the ruby in brilliancy. These feathers are of singular strength and texture, lying close together like scales, and varying, when moved before the eye, from a deep black to a fiery crimson and burning orange. The female is destitute of them. The young males begin to acquire them in September. The family *Trochilidæ* has been divided into several groups, not all of which, however, are equally distinguished by brilliancy of colouring; in some the beauty of ornament is confined to the males. These birds are, on the whole, intellectually low; their eye is dull, and their movements are not regular as in the bees; for while the insect goes systematically through the flowers, the bird jerks from one to another. Even in daylight some of them seem to have difficulty in recognizing and avoiding an obstacle. Bates remarks that a species of *Phaëthornis* poised in front of his face. Several species at a distance resemble moths of the genus *Macroglossa*, and these hawk-moths thus have immunity from some of their foes, though the resemblance is itself a source of danger, since Bates shot moths till practice taught him to distinguish them. See Wilson's American Ornithology, and the Naturalist's Library, by Sir William Jardine, vols. i. and ii., Edinburgh, 1833; Lesson's Histoire Naturelle des Colibris (1830); Gould's Monograph of the Trochilidæ (5 vols., 1850–59); and Mulsant and Verreaux, Histoire Naturelle des Oiseaux-Mouches ou Colibris (4 vols., 1876).

HUMMING-BIRD HAWK-MOTH, a moth of the family Sphingidæ, *Macroglossa stellatarum*, one of the most beautiful of the diurnal species of moths. It is remarkable for the loudness of the sound which it produces by means of its wings. When feeding, it inserts its long proboscis into the narrowest tubular flowers. See preceding article.

HUMUS, a substance which occurs in vegetable mould, and in liquids containing decomposing vegetable matter. On boiling sugar for some time in dilute acid, dark-brown or black scales separate, which, when washed with water, dissolve partially in ammonia, leaving an insoluble body called *humin* or *ulmin*. Peaty soil yields an amorphous substance called *humic acid*; when this is present in a soil to a moderate amount it increases its heat-absorbing power, and it also enables a sandy soil to retain a larger amount of water than it would otherwise do.

HUNDRED, in England, a division of a shire or county. It was so called, according to some writers, because each hundred found 100 sureties of the king's peace, or 100 able-bodied men of war. Others think it to have been so called because originally composed of 100 families. Hundreds are said to have been first introduced into England by Alfred. They seem to have previously existed in Denmark; and in France a regulation of this sort was made above 200 years before with a view of obliging each district to answer for the robberies committed in it. Something like this institution may be traced back to the ancient Germans, from whom were derived the Franks, who became masters of Gaul, and the Saxons, who settled in England. Formerly, if a crime was committed, such as robbery, arson, killing or maiming cattle, destroying turnpikes, &c., the hundred had to make it good; but by 7 and 8 Geo. IV. cap. xxvii. hundreds are now only liable for damage done by rioters acting feloniously. A plaintiff cannot proceed by action unless his loss exceeds £30, and he or his servant must within seven days go before a justice and state on oath the names of the offenders, and engage to prosecute them.

HUNDRED DAYS (French, *Cent-jours*), a name often applied to the period between March 20, 1815, when Napoleon arrived at Paris after escaping from Elba, and June 28, 1815, the date of the restoration of the Bourbons. The phrase is said to owe its origin to the prefect of Paris, who welcomed back Louis XVIII.

HUNDRED YEARS' WAR, the ordinary name for the prolonged struggle between France and England which began in 1337 and ended in 1453. Among the chief of the immediate causes of the war was Edward III.'s claim to the French throne, but the keen rivalry of the two nations rendered conflict inevitable. It lasted during the reigns of five English kings, from Edward III. to Henry VI., and of five French kings, from Philip VI. to Charles VII. Four periods may be distinguished with fair precision, namely (1) 1337–64, marked by the triumph of the English arms; (2) 1364–80, in which France recovers much lost ground under Charles V.; (3) 1380–1429, a time of fresh disaster to the French; and (4) 1429–53, ending in the expulsion of the English from France.

HUNGARY (Hungarian, *Magyar-Ország*, Land of the Magyars), a kingdom in the south-east of Europe, forming, together with Austria, the Austro-Hungarian monarchy. It includes, in its most extensive acceptation, Hungary Proper, Transylvania on the east, Slavonia and Austrian Croatia on its south-western sides, extending in this direction so far as to comprise a strip of coast on the Adriatic Sea, together with the former Military Frontiers, a long strip of territory on the southern borders; total area, 125,039 square miles, with a population (1900) of 19,203,531. The capital is Budapest. But in a more restricted sense Hungary proper is limited to the territory encircled from the east round the north to the north-west by the Carpathian Mountains; bounded west by the river March and some offsets of the Noric Alps; south-west by the Drave; south and south-east by the Danube and the Transylvanian Alps (a continuation of the Carpathian range); with an area of 86,471 square miles, and a population of 16,653,332. Hungary Proper may be considered as a large basin surrounded by mountains on every side except the south; but even there the natural boundaries of this geographical basin are completed at no great distance from the frontier by the highlands of Croatia, Bosnia, and Servia, that meet those of Walachia and Transylvania at the 'Iron Gate', a pass formed by the abrupt divisions of the mountains on either side of the Danube, which there forms a celebrated rapid. From that point the Carpathians proceed at first east, but afterwards successively north-west and south-west, receiving in their course the various names of the Czerkat, Karpfen, Freistadt, Tatra, Neutra, Jablunka, &c., ranges. Several of their summits rise to between 8000 and 9000 feet above the sea. A third part of the whole extent of Hungary is covered with their ramifications; and amongst these are the Matra and Hegyallya ranges, on the sides of which latter are the vineyards yielding the far-famed Tokay wine. The Carpathians are richly wooded in many parts, their branches are interspersed with numerous romantic and fertile valleys, and contain many productive mines. A range of mountains also separates Hungary from Transylvania. On the west the Leitha Mountains, a spur of the Alps separating Hungary from Styria and Austria, progressively decline towards the Danube. The Bakonywald (Bakony Forest), another Alpine spur, upwards of 2000 feet in height, and clothed with dense forests of oak, beech, and other trees, intersects the south-west region of Hungary in a north-east direction to near Waitzen, where the Danube bends south, and with the Matra Mountains, beyond that river, divides Central Hungary into a greater and a smaller plain, respectively about 21,000 and 4000 square miles in extent. The Danube and Theiss rivers traverse the south half of the country in parallel streams about 60 miles apart, the former previously flowing from the west, and the latter from the east or north-east to near the latitude of the capital. Near Eszek, in Slavonia, the Danube, met by the Drave, turns suddenly again to the east, and forms all the rest of the south frontier of Hungary, receiving in this part of its course the Theiss and several minor affluents. The March, Waag, Neutra, Gran, and Ipoli, in Upper Hungary, flow to the Danube from the north; the Bodrog, Schajo, Hernad, and Zagyva, flowing from the same direction, unite with the Theiss; and the Szamos, Körös, Maros, &c., join that river from the east. The Poprad, in the north, flows into Galicia, and is tributary to the Vistula, it being the only Hungarian river not belonging to the basin of the Danube. The Drave forms the south-west frontier on the side of Croatia and Slavonia, and is joined in Hungary by the Mur from Styria. Excepting these two, the Raab, which joins the Danube near the town of its name, is the only river of much magnitude in the south-west quarter of the country; but in that division of Hungary are its two principal lakes, on either side of the Bakonywald—Balaton, in the great plain, and the Neusiedler-See (Hungarian, *Fertö Tava*), close to the border of Austria, and having on its banks the palaces and chief possessions of the

Esterhazy family. Lake Balaton is nearly 50 miles in length by 10 miles in breadth; the Neusiedler-See is about the same breadth, but only about half as long as the other lake. The water has several times disappeared from the Neusiedler-See. The last occasion was between 1865 and 1870, when its bed was cultivated. In the Carpathians are several smaller lakes, between 4000 and 5000 feet above the sea. Between Pressburg, and Comorn, and Raab the Danube divides into branches inclosing the Great and Little Schütt, two islands of considerable size and high fertility. Numerous other islands are formed by it and by the Theiss in the great plain; and along both of these rivers, in the lower part of their course, are extensive marshes and swamps, especially along the Theiss. The total area of the morasses in Hungary has been estimated at 1,500,000 acres, or upwards of 2300 square miles; within the nineteenth century enough marsh-land was drained to furnish subsistence for 500,000 inhabitants. Mineral springs are numerous; the most celebrated are those which form the baths of Mehadia in the Banat.

The situation of Hungary, and particularly the nature of its surface, render it one of the healthiest countries in Europe. Protected from the north winds by high mountains it is open to the mild sea-breezes from the south, which are tempered by the great bodies of water. It is also owing to the variety of its surface that Hungary possesses so great a diversity of climate, which, combined with the fertility of the soil, abundantly supplies her with all the natural productions necessary for the comfort of man. All kinds of corn, a sort of maize, rice, kitchen vegetables, and garden plants of every description, melons (which are cultivated in open fields), Turkish pepper, fruits (particularly plums, for the sake of the brandy prepared from them, called *Slivoritza*), wines of different kinds, wood, gall-nuts, potash, tobacco, hemp, flax, hops, saffron, woad, madder, sumach, cotton, and rhubarb are among the products of Hungary. Horses, cattle, sheep, hogs, game (in the north bears), poultry, fish (amongst which the sturgeon and salmon, *Salmo dantex*, are the principal), bees, and silkworms are among the productions of the animal kingdom. Among the minerals are gold, silver, copper, iron, lead, zinc, cobalt, antimony, sulphur, arsenic, salt, soda, saltpetre, alum, vitriol, marble, coals, peat; amongst the precious stones the opal and chalcedony are remarkably beautiful.

Hungary, including Transylvania, used to yield nearly a half of all the gold annually obtained in Europe. Its principal localities are Kremnitz, Chemnitz, and other places in the north, and Nagy Banya on the Transylvanian frontiers. Silver is found in independent localities, though more frequently in connection with the gold. They are sometimes found pure, but generally in combination with copper.

The great number of distinct races with entirely different habits which is found in Hungary is remarkable. The Magyars, however, are by far the predominating race, and their relative importance is increasing. According to the census of 1900 on the basis of language, the races inhabiting Hungary proper were divided as follows:—

Magyars	8,588,834
Germans	1,980,423
Roumanians	2,784,726
Slovacks, Bohemians, Moravians	1,991,402
Ruthenians	423,159
Servians	434,641
Croats	188,552
Others	329,837
Total	16,721,574

As regards religion there were 8,198,497 Roman Catholics in the monarchy, 3,685,092 Protestants, and 2,199,195 of the Greek Church, besides 1,841,272 Greek Catholics. The Magyars, who are the dominant race, are located for the most part in the centre of the kingdom. They are high-spirited, brave, and warlike, generous to profusion, and, according to travellers, more sincere than their Servian and Walachian neighbours; impatience of control, pride, indolence, and ignorance are their besetting faults. Their general deportment is serious; and in many respects they resemble the Turks, who followed them out of Asia, and belong to the same great family of mankind. The Magyar costume is remarkable for its picturesque elegance. Most of the Hungarian nobles are Magyars; and it is by this section of the population that the constitutional form of government and municipal institutions have been mainly, if not wholly, upheld. The Slovacks are amongst the people apparently the earliest settled in Hungary; they inhabit the north-west, and are similar in race, customs, and language to the adjacent Moravians, to whose extensive empire they belonged before the Magyar conquest. They are mostly Roman Catholics, but number also upwards of 500,000 Protestants, chiefly Lutherans. The Ruthenians or Rusniaks dwell beneath the North and North-eastern Carpathians; they are nearly all of the Greek United Church. The Roumanians (Walachians) occupy a tolerably wide tract of country on both sides of the west and north boundaries of Transylvania; like the Rusniaks they chiefly profess the Greek form of religion. They are far behind the Slovacks, and, indeed, nearly all the other nations of Hungary, in education and civilization. They appear to be the descendants of Italian colonists, placed in Dacia during the Roman dominion there, and have been accordingly called *Daco-Romans*—an epithet to which their classic features, easy manners, language, and antique costume seem to give them a claim. They call themselves *Romouni;* and speak a dialect of Latin, but they write it with the Cyrillian or Russian character. In this last particular they unite with their Servian neighbours inhabiting the Banat on their south-west. The Croats people nearly all Slavonia and Croatia, and stretch into seven of the counties of Hungary Proper as far as the county of Pesth; they are nearly all Roman or Greek Catholics. The Wends (Vandals) inhabit two counties in the west; the Bulgarians the town of Theresianopel, and a few other parts of the Banat; the Montenegrins a part of the county Temes; and the Armenians portions of three of the eastern counties. The Germans appear, in the first instance, to have emigrated into the country during or before the seventh century, subsequently to which many successive immigrations took place, especially under Geyza, king of Hungary, who ascended the throne A.D. 1141, and who established large numbers of German colonists from Franconia, Thuringia, and Alsace in several of the northern counties, and in Transylvania. They speedily became dispersed in detached settlements over all Hungary; and early in the thirteenth century Pesth was described as a 'large and rich German town.' In the 18th century other Teutonic immigrants, with some French refugees, settled in the kingdom. The Germans are marked by their industry and thrifty condition, but also, it is said, by their litigious and avaricious propensities. They people the greater part of the western frontier, from Pressburg and around the shores of Lake Neusiedler south nearly to the limit of Croatia; elsewhere they are most numerous in the county of Zips, the mining districts, the Banat, and especially in the towns, where they compose the bulk of the trading population. About

360,000 of these are Roman Catholics, and 180,000 Lutherans.

The Hungarian has a natural inclination to agriculture and the breeding of cattle. Both are, however, still in a backward state, though making rapid advances. But the inexhaustible fertility of nature supplies every deficiency of industry and skill, and Hungary is now one of the chief corn-growing countries of Europe, much wheat and flour being exported. Hungarian wheat is well known for its excellent quality. Many improvements are made by individual proprietors, and Hungary may justly boast of a large number of technical institutes in which students are thoroughly trained in agriculture. Next to France, Hungary is the chief wine-producing country of Europe, both as regards the quantity and the variety of the product. The annual produce of Hungary and the connected territories is estimated at between 26,000,000 and 27,000,000 eimers, of about 15 gallons each. The finest variety is the Tokay, which is produced in the Hegyallya, in the county of Zemplin. Mining is not yet carried on to a great extent; but the production of coal and iron is rapidly increasing. The principal artisans are tanners, furriers, manufacturers of *tschism* (cordovan boots), lace-makers, harness-makers, makers of wooden wares, of straw-plait work, &c. There are few extensive manufactures in Hungary. Iron and copper, linen, leather, alum, and saltpetre, are some of the articles of industry. There are numerous iron and steel works, some iron-foundries, tin-plate and wire works. The potteries, the glass manufactories, the sugar-refineries and beet-root sugar works, the soap-works, the tallow, stearine, and wax-candle works; the soda, saltpetre, and potash works, and the brandy distilleries, deserve to be mentioned. Trade is almost exclusively in the hands of the Germans, Greeks, and Jews. Internal commerce is promoted by the railways and rivers, the Temes and Francis canals (the former 75, the latter 60½ miles long), the fairs (which amount to 2000), and the complete absence of tolls. The railways in 1902 had a total length of 10,813 miles, 4769 miles being state lines and other 4187 worked by the state. The total length of navigable rivers and canals in the monarchy is said to be fully 3000 miles. The Danube is the most important highway of traffic, but the foreign trade by it is comparatively small. Inland navigation and roads are carefully attended to.

With regard to popular education the Hungarian provinces are somewhat behind the other provinces of the Austrian monarchy, but great advances have recently been made. Attendance in elementary schools is compulsory from the completion of the sixth year (in Croatia and Slavonia the seventh) till the completion of the twelfth, and also in continuation-schools up to the age of fifteen. Every parish or commune is also bound to maintain an infant school. The great bulk of the schools are supported by the denominations. Besides gymnasiums and real-schools there are numerous technical schools for arts and industries of all kinds. There are universities at Budapest, Klausenburg, and Agram, attended by over 6000 students. Of the 1213 periodicals issued in 1898, 893 were in the Magyar language. The inhabitants belong chiefly to the Roman Catholic Church, the Greek Catholic ('United', or acknowledging the supremacy of the pope), the Greek Non-united or Orthodox Church, and the Lutheran and Calvinistic confessions. The Roman Catholic clergy are powerful by reason of their large landed property, and the influence they possess over the appointments to many offices. There are three Roman Catholic archbishops and seventeen suffragan bishops, with a Greek (United) Catholic archbishop and five suffragan bishops. Among the Protestants, laymen and clergymen united manage the affairs of the different congregations under the direction of superintendents. Lutherans and Calvinists have each four superintendents in Hungary and one in Transylvania. The various religious bodies have long been in the enjoyment of equal rights in Hungary and Transylvania.

A sketch of the Hungarian constitution has already been given in the article AUSTRIA. Hungary is divided into counties and districts, according to a very old division of the country. These have the right to administer their own internal affairs. At the head of each is an *Obergespan* (or lord-lieutenant) and two *Vicegespane*. There are three county courts in civil cases, according to the importance of the subject in question, consisting either of a judge with a jury, or of the vice-officer of the county with a judge and jury, or of the supreme tribunal of the county (*Sedes Judiciaria, Sedria*), which also revises the decisions of the two other courts and of the seignorial courts. The courts of appellate jurisdiction are the Royal Table (which, however, in several cases has original jurisdiction) and the Table of the Seven. The former sits in Budapest and the latter in Agram. They are both comprised under the name of *Curia Regia*, the sentences of which have the force of law in case there is no positive law.

History.—Among the nations which occupied parts of Hungary before its conquest by the Magyars we find the Dacians, Bastarnæ, Illyrians, Pannonians, Sarmatians, Vandals, Bulgarians, Jazyges, Alans, Huns, Marcomanni, Longobards, &c. The Romans held the south-west part of the country under the name of Pannonia, while the south-east belonged to their province of Dacia. Various Slavic tribes, together with Walachians, Bulgarians, and Germans, were the chief occupants at the time of the Magyar invasion. The Magyars, a warlike people of Turanian race, had made various migrations, and long dwelt in the vicinity of the Caucasian Mountains, and afterwards in the region between the Don and the Dniester, before they approached and crossed the Carpathians (about 887) under the lead of Almos, one of their seven chiefs (*vezér*), and elected head (*fejedelem*) or duke. They were divided into seven tribes and 108 families, had a compact consecrated by oaths, which guaranteed justice and equality among themselves, and a religion which in various features resembled the Aryan element worship of the Medo-Persians, but also included the notion of a Supreme Being. Arpád, the son of Almos, conquered the whole of Hungary and Transylvania, organized the government, and also made various expeditions beyond the limits of these countries. These incursions were extended under his son Zoltán (907–946) and grandson Taksony (946–972), spreading terror and devastation as far as the German Ocean, the south of France and Italy, and the Black Sea. These formidable enemies, whose active cavalry it was almost vain to attack, were first defeated by Henry I., the German emperor, at Merseburg in 933; they then invaded Franconia in 937, and Saxony in 938, were defeated at Stederburg, and also on the river Ohre. Their last incursion into Bavaria (954 and 955) terminated with their complete overthrow on the Lech, where Otho I., king of the Germans, conquered them. They gradually learned from the Slavonians and Germans whom they conquered, and from the prisoners whom they had taken in their incursions, the arts of peace, agriculture, and manufactures. The hospitality of Geysa (972–997), and the religious zeal of Sarolta his wife, did much to attract strangers

from different countries and of all classes into Hungary. The Hungarians violently opposed the introduction of Christianity by the Bishops Pellegrin of Passau and Adelbert of Prague, and Geysa was obliged to leave the farther extension of it to his son Stephen (997–1038), who finally prevailed by the assistance of Latin monks and German knights. Stephen was rewarded for his services in extirpating the heathens by a crown from Pope Sylvester II., part of which still remains on the sacred crown of Hungary, and by a patriarchal cross, with the title of *apostolic king* (1000). Thus Stephen founded the kingdom which, according to the notions of that period, he endeavoured to strengthen by the power of the hierarchy and the aristocracy. He established ten richly endowed bishoprics, and divided the whole empire into seventy-two counties, with an officer at the head of each, responsible only to the king, and invested with full military and civil power. These officers and the bishops formed the senate of the kingdom, with whose concurrence King Stephen granted a constitution, the principal features of which were never lost. The unsettled state of the succession to the crown, and the consequent interference of neighbouring princes and of the Roman court in the domestic concerns of Hungary, the inveterate hatred of the Magyars against the foreigners, who were favoured by Peter (1038–46), the successor of Stephen, the secret struggle of paganism with Christianity, and particularly the arrogance of the clergy and nobility, long retarded the prosperity of the country. The religious zeal and bravery of St. Ladislaus (1077–95), and the energy and prudence of Coloman (1095–1114), shine amidst the darkness of this period. These two monarchs extended the boundaries of the empire, the former by the conquest of Croatia and Slavonia (1089), the latter by the conquest of Dalmatia (1102). They asserted with firmness the dignity of the Hungarian crown and the independence of the nation against all foreign attacks, and restored order and tranquillity at home by wise laws and prudent regulations.

The introduction of German colonists from Flanders and Alsace into Zips and Transylvania by Geysa II. (1141–61) had an important influence on those districts; and the connection of Hungary with Constantinople during the reign of Béla III. (1173–96), who had been educated in that city, had a favourable effect on the country in general. The Magyars, who had previously passed the greater part of the year in tents, became more accustomed to living in towns and to civil institutions. Several court officers and a royal chancellor were created on the model of the Greek court. On the other hand, Hungary became connected with France by the second marriage of Béla (1186) with Margaret, sister to Henry, king of France, and widow of Henry, king of England. She introduced French elegance at the Hungarian court, and at this time we find the first mention of Hungarians studying at Paris; but these improvements were soon checked. The rich nobility and the clergy availed themselves of the weakness of Andrew II. (1205–35) to extend their influence and power. The former extorted a confirmation and extension of their privileges by the golden bull in 1222, the latter a favourable concordat. The reforms of Béla IV. (1235–70) were interrupted by the invasions of the Mongols (1241), and the kingdom was in a most deplorable condition. After the retreat of these wild hordes Béla endeavoured to heal the wounds of his country. He induced Germans to settle in the depopulated country, and elevated the condition of the citizens by increasing the number of royal free cities; but the coronation of his son as co-regent gave rise to many disputes between them, which weakened the royal authority and hastened the decline of the state. With Andrew III. (1290–1301) the male line of the Arpád dynasty became extinct. The throne was now open for competition, and the royal dignity became purely elective. Charles Robert of Anjou, by his mother a descendant of the extinct dynasty, was the first elected (1309). He improved the currency, introduced a new system of taxation, which extended also to the peasants of the nobility and clergy, and substituted regular judicial proceedings for trials by ordeal, which were then practised. Louis I. (1342–82) added Poland, Red Russia, Moldavia, and a part of Servia, to his kingdom. His expeditions and campaigns made the nation acquainted with foreign civilization. He founded a high school (1367) at Fünfkirchen, delivered commerce from exorbitant duties, and banished the Jews from the country. The reign of Sigismund (1387–1437) is interesting from his disputes with the oligarchs, who even kept him in prison for several months, the invasion of Hungary by the Turks (1391), and the war with the Hussites. Although he was much engaged as Roman emperor with the affairs of Germany and the Catholic Church, he introduced equality of weights and measures and the first military regulation into Hungary, raised the royal free cities to the privilege of an estate (1405), and founded an academy at Buda. From their first appearance the Turks constantly disturbed the tranquillity of Hungary, which served as a bulwark to the rest of Europe. The death of Ladislaus I., in the unfortunate battle of Varna (1444) is the more to be regretted, as the plan of the hero John Huniades, for driving the Turks from Europe, failed through the coldness of the Christian courts and the intrigues of his enemies.

Matthias Corvinus (1458–90), son of Huniades, held the reins of government with a firm hand. Combining the talents of a diplomatist and a general, he silenced or defeated all his enemies at home or abroad, secured the public tranquillity, which had been but too often disturbed by his judicial organization of the counties, and gained the love and confidence of the nation, notwithstanding the severe measures which he was often compelled to adopt. It is still a proverbial expression with the lower classes in Hungary, 'King Matthias is dead, and justice with him.' He showed his love of learning by the foundation of a new university at Pressburg (Istropolis), 1467, by inviting learned men from foreign countries, particularly from Italy, and by his excellent library, in the royal castle of Buda, the treasures of which were scattered soon after his death.

During the reigns of Ladislaus II. (1490–1516) and Louis II. (1516–26) the ambition and rapacity of the optimates, headed by Stephen Zapolya, and afterwards by his son John, excited domestic troubles and caused an insurrection of the peasants, which was only suppressed by the severest measures (1514), while they destroyed the foreign influence of the kingdom. The battle of Mohács (1526), in which Louis II. lost his life, and which for 160 years made a great part of Hungary a Turkish province, was the natural consequence of this state of things. The rest of the country was in dispute between the rivals Ferdinand of Austria and John Zapolya. The contest was decided by the Protestants, who, fearing the persecution of Zapolya, declared for Ferdinand. Their adherence gave him the superiority, and Zapolya was compelled to rest satisfied with the possession of Transylvania and some counties of Upper Hungary; but this division of the kingdom caused continual disputes with the descendants of Zapolya, instigated by the Turks and the French, and together with the persecutions of the Protestants (particularly after the admission of the Jesuits, 1561), gave rise to civil

commotions, which were quieted by the treaties of Vienna with Stephen Botskay (1606), of Nikelsburg with Gabriel Bethlen (1622), and of Lintz with George Rakoczy (1645). These circumstances delayed the expulsion of the Turks, in which Leopold I. finally succeeded so far that he took Buda (1686), and by the Peace of Carlowitz (1699) recovered the rest of Hungary (except the Banat) and Transylvania. This treaty, however, and the establishment of the *commissio neoacquistica*, to decide all claims on the countries recovered from the Turks, gave rise to new troubles, which were not quieted until the Peace of Szathmar in 1711.

The Congress of Passarowitz (1718) restored the Banat to Hungary, and the Peace of Belgrade (1739) terminated hostilities with the Porte for a long time. Charles VI. (1711–40) by the pragmatic sanction secured the inheritance of the Hungarian crown to the female descendants of the house of Hapsburg, and improved the administration of the kingdom by giving the royal chancery and the vice-regal office an organization better suited to the age. He also formed a standing army for Hungary, and established the military contribution for its support. Maria Theresa (1740–80) did much for the improvement of Hungary by the promulgation of the rural code, called *Urbarium* (1765), the object of which was to fix the services and improve the condition of the peasants; also by the formation of village schools (1770), and the abolishing of the order of Jesuits (1773). It cannot be doubted that Joseph II. (1780–90), one of the greatest sovereigns of his age, was influenced by the best intentions in the changes which he undertook in the Hungarian constitution; but his zeal made him forget the necessity of proceeding gradually in such reforms. The nation, far from entering into his views, opposed them, and Leopold II. (1790–92) was compelled to revoke the ordinances of his brother, who, besides, had never been crowned in Hungary. Leopold was succeeded by his son Francis I. (1792–1835). The French revolution had then commenced, and was assuming dimensions which filled all the courts of Europe with alarm. A kind of crusade for the purpose of putting it down by main force was in consequence planned, and Francis entering into it with the utmost eagerness, found no difficulty in inducing the Hungarians to furnish him with their full quota of men and money. In the disasters which followed Hungary necessarily suffered along with the other parts of the Austrian dominions, and the zeal with which she had furnished the means of carrying on the war was so much supplanted by an opposite feeling, that loud complaints began to be heard. The court of Vienna and the Hungarian diet were thus mutually dissatisfied, and much recrimination ensued, till Francis, encouraged by the downfall of Napoleon, took the bold step of endeavouring to silence discontent by depriving it of the only organ through which it could be legitimately and authoritatively expressed. Accordingly for a period of nearly ten years no diet was called, and a system of absolutism prevailed. This mode of putting down national feeling only gave it a deeper seat and a wider extent, and at length in 1825, when open resistance was threatened, a new diet was summoned. This measure, though it seemed at first to restore harmony, being obviously dictated by necessity and not by choice, gave new courage to the opposition. The members indulged in a freedom of speech which had not previously been tolerated, and even ventured to make proposals which would at one time have been denounced as treason. At this diet Count Stephen Széchényi particularly distinguished himself, and gave an entirely new character to the debates, when, to the astonishment of the bishops and barons, he began to speak not in the Latin, to which they had hitherto been accustomed, but in the Magyar tongue. The example thus set was quickly followed, and the diet became truly a popular assembly. The advantages gained in 1825 were followed up, particularly in the diets of 1830 and 1832. In the former the concession as to recruiting, the appointment of native officers, and the formal adoption of the Magyar language, were the chief triumphs of the popular party; in the latter the invidious privileges of the nobles were openly attacked and earnest appeals made in favour of the peasantry. In 1835, while these important questions were engrossing the public mind, Francis died, and was succeeded by his son Ferdinand, whose feebleness both of mind and body totally unfitted him for the troublous times in which his reign commenced. His ministers, aware of the additional difficulty they would now have in carrying matters with a high hand, made minor concessions in the hope of eluding the demand for greater; and on finding that this policy did not succeed, committed the gross blunder of attempting to crush the national spirit by throwing several of the most popular leaders into prison. Among those thus treated were Deák, Klauzál, and Kossuth. The only effect was to produce a diet composed almost entirely of individuals who had voluntarily pledged themselves, or been pledged by their constituents, to oppose the government to the utmost. This diet, which met in June, 1839, scarcely allowed a measure proposed by the Austrian ministers to pass without subjecting it to more or less important modifications. The struggle between government and the national party continued without intermission for several years, generally to the advantage of the latter, who in 1847 put forth a programme of their political creed, in which they claimed reform of the feudal system, due representation of the towns, equality before the law and in taxation, publicity in the courts, liberty of the press, and a responsible ministry. In the election for the diet those who pledged themselves to this programme were generally successful, and it thus became apparent that a crisis was approaching. The diet was opened by Ferdinand in person in November, 1847, and was engaged in the discussions raised by the above programme when the French revolution of February, 1848, suddenly broke out. The Austrian government was unable to withstand the shock, and nothing remained for it but to endeavour to save itself from total destruction by any amount of hasty concession. Count Louis Batthyáni was at once intrusted with the formation of a Hungarian ministry, in which the portfolios of finance, justice, and commerce were held respectively by Kossuth, Deák, and Klauzál; and the diet, after passing laws embodying everything of importance contained in the programme, was formally closed on the 11th of April by Ferdinand in person, amid the acclamations of the people. The court of Vienna in making all these concessions had only yielded to pressure, and there was therefore little reason to expect any cordial co-operation from it in carrying them into effect. So far from this, it soon appeared that the government was preparing to avail itself of the first favourable opportunity to retrace its steps. The first proof of this was given by its stooping to fan internal discord. Here success was only too easy. The Rascians of the Banat and the Croats, jealous of the ascendency of the Magyars, demanded separate rights and a separate administration, and without waiting to effect the object by negotiation flew to arms. The Walachians of Transylvania, influenced by similar feelings, attacked the Magyars with the utmost fury; while the Saxons of the same province, allured by the hope of separate privileges, kept watching their opportunity. When the Hungarian ministry, in

order to put down these insurrections, applied to Vienna for the recall of the Hungarian regiments, their request was evaded, and the confusion increased. There could now be little doubt as to the double part which the court of Vienna was playing; but its policy was not developed without disguise till December, 1848, when the weak Ferdinand was induced to abdicate in favour of his nephew Francis-Joseph I. Hungary was now regularly invaded by an Austrian army under Prince Windischgrätz, and a series of pitched battles were fought with alternations of success; but upon the whole so much to the advantage of the Hungarians, that Austria was obliged to stoop to the humiliation of calling in the aid of Russia. It was immediately granted, and the Hungarians had in consequence to encounter a double foe. Their heroism, however, was for a time more than a match for superior numbers, and they gained a series of victories which compelled a joint force of Austrians and Russians in Transylvania to take refuge in Turkey, and Windischgratz to abandon Pesth and recross the Danube. Meanwhile the contending parties, not confining themselves to military operations, were endeavouring to carry out their respective objects by civil acts. On the 4th of March, 1849, Francis-Joseph promulgated a new constitution, by which the independence of Hungary as a separate kingdom and all its ancient rights were annihilated. This was met, on the 4th of April, by a proposal made to the Hungarian diet by Kossuth, as president of the Committee of Public Safety, and carried by acclamation. It was to the effect that the house of Hapsburg, by levying war against Hungary, breaking up its integrity, and calling in the aid of a foreign power, had forfeited all right to the Hungarian crown. The future form of government being in the meantime left undecided, Kossuth was appointed Governor of Hungary, with a new ministry. This arrangement was not destined to be of long duration. Russia, though repulsed in the first instance, was about to repeat the invasion with an overwhelming force. Ultimately two imperial armies took the field, and the Hungarians after many heroic deeds were obliged to succumb. Kossuth having resigned his governorship, and in concert with such of the ministers as were present made Görgei dictator, a surrender, said to have been previously arranged with the Russian general, was immediately carried into effect (13th August, 1849). For this act Görgei stands branded by his countrymen as a traitor. The kind of pacification reserved for Hungary may be inferred from the fact that it was intrusted to the merciless Haynau. Blood flowed freely, and some of the greatest statesmen and soldiers of Hungary—Batthyáni, Nagy Sándor, Aulich, Pöltenberg, Kis, Damjanics, and others perished on the scaffold. The nation was reduced to the position of a crown-land of the Austrian Empire, and in 1851 the Archduke Albrecht was appointed governor. It was not, however, until the following year, when the emperor visited Hungary, that martial law was suspended, and a partial amnesty granted. The imposition of Austrian laws and institutions, and the evident intention of Francis-Joseph to completely incorporate Hungary into the Austrian Empire, roused, however, even those conservative nobles who had been opposed to Kossuth and the advanced liberals. The concordat with the pope, entered into in 1855, which put the educational system entirely into the hands of the Roman Catholic clergy, added to the national hatred. The disastrous war with France and Italy in 1859, which cost him Lombardy, compelled the emperor to adopt conciliatory measures towards Hungary; but the October diploma of 1860, which, while recognizing in some respects the right of Hungary to an independent government, left the electoral power in the hands of the German or imperial party, was far from satisfactory to the Hungarians, who adopted a system of passive resistance, and refused to send their deputies to the Reichsrath. In 1865 the constitution of 1860 was suspended, and the emperor, on a visit to Pesth, issued a decree ordering the suppression of military tribunals for the trial of offences committed by civilians in Hungary, and promised a diet, which would make known to him the grievances and just wishes of the people. At the same time he intimated that he would soon return to be crowned King of Hungary according to ancient form. The diet was opened in presence of the emperor on the 14th December, 1865, but it soon became evident that Francis-Joseph had no inclination to grant its request for a separate ministry for Hungary. During the Austro-Prussian war of 1866 all domestic disputes were suspended, and Hungary readily supplied men and money; but the diet was prorogued on account of the war. It was reopened on the 19th November, and in the message or rescript on opening the session the emperor wrote: 'If the diet's deliberations result in the removal of difficulties connected with the unity of the monarchy, which must be maintained, the wishes and demands of Hungary will also be complied with.' The address in answer was not agreed to until the middle of December, and it stated that the rescript was not satisfactory, as it did not restore the constitution of 1848, which it was held was indispensable; and it prayed for an amnesty to all persons exiled for political offences. In the meantime the Diet of Lower Austria demanded the convocation of the Reichsrath, to which the government commissioner replied that this would be equivalent to breaking off the negotiation with Hungary. On 2d January, 1867, an imperial patent announced that the government was about to summon a Reichsrath, a common chamber, wherein the rights and claims of Hungary were to be discussed. New elections were ordered of the Hungarian provincial diets, whose only object was to be the naming of deputies to the Reichsrath, which was to meet on the 25th February. Before that day, however, the restoration of the Hungarian constitution was decreed, the independence of Hungary was recognized, and a separate administration appointed, for which a solemn *Te Deum* was sung in all the Hungarian churches, and addresses of confidence in the new ministry poured in from all sides, not only from Magyar, but from Saxon, Servian, and Walachian communities. On the 2d March the diet resumed the legislative functions which it had declined previous to the restoration of the constitution. On 9th April the motion for union with Croatia was adopted without a debate, and for some time so much moderation and loyalty were displayed that difficulties seemed to vanish, and the reconciliation between the crown and the nation appeared complete. The houses then adjourned till May. On 8th June the emperor and empress were crowned King and Queen of Hungary with the utmost pomp, and with the ancient ceremonies, taking the oath to maintain the constitution and the rights of the Hungarian people. The first article of the oath set forth the legal succession to the throne of Hungary and the adjacent countries; the constitution, the independence, freedom, and integrity of the country; the strict maintenance of all laws; the second article declared that the crown shall not be removed from the country; the third, that the countries legally and historically forming portions of Hungary are incorporated with that country; the fourth declared that in the event of the extinction by death of successors to the Hungarian crown of the house of Hapsburg, Hungary shall have the right of free election of a sovereign;

the fifth article engaged that all future kings of Hungary shall swear to maintain the laws. The acquisition of national independence after so many years of incessant effort diffused a general joy in Hungary; but was not so well received by the German population, or by the Czechs in Bohemia. In this kingdom a claim for a similar acknowledgment of its nationality was made; but was feebly supported, and soon ceased, though it has since repeatedly made itself heard. The Hungarian diet then occupied itself with apportioning its share of the national debt, its proportion of taxes and of men for the army, and the promotion of measures for the improvement of the trade and resources of the country. The dualism of the Austrian Empire was thus finally constituted, the master-spirit in the movement among Hungarian politicians, and the director of the national policy till his death in 1876, being Deák. He was succeeded in personal influence by Tisza, who held office from 1875 to 1890. Since 1867 great advances have been made by Hungary in all that constitutes true progress, and on the whole there has been little friction between it and the Austrian half of the dual monarchy. Discontent has sometimes been manifested by the Croatians at their subordination to Hungary; and it was only on condition that their language, customs, and self-government should be preserved that a union was effected.

Hungarian Literature.—The Hungarians, impelled partly by the spirit of adventure which characterized the middle ages, and partly by the demands of assistance from foreign princes, emigrated from Asia, and spread over the disconnected provinces of Eastern Europe, until they reached a country with a settled constitution and a consolidated government (Germany under Henry I. and Otho I.), which set bounds to their warlike incursions (in 955). From this period the attention of the people, previously occupied with external subjects, began to be turned inward upon itself. The civilization of the Magyars commenced, and advanced so rapidly that, in less than fifty years, the domestic and foreign security of the kingdom was established, industry awakened, milder manners introduced, and the nation prepared for the reception of Christianity; but instead of being contented with this gradual progress, and awaiting the natural development of the national character, Stephen I. and most of his successors imprudently endeavoured to hasten the progress. The discontents caused by this policy were increased by the frequent admission of foreigners into the clerical and noble orders, by the exaltation of the clergy to the highest rank in the kingdom, by the preference given to the Latin over the national language, not only in the church, but in judicial proceedings, legal documents, and forms. These circumstances gave rise to an opposition which, though checked in some degree by the prudent measures of the princes of the house of Anjou in the fourteenth century, was afterwards continually renewed. The Latin language predominated in this country, as it did at that time in every country which had reached any degree of civilization; but in Hungary it continued prevalent almost to the present day, while other nations employed it only as an instrument of learning. The use of a dead language in common life, as well as on all scientific subjects, could neither be advantageous to the language itself, to the general improvement of the people, nor to the national literature. Notwithstanding these disadvantages, some buds of literature from time to time unfolded themselves, and native genius, though chained, would sometimes attain distinction; yet how much greater would have been the results if the spirit of the nation had been permitted a free development of its peculiarities, under the influence of national manners! Though with the introduction of Christianity into Hungary the Latin language acquired the ascendency in the church, in schools, and public affairs; yet the Hungarian was used in commerce, in the camp, and even the resolutions of the diet were first drawn up in Hungarian. When the missionaries addressed the people in Latin an interpreter was usually present; and there are several relics of poetry, sacred eloquence, and state papers extant in Hungarian. A new impulse was given to this language on the accession of the house of Anjou to the throne of Hungary. The Latin was indeed still the language of church and state; but the Hungarian became the language of the court. Documents were drawn up in Hungarian, and the Hungarian oath, in the Corpus Juris Hungariæ, dates from this time. The Holy Scriptures were translated into Hungarian; in the imperial library of Vienna there is a MS. translation of 1382; and in spite of the violent opposition of the Inquisitores Hereticæ Pravitatis, several translations were published. In 1465 Janus Pannonius wrote a Hungarian grammar, which is lost. The sixteenth century was favourable to Hungarian literature, through the religious disputes in the country, the sacred, martial, and popular songs, as well as by the histories written and published for the people, and the multiplied translations of the Bible. It then reached a degree of perfection which it retained until the latter part of the eighteenth century. Among writers of ballads or metrical tales belonging to the sixteenth century may be mentioned Tinódi, Kákonyi, Tsanádi, Valkai, Tserényi, Szegedi, Illésfalvi, Fazékas, Balassa, &c. A higher aim was manifested by the epic poems of Count Niklas Zrinyi (1652), Ladislaus Lissthi (1653), Christopher Paskó (1663), Count Stephen Kohary (1699), and in particular the numerous and excellent productions of Stephen von Gyöngyösi (1664–1734), as well as the lyric poems of Rimai, Balassa, Benitzky, &c. In 1653 an encyclopædia of all the sciences, and in 1656 a work on logic, were drawn up in the Hungarian language by John Tsere (Apátzai). A large number of grammars and dictionaries were printed from the sixteenth century to the eighteenth. But the hopes of the further development of Hungarian literature were not realized; a Latin period again succeeded, from 1700 to 1780, during which time numerous and finished works were composed in Latin by Hungarian writers. In 1721 a Latin newspaper was established, and the state calendar, which commenced in 1726, was regularly published in Latin. In 1781 the first Hungarian newspaper was printed in Presburg.

After Joseph II. died (1790) many violent yet bloodless changes were made in the Hungarian constitution, and several laws were passed in favour of the Hungarian language. It was required to be used in all public proceedings. Courses of lectures were delivered in Hungarian in some of the schools, and it was taught in all of them. Several periodicals were established, Hungarian theatres erected in Buda and Pesth, many works were written both in poetry and prose. The modern period of Hungarian literature may be said to date from the time of Joseph II. The epic poem of Arpád was written by Andrew Horváth, and published at Pesth in 1830. The brothers Alexander and Charles Kisfaludy acquired a great and deserved reputation as poets and dramatists, and did much towards developing the national language and literature. The latter (who died in 1830) may be looked upon as the founder of the modern drama in Hungary. The most celebrated works of the former are his lyrical master-piece, Himfy Szerelmei (Himfy's Love, 1807), his Regék a Magyar elöidöböl (Tales of the Early Hungarian Times), and his historical tragedies, which were partly modelled on those

of Schiller. The development of the Hungarian literature owes much to the influence of the periodical press, which spread abroad a taste for literature at the same time as it intensified the sentiment of nationality among the people. In this department the name of Kossuth deserves honourable mention. Previous to the troubles of 1848–49, which checked for a time the natural growth of the literature, almost every species of composition was successfully practised. Works on politics and narratives of travel were written by Eötvös, Szechényi, Szalay, Szemere, &c.; on history by Stephen and Michael Horváth, Szalay, and Jaszay; on philology by Fogarassy and Bloch; works on the exact sciences, however, were confined to translations from the German, French, and English. Novels and romances were written by Baron Jósika, Eötvös, Kemény, Kuthy, Nagy, Pálffy, &c., which, though of no great originality, showed considerable artistic skill, and helped to diffuse a more correct style. The dramatic pieces of Eötvös, Obernyik, Vörösmarty, and the prolific Szigligeti—who for a long time had almost the exclusive possession of the national stage—have greater value and originality. It is in poetry, strictly so called, however, that modern Hungarian literature shines. Many of the poems (songs, ballads, &c.) of Czuczor, Vörösmarty, Bajza, Garay, Bachot, Szász, Erdélyi, Kerény, and others, are among the finest things that modern literature has produced. In this field the palm must be awarded to Alexander Petöfi, who completely freed Hungarian poetry from its dependence on foreign models and subjects, and inspired it with a life drawn fresh from nature and national feeling; and who, in artistic skill and masterly handling of his mother tongue, ranks as a model. Tompa, Hiador, Lisznyai, and others, have copied him with more or less success. The collection of ancient Hungarian national poetry, compiled and edited by John Erdélyi, at the instance of the Kisfaludy Society (three vols., Pesth, 1845–47), contributed greatly towards bringing back the modern poetry to nature and originality, and to impress upon it the stamp of nationality. The ill success of the revolutionary struggle seemed for a time to have dealt a heavy blow to the progress of Hungarian literature, the most gifted writers having either fallen in battle (as Petöfi), or been imprisoned or banished. Time, however, opened the prisons and brought back the exiles; to the writers already mentioned others were added, and an active literary life again began. The greatest recent Hungarian poet is John Arany, who surpasses even Petöfi in artistic feeling, and whose national epic Toldi, is looked upon as a master-piece. Baron Jósika holds the first place among the novelists; Jokay, Kuthy, Bérczy, Pálffy, and Dobzsa are also favourite fiction writers. Narratives of travel have been written by Count Andrassy, Ladislaus Magyar, Vámbéry, &c.; on politics by Esengery, Szalay, Pákh, and Eötvös. National history has attracted much attention; and besides the works of Szalay and Horváth, we should mention Teleki's Age of Hunyad, Jászay's Hungary after the Battle of Mohács, Salomon's The Rule of the Turks in Hungary, &c. Many excellent translations of modern foreign works have been made, some of which, such as Esengery's translation of Macaulay's History of England, and Somssich's translation of Guizot's Histoire de la Révolution d'Angleterre, rival the originals in style. The best works on Hungarian literature are those of Toldy, some of which have been translated into German.

Hungarian Language.—The language of the Magyars, as spoken and written at present in Hungary, is a phenomenon in philology well worthy of study, and the knowledge of it unlocks rich stores for the philosophical historian and philologist. It is classed in the Ugric branch of the northern division of the Turanian family of languages, and as such is most closely allied to the Ostiak, Vogulic, and Mordvinic, though it is also nearly akin to the Finnish and the Turkish. Differing from all the cultivated languages of Europe in internal structure and external form, the Hungarian nevertheless was obliged to express with the Roman alphabet, adopted with Christianity, all the Asiatic shades of sounds. The alphabet contains the following twenty-six simple and six compound sounds, pronounced as in Italian, except where otherwise marked:—eight vowels: *a* (like *a* in what, swallow), *e* (=*é* French), *i* and *y*, *o*, *u*, *ö* (= French *eu* or German *ö*), *ü* (French *u*); eighteen consonants: *b*, *d*, *f*, *g*, hard, *h* (German), *j* (German), *k*, *l*, *m*, *n*, *p*, *r*, *s* (English *sh*), *t*, *v* (also *w*), *z* (French), *sz* (English *s*), *zs* (or *'s*, French *j*); four compounds with *y*: *gy* (pronounced *dy*, *gyar*, factory, pronounced *dyar*, in one syllable), *ly* (French liquid sound as in *fille*), *ny* (French and Italian *gn*), *ty*; and two compound sibilants: *cs* (written also *ch* and *ts* = English *tch*), and *cz* (English *ts*). If we add the long vowels, marked with the acute accent, *á*, *í*, *ó*, *ő* (long *ö*), *ú*, *ű* (long *ü*), we have thirty-eight sounds in all, besides *x*, which is used in foreign names. The Hungarian has adopted a good many Slavic, Latin, German, Greek, and other foreign words; but it still retains the essential characteristics of its grammar and phonology. As in the other Turanian languages the root is never obscured in words, whatever changes they undergo. Determining or modifying syllables are placed at the end, and have a double form, always taking a different vowel when attached to a sharp-vowel root from what they have when attached to a flat-vowel root. This is a general characteristic of the Turanian languages. These suffixes represent the case-endings of nouns and the conjugations of verbs in other languages, and are very numerous. Hungarian is destitute of diphthongs. At the beginning of a syllable the Hungarian never allows more than one consonant; in foreign words which begin with two consonants, the consonants are made to go with different syllables by putting a vowel before them (for example, of *schola* they make *iskola*), or a vowel is put between (as from *król* they make *király*). In common with the other languages allied to it, it has no distinction of sex whatever. Family names are considered as adjectives, from which they mostly originated, and hence are put before the baptismal name; for instance, Bátori Gábor (Gabriel Bátori), as if it were the Batorish Gabor, the Gabor of the Batori family. The beautiful proportion between vowels and consonants, the accurate shadowing and full articulation which every syllable requires (the Hungarian suffers no mute vowels), and the fixed succession of vowels, give to the Hungarian language a character of masculine harmony, in which it will bear a comparison with any other. The richness and expressiveness of its various forms give it great energy; the regularity of its inflections and compositions, in which it is to be compared with the Sanskrit, makes it clear and distinct, and its infinite power of composition gives it the means of increasing its stores beyond almost any western language. If it is actually not so much developed, this is easily accounted for from two circumstances—that Slavonic, Servian, German, modern Greek, Walachian, Italian, &c., are spoken in the country at the same time; and that it was for a long time excluded from public transactions, from the church, and even from conversation, where German and French took its place. Little attention has as yet been devoted in Great Britain to Hungarian.

HUNGER, the feeling of a want of food. It is a sensation usually referred to the stomach, and it may be relieved by the introduction into the stomach of

substances even such as are incapable of yielding any nutritious elements. Such relief is, however, only temporary. In catarrhal and other affections of the stomach the sensation is much modified, and may be abolished. Relief to the sensation is obtained also by the introduction of nourishing materials into the bowel by injection, or into the blood by other methods, without anything being introduced into the stomach. So that, while the sensation may be due partly to the condition of the nerve-endings of sensory nerves in the stomach, it is not exclusively so produced. Impressions affecting the nerves of other portions of the alimentary tract, and derived also from organs in need of nutriment, have likely some part in the production of the sensation of hunger. That the stomach is not the exclusive seat of the nervous excitation which causes the sensation is shown by the fact that in certain diseases where the glands of the abdomen are so affected that absorption of nutritive material is interfered with and the blood receives little material for the repair of waste, a voracious appetite and constant hunger may be experienced by the sufferer, in spite of the consumption of large quantities of nutritious food. The relation of the central nervous organs, moreover, to the sensation of hunger must not be forgotten. Everyone knows how mental impressions may arouse the sensation, and how even acute hunger may be suddenly and completely abolished or suspended by intellectual operations or emotional states. Certain drugs also have a marked effect in diminishing the sensation. The use of narcotics, tobacco, and alcohol diminishes the feeling. Such drugs diminish tissue waste, but that effect could only account for delay in the occurrence of the sensation, and could not explain the cessation of the feeling due to waste which has already occurred. Coca is a drug which has been found capable of keeping the sensation in abeyance.

HUNIADES, JOHN CORVINUS (HUNYADY JANOS), Voyvode of Transylvania and Regent of Hungary, a distinguished military commander, born about 1400. He was by birth a Wallachian. The name Corvinus was derived from the place of his birth, the village of Corvinum, or, according to others, the Castle of Pietra de Corvo; that of Huniades was from a small estate on the borders of Wallachia and Transylvania. He was made Ban of Severin by the Emperor Albert II. He headed the party which called Ladislaus I., king of Poland, to the crown of Hungary in 1440. Ladislaus named him Voyvode of Transylvania and Ban of Temesvar, and gave him the command in the southern provinces of Hungary. In 1442 he gained several victories over the Turks, particularly the battle of Vasag, which nearly destroyed the Turkish army. He also contributed to the successful campaign of the following year, which led to the conclusion of the peace or ten years' truce of Szegedin in June, 1444. This peace was almost immediately broken by Ladislaus, in consequence of Amurath having withdrawn his army to Asia. The king was defeated and killed at the battle of Varna, 10th November, 1444, and Huniades in escaping was made prisoner by his personal enemy Drakul, voyvode of Wallachia. Having in 1445 been made captain-general and Regent of Hungary, he overran Wallachia the following year, and captured and executed Drakul and his son. In 1448 he crossed the Danube with a large army to revenge the defeat of Varna, but after three days' battle on the plain of Kossova he was defeated and compelled to take flight. He was captured by the Despot of Servia, who exacted heavy conditions for his ransom, which, however, the pope cancelled. In 1452 he was again appointed Regent of Hungary, and in 1454 compelled the Turks, who had overrun Servia, to cross the Danube. In 1456 Mohammed II. had made great preparations for the siege of Belgrade, the defence of which devolved entirely upon Huniades. He repelled a general assault, and compelled Mohammed to raise the siege on 22nd July. A pestilential disorder breaking out among his troops compelled him to retreat, and he himself fell a victim to it at Semlin, August 11, 1456. His son Matthias Corvinus became King of Hungary.

HÜNINGEN, or HUNINGUE, a town of Germany, in Upper Alsace, on the left bank of the Rhine, 2½ miles below Basle. It was fortified by Vauban for Louis XIV. (1679–82), and had a bridge across the Rhine. The fortifications were partly dismantled at the Peace of Ryswick in 1697, and the bridge was destroyed in 1752. On 26th October, 1796, Moreau crossed the Rhine at Huningen, and on 2nd February, 1797, it surrendered to the imperialists. The Austrians and Bavarians crossed the Rhine here for the invasion of France on 17th December, 1813. The fortress was again taken by the allies in 1814, and destroyed in 1815. It now has a bridge of boats and an iron railway-bridge, and a famous piscicultural establishment, besides dyeworks, chemical and cigar works, &c. Pop. (1895), 2122; (1900), 2936.

HUNS, a people who make their appearance in authentic history about A.D. 375. Ethnologists identify them with a Mongolian people of Northern Asia, who invaded the Chinese Empire about 200 B.C., and after various migrations entered Europe, and drove the Goths from Dacia into Moesia and Thrace. At the time already mentioned (A.D. 375) Ammianus Marcellinus mentions them as situated to the west and north of the Alans, a closely-allied people who occupied the Caucasus and the frontier of Circassia. They appear afterwards to have sided with the Goths of Moesia against the Romans, and sometimes in alliance with the emperors, who purchased their services, and sometimes in hostility with them, they continued to extend their dominion along the Danube until the time of Attila (434), their greatest leader, whose reign constitutes the best-known period of their history. (See ATTILA.) The Kingdom of Attila broke up at his death, and the subsequent history of the Huns becomes again a subject of ethnological, philological, and historical criticism. Some modern critics identify the Huns with the Bulgarians. Ethnologically they are believed by the same authorities to be members of the Turk family. The name Hun appears to be only a collective designation. That the peoples to whom it belonged were of Asiatic origin; that they migrated westward, and established themselves in Dacia and Pannonia; that they formed under Attila the centre of a powerful confederation, including Gothic and other populations which made extensive conquests, appear to be the best-ascertained facts in their history.

HUNT, JAMES HENRY LEIGH, a well-known poet and elegant writer, was born at Southgate, near London, on 19th October, 1784. His father was a West Indian, who married an American lady, and settled at Philadelphia as a lawyer; but the loyalty of his principles compelled him, after the outbreak of the American war, to quit the country for England. Here he took holy orders, and acted for some time as tutor to Mr. Leigh, nephew of the Duke of Chandos, from whom the subject of the present article received his name. Leigh Hunt was educated at Christ's Hospital, at which school he remained till his fifteenth year, and attained the distinction of first deputy Grecian. On leaving school he entered the office of his brother, who was established in business as an attorney, and afterwards obtained a situation in the war office. In this post he continued till 1808, when, in conjunction with his brother John, he started the Examiner newspaper, which afterwards

attained such eminence as a leading organ of the Liberal party. Previous to this he had made various literary attempts, first in a collection of juvenile poems, published for him by his father in 1801; and subsequently by theatrical and literary critiques furnished by him to the News, a Sunday paper commenced by his brother in 1805. These critiques were published in a collected form in 1807. On the establishment of the Examiner by the Hunts the paper became prominent for the fearlessness with which public matters were discussed, and it was not long before its conductors were made to feel the weight of official resentment. For an article against flogging in the navy they were tried before Lord Ellenborough, but were defended by Lord (then Mr.) Brougham, and acquitted. A second prosecution had more serious consequences, and was occasioned by an article in the paper of 22d March, 1812, reflecting on the character of the prince regent, whose debaucheries were then a subject of public scandal. One specially offensive expression was styling him a 'corpulent Adonis of fifty.' It resulted in the brothers being sentenced to pay a fine of £500 each, and to suffer two years' imprisonment. This last penalty was endured by Leigh Hunt in a manner which alleviated considerably the inconveniencies of incarceration, being cheered by frequent visits from his friends, who also, by the way in which they fitted up his cell with all the appliances of physical and intellectual comfort, rendered it a little elysium. During his confinement he employed himself in several literary works, which were published after his release. They include the Feast of the Poets (London, 1814); the Descent of Liberty, a Mask (1815); and the Story of Rimini (1816). This last is his longest, and generally considered his best poem, though, in common with his other writings, it was mercilessly assailed by the Tory critics, Theodore Hook among others contributing his squib,—

> 'O jiminy, jiminy!
> What a niminy piminy
> Story of Rimini!'

In 1818 appeared Foliage, a collection of original poems and translations from Homer, Theocritus, Bion, &c.; and in 1819 the Indicator was started, a weekly journal on the model of the Spectator, which contained some of his best essays. In 1822 he proceeded to Italy, having received an invitation thither from Byron and Shelley, the latter of whom was drowned a few days after his arrival. The three friends had projected a newspaper called the Liberal, which was carried on for some months by Byron and Hunt; but it proved unsuccessful, and a coolness also arose between them which led to a separation. Leigh Hunt continued to reside for several years in Italy with his family, and on his return to England published Recollections of Lord Byron and some of his Contemporaries (two vols. 1828), which provoked somewhat the indignation of the noble poet's friends. Among his subsequent works may be mentioned Sir Ralph Esher, a prose romance (three vols. 1832); Captain Sword and Captain Pen, a satirical poem on war (1835); A Legend of Florence, a play represented with some success at Covent Garden in 1840; Stories from the Italian Poets (two vols. 1846); Imagination and Fancy, and Wit and Humour, a series of selections from the English poets (1844 and 1846); Men, Women, and Books (1847); A Jar of Honey from Mount Hybla (1848); the Town, its Memorable Characters and Events (1848); Autobiography (three vols. 1850); Table Talk (1851); The Old Court Suburb (two vols. 1855). In addition to these and other writings, he published editions of the dramatic works of Wycherley, Congreve, Vanbrugh, and Farquhar, of Beaumont and Fletcher, and of Sheridan. He was also at different times editor of the Tatler, the London Journal, &c., and contributed extensively to various periodicals. In 1847 a pension of £200 a year was bestowed on him by Lord John Russell's government. He retained his faculties almost unimpaired to the last, and died on 28th August, 1859. Leigh Hunt's prose style is light, graceful, and gossiping. As a poet his grand characteristic, according to Moir, is word-painting, in which he excels even Keats. He often carries this quality, indeed, to the extent of strange and affected conceits. He is frequently happy in imitative translations, and he caught a good deal of the tone of the Italian poets.

HUNTER, JOHN, an eminent surgeon, anatomist, and physiologist, was born at Long Calderwood, Lanarkshire, on 13th February, 1728. Being the youngest of ten children, his education was very much neglected, and he appears by the age of twenty to have learned little more than to read and write. He had previously to this assisted his brother-in-law, a carpenter in Glasgow, for some time in his trade; but the business proving unfortunate, he returned to Long Calderwood, and wrote to his brother William, then a prosperous surgeon in London, offering his services as an anatomical assistant. His offer was accepted, and he arrived in London, to which he rode with a companion on horseback, in September, 1748. His first essays in anatomy showed remarkable talent, and won the entire approval of his brother. In 1749 and 1750 he studied surgical pathology under Cheselden at Chelsea Hospital, and already began to make original observations, which his subsequent experience confirmed. In the latter year he was far enough advanced to relieve his brother in the dissecting-room. In 1751 he attended St. Bartholomew's Hospital. In 1753 he entered St. Mary's Hall, Oxford, as a gentleman commoner, but his matriculation was not persevered in, and next year he entered as a surgeon pupil at St. George's Hospital. Two years afterwards he was appointed house-surgeon of this hospital, a temporary appointment held by a resident pupil. In 1754 or 1755 he was admitted to a partnership in his brother's school of anatomy, and continued to lecture there till 1759. From the neglect of his early education he had great difficulties to contend with as a lecturer, but as an anatomist he was pre-eminent, and enriched the science with several valuable discoveries. To extend his knowledge of anatomy he applied to the keeper of the Tower and the proprietors of several menageries for the bodies of animals which died under their care. His health being affected by severe application, and symptoms of consumption appearing, he procured in 1760 the appointment of staff-surgeon, and went in the following year with the army to Belle Ile, and afterwards to Portugal, an experience which enabled him to acquire material for his work on gun-shot wounds. On the conclusion of peace in 1763 he returned to London with his health re-established, and commenced practice as a surgeon. He also lectured on anatomy and surgery, but neither as a practitioner nor as a lecturer did he make rapid progress in public estimation. The hastiness of his manner, and the deficiency of his general education, were adverse to him in both matters, and he himself chiefly aimed at securing by his profession the means of support, and of carrying on his scientific investigations, to which he was much more attached. In 1767 he received an unexpected proof of the high estimation in which he was held by men of science in being elected a member of the Royal Society, and in 1768 he was appointed surgeon to St. George's Hospital, which, by extending his practice, and enabling him

to take pupils from whom he received large fees, greatly enlarged his income. His investigations at this time extended over every branch of natural history, particularly pathology, comparative anatomy, and physiology, to which he devoted his entire leisure time. Among his pupils were Jenner and Sir Everard Home, whose sister he married in 1771. In 1773 he was attacked with a disease of the heart, of which he ultimately died, but his general health continued good for many years. In 1776 he was appointed surgeon extraordinary to the king. In 1785, the attacks of heart disease becoming more frequent, he was compelled for a time to leave London. In 1790 he was appointed inspector-general of hospitals and surgeon-general to the army. On 16th October, 1793, he attended a meeting of the governors of the hospital, and having left the room in consequence of a dispute with one of his colleagues, fell dead in the arms of one of the physicians of the hospital. He was buried in the vault of the parish church of St. Martin's-in-the-Fields, whence his remains were removed in 1860 to Westminster Abbey. Hunter left at his death a museum which he had built for himself, and filled with upwards of 10,000 preparations illustrative of the departments of science to which his attention had been devoted. It was afterwards purchased by government, and presented to the Royal College of Surgeons. At the time of his death he was engaged in preparing a catalogue of his museum, with a view of embodying it in a work containing the results of all his labours and investigations. The preparation of the catalogue was afterwards intrusted to his brother-in-law Sir Everard Home, who, in accordance with an alleged wish of Hunter's, instead of completing it burned the greater part of his manuscripts. In addition to papers contributed to the Transactions of learned societies, his leading works are the Natural History of the Human Teeth (1771); A Treatise on the Venereal Disease (1786); Observations on certain parts of the Animal Economy (1786); A Treatise on the Blood, Inflammation, and Gun-shot Wounds (1794). His works have been collected and published with notes by J. F. Palmer (London, 1835). The best life of Hunter is that by Ottley (1835). Mrs. Hunter wrote some ballads which have been much admired—among them, My Mother bids me bind my Hair.

HUNTER, William, M.D., elder brother of the preceding, and collector of the Hunterian Museum now in the University of Glasgow, was born at Long Calderwood, May 23, 1718; and at the age of fifteen was sent to Glasgow University, where he passed five years in studying as a candidate for holy orders. But having accidentally become intimate with Dr. Cullen, then practising physic at Hamilton, he became disgusted with theology, and commenced the study of medicine. In the year 1737 he went to reside with Cullen, and afterwards was received into partnership by him; but in 1740 he went in the winter to Edinburgh to complete his studies, and in the summer of the year following went to London, and at first lived as a pupil in the house of Dr. Smellie the accoucheur. Dr. James Douglas engaged him as his assistant in making dissections for a work on the anatomy of the muscles, which he then was preparing to publish. After Dr. Douglas' death in the following year he continued to reside in the family, superintending the education of his son, and attending St. George's Hospital as a pupil under Dr. Frank Nichols. In 1745 he communicated a paper to the Royal Society respecting the structure of the cartilages of the human body, and in 1746 he received the appointment of lecturer on anatomy to a society of naval surgeons. The profits arising from this first attempt amounted to 70 guineas, great part of which he very generously lent to some fellow-students and lost. In 1747 he became a member of the College of Surgeons, and practised surgery and midwifery, but at length confined himself entirely to that branch, in which he soon outstripped Dr. Smellie, and was appointed accoucheur to the British Lying-in Hospital. It was rather before this time that he spent some weeks on the Continent, where he accompanied young Douglas through Holland and Paris; and having been greatly struck with seeing the anatomical museum left by the great Albinus at Leyden, it is conjectured that he then formed the design of emulating the labours of that celebrated anatomist. On the death of Sir Richard Manningham and resignation of Dr. Sandys, he became first in his line of practice. In 1750 he obtained his Doctor's degree from the University of Glasgow, and then quitted Dr. Douglas' family, and took a house in Jermyn Street; and having been consulted on the pregnancy of Queen Charlotte in 1762, he was received into great favour by the king.

In the first volume of Observations and Inquiries, published by the Medical Society in 1757, appeared Dr. Hunter's History of an Aneurism of the Aorta; and he was an important contributor to the subsequent publications of the society, of which he was chosen president on the death of Dr. Fothergill. In 1762 he published a work entitled Medical Commentaries (4to), to which was subsequently added a Supplement, the object of which was to vindicate his claim to some anatomical discoveries, in opposition to Professor Monro of Edinburgh, and others. In 1764 he was appointed physician-extraordinary to the queen. Dr. Hunter was elected a fellow of the Royal Society in 1767; and in 1768, on the establishment of the Royal Academy of Arts, he was appointed professor of anatomy. He was made a foreign associate of the Royal Medical Society at Paris in 1780, and of the Royal Academy of Sciences in 1782. The most elaborate and splendid of his publications, the Anatomy of the Human Gravid Uterus (folio, illustrated by thirty-four large plates), appeared in 1774. In 1777 he joined Mr. Watson in presenting to the Royal Society a Short Account of the late Doctor Maty's Illness, and of the Appearances on Dissection; and in 1778 he published Reflections on the Section of the Symphysis Pubis. Two Introductory Lectures to his Anatomical Course, which he had prepared for the press, were published after his death. About 1765 he projected founding a great school of anatomy, and in 1770 he purchased and completed a house and theatre in Great Windmill Street, in which he constituted a splendid museum. At first he only contemplated a collection of preparations in human and comparative anatomy, but in 1761 he was tempted to become the purchaser of Dr. Fothergill's collection of shells, corals, and other objects of natural history, for which he gave £1200, and when Sir Robert Strange died he purchased the pictures of that artist, as well as those which belonged to Mr. Foulis of Glasgow. He also added to his museum a collection of ancient coins and medals, which was formed originally at an expense of about £23,000, and is one of the completest and most valuable in existence. Of a part of this collection his friend Dr. Combe published an elegant catalogue in 4to in 1783.

Dr. Hunter had been subject to attacks of irregular gout as early as the year 1773, when he thought of relinquishing practice, and his death happened on the 30th March, 1783. A few hours before his death he said to his friend Dr. Combe, 'If I had strength enough to hold a pen I should write how easy and pleasant a thing it is to die.' In his last testament he bequeathed the whole of his splendid museum,

valued at £150,000, to the University of Glasgow, with the sum of £8000 in cash to be expended in an appropriate building for its reception, and a further sum of £500 per annum to bear the charges of its preservation. To his nephew, Dr. Baillie, he bequeathed his family property of Long Calderwood, but Dr. Baillie very generously gave it to John Hunter, who had unfortunately had a quarrel with his brother Dr. William some years before about some anatomical trifle. The museum was left subject to the liferent of Dr. Baillie, who very handsomely relinquished it in 1808, when it was transferred to Glasgow.

HUNTINGDON (contracted *Hunts*), a small inland county of England, surrounded by the counties of Northampton, Cambridge, and Bedford; area, 234,218 acres. In the western and southern parts the surface is slightly varied. The north-eastern portion is included within the level of the fens, and is principally devoted to grazing. There is comparatively little timber in the country, although it was at one time covered with wood. Soil generally clayey or gravelly loam, but, excepting the meadows, which are among the richest in England, not very fertile. Agriculture has been much improved of late years, the fen-men in particular excelling in the management of the plough, so that, upon the whole, the farming is above the average. Of the total area, nearly 90 per cent is under crops and grass. Wheat occupies about 33,000 acres, barley about 20,000, and oats about 11,000. Green crops occupy nearly 20,000 acres, and there are about 86,000 in permanent pasture. The breed of sheep is of a mixed description, nearly approaching to the Leicestershire and Lincolnshire species, with which the native breeds have been much crossed. The cattle, formerly of mixed and generally inferior breeds, have been improved by the introduction of short-horns. Dairy-farming, however, is not much followed. Pigeon-houses are extremely numerous, more so, it is said, than in any other county of England, excepting Cambridge. Estates are generally extensive, but small farms, let yearly, predominate. The manufactures are unimportant. Several shallow lakes have been drained and brought into cultivation. Huntingdonshire is divided into four hundreds, exclusive of the town of Huntingdon, and 103 parishes. It returns two members to Parliament—one from each of its two divisions (N. and S.). It contains no parliamentary borough. The county formed a part of the British kingdom of the Iceni and of the Saxon Mercia. It was entirely under forest law till the reign of Henry II. David, prince of Scotland, through marriage, became Earl of Huntingdon in 1108. Pop. in 1881, 54,991; in 1891, 57,761; in 1901, 57,773.

HUNTINGDON, capital of the above county, 59 miles north by west of London, occupies a gentle acclivity above the north bank of the Ouse, and is a station on the Great Northern Railway. It contains a spacious market-place, and has two fine old parish churches. The trade is chiefly in corn and wool, and there are two large breweries, iron-foundry, brick-works, flour-mill, and an oil-mill and oil-cake manufactory. Oliver Cromwell was born and went to school here. Pop. in 1891, 4346; in 1901, 4261.

HUNTINGDON, Selina, Countess of, the second daughter of Washington, Earl Ferrers, was born in 1707, and married June 3, 1728, to Theophilus, earl of Huntingdon. She became a widow in 1746, and four of her numerous family died in youth. She now became distinguished for her religious zeal, adopting the principles of the Methodists, particularly of George Whitefield, whom she appointed her chaplain. Her rank and fortune giving her great influence, she was long considered as the head of the Calvinistic Methodists. She founded a college for the education of ministers, and built and acquired numerous chapels, there being at her death sixty-four of these belonging to 'the Countess of Huntingdon's Connexion', a body which still exists as a religious denomination. She died June 17, 1791.

HUNTLY, a town of Scotland, Aberdeenshire, 41 miles N.W. of Aberdeen, pleasantly situated on the Bogie in a good agricultural district. Pop, (1901), 4136.

HUNYADY. See Huniades.

HURD, Richard, an eminent English prelate and philological writer of the 18th century. He was born in 1720 at Congreve, in Staffordshire; went to Emmanuel College, Cambridge, in which he obtained a fellowship in 1742, and in 1749 published Horatii Ars Poetica, Epistola ad Pisones, with an English commentary and notes. In 1750 he published a Commentary on the Epistle of Horace to Augustus. A satirical attack on Dr. Jortin, in defence of Warburton, in an Essay on the Delicacy of Friendship, he afterwards endeavoured to suppress. In 1757 he published Remarks on David Hume's Essay on the Natural History of Religion (8vo). His dialogues, moral and political, with Letters on Chivalry and Romance, appeared at different times from 1758 to 1764, and were republished collectively in 1765 (three vols. 8vo). In 1767 he was made Archdeacon of Gloucester, and in 1768 commenced a series of sermons on the prophecies, preached at the lecture founded by his friend Warburton at Lincoln's Inn. These discourses were published under the title of an Introduction to the Study of the Prophecies concerning the Christian Church, in Twelve Lectures (1772). In 1775 Dr. Hurd was raised to the bishopric of Lichfield and Coventry, and not long after was made preceptor to George IV. and his brother the Duke of York. He was translated to the see of Worcester in 1781, and at the same time was bestowed on him the confidential situation of clerk of the closet. The king afterwards desired to elevate Dr. Hurd to the primacy, but he modestly declined the offer. In 1788 he published an edition of the works of Bishop Warburton, in which he omitted some of the productions of his deceased friend. In 1795 he published a kind of supplement to the works of Warburton, in the form of a biographical preface, and he subsequently also published the correspondence of Warburton, which was his last literary undertaking. He died 28th May, 1808.

HURDLES, frames formed of perpendicular stakes with horizontal bars, and braced with diagonal pieces for the purpose of forming temporary fences. The hurdles are placed end to end, the lower ends of the stakes being inserted in the ground, and the upper ends fastened together.

HURDWAR, or Hardwar (The Gate of Hari or Vishnu), a town of Hindustan, in the North-west Provinces, 105 miles N. by E. of Delhi, at the foot of the Himálayas, on the right bank of the Ganges, which here, where it enters the great plain of India, through a narrow gorge, is a beautiful limpid stream. Hardwar is one of the principal places of Hindu pilgrimage in connection with the ceremonial of bathing in the Ganges. The pagodas, with the ghauts (flights of steps) for bathing, occupy the right bank of the river, under the town. The Fakirs, who make Hardwar their abiding place, have generally caves hollowed out in the rock above the pass, and accessible by means of ladders only. The holy bathing spot is reached through a passage which originally admitted only four persons abreast, while, during the season of the pilgrimage, from 200,000 to 300,000 devotees pressed eagerly forward to gain precedency in plunging into the stream. In 1819, 430 persons were squeezed to death in the dreadful struggle thus

occasioned, after which accident government constructed the presently enlarged ghaut of 60 steps, 100 feet in width. The depth of water at the proper season is only 4 feet, and both sexes plunge in indiscriminately. A great fair is held simultaneously with the pilgrimage, when countless multitudes of all ages, all costumes, and all complexions are assembled from every part of India; and animals of all kinds, and from all parts of the globe, are exposed for sale, including leopards, bears, and sometimes the cubs of the tigress, horses, elephants, camels, buffaloes, cows, sheep, dogs, cats, monkeys, &c.; likewise shawls from Cashmere, woollen cloths and sauces from England, watches from France, pickles from China, gums and spices from Arabia, and rose-water from Persia. When a transaction is about to be entered into, the buyer and seller, in order to conceal what passes from by-standers, throw a cloth over their hands, and treat as to price by pressing certain joints of each other's fingers. The number of visitors to Hurdwar have been estimated, one year with another, at 2,000,000, or more. Pop. (1901), 25,597.

HURDY-GURDY, a stringed instrument of a very simple description, played by turning a handle, which causes the strings to sound by the friction of a wooden wheel, while by the use of finger stops they are lengthened or shortened so as to produce the various notes of the diatonic scale. It is mostly used by itinerant musicians.

HURON, Lake, one of the five great lakes of North America, having west the United States territory, and on the other sides the Canadian province of Ontario. It is 270 miles long and 180 miles broad at its widest part, but the southern division of the lake, for 50 miles north from its outlet by the river St. Clair, is not wider than 50 or 60 miles. The area is 23,780 square miles. It lies 594 feet above sea-level. The Great Manitoulin Islands, in the north part of the lake, and the long peninsula which terminates in Cabot's Head and Cape Hurd, divide Lake Huron into two parts—the northern portion being called Georgian Bay. This bay is studded with islands, several thousands in number, and varying in size from a few square feet to many acres. Great Manitoulin Island, the largest of the group known by the same name, is about 100 miles long, and from 4 miles to 25 miles wide; it is the only one inhabited. Lake Huron receives the waters of Lake Michigan through the Strait of Mackinac, on the north-west; and the waters of Lake Superior through the River Ste. Marie, on the N.N.W., and empties itself by the St. Clair River into Lake St. Clair, whence, by the Detroit River, it enters Lake Erie. The waters of the lake are remarkably pure and clear, and the shores are generally low and forest-clad.

HURONS. See Wyandots.

HURRICANE (in Spanish, *hurracan*; in French, *ouragan*; in German, *orkan*), a word, according to the most probable supposition, picked up by voyagers among the natives of the West Indies; properly a violent tempest of wind, attended with thunder and lightning, and rain or hail. Hurricanes appear to have an electric origin: at the moment that the electric spark produces a combination of oxygen and hydrogen a sudden fall of rain or hail is thus occasioned, and a vacuum formed, into which the circumambient air rushes with great rapidity from all directions. As a distinctive term it is applied especially to the violent storms sometimes experienced in the West Indies, thus corresponding to the typhoon of the Chinese seas. The strength of the wind in a genuine hurricane is something tremendous. Corn, vines, sugar-canes, forests, houses, everything is swept away. The hurricane of the temperate zone moves with a velocity of about 60 feet a second; those of the torrid zone from 150 to 300 feet in the same time. See Cyclone.

HUSBAND and WIFE. Of all private contracts that of marriage most intimately affects the social condition of a community, and gives rise to the most numerous and important relations, rights, and duties. It has for this reason been invested with a peculiar religious character, and was made one of the seven sacraments of the Roman Catholic Church. Marriage, accordingly, is often celebrated in places of public religious worship, in both Catholic and Protestant countries; and the ministers of religion, even in countries where the church has no judicial jurisdiction whatever over the rights arising from this contract, still officiate, for the most part, at its solemnization. (As to the forms of solemnizing marriage, and as to its dissolution, see Marriage and Divorce.) The first and one of the most important rights resulting from this contract is the control, in a greater or less degree, according to the laws of different countries, which it gives to the husband of the person of the wife. The terms in which this right is expressed in the laws of England are stronger than those of the Roman civil law, or the modern codes derived from it. The codes founded on the civil law consider the husband and wife as distinct persons, who may have separate estates, contracts, debts, and interests. The old writers in the English law express themselves more directly upon this subject than is grateful to modern ears, putting the authority of the husband upon a footing similar to that of a parent over a child, or a master over a servant; and in this case, as in those, they very composedly lay down the rules and limits of the exercise of this authority, describing the degree of coercion permitted by the law to be used, and the degree of correction which it allows to be administered by the husband. In modern times these doctrines are expressed in more cautious and qualified terms, and altogether the law, as a result of various enactments, has become much more favourable to the wife than formerly, and gives her much more of an independent position in regard to her husband. In respect to the children—as a divided authority, where the voices would be equal, would lead to embarrassment—the law assigns the guardianship and authority over them to the father, to which the mother succeeds, in a great degree, on his decease, though not wholly, for the children may, at a certain age in their minority, choose guardians for themselves in case of the father's decease. But as by recent legislation a wife whose husband has been guilty of persistent cruelty to her, or has wilfully neglected to provide reasonable maintenance for her or her infant children, may easily obtain an order of court that she is no longer bound to cohabit with him, so the legal custody of the children may also be entrusted to her, while the husband continues liable for both her and their support.

As the law assigns a certain ascendency to the husband, so it provides some compensation, by imposing upon him stronger and more extensive obligations; and both the authority and the obligations of the husband are more extensive where the common law of England has sway than where the Roman law is the fountain of civil jurisprudence. As this common law, according to its original spirit and usual operation, leaves the wife destitute of the means of supporting herself, it imposes upon the husband the obligation of supporting her, in the most direct and absolute terms. In respect to the distinct possession of property, and distinct civil abilities of the two parties, in regard to the acquisition and management of property, the law of England and the codes spring-

ing from the Roman law are widely different, and give rise to striking diversities in the civil relations of families under these respective systems.

By the theory as well as the practical administration of the common law of England, the civil rights and abilities of the wife were, until recently, mostly merged by the marriage. The husband and wife were considered in law to be one person, and that one person recognized by the law was the husband. By the very act of the marriage the chattels of the wife became the property of the husband. He had a right also to collect all the debts due to her; but then he also at the same time incurred a corresponding obligation, for he at once became liable to pay all her debts. But the common law as to the property of married women having been deemed in many cases to operate oppressively against the wife, the course of recent legislation has tended progressively towards the withdrawal of her estate from the husband's control. The first step in this direction was taken by the promoters of the Divorce Act of 1857 (20 and 21 Vict. cap. lxxxvii.), which enacted that a wife deserted by her husband might obtain a magistrate's order to secure her earnings from being appropriated by him. Subsequent acts intended to give the wife still more extended control over her property were passed in 1870 and 1874, but on account of their complicated nature, and of their leaving many grave questions unsettled, a further measure was thought desirable. At last, in 1882, an act was passed which marks the commencement of a new era in the relations of married persons as regards property, for it is the first act that has fully acknowledged the legal existance of a married woman as distinct from that of her husband. This act (45 and 46 Vict. cap. lxxv.) begins by enacting that a married woman shall be capable, after the 1st of January, 1883, of acquiring, holding, and disposing by will or otherwise, of property as if she were an unmarried woman, and that she may enter into any contract, and sue or be sued without the participation of her husband either in her losses or gains; but any contract entered into with a married woman will bind not only the separate property she then possesses, but also all that which she may afterwards acquire. A woman carrying on a business separately from her husband will be subject to the bankruptcy laws as if she were unmarried. By sect. 2 a woman married on or after the 1st of January, 1883, is entitled to retain as her separate property everything of which she may be possessed at the time of marriage or may acquire afterwards; and by sect. 5 a woman married before the 1st of January, 1883, is entitled to retain all property coming to her after that date. Every married woman has ample remedies at law for the protection and security of her separate property. By sect. 12 she has even against her husband the same civil remedies, and also the same remedies by way of criminal proceedings for the protection and security of her own property as if she were unmarried; but she cannot take criminal proceedings against her husband while they are living together, and neither a husband nor a wife can sue the other for a tort. As regards the liability of husbands for debts contracted by their wives before marriage, it must be observed that, subject to the Statute of Limitations, a husband married before the 9th of August, 1870, is liable generally for such debts, while a husband married on or after that date, and before the 30th of July, 1874, is totally exempt, though by the marriage he may have acquired property with his wife. A husband married on or after the 30th of July, 1874, and before the first of January, 1883, is responsible to the extent of the property his wife may have brought him, and a husband married on or after the 1st of January, 1883, is not liable for the antenuptial debts of his wife. Generally, a husband is not bound by the contracts of his wife unless they are made by his express or implied authority. A wife may pledge her husband's credit for what is necessary to her own support; but should any articles be supplied to the wife which are not considered necessaries, the legal presumption is that the husband did not consent to his wife's contract. The question whether she is acting as his agent is one of fact, and the mere fact of cohabitation does not raise a presumption of agency. If a tradesman has been regularly paid for goods taken up on credit by a wife, he is entitled to believe that she has her husband's authority. But if a husband has forbidden his wife to take up goods on credit, even though he has not made this public, he will not be liable for debts contracted by his wife with a tradesman with whom she has not hitherto had dealings. Where a separation has taken place owing to the wife's adultery, whether it be by a decree of judicial separation, or by her voluntary elopement, he is not responsible for necessaries supplied to her. With respect to criminal law, should a wife commit a felony in the presence of her husband, it is presumed that she acted under his coercion, and she is thus excused; such presumption may, however, be rebutted by evidence. No protection is extended to the wife in cases where the crimes are such as are prohibited by the laws of nature or are heinous or dangerous. Generally a wife may be found guilty with her husband in all misdemeanours. Should a wife incite her husband to the commission of a felony she is considered an accessory before the fact, but she cannot be treated as an accessory for receiving her husband knowing that he has committed a felony.—Regarding the maintenance of the wife, a husband deserting his wife or children, and leaving them chargeable to a parish, is liable to have his goods seized and sold to pay for their keep; and when a married woman requires relief from the poor-rates without her husband, an order may be made upon the husband by the justices in petty sessions to maintain his wife by paying towards the cost of her relief such sum, in such manner, and to such persons as the justices may deem proper.—In the matter of giving evidence, the husbands and wives of the parties, and of the persons in whose behalf the suit is brought or defended, may be summoned to give evidence on behalf of any of the parties. No husband can be compelled to give evidence against his wife nor any wife against her husband in any criminal proceeding unless for an offence against the person. On the petition of a wife to the Divorce Court for dissolution of marriage on the ground of adultery and cruelty, or of adultery and desertion, husband and wife are competent and compellable to give evidence of, or relating to, cruelty or desertion, and the parties to any proceeding instituted in consequence of adultery, and the husbands and wives of such parties, are competent witnesses, but are not compellable to answer any question tending to show that he or she has not been guilty of adultery, unless such witness shall have already given evidence in the same proceeding in disproof of his or her alleged adultery.—In Scotland the control over the property of a wife is now limited by the 44 and 45 Vict. cap. xxi., which abolished altogether the right of a husband to control the income of his wife's estate where a marriage is contracted after the passage of this act (18th July, 1881), and the husband shall at the time of the marriage have his domicile in Scotland. The special provisions of the act are that the wife shall not be entitled to assign the prospective income of her movable or personal estate, whether acquired before or during the marriage, or, unless with her

husband's consent, to dispose of it. Any money of the wife lent or intrusted to her husband or inmixed with his funds, shall be considered assets of the husband's estate in bankruptcy, under reservation of the wife's claim to a dividend as a creditor for the value of such money after the claims of the other creditors have been satisfied.—In the United States the tendency of recent legislation has always been in favour of securing the wife's control over her own property. In New York, New Jersey, Pennsylvania, and Maryland she may manage her property as if she were single, sue and be sued alone in all actions arising out of it, and may sue alone to recover damages for injury to her person or character. The movement in this direction is being followed by most of the other states.

HUSKISSON, WILLIAM, statesman and financier, was born in Warwickshire, 11th March, 1770. He was sent to Paris in 1783, where his uncle, Dr. Gem, was physician to the British embassy, to study medicine. In 1789 he became an enthusiastic sympathizer with the French revolution, was present at the taking of the Bastille, and joined the Club of 1789, instituted the following year. He made a speech at the club against the proposed creation of paper money, and withdrew from it when the assembly decreed the issue of assignats. His views of the revolution afterwards underwent a change. In 1790 he was appointed secretary to Lord Gower (Marquis of Stafford), the British ambassador; and when the ambassador was recalled in 1792 he returned to England, and secured the friendship of Pitt and Dundas, to whom Lord Gower introduced him. He was first placed at the head of the Alien Office, instituted for the purpose of attending to the claims of the French emigrants, and in 1795 he became under-secretary for war and the colonies. In 1796 he was elected member of Parliament for Morpeth. He resigned his post when Pitt retired in 1801, and did not again obtain a seat in Parliament till 1804. In Pitt's administration formed in this year he became secretary of the treasury, and during the Whig ministry that succeeded Pitt's death he was an active member of the opposition. In 1807 he resumed his post as secretary of the treasury, which he resigned in 1809 when Canning retired from the ministry. In 1814 he accepted the appointment of chief commissioner of the woods and forests. In 1823 he was elected M.P. for Liverpool, and appointed president of the board of trade, and treasury of the navy. In 1827 he became secretary of state for the colonies in the cabinet of Lord Goderich. He retained his post on the accession of the Duke of Wellington to office, but shortly afterwards resigned it. He was killed at the opening of the Liverpool and Manchester Railway, 15th Sept. 1830. He seldom spoke in Parliament except on commercial or financial subjects, on which he was an authority. He also anticipated Peel in his advocacy of a free-trade policy. A collective edition of his speeches in and out of Parliament was published in London in three vols. 8vo, 1831. His speeches on the corn-laws, currency, and commerce are said to be about the best in the language.

HUSS, JOHN (*Hus, Johann*), was born at Hussinatz in Bohemia, whence his name; according to some authorities in 1369, according to others in 1373. Being of a poor family, he was sent by a feudal patron to the University of Prague, where he was distinguished for his talents and industry. Having become the servitor of a professor, to whose library he thereby had access, he had an opportunity of acquiring a degree of theological information which for that age was remarkable. In 1396 he took the degree of Master of Arts, and in 1398 delivered public theological and philosophical lectures. In 1400 he was ordained a priest, and in 1401 made dean of the faculty of philosophy in the university. In 1402 the office of Bohemian preacher in the Bethlehem chapel at Prague, which was established by a private foundation, was conferred on him. Here he began to acquire influence over the people, with whom as well as with the students his sermons were very popular, and being soon after made confessor to the Queen Sophia, he thus gained access to the court. Since 1391 he had been acquainted with the writings of Wickliffe. His knowledge of the Scriptures soon made him feel the justice of that bold reformer's attacks on the abuses of the church, and he now became himself the boldest advocate of a reform which should restore to the corrupt church the simplicity and purity of scriptural Christianity. His boldness did not long remain unobserved, and as in the frequent disputes of the Germans with the Bohemian academicians, he took part with the latter, he had soon to contend with powerful enemies. This made a national division of that which hitherto had been only a contest between the philosophical schools of the Realists, to which Huss belonged, and of the Nominalists, to which most of the Germans had attached themselves. A large body of German professors and students left Prague, founded the University of Leipzig, and gave a new impulse to some of the other universities of Germany, a loss which Prague and Huss himself, who was now (1409) made rector of the university, sensibly felt. Yet he could not be attacked in Bohemia; the great schism had exposed the weakness of the priesthood where the nobility and people were excited against the arbitrary decrees of the pope by some bold spirits, who served as the precursors of Huss's doctrines, and thus became accustomed to judge freely; the government of Wenceslaus favoured the anti-papal spirit of many among the people from political grounds, and from an inclination favourable to Huss, who was generally esteemed. He ventured, therefore, to censure publicly the corrupt morals of the priests and the laity, and to preach against the sale of Papal indulgencies in Bohemia; he said nothing new when he declared masses for the dead, image-worship, monastic life, auricular confession, fasts, &c., to be inventions of spiritual despotism and superstition, and the withholding of the cup at the Lord's supper unscriptural. The new pope, Alexander V., finally summoned him to Rome, and as he did not appear the Archbishop of Prague, Sbynko, commenced the immediate persecution of this preacher of the truth. About 200 volumes of copies of Wickliffe's writings were burned in 1410 in the archbishop's palace, and the Bohemian preaching at the Bethlehem chapel prohibited. But Huss did not obey either this prohibition or the new summons of John XXIII., but appealed, as his envoys at Rome were imprisoned, to a general council.

When the pope caused a crusade against Ladislaus of Naples to be preached in Bohemia, Huss opposed it in the warmest manner, and his friend Jerome expressed himself on the subject in violent language, which the pope ascribed to Huss, who was in consequence excommunicated, and Prague laid under an interdict as long as Huss should remain in it. Huss, therefore, distrustful of the protection of the weak King of Bohemia, went to the feudal lord of his birth-place, Hussinatz, whose name was Nicholas. Here, and in many places in the circle of Bechin, he preached with much success; here he also wrote his memorable books On the Six Errors, and On the Church, in which he attacks transubstantiation, the belief in the pope and the saints, the efficacy of the absolution of a vicious priest, unconditional obedience to earthly rulers, and simony, which was then extremely

prevalent, and makes the Holy Scriptures the only rule of matters of religion. The approbation with which these doctrines were received, both among the nobility and common people, increased the party of Huss in a great degree; and as nothing was nearer to his heart than the diffusion of truth, he readily complied with the summons of the Council of Constance to defend his opinions before the clergy of all nations. Wenceslaus gave him the Count Chlum and two other Bohemians of rank for his escort. The Emperor Sigismund, by letters of safe conduct, became responsible for his personal safety; and John XXIII., after his arrival at Constance, November 4, made promises to the same effect. Notwithstanding this, he was thrown into prison, November 28, after a private examination before some of the cardinals, and in spite of the reiterated remonstrances of the Bohemian and Moravian nobles, was kept in confinement, and though sick, was not permitted an advocate. At a public examination, June 5, 1415, the fathers of the council interrupted him in his defence by loud and vehement vociferation. In a trial on the 7th and 8th of June he defended himself at length in the presence of the emperor; but his grounds of defence were not regarded, and an unconditional recantation of heresies which he had not taught, as well as those which he had, was demanded of him. Huss, however, remained firm in his belief, and the last examination (July 6) issued in a sentence of death, which had long before been determined on. Huss on this occasion reminded the emperor of his promise of safe conduct, at which Sigismund could not refrain from showing his shame by a blush; yet the hatred against a man who had ventured to speak the truth was too great to allow any hopes of safety. He was, without being convicted of any error, that same day burned alive, and his ashes were thrown into the Rhine. On his way to the pile he was observed to smile at a place where some of his writings had been burned, and afterwards expired in the midst of joyful prayers. Even his enemies speak with admiration of his unblemished virtue and his firmness in the hour of death. The fifth centenary of his birth was celebrated in Bohemia in 1869, in which year an edition of his works was published.

HUSSARS, originally the name of the Hungarian cavalry, raised in 1458, when Matthias I. ordered the prelates and nobles to assemble with their cavalry in his camp. Every twenty houses were obliged to furnish a man, and thus from the Hungarian word *husz* (twenty) was formed the name *Huszar, Hussar*. The arms and dress of this light cavalry were afterwards imitated, and the name borrowed by other nations.

HUSSITES. After the death of Huss, his adherents took up arms for the defence of their principles, and against the authority of the Emperor Sigismund. The war began, 30th July, 1419, by an insurrection in Prague, headed by Johann Ziska, chamberlain of King Wenceslaus, who had already served with distinction in foreign wars. Ziska formed a disciplined army, fortified Tabor, and raised himself to the position of a protector of the kingdom. He died, 12th October, 1424, and was succeeded by Procopius, who also distinguished himself by many victories. The excesses of this party, however, who were called the *Taborites*, alienated the moderate Hussites, who called themselves *Calixtines*, and who finally united with the Catholics by the Compact of Prague in 1433 to acknowledge Sigismund as king, certain concessions, especially the use of the cup for the laity, having been made to them by the Council of Basel. The Taborites were defeated and Procopius killed on 31st May, 1434. The Taborites henceforth declined as a political party, and finally became merged in the Bohemian Brethren. See BOHEMIA and BOHEMIAN BRETHREN.

HUSTINGS (Anglo-Saxon, *hus*, house, and *thing*, cause, council). (1) Formerly the county court of London, of great antiquity, held before the lord-mayor and aldermen in London, the sheriffs and recorder in Guildhall. There were also hustings at York, Winchester, Lincoln, &c.—(2) The platform from which candidates for seats in Parliament addressed the constituency on their nomination previous to the act passed in 1872 for carrying out elections by means of the ballot, and which abolished the old method of nominating candidates.

HUTCHESON, FRANCIS, LL.D., philosophical writer, was born in the north of Ireland, August 8, 1694, and in 1710 was entered a student in the University of Glasgow. After spending six years at Glasgow, he returned to his native country, where he was licensed to preach among the Dissenters, but accepted the invitation of some gentlemen acquainted with his talents to set up a private academy in Dublin. In 1725 the first edition of his celebrated Inquiry into the Ideas of Beauty and Virtue appeared without his name; but its merit would not allow the author to be long concealed. In 1728 he published his Treatise on the Passions, which has often been reprinted, and is admired even by those who dispute the soundness of its philosophy. In 1729 he was called to the chair of philosophy at Glasgow. He died in 1746, in his fifty-third year. In 1755 was published from his MSS. a System of Moral Philosophy (in three books, two vols 4to), to which is prefixed some account of the Life, Writings, and Character of the Author, by Dr. Leechman, professor of divinity in the University of Glasgow. The philosophy of Hutcheson is based primarily on that of Locke, and in morals he belongs to the school of Shaftesbury and Butler. His particular theory of conscience as a distinct sense, which he derived by a process of reasoning from the principles of Locke, was attacked by Richard Price in a celebrated work, Principal Questions and difficulties in Morals. The views of Hutcheson and Price are reviewed in Jouffroy's Cours de droit Naturel. Hutcheson was a writer of considerable originality, and is justly regarded as the precursor of Reid, and the founder of the Scottish school in philosophy. An admirable résumé of his works is contained in Cousin's Philosophie Écossaise.

HUTCHINSON, JOHN, an officer of the Parliament, and Governor of Nottingham Castle during the great civil war, was the son of Sir Thomas Hutchinson of Owthorpe, and was born at Nottingham in September, 1615. After attending the free schools of Nottingham and Lincoln he entered Cambridge, where he remained till his twentieth year, and then removed to London to study law. In 1638 he married Lucy, the second daughter of Sir Allan Apsley. His family increasing he had thoughts of adding to his income by purchasing a place in the Star-chamber, and had, as he imagined, completed all the necessary arrangements, when the seller changed his mind. This was fortunate, as the Star-chamber, which had too long been the instrument of an odious and tyrannical government, was suppressed by Parliament the very next year. Politics having now become the engrossing topic, Mr. Hutchinson, after he had made it a matter of conscience carefully to study both sides of the question, joined the popular party, and came to be regarded as a Puritan. A warrant for his apprehension was accordingly issued; but he made his escape, and after residing for some time in Northamptonshire, returned to Nottingham, where he became the soul of his party. After accepting a colonelcy in a regiment of foot, he was appointed

Governor of Nottingham Castle, which he defended against the royalists with great skill and gallantry. On the termination of the war he was returned to Parliament for his native county, and went all lengths with the republican party, actually sitting as one of the judges on the king's trial, and concurring in the sentence which condemned him to die. This questionable specimen of his stern republicanism is somewhat relieved by his subsequent consistency in condemning Cromwell to his face for his arbitrary conduct in dismissing Parliament, and usurping the office of king under the name of Protector. On Cromwell's death Colonel Hutchinson again took his seat in Parliament; but in consequence of Monk's ascendency, and his own refusal to make a suitable apology for his past conduct, was suspended. With some difficulty having been comprehended in the act of amnesty he retired to the country. The authorities, however, had not yet done with him; and after a vain attempt to make him turn informer, he was committed to the Tower in October, 1663, on some vague suspicion of treason. Here he remained a close prisoner for ten months without being made acquainted with the charge brought against him, and was then carried to Sandown Castle, in Kent, where the damp and confinement brought on an aguish fever, which terminated his life on the 11th of September, 1664, in the forty-ninth year of his age. His wife Lucy, who not only shared his fortunes like a true and faithful wife, but had also thoroughly imbibed his republican sentiments, has erected a durable monument, both to his fame and to her own, by leaving behind her a volume of Memoirs, which was first published in 1806, has been several times reprinted, and in the branch of literature to which it belongs is not surpassed by any work in the English language.

HUTTEN, Ulrich von, a German knight, distinguished for his poems and satires, and for the influence which his writings exercised upon the Reformation. He was descended from an ancient family, and was born at the family castle of Steckelberg on the Main, in 1488. In his tenth year his father placed him at Fulda, in order to educate him for a monk. The monastic school there was one of the most famous in all Germany, and he received an excellent education; but the monastic life corresponded so little with his inclination, that he fled to Erfurt in 1504, where he became intimately acquainted with several scholars and poets. A pestilence drove him in the next year to Cologne, whence he accompanied Rhagius, one of the professors in the university there, to Frankfort, where he resided three years. But quiet did not long accord with his restless disposition. He travelled in the north of Germany, although tormented with a loathsome disease, which made its first appearance at this time, and visited Greifswald and Rostock, where he was welcome as a poet and man of talents, and where he supported himself by his labours. In 1511 he went to Wittenberg, where he published a work on versification. From thence he proceeded to Pavia to study law, and if possible to conciliate his father. During the time of his residence there, Pavia being taken by the Swiss in the service of Maximilian I., he removed to Bologna, after having been stripped of his property by the soldiers. He was compelled by want to enter the imperial service in 1513, in which he only remained for a year. Ulric, duke of Würtemberg, having murdered a cousin of Hutten, Hutten gave free course to his indignation in poems, letters, and addresses, which made him known throughout Germany. He distinguished himself no less in the Reuchlinian controversy with the Dominican Hogstraaten in Cologne. Hutten vigorously defended the learned, honest, and persecuted Reuchlin, particularly in satires, and the Epistolæ obscurorum Virorum, in which he had the greatest share, contributed to display the monks in all their nakedness. To please his father he went again to Italy in 1515, to take the degree of Doctor of Laws in Bologna. He first visited Rome, and afterwards went to Bologna; but he could not remain anywhere long, and soon returned by way of Venice to his country, where he was adorned with the poetic laurel in Augsburg, by the fairest of the German maidens—Constantia, the daughter of Peutinger—and was knighted by Maximilian.

In Italy Hutten had become acquainted with the monastic life in all its deformity, and was so much the enemy of the clergy, that by his edition of Laurentius Valla, De falso credita et ementita Donatione Constantini, he declared war upon them, and opened the way for Luther. In 1518 he entered the service of Albert, archbishop of Mayence, and made several official journeys to Paris. He also accompanied the archbishop to the diet at Augsburg, where Luther held his well-known discussion with Cajetan, and Hutten, in a Demosthenic oration, urged the German princes to a war against the Turks. He took the field with the Suabian League in 1519, against his hereditary enemy, Ulric of Würtemberg, where he contracted an intimacy with Francis of Sickingen. He retired to the solitude of his paternal castle, to engage anew in the controversy with the monks. Here he published work after work, exhibiting in a strong light the arrogance and corruption of Rome; but as the objects of his attacks complained to his patron, Albert of Mayence, he lost eventually the favour of the latter, and forming publicly a connection with Luther began to write altogether in German, instead of Latin as he had formerly done. At length the Roman authorities demanded that he should be delivered up to them: attempts were made to assassinate him, and he was not safe even in the headquarters of Charles V. But his friend Sickingen allowed him an asylum in his castle, whence he issued new missives to princes and people. Meanwhile Sickingen became involved in a bloody feud with the Archbishop of Treves, which terminated unhappily for the former, and Hutten had to seek another place of refuge. He hoped to find it in Switzerland; but Erasmus was opposed to him, so that he was obliged to change from one place to another, till finally, overpowered by a new attack of his disease, he died on the island of Ufnau, in the Lake of Zürich, Aug. 23, 1523.

Hutten was one of the boldest and most free-spirited men of his time; a forerunner and promoter of the Reformation. He met Luther only once at Augsburg, in 1518; but he was at that time impressed with little respect for the reformer, although he had afterwards the greatest veneration for him, as he had also for Reuchlin. As a writer he was regardless of many of the *bienséances* by which more cautious men temper their hostility even to the most flagrant abuses. Injustice, falsehood, hypocrisy, and tyranny filled him with indignation, and he unmasked them with all his power. While all his friends were trembling his courageous spirit knew no fear. There are forty-five works from his hand, exclusive of several which are not certainly known to be his. A complete collection of his works in five vols. is published by Böcking (Leipzig, 1859–70), to which is prefixed an Index Bibliographicus Huttenianus. Besides older biographies there is one by Strauss, in two vols. Leipzig.

HUTTON, Charles, LL.D., an eminent mathematician, was born at Newcastle-upon-Tyne, Aug. 14, 1737, and his father, who was a viewer of mines, intended to devote him to his own employment. He received a little instruction in the rudiments of

the Latin language, and in the elements of the mathematics: but he owed nearly the whole of the subsequent acquirements to his own application. Having received an injury in one of his arms he was found unfit for his intended occupation, on which the natural bent of his inclinations led him to prepare himself for becoming a mathematical teacher. The destruction of the old bridge at Newcastle having attracted his attention to the subject of the construction and properties of arches, he was led to the production of a small work on the Principles of Bridges (1772). which laid the foundation of his future fame. He was in 1773 appointed professor of mathematics at Woolwich Academy, elected a fellow of the Royal Society in 1774, and in 1779 received the degree of LL.D. from the University of Edinburgh. In 1785 he published his Mathematical Tables, preceded by an introduction, tracing the progress and improvement of logarithms from the date of their discovery. Next year Dr. Hutton published a quarto volume of Tracts, Mathematical and Philosophical, which was not long after followed by his Elements of Conic Sections, for the use of the academy at Woolwich. His Mathematical and Philosophical Dictionary (two vols. 4to) appeared in 1795–96, of which a new and greatly enlarged edition was published in 1815. In 1798 he gave the world the first edition of his Course of Mathematics, in two vols. 8vo, to which a third was added in 1811. From 1803 to 1809 he was employed, in conjunction with Drs. Pearson and Shaw, in an abridgment of the Philosophical Transactions published in eighteen 4to volumes. In 1812 he published another collection of Tracts on mathematical and philosophical subjects. He died Jan. 27, 1823, in his eighty-sixth year.

HUTTON, James, a natural philosopher, distinguished as the author of a system of geology which bears his name. He was born at Edinburgh on June 3, 1726, and studied in the university under Maclaurin, the celebrated mathematician. He also applied himself to chemistry, and went to Leyden, where he graduated as M.D. in 1749. He then devoted himself to the study of agriculture, both in its theoretical and practical aspects. About 1768 he settled at Edinburgh, where he published numerous works relating to natural philosophy, among which are Dissertations on different Subjects in Natural Philosophy (Edinburgh, 1792, 4to); an Investigation of the Principles of Knowledge, and of the Progress of Reason from Sense to Science and Philosophy (Edinburgh, 1794, three vols. 4to); Theory of the Earth, with Proofs and Illustrations, (Edinburgh, 1795, two vols. 8vo). His death took place on March 26, 1797. The geological system, or theory of the earth, proposed by this philosopher, excited a warm controversy among men of science, and met with an advocate in Professor Playfair, who, in 1802, published a work entitled Illustrations of the Huttonian Theory of the Earth; and in Sir Charles (then Mr.) Lyell, who published his Manual of Geology in 1832. Hutton is the father of modern geology, since he first recognized the similarity of processes in the past and present, and thus laid the basis of that doctrine of uniformity which Lyell popularized and combined with the stratigraphy of William Smith, and the palæontology of Cuvier.

HUXLEY, Thomas Henry, biologist, was born at Ealing, Middlesex, May 4, 1825, his father being one of the masters of Ealing School. After attending this institution for a few years he went to study medicine with a brother-in-law who was a doctor. His medical education was continued at Sydenham College, and more especially at Charing Cross Hospital, and on completing his curriculum there he passed his first examination for the degree of Bachelor of Medicine in the London University, taking high honours in physiology. In 1846 he entered the medical service of the navy, and in the end of this year was appointed assistant-surgeon of the *Rattlesnake*, which was sent on an exploring and surveying cruise in the seas on the east and north-east of Australia. The voyage lasted four years, and gave Huxley an opportunity of gaining an almost unrivalled knowledge of marine zoology. Various papers on this subject were contributed by him to the Linnæan and the Royal Society (one of them gaining a medal from the latter body, of which he was elected a member in 1851), and a further result of his investigations was the important work published in 1859, entitled The Oceanic Hydrozoa. Shortly after his return he withdrew from the naval service, and in 1854 he was appointed lecturer or professor of natural history in the Royal School of Mines, a post with which was long combined that of naturalist to the geological survey. With the School of Mines (or Royal College of Science) his name was associated to the last, though latterly only in an honourary capacity. In 1855 he was appointed Fullerian professor of physiology to the Royal Institution, and delivered four courses of lectures in as many years; while about this time he was also an examiner for seven years to the University of London. The posts of Croonian lecturer to the Royal Society and Hunterian professor in the College of Surgeons were also filled by him. Lectures to working men, in 1860, on the Relation of Man to the Lower Animals, gave rise to much discussion, and led him to treat the subject in his Evidence as to Man's Place in Nature (1863). By this time the Darwinian theory had given rise to much excited controversy, and Huxley's thorough-going Darwinism brought many a bitter attack upon him. In 1862 he was appointed by government to assist in inquiring into the effects of the acts regarding trawling for herring; and subsequently his labours and advice had much influence in determining the course of fishery legislation and administration. Royal commissions of various kinds had also Huxley as an active member, as, for instance, on contagious diseases, Scottish universities, and vivisection. In 1870 his name became more prominent than ever on the publication of his collection of papers entitled Lay Sermons, Essays, and Reviews, which met with fierce denunciation in many quarters. In this year he presided over the Liverpool meeting of the British Association, and was also elected a member of the first London School Board. In 1872 he was elected Lord Rector of Aberdeen University; in 1875–76 he lectured on natural history in Edinburgh University in room of Professor Wyville Thomson. In 1883 he held the high position of president of the Royal Society. In 1881–85 he was inspector of salmon fishings, but in the latter year ill-health compelled him to resign this and his other public offices. Latterly he resided at Eastbourne, and there on June 29, 1895, he died. He had received honorary degrees from several universities, medals from various societies, and was a member of many learned academies. Among his works other than those already mentioned are: An Introduction to the Classification of Animals; Manual of the Anatomy of Invertebrated Animals; Manual of the Anatomy of Vertebrated Animals; Physiography; Critiques and Addresses; Science and Culture, and other Essays; Essays on Some Controverted Questions. His various essays have been published collectively in nine volumes (1893–95), with a short autobiography prefixed, in which he tells us that his life has been devoted 'to the popularization of science; to the development and organization of scientific education; to the endless

series of battles and skirmishes over evolution; and to untiring opposition to that ecclesiastical spirit, that clericalism, which in England, as everywhere else, and to whatever denomination it may belong, is the deadly enemy of science'. See the Life by his son (1897).

HUY, a town of Belgium, 18 miles south-west of Liége, in a beautiful valley on the Meuse. It has a fine Gothic church, and a citadel (now the public prison). Its manufactures are varied, and its trade is extensive. Pop. (1900), 14,644.

HUYGENS, CHRISTIAN, distinguished for his researches and discoveries in the departments of mathematics, physics, and astronomy, son of Constantine Huygens, a poet, was born in 1629 at the Hague. He studied at Leyden in 1645, and at Breda, where he went through a course of civil law from 1646–48. He visited Denmark in 1649, and France in 1655. Up till 1665 he resided alternately in Holland, France, and England. In 1666, having accepted an invitation from Colbert, he settled in Paris, where he remained till 1681, when he returned to Holland on account of his health. He visited England again in 1689, and died at the Hague in 1695. Huygens' investigations on the oscillations of the pendulum, which are contained in his work Horologium Oscillatorium sive de Motu Pendulorum ad Horologia adaptato Demonstrationes Geometricæ (Paris, 1673), are among his most important contributions to science. He found that oscillations in circular arcs vary to some extent with the width of the arc; that this variation is avoided by causing the pendulum in its vibration to describe the arc of a cycloid, instead of the arc of a circle, and he effected this by giving it cycloidal cheeks to regulate its movement. The extreme difficulty of making the cycloid cheeks with sufficient accuracy has caused this plan to be abandoned in practice; but the property of the cycloid thus demonstrated, the discovery that the cycloid is its own evolute, and the method of finding the centre of oscillation, were all valuable discoveries. Huygens was also among the first to apply the circular pendulum to the construction of clocks. This he did in 1656. In 1675 he described the spring pendulum as used in watches. The priority of this discovery, although it was made by him independently, is disputed. In 1669 he sent to the Royal Society, simultaneously with Wren and Wallis, a solution of the problem proposed by them of the demonstration of the laws of impact. In 1659 he published his system of Saturn, in which he first proved that the ring completely surrounds the planet, and determined the inclination of its plane to that of the ecliptic. In 1690 he published important treatises on light and on weight. His Traité de la Lumière was founded on the undulation theory, and explained the property of double refraction, but in consequence of the prevalence of the Newtonian theory it was long neglected. In his Discours sur la Nature de la Gravité, although influenced by Cartesian theories, he made some important observations. He explained the slower movement of the pendulum at the equator by the centrifugal force derived from the movement of the earth, which he calculated to equal the seventeenth part of the weight of a body. He also found that the plumb-line was not directed to the centre of the globe, the figure of the earth being an ellipse flattened at the poles. He competed for the prize offered by Pascal, for the demonstration of the properties of the cycloid; but though he answered many of the questions asked by Pascal, none of the competitors answered them all. He preferred Descartes' theory of vortices to Newton's discovery of mutual attraction; but even at an advanced age he made concessions to Newton which proved his candour and freedom of jealousy. His Cosmotheoros and Dioptrique appeared after his death. The former was a speculation regarding the inhabitants of the moon and planets. In the Dioptrique he treats of the coefficients of refraction, the construction of telescopes, &c.

HUYSUM, JAN VAN, a highly distinguished flower and fruit painter, was born at Amsterdam in 1682. He surpassed his predecessors in softness and freshness, in delicacy and vivacity of colour, in fineness of pencilling, in the disposition of light, and in exquisite finish. His father, Justus Huysum, a picture-dealer and a painter of moderate merit, at first employed him in all branches of painting; but young Huysum at a maturer age felt a decided inclination for the representation of the productions of the vegetable kingdom. He therefore separated from his father, and married about 1705. He knew how to penetrate the secrets of nature, to seize the transitory blossom in its most perfect state, and to represent it with enchanting truth and variety of colours. He was so jealous of rivalry that he permitted no one to see him at work, nor would he take any pupils except his brother Michael and the daughter of a friend. His flowers have more truth and beauty than his fruits; the drops of dew and insects which he painted on them are like real life. He died at Amsterdam, 1749. His brother Justus was a battle painter, and died at the age of twenty-two years. The third, Jakob, copied his brother's flower and fruit pieces so perfectly that they brought a very high price. He died in England in 1740.

HWANG-HO. See HOANG-HO.

HYACINTH. The numerous and splendid varieties of the garden hyacinth (*Hyacinthus orientalis*) have always been general favourites. In Holland upwards of 2000 varieties have received distinct names, recognized by the different florists, and the price of 1000 florins has been paid for a single plant. The environs of some of the Dutch towns astonish the traveller, from the gorgeous appearance produced by the vast profusion of these flowers. The wild plant is a native of the Levant, and has a bulbous root, from which rise a few linear-lanceolate leaves and a leafless stem, bearing six or eight bell-shaped flowers of a blue or white colour. The cultivated double varieties have very graceful forms and a remarkable diversity of colour. The natural affinities of this plant place it in the same family with the squill and onion. Grown in glasses the hyacinth is a common ornament of rooms.

HYACINTHUS, in ancient mythology, a youth greatly beloved by Apollo and Zephyrus. He returned the former's love, and Zephyrus, incensed at his coldness and indifference, resolved to punish his rival. As Apollo, who was intrusted with the education of Hyacinthus, once played at quoits with his pupil, Zephyrus blew the quoit, as soon as it was thrown by Apollo, upon the head of Hyacinthus, and he was killed with the blow. Apollo was so disconsolate at the death of Hyacinthus that he changed his blood into the flower called *hyacinth* after him.

HYADES, a group of nymphs in the Greek mythology, variously described by different authors. According to one account, which makes them the daughters of Atlas, their number was twelve or fifteen, of whom five were placed among the stars as Hyades, and seven or ten under the name of Pleiades. According to some traditions they brought up Zeus, and according to others they were the nurses of Dionysus.

HYÆNA, a well-known and savage genus of carnivorous animals of considerable size, distinguished at a glance by the great disproportion between the very strong but somewhat crooked fore-legs and their

somewhat weak hind-legs and drooping hind-quarters. The dental formula of the hyæna is: incisors $\frac{6}{6}$, canines $\frac{1}{1}$–$\frac{1}{1}$, molars $\frac{4}{4}$–$\frac{5}{5}$ = 34. These teeth are well adapted, from their great thickness and strength, to break bones. The head of the hyæna is of a moderate size and massive; the jaws are remarkably strong, shorter in proportion than those of dogs, and longer than those of cats; the tongue is furnished with rough papillæ; the eyes are large, and have longitudinal pupils; the ears are long, erect, very open, and directed forwards. There are four toes on each foot. The strength of jaw manifested by the hyæna is remarkable. It crunches into fragments bones which resist the jaws of the lion, and seems to swallow the splinters with peculiar relish. In old hyænas the teeth are found to be much worn away, and often the crowns have almost disappeared. Naturalists have described several species of the hyæna. They are all nocturnal animals which pass the day in solitude in caves or other hiding-places, which they quit at night in order to seek their prey in bands. Carrion is a favourite food, and the stench attracts the hyæna by night as it does the vulture by day. In some cases they dig up dead bodies and devour them. They also prey on living animals, and flocks of sheep and goats suffer severely from their ravages in some localities. They are cowardly brutes, however, and the larger animals and man have little to fear from them. The common or striped hyæna (*Hyæna striata*) is a native of Northern Africa and parts of Asia, even eastward to Burma. It is about the size of a large dog, of a brownish-gray colour, and marked with transverse bands of dark brown on the body, which become oblique on the flanks and legs. The hair upon the line of the back is much thicker and stronger than on any other part, forming a sort of mane, extending from the nape of the neck to the origin of the tail. This species was well known to the ancients, who entertained many absurd notions respecting it, believing that its neck consisted of but one bone; that it changed its sex every year; that it could imitate the human voice; &c. It was formerly supposed that the hyæna was untamable, but that it can be completely tamed there is not the shadow of a doubt. The spotted hyæna (*H. crocuta*) has a considerable resemblance to the former species, but is larger, and is marked with numerous round blackish-brown spots instead of stripes, nor is the mane so large. This species inhabits many parts of Africa, and used to be peculiarly numerous around the Cape of Good Hope. There is another species, the brown hyæna (*H. brunnea*), which differs from the preceding by having stripes on the legs, the rest of the body being of a dark grayish-brown. It also inhabits the south of Africa. An extinct species, the cave hyæna (*H. spelæa*), was abundant in England, France, and Germany anterior to the glacial epoch, and has left its remains in many caves of these countries. The Aard-vark (*Proteles*) is akin to the hyæna, but it has the molar series $\frac{5}{5}$–$\frac{5}{5}$ or $\frac{4}{4}$–$\frac{4}{4}$, the anterior limbs five-toed, and the muzzle pointed. This South African genus and the hyæna are the only two members of the family *Hyænidæ*, but many zoologists place the aard-wolf in a separate family. See illustrations at CARNIVORA.

HYÆNA-DOG (*Lycaon pictus*), an animal inhabiting great part of Africa south of the Sahara, and having closest affinities with the dog, but resembling the hyæna in some respects. It is coloured irregularly white, yellow, and black, hunts in large packs, and is thus able to prey on the largest antelopes.

HYALONEMA. See SPONGE.

HYBERNATION. See DORMANT STATE.

HYBLA, a mountain in Sicily, where thyme and odoriferous flowers of all sorts grow in abundance. It was famous in ancient times for its honey.

HYBRID, an individual, the produce or offspring of different species, varieties, or genera of animals and plants, which, however, are generally nearly allied. The most common instances of hybrids are those resulting from the connection of different varieties of the same species, as of the produce of the wild boar and domestic sow, or of the different varieties of roses, that result from intercrossing, &c. Hybridity may be of three kinds—1st, *natural*, as the spontaneous connection of animals in their wild state; 2nd, *excited*, as when domestic animals, in opposition to their instincts, cross under the influence of man; and 3rd, *accidental*, which occurs in fishes and in plants. Much uncertainty prevails respecting the productive crossing of species, but it seems to be established that while the crossing of different genera may result in offspring, that of different orders will not. Numerous observations have established that many plants produce specific hybrids in a state of nature, and different species of insects have been observed to cross under similar circumstances. In the case of fishes, artificial impregnation has been successful between different species of the genus *Cyprinus* or carp. Among birds, hybrids are obtained between the goldfinch and canary, the reeve and the pheasant, the pheasant and the domestic fowl, the swan and the goose, &c. Among mammals, hybrids are freely obtained from the connection of the different species of the genus *Equus*, as the horse and zebra, zebra and ass, and the horse and ass, the produce of the last two being the mule proper. Hybrids have also been produced between the lion and tiger, the dog and wolf, the dog and fox, the dog and jackal, hare and rabbit, goat and sheep, and the goat and ibex. Among reptiles (or rather amphibians) the most striking case of hybridity is that between the toad and frog. The propagative power of hybrids is either absolutely null, or is limited to a reversion to the original specific form, for the natural tendency is to prevent hybridity altogether, and when it has occurred, to arrest the production of the varieties so obtained. The general law with regard to hybrids seems to be that individuals of two nearly allied species will interbreed, but that their offspring are not productive between themselves, though they may be impregnated by an individual of the pure breed. Thus, a reversion of the hybrid to the pure breed is specially provided for by a natural law. The question of purity of species is intimately connected with that of permanence of species, and is of exceptional interest at the present time.

HYCSOS, HYKSOS, or HYKSHOS, derived, according to Josephus, from *hyk*, a king, and *shos*, a shepherd; or, according to others, from *hyk*, a captive, and *shos*, a shepherd. A third explanation makes the name equivalent to 'robber kings'. According to the Egyptian annals they were a conquering nomadic race from the East, who, under Salatis, their first king, took Memphis, rendered the whole of Egypt tributary, and maintained a garrison of 240,000 soldiers in the strong city of Avaris, on the east of the Bubastite arm of the Nile. The period of their invasion and conquest of Egypt has been variously computed at from 2567 to about 1800 B.C., and consequently the date assigned to their expulsion varies proportionately, Bunsen making it 1639 B.C., Lepsius, 1842 B.C.; but trustworthy data fix it at about 1500 B.C. The only detailed account of them in any ancient writer is a passage of a lost work of Manetho, cited by Josephus in his rejoinder to Apion, which furnishes

us with probably authentic facts, though numbers are exaggerated—a defect common to almost all primeval records. According to Josephus they consisted of six kings, who reigned nearly 260 years; but as Manetho, in the passage quoted, assigns to the dynasty a period of 511 years, we must conclude that to the six kings mentioned by him we must add a long additional period of rule under their descendants. They were finally expelled by the Egyptians, and, according to Manetho, they passed into Syria; but, fearing the power of the Assyrians, who were then masters of Asia, they built a city in Judæa, and called it Jerusalem. Josephus evidently wishes the inference to be drawn that the Hycsos and the Hebrews are identical, and that they were the shepherd captives, such as the Hebrews were under the dominion of the Pharaohs 'who knew not Joseph'. It appears from the monuments that they entered Egypt about the fourteenth Egyptian dynasty, and that their entrance was attended with almost no violence. The greatest conflict of opinion as to their race or origin has prevailed, but it is probable that they were not Semites.

HYDASPES, a river of India, the modern Jhelum, a tributary of the Indus, and one of the five which give the Punjab its name. It rises in the north-western Himalayas, in Cashmere, and after flowing nearly south, falls into the Chenab.

HYDE, a municipal borough and market town of England, in Cheshire, about 7 miles E.S.E. of Manchester, and 4½ N.E. of Stockport. It has several good streets and many handsome shops, and has quite a modern appearance. It has several churches and a number of chapels, a town-hall (1885) in the Renaissance style, public baths, &c. There are a literary and scientific institution; a technical school; a free library; and a mechanics' institute. The inhabitants are largely employed in cotton spinning and weaving, engineering and other works, the manufacture of hats, and coal-mines. The extension of the cotton manufacture has rapidly raised Hyde from a mere village to a considerable town. Its population in 1871 was 14,223; in 1901, 32,768.

HYDE, or HIDE (Anglo-Saxon, *hīd*, *hīgid*), a measure of land, the quantity of which is not well ascertained, as it is variously given as 60, 80, 100 and 120 acres—a fact which may be accounted for on the supposition that the quantity varied with local usage. It was such a portion of land as might be ploughed with one plough in a year. As a measure of land it is frequently mentioned in Domesday-book and in old English charters.

HYDE, EDWARD, Earl of Clarendon. See CLARENDON.

HYDE PARK, a park in the West End of London, adjoining Kensington Gardens. It derived its name from having been the manor of the Hyde belonging to the Abbey of Westminster, and contains nearly 400 acres. It abounds with fine trees and pleasing scenery. It became crown property on the dissolution of the monasteries in 1535; was surveyed, divided, and sold in 1652; and was resumed by the crown in 1660. It was soon afterwards opened to the public. The sheet of water called the Serpentine River, although it has not the least resemblance to a river, was made between 1730 and 1733 by order of Queen Caroline. It is much frequented in summer for bathing, and during frosts for skating. At the eastern end of it is an artificial waterfall constructed in 1817. On the south side are the barracks of the Life-guards. The Crystal Palace of 1851 was erected on the south side of Hyde Park. Political meetings are sometimes held in this park, and during the discussion of the Reform Bill of 1868 these meetings (held in defiance of the government) led to rioting and injury to property. Reviews are occasionally held in the open part of the park. It has at several times suffered curtailment, large part of Kensington Gardens, as well as the site of Apsley House, having been taken from it.

HYDE PARK, a town of the United States, in Norfolk county, Massachusetts, on the river Neponset, 7 miles to the south of Boston. It has manufactures of iron goods, paper, cottons, woollens, chemicals, &c., and it contains the residences of many Boston business men. Pop. (1900), 13,244.

HYDERABAD, or HAIDARABAD, a state of Hindustan, comprehends the greater part of the country between the Godavari and the Krishna, or the territory known as the Deccan, and is in possession of a powerful Mohammedan prince, the Nizam; area, 82,697 square miles. Nearly the whole country is parcelled out into feudal lordships. The soil is fertile, and when well manured bears any kind of crops, but when uncultivated for a few years it becomes covered with jungle. The chief products are rice, wheat, maize, sugar-cane, tobacco, cotton, indigo, fruits, and timber. There are large flocks of sheep, and honey and bees'-wax are plentiful. Woollen and cotton fabrics are manufactured, and hides, dye-stuffs, gums, and resins are the chief articles of commerce. The climate is generally good. Among the wild animals are the tiger, leopard, nylgau, antelope, and buffalo. Pop. (1891), 11,489,210; in 1901, 11,174,897.

HYDERABAD, the capital of the above state, stands upon the right or south bank of the Mussi, at an elevation of 1672 feet above the sea, in the midst of a highly picturesque country overspread with granite hills and isolated rocks of various forms. Its palaces and mosques, seen in combination with the buildings of the British residency, give it an appearance of much grandeur, but it contains a mixture of stately houses, with low and dirty hovels in narrow irregular streets. It is surrounded by a weak stone wall, forming an irregular quadrangle about 2¾ miles long upon the river, and 2 miles broad. A handsome bridge connects the city with a crowded suburb on the left bank of the river, in which stands the residency. The river, when full, is between 400 and 500 feet wide. The residency is walled, and approached through two gateways. It is a handsome building, with wings resting on an arched basement, to which there is an ascent by a noble flight of twenty-two steps. The palace of the Nizam is of great extent, and in the usual style of native buildings. The Chaur Manar or Four Minarets, the most conspicuous monument of any antiquity in Hyderabad, was built by the founder of the city about 1590. It stands at the junction of the four principal streets of the town, which pass through the great arches on which the building is supported, and has a very striking appearance. It was erected for a Mussulman seminary or college, but is now used for warehouses. There are manufactures of silks, with gold embroidery in the weft, and of turbans and trinkets. Pop. in 1891 (with suburbs), 312,390; in 1901, 446,291.

HYDERABAD, or HAIDARABAD, a town and fortress of Hindustan, capital of Sind, on the left bank of the Indus, from which it is between 3 and 4 miles distant, and 110 miles from its junction with the sea, situated on, or rather scattered over, a rocky eminence about 200 feet high. The streets are narrow and dirty, and the houses built of clay, wood, and brick, mere hovels, The bazaar, however, is extensive, forming one street the entire length of the town, and displays considerable bustle and appearance of business. The fort is of a quadrangular form, with

circular projecting towers at intervals. It is surrounded with a single brick wall of 30 to 40 feet in height, and in part also by a ditch of 8 to 10 feet wide, and 5 to 8 feet deep, crossed by a wooden bridge. Here also is a palace of the Ameers, a square brick building inlaid with coloured porcelain tiles. From its elevated position, and bold though irregular outlines, the fort has a very imposing appearance from a distance, but has little real strength. The principal manufactures of Hyderabad are arms of various kinds, and ornamental silks and cottons. In the immediate vicinity are some handsome tombs. Pop. (1891), 58,048; (1901), 69,378.

HYDER ALI KHAN, Regent of Mysore, and one of the greatest Mohammedan princes in India, was a formidable enemy to the English in Hindustan, in the latter part of the 18th century. He was born at Boodicoota, near Colar, on the frontiers of Mysore. On the death of his father, who was a general of the Rajah of Mysore, he removed with his mother and elder brother, Shabaz Sahib, to Bangalore. Shabaz, through the influence of a maternal uncle, became an officer in the service of Mysore; Hyder, on the contrary, led an idle dissolute life, and was twenty-seven years of age before he gave any signs of the great capacity which he afterwards manifested. After the siege of Deonalli, where he first distinguished himself, his rise was rapid, and the whole power of the state fell into his hands. At last, having deposed Kandih Rao, he was chosen Rajah of Mysore in 1762. He so greatly extended his dominions, that in 1766 they contained 84,000 square miles, and afforded an immense revenue. His reign was passed in wars with the English and with the Mahrattas, the former of which powers excited his peculiar jealousy. A treaty which he made with the East India Company, 4th April, 1769, was violated in 1780, and, forming an alliance with the Mahrattas, he obtained the services of French officers, and took Arcot on the 31st October of the same year. He was defeated by Sir Eyre Coote, June 1, 1781. The Mahrattas now joining in a league against him, he carried on a disadvantageous war, during the continuance of which he died, in 1782. For an account of the subsequent fate of his empire, see TIPPOO SAIB.

HYDRA, in fabulous history, a celebrated monster, which infested the neighbourhood of Lake Lerna in the Peloponnesus near the well of Amymone. It was the fruit of Echidna's union with Typhon, though some represent it as the issue of Styx and the Titan Pallas. It had a hundred heads according to Diodorus, fifty according to Simonides, and nine according to Apollodorus, Hyginus, &c. The central head was immortal. As soon as one of those heads was cut off two immediately grew up if the wound was not stopped by fire. It was one of the labours of Hercules to destroy this monster, and this he effected with the assistance of Iolaus, who applied a burning iron to the wounds as soon as one head was cut off. The central head the conqueror buried under a huge rock. While Hercules was destroying the hydra, Hera, jealous of his glory, sent a sea-crab to bite his foot. This new enemy was soon despatched, and Hera, unable to succeed in her attempts to lessen the fame of Hercules, placed the crab among the constellations, where it is now called the *Cancer*. The conqueror dipped his arrows in the gall of the hydra. From that circumstance all the wounds which he gave proved incurable and mortal.

HYDRA, an island belonging to Greece, in the Archipelago, on the east coast of the Morea, between the Gulfs of Nauplia and Egina; greatest length, N.N.E. to S.S.W. 12 miles; breadth, about 3 miles; area, 30 square miles. Its surface, though not very elevated (highest point 1939 feet), is almost entirely composed of bare sterile rocks; so that the inhabitants, unable to derive subsistence from the soil, have been in a manner compelled to devote themselves to trade and commerce. And not only in these have they been eminently successful, but Greece is in no small degree indebted for her ultimate independence to the patriotic efforts of the Hydriotes, who, by their fleets, boldly maintained the cause, when it would otherwise have seemed hopeless. The principal town of the island bears the same name, and stands on the north-western shore, on a rugged height, on which not a speck of verdure is seen. Owing to the nature of the site, the streets are uneven and even precipitous, but are kept remarkably clean, and the houses are built in the most substantial manner. The principal manufactures are silk and cotton stuffs, soap, leather, &c. The trade embraces a large share of the transit between the Black Sea and the Mediterranean. The nucleus of the town was formed by a few fishermen and peasants from the mainland who had fled from the tyranny of the Turks. Crowds followed these in the fifteenth and sixteenth centuries. During the war of independence, Hydra was almost the only place where the Greeks could feel themselves secure, and they accordingly crowded to it from all quarters, and raised its population to nearly 40,000; but when the whole continent of Greece became a safe residence, numbers who had taken up their abode here withdrew. Pop. about 7,000.

HYDRA (the Water-snake), a southern constellation of Ptolemy. It is remarkable for its great length, and attempts have been made to subdivide it, but no successful subdivision has yet been introduced. The constellations Corvus and Crater are generally represented as portions or as subdivisions of Hydra. α Hydræ is a star of the second magnitude.

HYDRA (in zoology). See HYDROZOA.

HYDRANGEA, a genus of shrubby plants of the order Saxifragaceæ, with about thirty species indigenous to eastern Asia and temperate America. They have large, simple leaves and very large cymes of flowers, the outer ones being infertile. The *H. vulgaris* grows on the Alleghanies, and in other parts of the Union, but not north of Philadelphia, in the Atlantic States. The *H. nivea*, a more ornamental shrub than the preceding, and differing by the white inferior surface of the leaves and the large size of the marginal flowers, seems to be more exclusively confined to the region about the southern portion of the Alleghanies, extending, however, as far north as Pennsylvania. The *H. quercifolia*, distinguished by its lobate leaves, inhabits the country bordering on the Gulf of Mexico, and is not unfrequently cultivated in our own gardens. The best-known species is *H. Hortensia* (*H. hortensis*), the Japan rose, which is the plant usually referred to when the Hydrangea is spoken of. It is sometimes referred to a separate genus. This plant is a general favourite in China and Japan, from whence it was originally brought; and, indeed, the fine corymbs of large rose-coloured flowers, which succeed each other throughout the whole season, added to the ease of cultivation, afford well-founded claims for distinction. The fruit is a multilocular capsule.

HYDRAULIC CRANE. The power originally employed to work cranes was manual labour exerted in turning the winch. But many cranes are now connected with machines worked by steam or other agency, and their movements are controlled by the usual arrangement of levers required for such purposes; these levers are so placed that the man in charge of the crane has complete power over all the operations of hoisting, lowering, and stopping. An important improvement in the working of cranes,

however, was effected by Lord Armstrong through the employment of hydraulic pressure. The mechanism consists of one or more hydraulic presses, with a set of sheaves, used in the inverted order of blocks and pulleys, for the purpose of obtaining an extended motion in the chain from a comparatively short stroke of the piston. The accompanying plate exhibits a sectional elevation and plan of the hydraulic crane, and also a plan and elevation of one of the hydraulic presses employed, with sheaves attached to multiply the motion fourfold. The power is applied not only for lifting the load, but also for swinging the jib, which latter object is effected by means of a rack or chain operating on the base of the movable part of the crane, and connected either with a cylinder and piston having alternate motion, like that of a steam-engine, or with two presses applied to produce the same effect by alternate action. The supply of water is derived from an apparatus termed the *accumulator*, which consists of a large cast-iron cylinder, fitted with a plunger, from which a loaded weight case is suspended, to give pressure to the water injected by a steam-engine. The load upon the plunger is usually such as to produce a pressure in the cylinder equal to a column of 1500 feet in elevation, and the apparatus is made sufficiently capacious to contain the largest quantity of water which can be drawn from it at once by the simultaneous action of all the hydraulic machines with which it is connected. Whenever the engine pumps more water into the accumulator than passes direct to the hydraulic machines, the loaded plunger rises and makes room in the cylinder for the surplus; but when, on the other hand, the supply from the engine is less, for the moment, than the quantity required, the plunger with its load descends and makes up the deficiency out of store. The accumulator also serves as a regulator to the engine; for when the loaded plunger rises to a certain height, it begins to close a throttle-valve in the steam-pipe, so as gradually to reduce the speed of the engine until the descent of the plunger again calls for an increased production of power. The absence of any sensible elasticity in water renders the motions resulting from its pressure capable of the most perfect control, by means of the valves which regulate the inlet and outlet passages of the machines; but this very property, which gives so much certainty of action, tends to cause shocks and strains to the machinery, by resisting the momentum acquired by the moving parts. Take the case of an hydraulic crane swinging round with a load suspended on the jib, the motion being produced by the water entering on one side of a piston and escaping from the other. Under such circumstances, if the water-passages be suddenly closed by the regulating valve, it is obvious that the piston, impelled forward by the momentum of the loaded jib, but met by an unyielding body of water deprived of outlet, would be brought to rest so abruptly as to cause, in all probability, the breakage of the machine. So also in lowering a heavy weight with considerable velocity, if the escape-passage be too suddenly closed, a similar risk of injury would arise from the abrupt stoppage of the weight, if a remedy were not provided. These liabilities, however, are effectually removed by applying, in connection with the water-passages to the cylinder, a small clack-valve, opening upwards against the pressure into the supply-pipe, so as to permit the pent-up water in the cylinder to be pressed back into the pipe whenever it becomes exposed to a compressive force exceeding the pressures on the accumulator. See plate above referred to, which shows a slide-valve provided with relief-clacks, and adapted for the turning apparatus of the hydraulic-crane. Two of these relief-clacks open against the pressure in the supply-pipe, so as to afford an escape for the water, which would otherwise be shut up in the cylinder when the exhaust-port closes, and the other two communicate with the discharge-pipe, so as to draw in a portion of waste water to fill up the small vacancy which would otherwise be left in the cylinder on the closing of the admission-port. By this means all jerks and concussions are avoided, and a perfect control over the movement of the machine is combined with great softness of action.

HYDRAULICON, a water organ or musical instrument acted upon by water, the invention of which is said to be of higher antiquity than that of the wind organ.

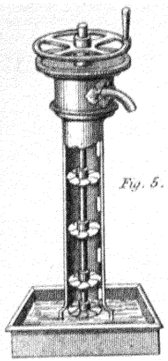
HYDRAULIC PRESS, properly called *Hydrostatic Press*, or *Bramah's Press* from the inventor. See HYDROSTATIC PRESS.

HYDRAULIC RAM. See HYDRAULICS.

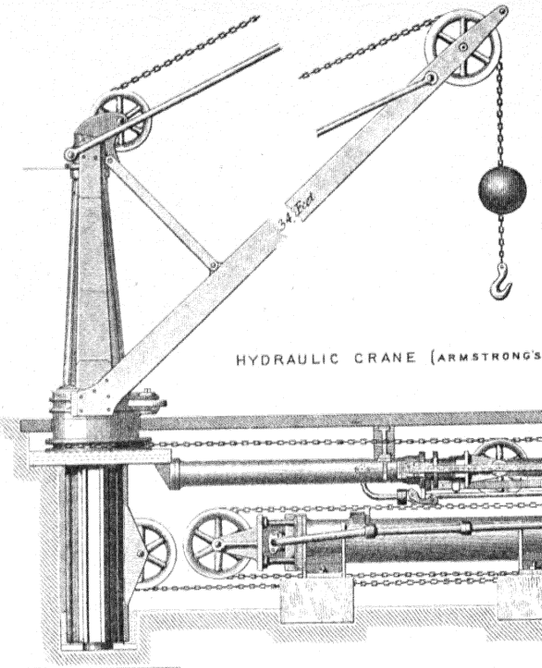
HYDRAULICS is the department of mechanical science which deals more especially with the flow of liquids in pipes and channels. One of the most important natural sources of energy is to be found in water which has been raised above the sea-level in the form of vapour by the sun's heat, and has fallen as rain or snow in elevated districts. On permitting the water to descend through a properly-constructed channel a machine may be set in motion by the flowing water. Various kinds of engines or machines are employed to utilize the energy of the water supplied to them; those in common use being water-wheels and turbines. Tidal wheels have also been constructed for the purpose of employing the rising and falling tide as a source of power. They have not, however, been very successfully applied as yet. It is impossible to enter here in any detail into this technical branch of engineering science, and we must content ourselves with a brief account of some of the most common hydraulic machines.

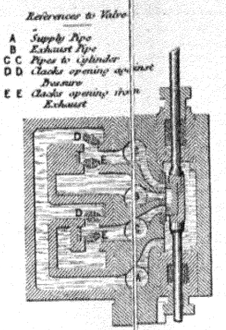
The particles of fluids are found to flow over or amongst each other with less friction than over solid substances; and as each particle is under the influence of gravitation it follows that no quantity of homogeneous fluid having its surface free can be in a state of rest unless every part of the surface is level. As the particles of all liquids gravitate, any vessel containing a liquid will be drawn towards the earth with a force equal to the weight of the liquid it contains. The pressure at any point of a fluid at rest is simply proportional to the depth of that point below the free level—a circumstance of great importance in the construction of pumps and engines for raising water. As liquids gravitate independently, if a hole be made in the bottom of the vessel the liquid will flow out, those particles directly over the hole being discharged first. This motion causes a diminished upward pressure about the original position of the particles, and the surrounding particles tend to flow in from all directions; thus, the whole mass of the water, and not merely the perpendicular column above the orifice, is set in motion. If the liquid falls freely its descent will be accelerated in the same manner as that of a falling solid body. (See MECHANICS.) When water flows in a current, as in rivers, it is in consequence of the inclination of the channel, but all such motion is affected by the form of the channel and the friction of its sides. Experimental investigation has provided various coefficients, whereby the resistance to the flow of water in pipes or channels can be calculated. As water in descending follows the same laws as other falling bodies its motion is accelerated; in rivers, therefore, we might perhaps expect to find the velocity and quantity discharged at different depths to be as the square roots of those depths;

Fig. 5.



HYDRAULIC CRANE (ARMSTRONG'S.)



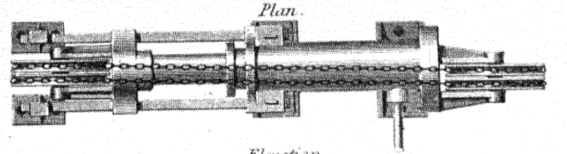


Slide Valve for turning apparatus.

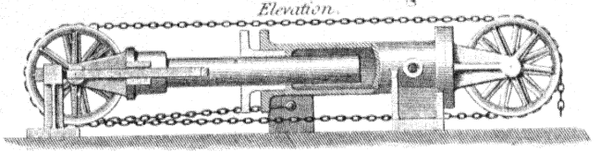
Inches 12 0 1 2 3 12 inches

Hydraulic Press with sheaves, for Water Cranes, &c.

Plan.

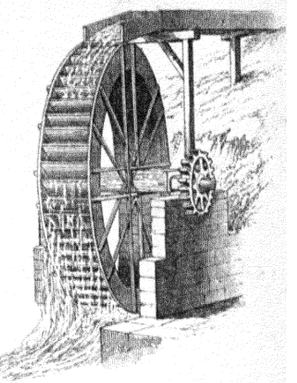


Elevation.



Inches 12 0 1 2 3 Feet

Fig. 9.



Sectional Elevation.

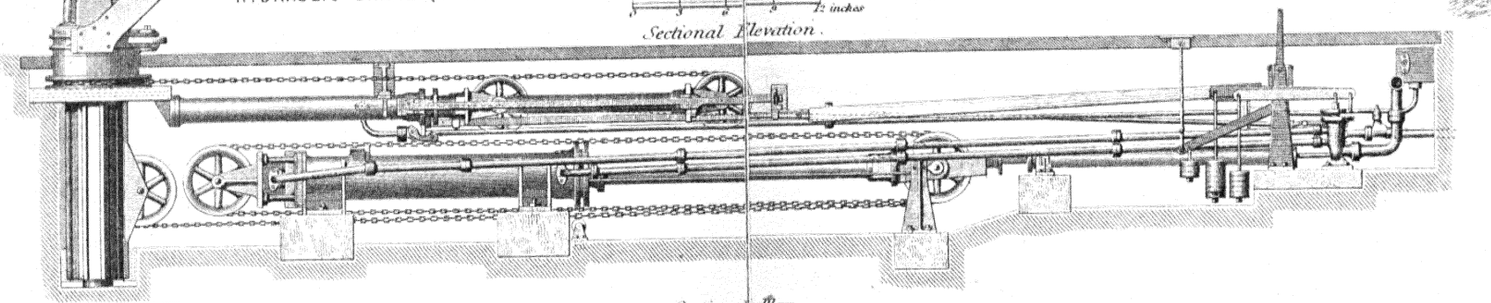
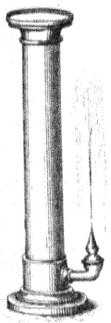
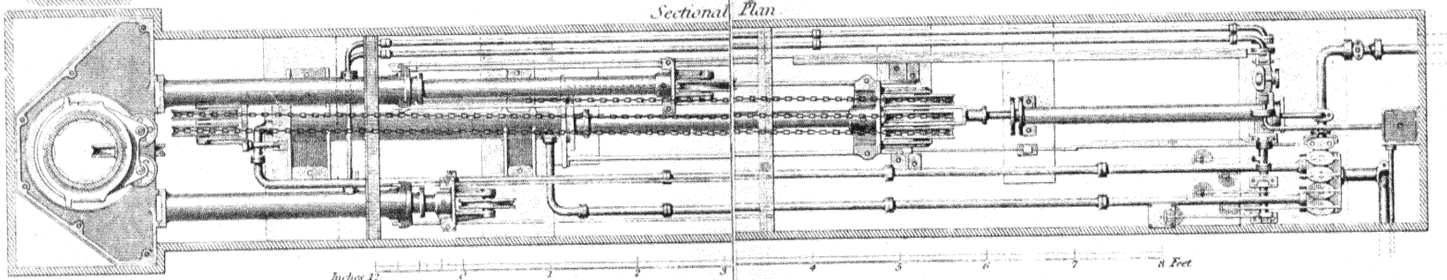


Fig. 1.



Sectional Plan.



Inches 12 0 1 2 3 4 5 6 7 8 Feet

Fig. 10.

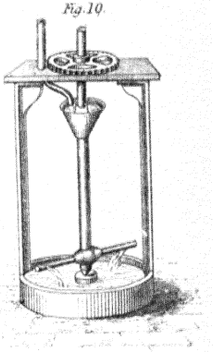


Fig. 2.

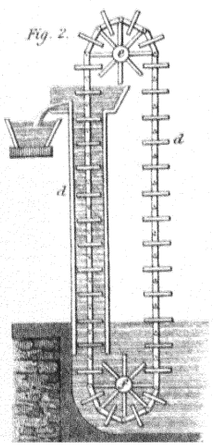


Fig. 3.

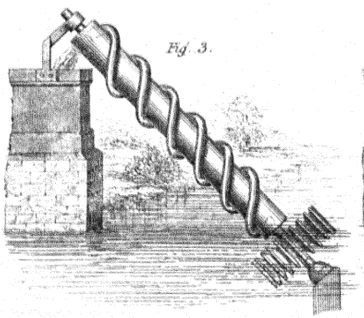


Fig. 4.

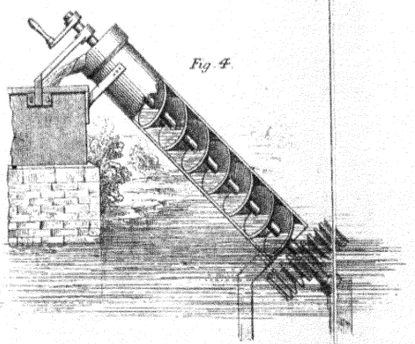


Fig. 6.

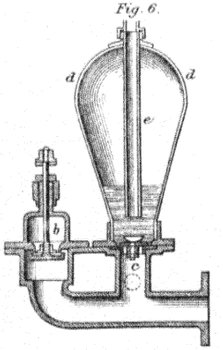


Fig. 7.

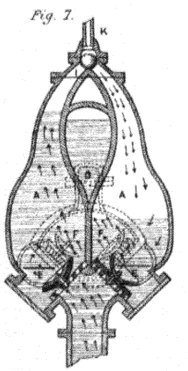
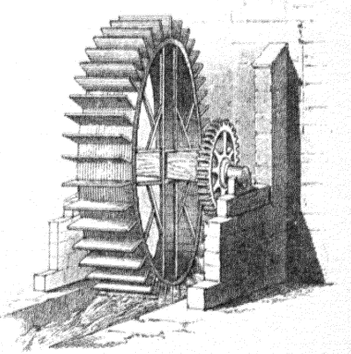
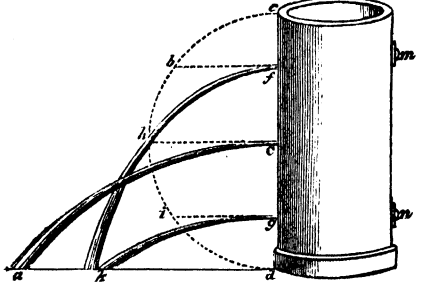


Fig. 8.



friction against the bottom, however, diminishes the rapidity of the flow. The law of the proportionality of the velocity of discharge to the square root of the depth applies, however, to the spouting of water through jets (as in the figure below). Thus, if a hole be made in the side of a vessel of water, the water at this orifice, which before was only pressed by the simple weight of the perpendicular column above it, will be pressed by the same force as if the water were a solid body descending from the surface to the orifice, that is, as the square root of the distance of those two points; and in the same way water issuing from any other orifices will run in quantities and velocities proportional to the square root of their depths below the surface. Now the quantity of water spouting from any hole in a given time must be as the velocity with which it flows; if therefore a hole A be four times as deep below the surface as a hole B it follows that A will discharge twice as much water in a given time as B, because two is the square root of four. A jet of water spouting from a hole in the side of the vessel half-way down will reach to the greatest horizontal distance (or range), which will be equal to the length of the column of which the orifice is the centre. Jets of water spouting from holes at equal distances above and below the central orifice will be thrown equal horizontal distances, but not so far as in the former case. The path of the spouting liquid will always be a parabola.

To examine these questions experimentally let two pipes of equal size, *m* and *n*, be fixed into the side of the vessel A, but so that the pipe *n* is placed four times deeper below the surface *c* than the pipe *m*. (In this case the orifices *f* c *g* are supposed to be closed.) If the surface of the water in the vessel be kept at the same height by pouring a constant supply in, and if two vessels, one of which would hold a pint, be placed under the pipe *m*, and the other which would contain a quart under the pipe *n*, both vessels will be filled in the same time from their respective pipes. Thus the quantities of water passing through equal holes in the same time are as the square roots of their depths. The horizontal distance to which a fluid



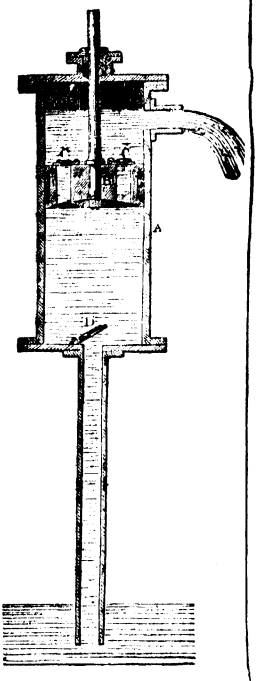
will spout from a hole made in the side of an upright vessel may be determined in the following manner. Let the vessel A be filled with water to the height of the surface, and let *d k a* be a horizontal plane upon which the jets fall; on *c d* as a diameter describe a semicircle *c h d*, whose centre c shall be the centre of the height of the column of fluid in the reservoir A; then if holes be made in the reservoir at the points *f* c *g*, and lines drawn from them to the semicircle perpendicular to the diameter of the semicircle, or the side of the vessel as at *f b*, c *h*, and *g i*: the distance to which water will spout from the holes *f* c *g* will be proportional to the length of line which cuts the semicircle. As c *h* is the longest line which can be drawn within the semicircle, the water spouting from c will reach the greatest horizontal distance *a*, and that range, if in vacuo, would be equal to twice the length of line drawn from the point of discharge to the semicircle. Though water will rise in pipes as high as the surface of the head from which it is supplied, yet in perpendicular jets it can never rise so high, because of the resistance of the air and the friction of the adjutage. The best kind of adjutage is the end of the tube covered with a thin plate, in which is made a smooth hole much less than the bore of the tube. With such an adjutage the water will ascend in a regular shape, and will meet with little friction in passing through the thin plate.

The machines that have been employed to raise water may be comprehended under four general heads:—1, those machines in which water is lifted in vessels by the application of some mechanical force to them. The earlier hydraulic machines were constructed on this principle, which is the simplest; such is the Persian wheel, which is merely a large vertical wheel having buckets attached to the rim, and moving in a reservoir of water. The buckets are filled at bottom as they pass through the water, and emptied at top, so that the water is raised a height equal to the diameter of the wheel. The wheel may be turned by animal power, or, if in running water, by fastening float-boards to the circumference. The *sakieh*, a modification of this machine in which earthen pots take the place of buckets, is in common use in Egypt. The common dredges for rivers and harbours are modifications of this kind of machine. The Archimedian screw, represented in fig. 3, with a modification of it, fig. 4, much used in Germany; the screw-pump, fig. 5, and the bucket-engine or chain-pump are all on the same principle. The *chain-pump* is shown in fig. 2 of the plate: it usually consists of a succession of long links of metal rods revolving like an endless rope over two wheels, *e*, *f*, one of which, *f*, must be under water. On this chain, between each joint, is fixed a flat piece of wood or metal, *d d d*, usually square, which is supported and kept in its place by the projecting arms of the wheels *f* and *e*, though at the same time they are permitted to turn with the same freedom as the chain; the wheel *e* is turned by a winch, which causes the whole chain to move, one side of it passing upwards, while the other side is continually descending in the same direction. The ascending side of the chain is made to pass through a box or pipe, one end of which is immersed in the water, the other end nearly reaching the upper wheel; this box corresponds in shape with the size of the plates, which fit pretty closely and form the pump. The succession of plates passing upward through the trunk forms a succession of cavities which are filled with water and are constantly discharged at the top. From the formation of this pump it will only work in deep water, and consequently cannot drain a reservoir to the bottom; but it has the advantage of not becoming choked with sand or weeds. It is for these reasons frequently used in draining the water from the foundations of bridges, docks, and other large works. If the top and bottom wheels *e*, *f*, of this machine be retained, while the tube or trunk is taken away, and a number of small boxes or buckets be attached to the chain instead of the plates *d d d*, the machine then becomes a *bucket-engine*, which is but another form of the Persian wheel already described. A pump on this principle is used in ships, and is called a *chain-pump*.

2. The next class of machines is that in which the water is raised by the pressure of the atmosphere, and comprises all those machines to which the name of *pump* is more particularly applied. These act entirely by removing the air from the surface of the

water, which may thus be raised to the height of about thirty-two feet. (See ATMOSPHERE, &c.) Whenever it becomes necessary to raise water to greater heights, the third class of machines, or those which act by pressure on the water, are employed. All pumps of this description are called *forcing-pumps*. (See below.)

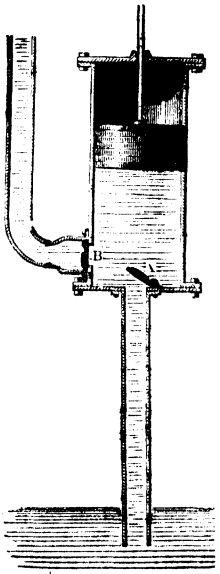
The common *suction*-pump consists of a hollow cylinder A, of wood or metal, which contains a piston B, stuffed so as to move up or down in the cylinder easily, and yet be air-tight: to this piston there is attached a rod which reaches at least to the top of the cylinder when the piston is at the bottom. In the piston there is a valve which opens upwards (in the fig. there are two valves C C), and at the bottom of the cylinder there is another valve D also rising upwards, and which covers the orifice of a tube fixed to the bottom of the cylinder, and reaching to the well from whence the water is to be drawn. This tube is commonly called the *suction*-tube, and the cylinder the *body* of the pump. When the piston is at the bottom of the cylinder there can be no air, or at least very little, between it and the valve D, for as the piston was pushed down the valve in it would allow the air to escape instead of being condensed, and when it is drawn up the pressure of the air would shut the valve, and there would be a vacuum produced in the body of the cylinder when the piston arrived at the top. But the air in the cylinder being very much rarefied, the pressure of the valve D on the water at the bottom will be greatly less than that of the external atmosphere on the surface of the water in the well; therefore the water will be pressed up the pump to a height not exceeding 32 feet. As the valves shut downwards, the water is prevented from returning, and the same operation being repeated, the water may be raised to any height, not exceeding the above limit, in any quantity.



The quantity of water discharged in a given time is determined by considering that at each stroke of the piston a quantity is discharged equal to a cylinder whose base is the area of a cross section of the body of the pump, and height the play of the piston. Thus if the diameter of the cylinder of the pump be 4 inches, and the play of the piston 3 feet, then by mensuration we have to find the content of a cylinder 4 inches diameter and 3 feet high. Now 4 inches is the third of a foot or ·333, hence $·333^2 \times ·7854 = ·11120 \times ·7854 = ·08733$ = the area of the cross section of the cylinder in square feet; hence $·08733 \times 3 = ·26199$ = the content of the cylinder in cubic feet = the quantity of cubic feet of water discharged by one stroke of the piston. Now 1 cubic foot of water weighs about 62·5 lbs. avoirdupois, wherefore $·26199 \times 62·5 = 16·374$ lbs. avoirdupois, and an imperial gallon is equal to 10 lbs. of water; whence, dividing the above number 16·374 by ten, we get the number of gallons = 1·6374. The piston throughout its ascent has to overcome a resistance equal to the weight of a column of water having the same base as the area of the piston, and a height equal to the height of the water in the body of the pump above the water in the well.

The *lifting*-pump, like the suction-pump, has two valves and a piston, both opening upwards; but the valve in the cylinder, instead of being placed at the bottom of the cylinder, is placed in the body of it, and at the height where the water is intended to be delivered. The bottom of the pump is thrust into the well a considerable way, and if the piston be supposed to be at the bottom it is plain that, as its valve opens upwards, there will be no obstruction to the water rising in the cylinder to the height which it is in the well, for, by the principles of hydrostatics, water will always endeavour to come to a level. Now when the piston is drawn up the valve in it will shut, and the water in the cylinder will be lifted up, the valve in the barrel will be opened, and the water will pass through it, and cannot return as the valve opens upwards; another stroke of the piston repeats the same process, and in this way the water is raised from the well; but the height to which it may be raised is not in this, as in the suction-pump, limited to 32 feet. To ascertain the force necessary to work this pump, we are to consider that the piston lifts a column of water whose base is the area of the piston, and height the distance between the level of the water in the well and the spout at which the water is delivered.

3. The *forcing*-pump constitutes the third class. Although atmospheric pressure is not necessary in the construction of forcing-pumps, it is, in most cases, resorted to for raising the water, in the first place, into the body of the pump, where the forcing action takes place. In machines of this kind the water may be raised to any height. The piston of this pump has no valve, but there is a valve at the bottom of the cylinder, as is shown at A. In the side of the cylinder, and immediately above the valve A, there is another valve B opening outwards into a tube, which is bent upwards to the height at which the water is to be delivered. When the piston is raised the valve in the bottom of the pump opens, and a vacuum being produced, the water is pressed up into the pump on the principle of the suction-pump. But when the piston is pressed down the valve A at the bottom shuts, and the valve B at the side which leads into the ejection-pipe opens, and the water is forced up the tube. When the piston is raised again the valve B shuts and the valve A opens. The same process is repeated, and the water is thrown out at every descent of the piston; the discharge therefore is not constant. It is frequently required that the discharge from the pump should be continuous, and this is effected by fixing to the top of the eduction-pipe an air-vessel. This air-vessel consists of a box, in the bottom of which there is a valve opening upwards into the box. This valve covers the top of the eduction-pipe. A



tube is fastened into the top of the box, which reaches nearly to the bottom of the box; it rises out of the box, and is furnished with a stop-cock. If the stop-cock be shut, and the water be sent by the action of the pump into the air-vessel, it cannot return because of the shutting of the valve at the bottom of the box; and because of the space occupied by the water, the air in the box is condensed, and will consequently exert a proportionate pressure on the water in the air-vessel, and force it up through the tube E. The stream of water issuing will therefore be continuous, the pressure being continuous.

4. The fourth class of hydraulic machines for raising water consists of such engines as act either by the weight of a portion of the water which they have to raise, or of any other water that can be used for such purpose, or by its centrifugal force, momentum, or other natural powers; and this class therefore includes some very beautiful and truly philosophical contrivances too numerous for us to describe. The centrifugal pump, and the water-ram are among the number.

The centrifugal pump, much used in engineering operations, consists of a drum or wheel containing a series of curved vanes; this wheel is encased in a circularly-shaped casing, gradually enlarging towards the outlet. The wheel with its vanes being rapidly rotated causes the water to be impelled outwards into the casing and ultimately discharged from the outlet. This machine is very similar in form to the vortex-wheel or turbine, afterwards explained and illustrated, the direction of flow of the water being, however, in the reverse direction.

An ingenious form of pump called the *pulsometer* has lately been devised and extensively employed. In this case there are few working parts. From fig. 7 of the plate it will be seen that it consists essentially of a double chamber AA, having a ball-valve I at top, and clack-valves EE at bottom. Steam is admitted at K to one of the chambers and presses out the water contained there, through F to the pipe D. Condensation then taking place a vacuum is formed, and the ball falls over and closes the opening through which the steam entered, and water flows up through the clack-valves and again fills the chamber. The steam in the meantime is now acting upon the water contained in the adjoining chamber. Condensation then taking place there the ball falls back to that side, and the operations go on alternately, the result being a steady stream of water sucked into one chamber after another, and then forced out and upwards by the steam pressure. The water is drawn into the machine from the centre.

The hydraulic ram is a very ingenious and useful machine for raising water, and depends for its action upon the impulse or momentum of flowing water and the pressure of air. The machine consists essentially of a short pipe or chamber fitted with two valves, and having placed over one of these valves an air-vessel. (See the accompanying plate, fig. 6.) *a* is the body of the ram, *b* and *c* the valves, and *d* the air-vessel. *e* is a pipe rising inside the air-vessel. Water is supplied to the body of the ram by a pipe coming from a reservoir at a small elevation above the ram, and part of this water is forced up through the pipe *e*, which may be carried to a considerable height above the source of supply. The rest of the water runs to waste through the valve *b*.

The action of the machine is as follows:—The weight of the valve *b* causes it to fall downwards (as shown by the dotted lines), and thus leaves an opening above it. The supply water rushes through this opening, but in doing so presses against the valve *b*, which has a rounded face below. This, after a little, causes the valve to rise and close the opening. The water which previously was flowing through the body of the ram is now suddenly confined there, and by its pressure, due to momentum, opens the valve *c*, which may be of the clack form, and a quantity of water passes into the air-vessel. The cessation of the outward flow and relief of internal pressure allow the valve *b* to fall again, and, the clack-valve *c* now closing, an outrush of water again takes place as before. The pressure of the flowing water upon the valve *b* once more closes this valve, and the clack-valve again opens and an additional quantity of water is forced into the air-vessel, and so on, by a series of pulsations, the action continues. The addition of water to the air-vessel causes compression of the contained air, which, reacting upon the water now inside this vessel, causes a portion of it to rise in the pipe *e* and ultimately to be delivered at the required height.

Various mechanical details have to be attended to so as to allow air to enter with the water in order to keep up the air supply in the air-vessel, also to prevent too great shock when the valves open and close. For the latter purpose india-rubber seating is found useful.

The efficiency (or ratio of useful work to total work) may be represented by $\frac{q\,H}{Q\,h}$, where q = quantity of water raised, and H = height to which this water is raised; Q = total quantity which enters the ram, and h the height or fall from the reservoir to the ram. In ordinary circumstances the value of the ratio $\frac{q\,H}{Q\,h}$ is equal to ·6 or $q = \frac{\cdot 6\,Q\,h}{H}$.

In some improved forms water from a different source than that which works the ram can be elevated. Thus the ram can be worked by water from a stream, whilst water drawn from a well can be raised.

We now come to the last part of our subject, the general consideration of water-wheels and other contrivances for moving machinery. Motion is generally obtained from water either by exposing obstacles to the action of its current, as in water-wheels, or by arresting its progress in movable buckets or receptacles which retain it during a part of its descent.

Water-wheels may be divided into two classes, viz.: vertical and horizontal wheels. In the former we have three classes: 1st, Undershot wheels; 2d, Overshot wheels; and 3d, Breast-wheels. The second division comprises the various forms of turbines which are now very largely employed.

The undershot wheel is the oldest form: it is merely a wheel furnished with a series of plane surfaces or floats projecting from its circumference, for the purpose of receiving the impulse of the water delivered under the wheel, as shown in fig. 8. As it acts chiefly by the momentum of the water, the weight of the water being scarcely called into action, it is only proper to be used where there is a great supply of water always in motion. It is the cheapest of all water-wheels, and is more applicable to rivers in their natural state than any other form of the wheel; it is also useful in tide-currents, where the water sets in opposite directions at different times, because it receives the impulse equally well on either side of its floats. In the overshot wheel the circumference is furnished with a series of buckets, into which the water is delivered from above. (See fig. 9 of the plate.) The buckets on one side being erect, will be loaded with water, and the wheel will be thus set in motion; the mouths of the loaded buckets being thus turned downwards by the revolution of the wheel, will be emptied, while the empty

buckets are successively brought under the stream by the same motion and filled. The breast-wheel differs from this in receiving the water a little below the level of the axle, and has floats instead of buckets. In improved forms of these wheels the floats are curved. In these two wheels the weight of the water is used as well as its momentum, and a much greater power is therefore produced with a less supply of water than is necessary for the undershot wheel. In order to permit these wheels to work with freedom, and to the greatest advantage, it is necessary that the *back* or *tail* water as it is called, or that which is discharged from the bottom of the wheel, should have an uninterrupted passage off; for otherwise it accumulates and forms a resistance to the float-boards. One of the simplest methods of removing it consists of forming two drains through the masonry on each side of the water-wheel, so as to permit a portion of the upper water to flow down into the tail in front of the wheel. The water thus brought down with great impetuosity drives the tail-water before it, and forms a hollow place, in which the wheel works freely even if the state of the water be such that it would otherwise form a tailing of from 12 to 18 inches. The drains may be closed whenever the water is scarce. Numerous other contrivances are in use, which our limits will not permit us to describe.

Turbines or horizontal water-wheels are now much used for the driving of machinery, and are very suitable for high falls of water, as the action of such wheels depends upon the impulse of the water and not upon its direct weight as in the overshot wheel. Turbines have been divided into three classes, viz.: 1st, *Parallel-flow turbines*, where the water is supplied and discharged vertically; 2d, *Outward-flow turbines*, where the water acts from the centre outwards; 3d, *Inward-flow turbines*, where the water acts from the outside, the currents flowing inwards towards the centre. In all cases the greatest efficiency is obtained when the water acts upon the blades of the wheel without causing a shock, and leaves the wheel without having any whirling motion. Different forms of turbine

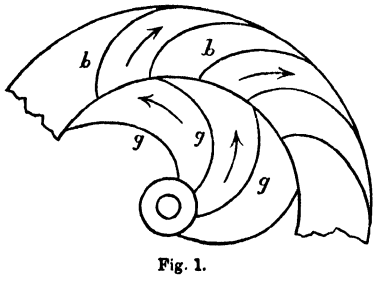


Fig. 1.

are now in use all more or less based upon the general arrangement as noted above, the objects of the inventors being to obtain the highest available efficiency. Figs. 1 and 2 show the forms of the blades and guides used, fig. 1 showing the arrangement for an outward-flow turbine, and fig. 2 for an inward-flow turbine, or vortex-wheel as it is sometimes called. The arrows in each case show the motion of the water, *g g g* being the guide-blades, and *b b b* the blades of the wheel. The water being directed by the guide-blades, impinges upon the wheel-blades, and by its pressure while gliding over these causes the wheel to rotate.

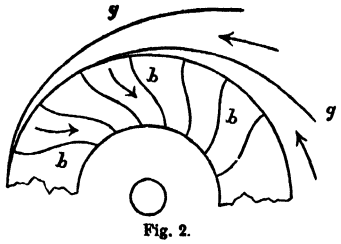


Fig. 2.

In Barker's centrifugal mill, shown in fig. 10 of the plate, the water does not act as in the contrivances above noticed, by its weight or momentum, but by the reaction that is produced by the outflowing of the water on the point immediately behind the orifice of discharge. It consists of a revolving vertical tube, which receives the water at the top, and at the bottom of which is a horizontal tube, extending on each side of it, and having apertures opening in opposite directions near the ends. The water spouting from these apertures keeps up by its reaction a constant rotatory motion. The power is increased by lengthening the arms.

HYDROCARBONS. The name of hydrocarbons is applied to a series of compounds which consist of carbon and hydrogen only. The number of bodies included in this series is very great, the simplest being that usually known as *marsh-gas* (CH_4). The production of hydrocarbons is brought about chiefly by the decomposition of organic substances, either slowly by natural causes, as in the case of marsh-gas itself; or by artificial means, as in the case of the destructive distillation of coal for the purpose of making gas. Petroleum oil, which is a mixture of liquid hydrocarbons, seems to owe its origin to the gradual decomposition of organic matter within the earth. Certain of the hydrocarbons are also found in the gums which exude from trees. The classification of the hydrocarbons is as yet incomplete; the greater number of those which are known may, however, be arranged in one or other of the following groups:—

1. The *Paraffins*. The general formula of this series is C_nH_{2n+2}. The lowest member of the series is the well-known marsh-gas, the composition of which is expressed by the formula CH_4. The paraffins form a homologous series (which see), each member containing one carbon atom and two hydrogen atoms more than its immediate predecessor.

2. The *Olefines*. General formula C_nH_{2n}, which tells us that the members of this series contain, for the same amount of carbon, two atoms less of hydrogen than those of the paraffin series.

3. The *Acetylene* series. General formula C_nH_{2n-2}.

4. The *Terpene* or *Turpentine* series. General formula C_nH_{2n-4}.

5. The *Benzene* or *Aromatic* series. General formula C_nH_{2n-6}.

For further information regarding these bodies see the article CHEMISTRY.

Although the greater number of the hydrocarbons are obtained from substances of animal or vegetable origin, many of them may be built up from inorganic constituents. Thus, a mixture of hydrogen sulphide and carbon disulphide when subjected to the action of copper at a red heat yields marsh-gas.

HYDROCEPHALUS. See DROPSY.

HYDROCHLORIC ACID. This important acid has been known in aqueous solution from very early times under the names of *spirit of salt* and *muriatic acid*. The true gaseous hydrochloric acid was discovered by Priestley in 1772. During volcanic eruptions hydrochloric acid is evolved, and is found in the water which collects in the crevices of the mountain; certain rivers also which take their rise in volcanic formations, especially in South America, contain this acid to the amount of 1 or 2 parts per thousand.

The more usual method employed for the production of hydrochloric acid is to decompose common salt (sodium chloride) by means of sulphuric acid; immense quantities are thus produced in the manufacture of soda ash (which see). The commercial acid is generally prepared by heating common sea salt in iron cylinders with crude oil of vitriol, and condensing the resultant gas in a series of stoneware Woulff's bottles. The cylinders are arranged in couples over a fireplace. On each end of the cylinder there is a screw-lid, through the posterior lid passes a funnel for the purpose of pouring in the oil of vitriol; a glazed earthenware tube passes, through a hole in the anterior lid, to the first receiver, from which another tube passes to the second, and so on. The receivers are generally arranged in rows; the acid which is formed in the first row contains a considerable quantity of impurities, that in the second row is generally tolerably pure. 100 parts of sea salt will yield by this process 130 parts of aqueous hydrochloric acid, having a specific gravity of 1·19.

As thus prepared the liquid contains about 30 per cent. of true hydrochloric acid (HCl). When fully saturated hydrochloric acid solution contains 40·7 per cent. of the true acid, its specific gravity being 1·21. On distilling this solution a liquid passes over, the amount of true acid in which depends upon the pressure at which the distillation has been conducted; or if the conditions be reversed, by keeping the pressure constant, and distilling the liquid (by means of a current of air) at varying temperatures, the amount of true acid in the distillate is then a function of the temperature. Hydrochloric acid gas may be condensed to a liquid by subjecting it to great pressure at a low temperature; and it has also been solidified. An interesting method of preparing hydrochloric acid consists in bringing equal volumes of chlorine (which see) and hydrogen together, and exposing the mixture to direct sunlight, when the two gases combine to form two volumes of hydrochloric acid. We thus learn that this gas consists of equal volumes of hydrogen and chlorine, and that consequently its formula is HCl. See CHEMISTRY.

One of the most remarkable properties of hydrochloric acid gas is its power of dissolving in water. If a dry glass flask, which is completely filled with the dry gaseous acid, be brought mouth downwards under water, and the stopper be then withdrawn, the water rushes so violently into the flask, as in many cases to break it. A strong solution of hydrochloric acid in water at ordinary temperatures gives off the gaseous acid, which condenses the atmospheric moisture with which it comes in contact, causing thereby white fumes.

Many of the metals are dissolved by hydrochloric acid, a series of salts being thus produced called chlorides. The general formula of this series is MCl, in which M represents a *monad metal*. See CHEMISTRY and METALS.

The chief use of hydrochloric acid in the arts is to supply chlorine to the bleaching-powder manufacturer. (See CHLORINE.) By the action of manganese di-oxide he breaks up the acid into its constituents, chlorine being evolved as a gas. By taking advantage of the fact that certain chlorides are decomposed at a high temperature by the influence of aqueous vapour, chlorine being evolved, Deacon has brought into use a process for obtaining the chlorine from hydrochloric acid, by passing this gas mixed with steam over hot bricks saturated with copper sulphate solution, whereby it appears that copper chloride is at first formed, and almost simultaneously again decomposed. Hydrochloric acid is also used in the preparation of glue, phosphorus, carbonic acid, for the manufacture of artificial waters, &c., and either alone or mixed with nitric acid, for dissolving various metals.

HYDRODYNAMICS, treats of the effects of the application of forces to fluids. The term is, however, very commonly used to denote that part of the science which treats of the application of forces so as to produce motion in fluids, in contradistinction to *hydrostatics*, which is concerned with forces applied to fluids at rest. *Hydrokinetics* is the proper designation of that part of the science: and the name Hydraulics is given to the subject when considered with respect to its practical bearing on engineering science.

HYDROGEN, is the name given to the lightest known chemical element. The name is derived from the Greek words *hudōr* or *hydōr*, and *gennaein*, to produce, and means *water-producer*. In the sixteenth century Paracelsus noticed that during the solution of iron in sulphuric acid air was evolved. In the following century Turquet de Mayerne and Boyle both observed that this air was inflammable; but it was not until the year 1781 that Cavendish showed that this air was not, as had been supposed, identical with other inflammable airs, but that it was a substance *sui generis*. In the same year Cavendish also proved that when this gas, which he called *inflammable air*, was burned in certain proportions with oxygen the whole of the gaseous mixture disappeared, the sole product of the reaction being water; hence arose the name hydrogen.

Hydrogen gas is generally prepared by essentially the same method as that by which Paracelsus originally produced it, namely, by the solution of a metal in dilute sulphuric acid. The most usual method is to act on water acidulated with sulphuric acid, by means of granulated zinc, when, without the application of heat, a violent action ensues, hydrogen is given off, and may be collected over the pneumatic trough (which see), while zinc sulphate remains in the generating vessel. As thus prepared hydrogen always contains impurities, principally sulphuretted hydrogen, phosphoretted hydrogen, arsenuretted hydrogen, and sometimes nitrous or nitric oxide; these are removed by passing the gas through tubes containing lead nitrate, silver sulphate, caustic potash, and lastly, to render it anhydrous, through pumice stone soaked in oil of vitriol. Another method for preparing this gas is to pass vapour of water over red hot iron-filings, when the water is decomposed, an oxide of iron being formed, and hydrogen gas being evolved. Hydrogen may likewise be prepared by submitting water to the action of an electric current, whereby it is decomposed into its elements hydrogen and oxygen. The leading characteristic of hydrogen is its great levity. The pure gas is about 14½ times lighter than atmospheric air, its specific gravity being ·0693. On account of this property it may be collected by simply holding a bottle mouth downwards over a tube leading from the vessel in which the gas is generated.

Hydrogen gas is colourless, and when pure tasteless; it is very inflammable, burning with a pale, very slightly luminous, but intensely hot flame. A mixture of hydrogen and air explodes when brought close to a lighted body, if oxygen be substituted for air the explosion is more violent. In his experiments Cavendish found that the loudest explosion was caused by the union of 2 volumes of hydrogen with 1 volume of oxygen; he was thus led to infer that when mixed in these proportions the whole of the hydrogen combines with the whole of the oxygen; and as he had shown that the sole product of the union was water, he reasoned that water must be composed of the two gases hydrogen and oxygen, in the proportion of two volumes of the former to one volume of the latter. See WATER.

The union of hydrogen with oxygen may also be brought about by the influence of a heated body, such as a red hot wire, or by the presence of certain metals, especially finely divided platinum. If a jet of hydrogen gas be directed on to spongy platinum the latter soon begins to glow, and speedily sets fire to the hydrogen. This effect is due to the power which finely divided platinum possesses of condensing gases on its surface; it is thus able to store up a large quantity of oxygen derived from the air, which it parts with to the hydrogen, and it is by the union of these two gases that the light is produced. If a jet of oxygen be directed through burning hydrogen the proportion of the two gases being duly adjusted, an intensely hot flame is produced. The temperature of this flame is so great that platinum wire is melted by it with ease, and is partially volatilized; rock-crystal may be melted by it, and a tobacco-pipe stem may be fused into a bead. If an infusible solid substance be brought into the flame the light emitted by the intensely heated solid is very brilliant. Thus, if a cylinder of lime be supported so that the flame plays upon the centre of the cylinder, the light which is emitted, when concentrated by a parabolic reflector, may be seen at a distance of more than 100 miles. If a long glass tube be brought over a jet of burning hydrogen a musical note is heard, the pitch and quality of which may be changed by lowering or raising the tube, or by substituting a narrower or wider tube for that originally employed. The formation of this note depends upon the production in the tube of a current of air, which again produces a flickering of the hydrogen flame, so that there ensues a rapid series of small explosions, which, taken together, cause in the ear the sensation of a continued musical sound.

Hydrogen unites directly and easily with chlorine, less easily with bromine, and with iodine only at a high temperature.

If hydrogen gas be breathed it imparts a peculiar squeaking tone to the voice; similarly a bell sounded in hydrogen is heard very indistinctly. When breathed for any length of time it cuts off the supply of oxygen which is essential to life, and although not directly hurtful, it thus acts as a poison indirectly.

The researches of Thomas Graham showed that hydrogen may be looked upon as a metal. Palladium it was found could be made to absorb many hundred times its own volume of hydrogen gas. The hydrogen thus '*occluded*' by the palladium Graham supposed to exist in the solid state, and assuming that it enters into the palladium with the density which it would possess if it existed as a solid in the free state, he calculated the density of this solid hydrogen, which he called hydrogenium, to be ·733. In many of its compounds hydrogen certainly plays the part of a metal, but in other compounds it may be regarded as playing the part of a non-metallic body. In 1877–78 M. Cailletet of Paris succeeded in liquefying hydrogen by greatly reducing its temperature and at the same time applying a pressure of 280 atmospheres. M. Pictet of Geneva almost simultaneously obtained hydrogen in the form of a steel-blue liquid, which issued from a jet and appeared to become changed into a hail of solid particles. These particles are now believed to have been, not solid hydrogen, but ice condensed from the air by the intense cold. More recently Prof. Dewar of London has effected the liquefaction of hydrogen in a more satisfactory manner, and has obtained it in the solid state as a frozen foam-like mass at the extremely low temperature of about −420° F.

The oxides of hydrogen are two in number, namely, hydric oxide or water H_2O, and hydric peroxide, H_2O_2. A description of the former of these will be found under the article WATER; of the latter we will here say a few words. This compound, hydroxyl or peroxide of hydrogen, is a kind of chemical enigma, its action under certain circumstances being often so very unlike what one would be led to expect from a study of its action in but slightly varied circumstances. This substance is a colourless transparent liquid, having a specific gravity of 1·452; it has a harsh taste, whitens the tongue, and thickens the saliva. If placed on the hand it produces violent itching. Hydroxyl is prepared by acting on barium dioxide with an acid, which forms a soluble salt with the barium, under which conditions the oxygen passes to the hydrogen of the acid, so producing the compound H_2O_2.

The formula of this substance may be written $H_2O.O$, which tells us that one of the unit weights or atoms of oxygen is not so closely held by the hydrogen as the other. This second atom of oxygen is ready to disengage itself and pass off as gas, or it may unite with another substance brought within its sphere of action. The readiness with which hydroxyl gives up one-half of its oxygen makes it a very energetic oxidizer; for if we consider the formula H_2O_2, we find that every 34 parts by weight of this body contain 32 parts of oxygen, 16 parts of which may at any moment pass from the substance to oxidize some other body. Hydroxyl, in virtue of this oxidizing power, converts sulphurous into sulphuric acid, lead sulphide into sulphate, ferrous into ferric salts, and so on. But with certain other oxides the action of this substance seems to be exactly opposed to that just noticed. Thus, if it be added to silver oxide (Ag_2O) a stream of oxygen is evolved, and metallic silver and water remain; a similar reaction takes place with many other oxides. Brodie has sought to explain this action, by saying that the two oxygen atoms of the hydric oxide are electrically opposed to each other; the one atom he regards as positive, the other as negative. When, therefore, an oxide whose oxygen may be said to be in a polar state, opposite to that of the unstable oxygen atom of hydroxyl, is brought into contact with this latter substance, the two oppositely polarized oxygen atoms rush together, and we have a stream of oxygen evolved, water and the metal of the oxide remaining. Thus,

$$\overset{-}{Ag_2O} + H_2\overset{+}{O}\overset{-}{O} = Ag_2 + H_2O + \overset{-}{O}\overset{+}{O}.$$

This reaction is in keeping with one of those by which hydrogen itself is produced, viz. by the action of hydrochloric acid upon copper hydride.

$$\overset{-}{Cu_2}H_2 + 2H\overset{+}{Cl} = Cu_2Cl_2 + 2\overset{-}{H}\overset{+}{H}.$$

Hydroxyl may be recognized in any liquid containing it, by the blue colour which is produced on the addition of ether, and a few drops of a solution containing chromic acid. The colour is owing to the solution in the ether of an unstable perchromic acid, which is the first product of the action of hydroxyl on chromic acid. For an account of the sulphides and phosphides of hydrogen, see the articles SULPHUR and PHOSPHORUS respectively.

HYDROGENIUM. The experiments of Professor Graham on the occlusion of hydrogen led him to infer that were hydrogen condensed to the solid form it would possess the properties of a metal, and to this hypothetical metal he gave the name hydrogenium. He obtained an alloy of hydrogenium with the metal palladium; and by ingenious reasoning from the properties of this alloy he inferred that hydrogenium must possess the following properties. It is a solid metal, of a white appearance; it possesses a certain amount of tenacity; it has electric conductivity

comparable with that of the metals; and it is also a magnetic metal. The specific gravity of the metal he estimates to be from ·854—·872. (See Proc. Royal Society, 1868, 1869.)

HYDROGRAPHY (Greek *hydŏr* or *hudor*, water, *graphō*, to describe), meaning literally a 'description of water,' is the name applied to that branch of physical geography which describes the water on the surface of the globe, whether occurring on land, as in springs, rivers, and lakes, or in seas and great oceans. It is sometimes used in a more restricted sense, and confined to a description of the bearings of coasts, of currents, soundings, islands, shoals, &c., with a more immediate view to navigation, and the construction of charts and nautical tables. Henry the Navigator was the first who constructed a tolerably reliable sea-chart, and laid the foundation of hydrography as a science. This was in the fifteenth century. In France and other countries, institutions specially formed for teaching navigation are called hydrographical schools. The hydrographic office is now an important department of the naval administration, its officers consolidating into available maps the results of the observations sent to them from time to time by those engaged in exploring expeditions, and by navigators from all parts of the world.

HYDROMETER, an instrument for determining the specific gravity of fluids. The name *lactometer* is also given to a small instrument of the kind when it is graduated in such a way as to be convenient for determining the specific gravity of milk, and by that means ascertaining its purity. The following is the hydrostatic principle on which the use of the hydrometer depends. When a solid body floats in a liquid, and thus displaces a quantity of the liquid, it is supported by the same upward pressure that formerly supported the liquid which it displaces. The weight of the solid body is thus equal to the weight of the liquid that it displaces. From this it will be perceived at once that the following two statements follow:—1, that the depth to which the same solid body is immersed in a liquid is greater as the density of the liquid is less, and less as the density of the liquid is greater; the depths to which the same body is immersed in various liquids are inversely proportional to the density of the liquids: 2, the weights required to immerse a given body equally deep in various liquids are inversely proportional to the densities of the liquids. On each of these statements a form of hydrometer is founded. One kind is often called the *constant weight* hydrometer, the other the *constant volume* hydrometer.

Fig. 1 shows the first kind. These instruments are usually made of glass; each of them has a large hollow bulb, below which there is a smaller bulb, weighted with mercury, to make the instrument float upright; and it is surmounted by a cylindrical glass stem which is graduated, the divisions being usually marked on a piece of paper inclosed within the stem. The depth to which the hydrometer sinks in the liquid gives, as has been explained, the

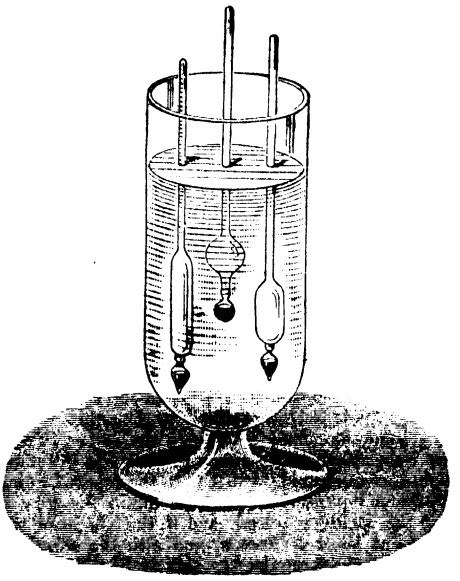


Fig. 1.—Forms of Hydrometer.

density. There are several methods of graduation of the stem. The size and form of the instrument, and the method of graduation adopted depend on the purpose for which the instrument is intended. For example, lactometers and alcoholometers are sometimes constructed in such a way that the readings on the stem afford an easy method of reading off the amount of water that has been added above a certain assumed point. For general use, however, it is usual to have the hydrometer graduated on some system, of which Beaumé's hydrometer and Twaddell's hydrometer are

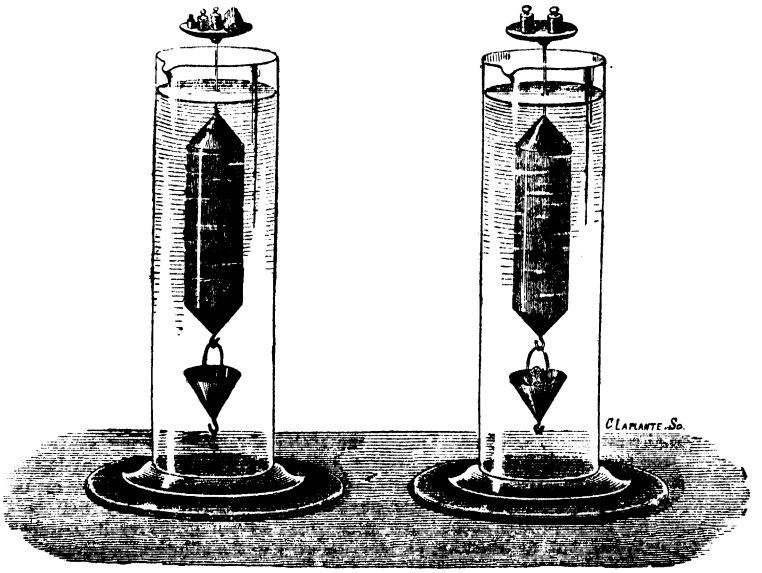


Fig. 2.—Nicholson's Hydrometer.

the best known. A table is generally employed, by means of which, from the reading on the hydrometer, the density of the liquid may be at once determined; otherwise a formula for calculation is used. For purposes requiring any degree of exactness over any considerable range a large number of hydrometers are used, each of them being applicable to a certain range of densities. Two instruments at least are always used: one for liquids having a greater, and the other for liquids having a less specific gravity than distilled water.

Of constant volume hydrometers we shall only describe one, namely, Nicholson's hydrometer; a beautiful instrument, which is adapted for determining the specific gravities not only of fluids, but of solids also. It is shown in fig. 2. It consists of a hollow cylinder of metal, surmounted with a very fine metallic stem, to the top of which there is attached a plate or pan for weights. From the bottom of the metallic cylinder hangs a kind of cup or basket. The whole instrument is weighted so as to float upright. On the fine metallic stem there is a marked point: and by putting weights on the upper pan the hydrometer is always made to sink precisely to the point. Thus the volume immersed is always the same. From what was said above, it is seen at once that different weights are required to sink it to the marked point in different liquids, the denser the liquid the greater being the weight required: and if the weight of the instrument itself is known, and also the *standard weight*, or weight required to sink it to the marked point in distilled water, the calculation of the specific gravity of any liquid from an observation with the instrument is very easy.

In order to determine the specific gravity of solids by means of Nicholson's hydrometer, the instrument is placed in distilled water and the solid body is put on the upper pan. Weights are then added till the hydrometer sinks to the marked point. But the *standard weight* of the instrument being known, it is plain that the difference between it and the weights that must be added on the upper pan to the weight of the body whose specific gravity is to be determined must be the weight in air of that body. The body is now transferred to the basket below the instrument, and the weight of the solid in water is similarly determined. From these data the specific gravity of the solid is calculated in the ordinary way. (See SPECIFIC GRAVITY.) The instrument here described is very convenient for use by mineralogists and others, being far more portable than a balance that would give equally trustworthy results.

HYDROPATHY (Greek, *hydōr*, water, and *pathos*, affection or disease), a method of treating diseases by the application of cold water, which has come extensively into practice of late years, though scarcely, as yet, recognized as a curative system by the medical profession. The efficacy of water as a hygienic medicine has been recognized from the earliest times. Hippocrates, Celsus, and Galen regarded water as of especial value in the treatment of acute diseases; and during the middle ages the same view was advocated by many famous physicians. During the 18th century in our own country there was a growing belief in its virtue as a curative agent, though rather in acute than in chronic diseases. Some physicians used water for internal treatment, and others for external treatment, but hydropathy, as now understood, combines both methods. It was originated by Vincent Priessnitz, a Silesian peasant, who having, when a boy of thirteen, sprained his wrist, applied it to the pump, and afterwards bound a wet bandage upon it. As this became dry he rewetted it, and thereby reduced the inflammation, but produced a rash on the surface of the skin. Shortly afterwards he crushed his thumb, and applied the wet bandage as before, and again an eruption showed itself. He concluded that the rash was an indication of impurity of blood; and having instituted a series of observations in regard to various wounds and ulcers on the persons of his neighbours, he was led to form a pathological theory, according to which disease is caused by an accumulation of morbific matter, which must be eliminated from the system by cold water applications and the observance of a strict regimen. His views were confirmed by an accident to himself, in which, through a cart running over him, he received some broken ribs and severe contusions, and was given over by the physicians; but on learning their opinion he tore off their bandages, and applied others wet with cold water. He also replaced his ribs by inflating his lungs while pressing the abdomen against a window-sill. Either through or in spite of this treatment Priessnitz contrived to recover, and the carrying out of this cold water theory became the object of his life. In rapid succession he invented the sponge bath, the wet sheet packing, the sitz, foot, and arm baths, the douche, the stream bath, the dripping sheet, the plunge, the dry blanket packing, and other appliances of the hydropathic system. In 1829 he established, at his native village of Gräfenberg, a range of baths, which speedily grew in reputation, and attracted visitors from all parts of Europe. The Austrian government lent him its patronage, and all the opposition of the medical faculty was unable to stem the popularity of the new system. The original establishment at Gräfenberg soon expanded into an extensive suite of buildings, stretching along the slope of one of the Sudetic mountains, and resorted to by troops of invalids, who sought to regain health by bathing, exercise, simple diet, and agreeable society. Other hydropathic institutions soon sprung up in other parts of Germany, and were at length introduced into England, a hydropathic society having been formed in London on 17th March, 1842. It was unfortunate that Priessnitz had not had a regular medical education, and that many of the most enthusiastic advocates of his system have no scientific knowledge of disease, and no professional culture. Hydropathy is popularly but unfortunately named the 'water-cure,' a designation both incomplete and misleading. Drs. Wilson, Johnson, and Gully were the first to commence the practice of the cold water cure in England, and by the able advocacy of the two latter, through their writings, the system took root and advanced rapidly in popular estimation. Hydropathic establishments were erected at Malvern, Ben Rhydding, Rothesay, and other parts of the United Kingdom; and before Priessnitz's death in 1851 he had the satisfaction of seeing his system adopted extensively both throughout Europe and the United States of America. The treatment pursued is mainly that introduced by him, with some modifications, that pursued at Gräfenberg having been extremely rigid and severe, and calculated to deter many persons from subjecting themselves to it. In many cases there can be no doubt of patients having received great and lasting benefit by a sojourn at a hydropathic institution, and the free use of cold water in its various forms of appliance; but it may well be doubted whether these advantageous results are not as much to be attributed to the ablutions, exercise, and diet to which in such circumstances they readily conform themselves as to any inherent curative virtue in the wet bandages, douches, and other forms of hydropathic treatment.

HYDROPHANE. See OPAL.

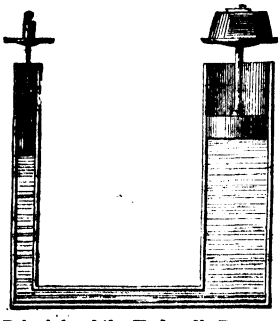
HYDROPHOBIA (from *hydōr*, water, and *phobos*, fear), a specific disease arising from the bite of a rabid animal. The animals most liable to be afflicted

with madness are dogs; but cats, wolves, foxes, &c., are also subject to it. The following description of the way in which rabies affects dogs is from a communication in the Sporting Magazine:—The symptoms of rabies in the dog are the following, and are given nearly in the order in which they usually appear: An earnest licking, or scratching, or rubbing of some particular part; sullenness, and a disposition to hide from observation; considerable costiveness, and occasional vomiting; an eager search for indigestible substances, as bits of thread, hair, straw, and dung; an occasional inclination to eat its own dung, and a general propensity to lap its own urine. The two last are perfectly characteristic. The dog becomes irritable; quarrels with his companions; eagerly hunts and worries the cat; mumbles the hand or foot of his master, or perhaps suddenly bites it, and then crouches as if for pardon. As the disease proceeds the eyes become red; they have a peculiar bright and fierce expression; some degree of strabismus, or squinting, very early appears—not the protrusion of the *membrana nictitans*, or haw, over the eye, which in distemper often gives the appearance of squinting, but an actual distortion of the eyes; the lid of one eye is evidently more contracted than that of the other; twitchings occur round that eye; they gradually spread over that cheek, and finally over the whole face. In the latter stage of the disease that eye frequently assumes a dull green colour, and at length becomes a mass of ulceration. After the second day the dog usually begins to lose a perfect control over the voluntary muscles. He catches at his food with an eager snap, as if uncertain whether he could seize it; and he often fails in the attempt. He either bolts his meat almost unchewed, or, in the attempt to chew it, suffers it to drop from his mouth. This want of power over the muscles of the jaw, tongue, and throat increases until the lower jaw becomes dependent, the tongue protrudes from the mouth, and is of a dark, and almost black colour. The animal is able, however, by a sudden convulsive effort to close his jaws and to inflict a severe bite. The dog is in incessant action; he scrapes his bed together, disposes it under him in various forms, shifts his posture every instant, starts up, and eagerly gazes at some real or imaginary object; a peculiar kind of delirium comes on; he traces the fancied path of some imaginary object floating around him; he fixes his gaze intently on some spot in the wall or partition, and suddenly plunges and snaps at it; his eyes then close, and his head droops, but the next moment he starts again to renewed activity; he is in an instant recalled from this delirium by the voice of his master, and listens attentively to his commands; but as soon as his master ceases to address him he relapses into his former mental wandering. His thirst is excessive (there is no hydrophobia, or fear of water, in the dog), and, the power over the muscles concerned in deglutition being impaired, he plunges his face into the water up to the very eyes, and assiduously but ineffectually attempts to lap. (In Johnson's Shooter's Companion the author observes, 'In those instances of hydrophobia which have fallen under my notice the animal has always been capable of lapping; however, in the disease called *dumb madness*, I have noticed symptoms similar to the above.') His desire to do mischief depends much on his previous disposition and habits. I have known it not to proceed beyond an occasional snap, and then only when the animal was purposely irritated; but with the fighting dog the scene is often terrific. He springs to the end of his chain; he darts with ferocity at some object which he conceives to be within his reach; he diligently tears to pieces everything about him; the carpet or rug is shaken with savage violence; the door or partition is gnawed asunder; and so eager is he in this work of demolition, and so regardless of bodily pain, that he not unfrequently breaks one or all of his tusks. If he effects his escape he wanders about, sometimes merely attacking those dogs which fall in his way; and at other times he diligently and perseveringly hunts out his prey; he overcomes every obstacle to effect his purpose; and, unless he has been stopped in his march of death, he returns in about four and twenty hours, completely exhausted, to the habitation of his master. He frequently utters a short and peculiar howl, which, if once heard, can rarely be forgotten; or if he barks it is with a short, hoarse, inward sound, altogether dissimilar from his usual tone. In the latter stages of the disease a viscid saliva flows from his mouth, with which the surface of the water that may be placed before him is covered in a few minutes; and his breathing is attended with a harsh, grating sound, as if impeded by the accumulation of phlegm in the respiratory passages. The loss of power over the voluntary muscles extends, after the third day, throughout his whole frame, and is particularly evident in the loins; he staggers in his gait; there is an uncertainty in all his motions; and he frequently falls, not only when he attempts to walk, but when he stands, balancing himself as well as he can. On the fourth or fifth day of the disease he dies, sometimes in convulsions, but more frequently without a struggle. After death there will invariably be found more or less inflammation of the mucous coat of the stomach; sometimes confined to the rugæ, at other times in patches, generally with spots of extravasated blood, and occasionally intense, and occupying the whole of that viscus. The stomach will likewise contain some portion of indigestible matter (hair, straw, dung), and, occasionally, it will be completely filled and distended by an incongruous mass. The lungs will usually present appearances of inflammation, more intense in one, and generally the left lung, than in the other. Some particular points and patches will be of a deep colour, while the neighbouring portions are unaffected. The sublingual and parotid glands will be invariably enlarged, and there will also be a certain portion of inflammation, sometimes intense and at other times assuming only a faint blush, on the edge of the epiglottis, or on the rima glottidis, or in the angle of the larynx at the back of it.

The hydrophobia seems to be spontaneous, and capable of being communicated only in certain animals—the dog, the wolf, the fox, and the cat. All animals which have become rabid by a bite do not appear to be able to transmit it to others; as the hog, cow, sheep. In regard to man, it is not certain whether the disease is communicable from the human subject. The hydrophobia is not commonly manifested in the time of greatest cold or greatest heat, but usually in March and April in wolves, and in May and September in dogs. It is rare in very warm or very cold climates. No particular cause of the rabies is known; it is a mistake to attribute it to a total privation of food, as a great number of experiments prove that this is not the effect of such a treatment. All observations seem to prove the existence of a rabid virus, which is more violent when it proceeds from wolves than from dogs; as, out of a given number of persons bitten by a rabid wolf, a greater number will die than out of the same number bitten by a dog. The communication of the virulent hydrophobia by inoculation cannot be denied, and is the best proof of the existence of the virus. The virus appears to be contained solely in the saliva, and does not produce any effect on the healthy skin. But i

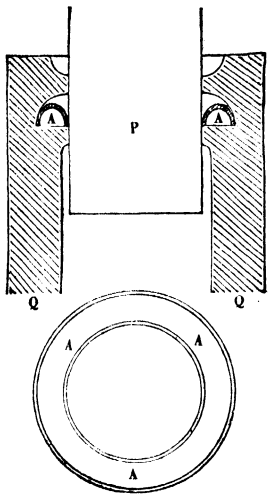
the skin is deprived of the epidermis, or if the virus is applied to a wound, the inoculation will take effect. The development of the rabid symptoms is rarely immediate; it seldom takes place before the fortieth or after the sixtieth day. It begins with a slight pain in the scar of the bite, sometimes attended with a chill; the pain extends and reaches the base of the breast, if the bite was on the lower limbs, or the throat, if on the upper extremities. The patient becomes silent; frightful dreams disturb his sleep; the eyes become brilliant; pains in the neck and throat ensue. These symptoms precede the rabid symptoms two or three days. They are followed by a general shuddering at the approach of any liquid or smooth body, attended with a sensation of oppression, deep sighs and convulsive starts, in which the muscular strength is much increased. After the rabid fit, the patient is able to drink. The disposition to bite does not appear to belong to any animals except those whose teeth are weapons of offence; thus rabid sheep butt furiously. A foamy, viscid slaver is discharged from the mouth; the deglutition of solid matters is difficult; the respiration hard; the skin warm, burning, and afterwards covered with sweat; the pulse strong; the fit is often followed by a syncope; the fits return at first every few hours, then at shorter intervals, and death takes place generally on the second or third day. A great number of applications have been recommended, but without success. The treatment of the disease consists in preventing its development, or in checking its progress. The former consists in cauterizing the wound with iron heated to a white heat, the pain of the cautery being less as the temperature is greater. The cautery is preferable to lotions, liniments, &c., but it should be applied early. Preparations of opium administered internally or by injection, mercurial frictions, belladonna, emetics, sudorifics, purgatives, &c., have been tried ineffectually. Calabar bean and Indian hemp have been used apparently with some success. The development of the disease in persons bitten seems to have been prevented in a number of cases by M. Pasteur, by his system of successive inoculations with rabid virus of greater and greater intensity, though the full success of this treatment is not yet proved.

HYDROSTATIC PRESS, or BRAMAH'S PRESS. The principle of this machine will be easily understood from the explanations given in our article on hydrostatics, and from the accompanying figures:—Let two tubes of unequal area be connected together, and the whole vessel filled with water. For simplicity let the area of the smaller tube be 1 square inch, and let the piston that closes it be loaded with 1 lb. From the principle of equal transmissibility of pressure a pressure of 1 lb. per square inch will be exerted on every part of the boundary of the fluid. There will thus be a pressure of 1 lb. per square inch put upon the piston that closes the larger tube; and if we suppose the area of the piston to be 16 square inches, it is evident that it must be loaded with 16 lbs. in order that the pressure to which it is exposed may be equilibrated. Thus a load of 1 lb. on the smaller piston supports 16 lbs. on the larger.



Principle of the Hydraulic Press.

The principle of the hydrostatic press was pointed out by Stevinus; but it was Bramah who, in 1796, by an ingenious contrivance, gave the principle practical application. A Bramah's press, as ordinarily constructed and used to provide immense pressure, is a simple enough contrivance. By means of a small pump water is pumped from a cistern through a small horizontal tube into the space that receives a large piston. The goods to which pressure is to be applied are placed between the plate attached to the large piston and an upper plate that is kept in position by powerful iron rods. The water-tight stuffing of the piston is the great difficulty in the construction of the machine, and it was the invention of a water-tight collar by Bramah that made the use of the press practicable. The diagram shows a section A A of the collar surrounding the piston P. The collar consists of a circle of solid leather, which is stamped by means of a die into the half-ring, of which a section is seen. When pressure is applied the water fills the channel formed by the half-ring, and squeezes the inner side of the ring against the piston, and this takes place with greater force the greater the pressure to which the water is subjected.



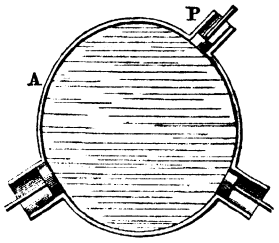
Cup-Leather.

HYDROSTATICS is the part of the general science of hydrodynamics that treats of the application of forces to fluids at rest. It is generally divided into two parts, one, hydrostatics proper, which deals with incompressible fluids, such as water, with liquids in fact; and the other, which deals with compressible fluids, that is, with gases. The latter part of the subject is commonly called *pneumatics*. We can only consider here a few of the leading principles of hydrostatics. The subject cannot be treated with anything approaching to completeness except at far greater length than that which our limits here allow us.

The property of fluids which distinguishes them from solids, is want of rigidity. A fluid offers no permanent resistance to forces tending to change its shape. The particles of a fluid are mobile: and while in the case of liquids very considerable forces of cohesion are exhibited, yet the particles show great freedom to alter their relative positions, and to pass from place to place within the general mass.

A very important property that follows from the nature of fluids is that of the equable transmission of pressure. For simplicity let us consider, in the first place, the case of a *weightless* liquid, and suppose it inclosed in a vessel A, which is fitted with a piston P. If pressure is applied to P it will be transmitted in all directions through the liquid. If other openings are made, and if they are fitted with pistons, it is evident that to keep each of these pistons in its place, pressure inward must be applied. The pressure that must be applied to any piston equal in area to the area of P is equal to the pressure on P: and if the area of one of the other pistons is greater or less than the area of P, the pressure required to keep it in its

place is proportionately greater than or less than the pressure that is applied to P. This principle, which is the most important in hydrostatics, finds a practical application in the Hydrostatic, or Bramah's, Press.



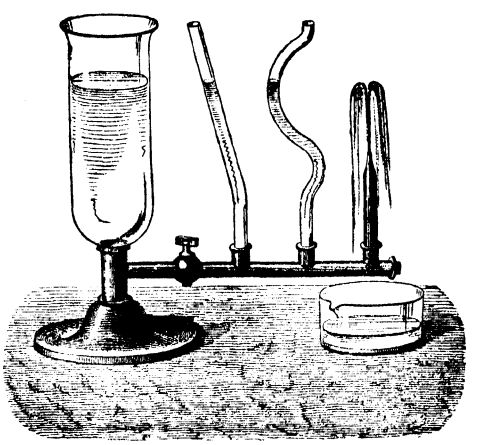
In measuring fluid pressure the area exposed to the pressure of the fluid is to be considered. Thus, it is usual to speak of pressure per square inch, pressure per square foot, or pressure per square centimetre in various cases. If it were required to calculate the force that must be applied to the rod of one of the pistons in the figure in order to keep the piston in its place, it would be necessary to know the area of the piston and the pressure upon it in pounds per square inch, or in grammes per square centimetre. When the pressure over a given area is not uniform we must then know the law of variation, or, at least, the average pressure over the whole area, in order to calculate the whole pressure upon it: and it will be readily understood that when, in such a case as this, *the pressure* per unit area at a point is spoken of, it is understood to mean the pressure which would be exerted on unit area were there found a unit of area pressed with a uniform pressure the same as that at the point in question.

Not only is pressure transmitted out to the surface or envelope of the liquid, as is shown in the figure, but within the fluid itself the particles are all pressed together. The pressure is transmitted to every point within the liquid, and may be observed to be acting there. When a solid is immersed in the liquid it is pressed at every point of its surface in the direction perpendicular to the surface at that point, and, in the case of the weightless liquid that we have been considering, with a pressure equal in amount per unit of area to that applied from without to the liquid. The pressure about any point in a fluid is equal in all directions, and when any surface is exposed to the pressure, the direction of it is normal to the surface at every point.

Leaving the theoretical conception of a weightless fluid, let us next consider the effect of the weight of a fluid on the pressure at any point within the fluid. It is evident, in the first place, that the lower layers of the fluid sustain more pressure than the upper layers. For whatever pressure the upper layers are exposed to is transmitted to the lower layers; and over and above that pressure, the lower layers have to support the weight of the superincumbent liquid. Thus, in the case of a liquid contained in a closed box and exposed to any pressure whatever, applied by means of a piston from without, this pressure is transmitted, as we have seen, to every part of the liquid; but any layer in the lower part of the vessel is exposed to an additional pressure due to the weight of the liquid above it.

The most important case to consider is that of liquids having a free surface, that is, a surface exposed to the air. Here the surface itself is level, that is, everywhere perpendicular to the direction of apparent gravity. This easily follows from the mobility of the particles of the liquid. Were the surface not level there would be a tangential force which would make it flow down till the level state is reached. In every horizontal layer throughout the liquid the pressure per unit area is the same; and this is the case independently of the shape of any vessel in which the liquid may be contained. The pressure per unit area in any horizontal layer depends only on the height of the free surface of the liquid above the layer considered, and the specific gravity of the liquid; and it is equal to *the weight of a column of the liquid of unit sectional area whose height is the height of the free surface.* This principle gives rise to remarkable results. Take, for instance, an apparatus consisting of a pair of circular boards connected by a belt of pliable leather (like a pair of bellows), and having a small tube inserted into an opening near the bottom, and from it a tall tube rising perpendicularly. Heavy weights may be put on the upper circular board, and if water be then poured into the upright tube they will be raised up by the pressure from below of the water. For the pressure to which the under side of the circular board is exposed is equal to the weight of a column of water whose section is that of the circular board, and whose height is the difference of the heights of the under surface of the circular board and of the free surface of the water in the small upright tube. When shown in this form the principle here employed is often called the *hydrostatic paradox*, on account of the very great pressure that a very small quantity of water may be made to give rise to. The principle just explained acts occasionally with immense force in nature. Thus, if there is a cavity of great extent and at a considerable depth in a rock, and if this cavity is filled with water, whilst a small stream runs down into it from a great elevation; in this case the pressure on all sides of the cavity when filled may become sufficient to rend the rock asunder.

It is a well-known principle that *liquids tend to find their own level.* Thus, in the accompanying,



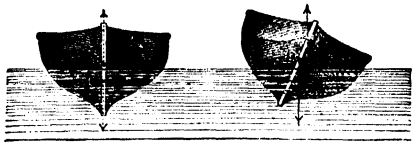
figure, showing a series of connected vessels, the liquid is seen to stand at the same height in the principal vessel and in the variously-shaped tubes communicating with it, while from the short, narrow-mouthed tube it spouts up to nearly the level of the water in the principal vessel.

When a solid is immersed either partially or wholly in a liquid a portion of the liquid is displaced. The solid is at the same time pressed at every point by the liquid, the pressure being always normal to the surface. The pressure from point to point may be calculated; but without any calculation there is one important principle evident, namely, that the upward pressure on the solid is greater than the downward by an amount equivalent to the weight of the liquid displaced by the solid. For if, instead of the solid, the quantity of liquid displaced by it were present, its weight would be upborne by the pressure on every

side. These pressures now act on the solid and, whether or not the solid floats under their influence, as much of the weight of the solid as corresponds to this pressure is supported by the surrounding fluid. These considerations applied to the phenomenon of floating bodies illustrate the principle just explained; and the experiments that are made for the purpose of determining the specific gravity of bodies heavier than water also depend upon that principle. In fig. 15 the apparatus that is used is shown. The body whose specific gravity is to be determined is suspended from the scale-pan of a balance, and its weight is determined. It is then placed in such a position that, hanging down from the scale-pan, it is immersed in water, and it is now found to have a smaller apparent weight, the apparent loss of weight depending on the volume of water displaced. According to the definition of specific gravity, the ratio of the observed weight in air (or more exactly in vacuo) to the loss of weight when the body is weighed in water is the specific gravity of the solid.

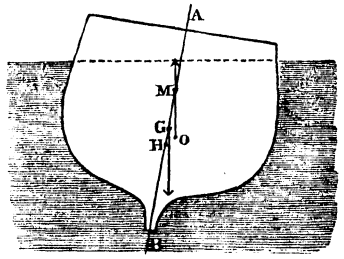
A very simple experiment serves to illustrate the principles that have just been discussed as well as some of those that will be considered in the following paragraph. Let any three jars of ordinary shape be taken. Let the first be filled with pure water, the second with moderately strong salt and water, and let the third be half filled with the salt and water, and then cautiously filled up with fresh water in such a way that the fresh water floats on the top of the brine. This may easily be done with a little care and practice. An egg put into the first sinks to the bottom. In the second it floats at the top, because the brine has a specific gravity so great that a volume of it equal to the volume of the egg weighs more than the egg weighs. In the third the egg will be seen to float at the surface where the brine and the supernatant fresh water are in contact. If now the brine and fresh water are stirred together so as to be mixed a liquid may be easily obtained by slightly varying the proportions of brine and fresh water, in which the egg will have little or no tendency either to sink or float, and in which, if it is placed in any part of the jar, it will remain at rest just supported. In this case the specific gravity of the liquid is such that a volume of it equal to the volume of the egg has precisely the same weight that the egg has.

The conditions of floatage and of stability of a body floating in a liquid are of great importance. A floating body displaces, as has just been remarked, a certain quantity of the liquid, and the weight of the solid body is equal to the weight of the liquid that is displaced by it. To calculate how much of the body is submerged, and how much floats above the liquid, it is only necessary to consider what volume of the liquid would be equal in weight to the weight of the floating body. For example, the specific gravity of ice is about $\frac{9}{10}$ of that of ordinary sea-water. Hence 9 cubic feet of sea-water weigh as much as 10 cubic feet of ice. Thus in an iceberg nine-tenths of the ice is under water, and one-tenth is above the surface. In ships and other floating bodies the stability depends on the form of the body. A sphere of wood floating in water is indifferent as to position. The slightest force is sufficient to overturn it from any given position, or to set it rotating in the water. With a ship, or other body that must float with one side upward, the stability is quite as important as the floating power. The accompanying figure illustrates the conditions of stability. When a solid body, such as the boat in the figure, is slightly displaced from its ordinary position of equilibrium, the forces that act upon it are seen to be twofold. First, there is the force of gravity on the solid acting vertically downward, which, if G be the centre of gravity, may be considered to act downward through that point; and secondly, there is the resultant of the upward pressures of the various portions of the liquid, which, if



O be the centre of these upward parallel forces, may be considered as equivalent to a single force acting vertically upward through that point. In the figure these two equal parallel forces are seen to form a mechanical *couple* whose tendency is to right the boat, and bring it back into its ordinary floating position. But if the upward vertical line through O were on the other side of the downward vertical line through G, it is plain that the effect of the couple would be to carry the boat away from the position in which it ought to float; and the boat would thus be unstable. The stability or instability of a floating body depends evidently on the form of the submerged portion of the floating body. This is a matter for calculation with engineers and ship-builders. But it must be remembered, that though a floating body may be very stable indeed in a certain position, yet when it has been displaced beyond a certain limit from its ordinary position, it may, from its shape, become actually unstable. This is not the case with a rowing-boat such as that represented in the figure, for no displacement short of putting the side under water would render this form of body unstable; but in some forms of ships this is the case, and it is want of attention to this principle that has caused many shipping disasters. A ship of low free-board may be very 'stiff,' as it is called, up to a certain limit, that is, may possess up to that limit very considerable righting moment, but by being pressed beyond a certain point by means of the sails, or by rolling beyond a certain limit in a heavy sea, it may actually become unstable, and overturn without hope of recovery.

The *metacentre* is a point in a floating body of great importance. The position of the metacentre in fact determines whether the equilibrium is stable or unstable in any case. Let AB in the figure be a



line drawn through the points G and H, the centre of gravity of the floating body, and the centre of the figure of liquid displaced when the body is floating with AB vertical. Let the body be then slightly displaced, and let O be the new position of the centre of the figure of the displaced liquid, and let M be the point in which AB is cut by a vertical line through O: *M is the metacentre when the displacement from the original position is infinitesimal.* If the metacentre is above G then the equilibrium is stable; if it is below G the equilibrium is unstable, and the body

being slightly displaced, it tends to fall farther and farther from its position of equilibrium.

There are many instruments and machines founded on the hydrostatic principles that have been laid down here. The barometer, the siphon, the pump, the hydrostatic press, the hydrometer, are examples. For information respecting them the reader must consult articles under the special names belonging to them.

HYDROZOA, that class of animals of which the fresh-water hydra is the most familiar example, the marine forms, the sea-firs and the like, being less recognizable members of the group. The hydra is a minute tubular animal, about half the length of a barley pickle; it is found attached to plants, but has the power of shifting its place, and may float about, mouth downwards, attached, so to speak, to the under surface of the water. It is of simple structure, consisting of a body wall, in which an outer and an inner layer are recognized, and an inclosed cavity which has only one aperture, the mouth, situated on the summit of a conical projection surrounded by a circle of tentacles. The inclosed cavity is the digestive sac from which the tissues of the wall receive nourishment directly by imbibition. The body and tentacles owe their mobility to the contractile fibres between the layers, from the outer of which they are derived. The outer surface, and especially the tentacles, are abundantly provided with *urticating organs* or *nematophores;* these are vesicles filled with fluid and containing a spirally coiled filament with a barbed tip; the vesicle bursts, and the spiral filament is discharged, whence the popular name *thread-cells*. This apparatus is defensive and offensive, the acrid fluid seeming to paralyze small animals, which are then drawn to the mouth by the tentacles and engulfed in the cavity. The animal multiplies by budding, a small outward projection of the two layers with a portion of the inclosed cavity gradually enlarging, the extremity opening and tentacles appearing, when the connection with the parent is severed, and the bud floats away independent. This process may be artificially imitated, each bit into which the animal may be cut up reproducing the original form. In autumn projections are seen within which ova and spermatozoa are developed, and this mode of reproduction secures the permanence of the species, the parent dying down in winter and the ova being hatched in spring. A still simpler form has been seen by De Greef, the *Protohydra*, which may be described as a microscopic hydra without tentacles. *Lar sabellarum*, a curious form discovered by Gosse, has two tentacles placed below the constriction which separates the oral pyramid from the rest of the body. The number and position of the tentacles varies in the soft forms; but in those which secrete a sheath the circlet is necessarily fixed. The ectoderm or outer layer of the body wall in certain groups secretes a delicate transparent structureless sheath, the *hydrotheca*, and this splitting off from the soft ectoderm forms a cup into which the polypites, as the individual hydroids of a compound mass may be called, are retracted. Budding may yield new individuals, which separate by fission from the parent, as in the hydra; or the connection may persist, as in the majority of the class, yielding a compound organism, all the parts of which may remain in vital connection. Polyzoa likewise furnish plant-like forms, but the individuals of the compound mass are independent of each other. From some of the compounds creeping stolons proceed, and from these arise fresh compounds, the connection of the several masses which may thus be developed being sometimes early severed. What have been called 'alternate generations' are beautifully illustrated in this class. A bud, exactly similar to those which become polypites, possessed of mouth, tentacles, and digestive cavity, may go through a peculiar modification of growth, so that it never becomes a nutritive individual, but the reproductive elements are developed between its ectoderm and endoderm, or the bud may assume the form of a swimming disc, a minute jelly-fish, either becoming free and swimming away or remaining fixed to the parent, but in either case the reproductive elements are developed in its body walls; or these swimming discs do not directly develop the elements, but give off buds in which ova and spermatozoa arise. From the ova developed in any of these ways the sessile individuals emerge and the cycle is thus completed. The modifications of the general plan here outlined furnish materials for the most interesting investigations in philosophical zoology, a well-known work of this kind being Allman's Monograph on the Hydroida (Ray Society's publication). The plant-like appearance of most hydrozoa, as the sea-firs (*Sertularia*), was indicated by the old name zoophyta, animal-plants, under which they were included. The resemblance is not confined to form: thus the branches come off in the intervals between cells, and are therefore part of the common stock, not equivalent to a cell or individual polype. But the polypes may undergo curious transformations. Thus they may be converted into swimming discs, or their development from the bud stage stopping before the mouth is opened, they may thereafter remain as floats, as in the *Physophora*. Or the bud may become elongated and flattened, forming the 'bract' of the same group. A number of such buds may, as in Sertularians, rise up on both sides of a branch and form a 'corbula' or basket within which the reproductive elements are developed.

The Hydrozoa may be wholly soft, or provided with a chitinous sheath, which (as in *Dicoryne*, the curious bristly incrustation of dead shells, chiefly whelks) may attain considerable thickness. The extreme strength of investment is found in the stony millepores which were formerly grouped under the corals, but were recognized by Agassiz as Hydrozoa.

The Hydrozoa are also known as Hydromedusæ, and are classed as among the Cœlenterata that are characterized by thread-cells and stinging-filaments. According to a recent classification they are divided into seven orders: I. *Hydrida*—solitary polypes, not presenting medusoid forms and not forming colonies—including only the fresh-water hydra; II. *Hydro-corallinæ*—the millepores; III. *Tubulariæ*—a numerous group, mostly forming colonies; IV. *Campanulariæ*—forming colonies, including sea-firs, &c.; V. *Trachomedusæ*—polypes developing directly from the egg and no medusæ known to exist; VI. *Narcomedusæ*; VII. *Siphonophora*—free-swimming colonies of medusæ, including *Velella*, *Diphyes*, *Physalia* (Portuguese man-of-war), &c.

HYDRUS, one of the southern constellations.

HYENA. See HYÆNA.

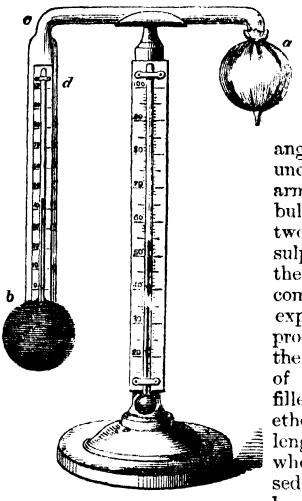
HYÈRES (ancient *Arcæ*), a town in France, department Var, 10 miles east of Toulon, on the south side of a hill, facing the Mediterranean. The situation is beautiful, and the mildness and dryness of the climate during the winter months attracts patients afflicted with chest or nervous disorders. It is built in the form of an amphitheatre, and in the lower part of the town there is a large and regular square adorned by a marble pillar, with a bust of Massillon, who was born here. The only edifices deserving of notice are the English church; one of the parish churches, which is a large and curious structure, perched on a precipice; the town-house, which has a good façade, fronting the market-place; and the remains of the ancient citadel, occupying the very summit of the hill on which the town

stands. The chief manufacture is orange-flower water; and there are numerous olive-presses, several distilleries, and silk-mills. The trade is in olive-oil, wine, oranges, citrons, and other fruits. One of the two annual fairs lasts two days. Pop. (1901), 9949.

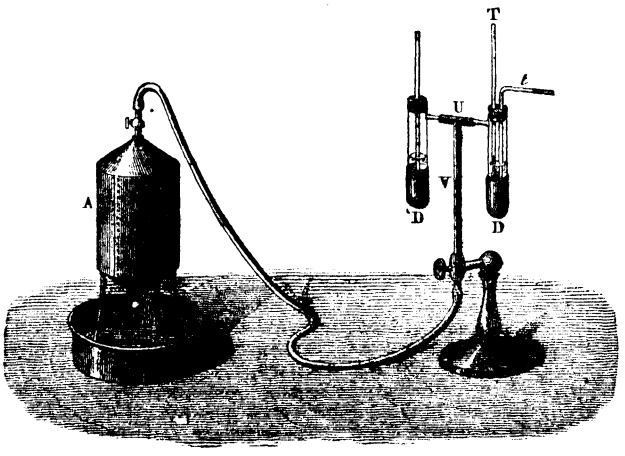
HYGIEIA, the goddess of health, daughter of Asclepius or Æsculapius. Her temple was placed near that of Æsculapius, and her statues were even erected in it. At Argos there was a celebrated sanctuary of the two divinities. She is represented as a maid of slender form, with a long flowing robe. She has a bowl in her hand, from which she is feeding a snake, the symbol of health.

HYGIENE, or the 'doctrine of health', is that part of medicine which teaches how health is to be maintained, and the duration of life prolonged, by a due attention to physiological or natural laws. General hygiene, or the care of the public health, is the object of what may be called political medical science; particular hygiene looks to men only as individuals. Hygiene has for its principal subjects of inquiry the nature of health, the means of maintaining the normal condition of all the organs, and the whole organism, with reference both to body and mind, the influences and external agencies beneficial or injurious to health, together with their mode of action, the signs of good health, the probabilities of its duration, or of derangements which may interfere with it. Hygiene at present more especially concerns itself with the external conditions of life, purity of air and water, wholesome meat, the adulteration of food, and so on. The crowding together of people in cities has rendered the part of hygiene more and more imperative. For the same reason the removal of waste from dwellings and cities, the subject of unhealthy trades, the disposal of the dead, &c., have acquired prominence. Both public and private hygiene has in modern times become the object of much more attention and of more successful investigation than formerly. France for a time took the lead, but was quickly followed by England. Model lodging-houses, washing-houses, public baths, were established by private associations; and the legislature provided for the appointment of Boards of Health in all the principal towns of the kingdom. Everywhere there are now sanitary inspectors, whose duty it is to see that drains are properly constructed and regularly flushed; that lodging-houses are kept clean and not overcrowded; and that whatever can be regarded as a nuisance shall be at once removed. Considerable powers are vested in them by the legislature, and the public health has appreciably improved. Similar administrative reforms were developed somewhat later in the United States, with equally beneficial results. See also the articles on HEALTH, SEWAGE, ADULTERATION, and such works as Simon's English Sanitary Institutions (1890); Stevenson and Murphy's Treatise on Hygiene and Public Health (2 vols., 1892–93); Lehmann's Methods of Practical Hygiene (Eng. trans. by Sir W. Crookes, 2 vols., 1893), &c.

HYGROMETER, HYGROSCOPE. It is of great importance in meteorology to ascertain the quantity of moisture in the air. The first hygrometers, or rather hygroscopes (for they did not determine the *quantity* of humidity, but merely showed the difference between a dry day and a damp day), were constructed of catgut, hair, or other fibrous material, having the property of lengthening when wet, and contracting when dry. The first hygrometer properly so called was made by Professor Daniell, whose ingenious contrivance is shown in the figure annexed. The instrument consists of a glass tube, bent at right angles into arms of unequal length. Each arm terminates in a bulb, the bulb *b* being two-thirds filled with sulphuric ether, and the bulb *a* being, at the commencement of an experiment, empty. In process of construction the tube is exhausted of air, and is thus filled with vapour of ether through its entire length. A thermometer whose bulb is immersed in the ether of the lower arm is inserted in the tube to register variation of temperature, and a second thermometer is attached to the stand of the instrument to show the temperature of the outer air. For use the bulb *b* has a zone of polished gold, and the bulb *a* a muslin cover. If sulphuric ether be dropped on the latter, as it evaporates the bulb is cooled, and the vapour of ether is condensed within it from the bulb *b*; and owing to the evaporation from *b* into *a* the temperature of *b* gradually falls. The operation is carried on, ether being dropped on *a* as is required, till the temperature of *b* is so far reduced that dew from the surrounding air just begins to condense upon it. By means of the thermometer contained in *b* the temperature is read off at the instant at which vapour begins to condense, and the dew-point is thus obtained. The *hygrometric condition*, that is, the ratio between the quantity of moisture that the air actually contains and the quantity which it is capable of containing at the existing temperature is then easily deduced.



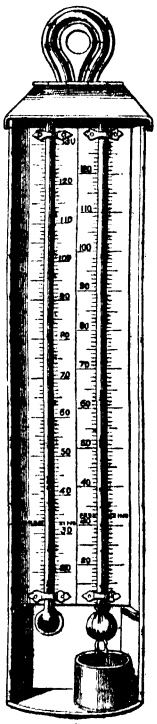
Daniell's Hygrometer.



Regnault's Hygrometer.

Regnault's hygrometer, shown in the above figure,

is an important modification of Daniell's instrument. D and D′ are two precisely similar cups or thimbles of polished silver; each is surmounted with a similar glass tube into which, by means of a cork, two thermometers are fitted, and the bulbs of the thermometers are covered with ether. Through the cork in one of the tubes a small glass tube *t* passes, and is carried down below the surface of the ether; while a side tube establishes communication with the vertical tube U V which is connected with an aspirator A (or vessel into which air is sucked at the top to supply the place of water which escapes at the bottom). There are no corresponding side tubes connecting the left-hand tube of the hygrometer D′. By means of the aspirator a current of air is drawn through *t*, it therefore bubbles through the ether, causing evaporation and cooling the ether till the dew-point is reached. This is observed with great nicety by means of the silver cap; for the instant the dew commences to deposit, the brilliant polish of the silver is dulled. The temperature of the air is at the same time read off by means of the other thermometer in D′. Regnault's hygrometer, both from its construction and from the use of the aspirator, avoids the too great proximity of the observer, which, from the nature of the experiments, is evidently objectionable.



Dry and Wet Bulb Hygrometers.

Mason's dry and wet bulb hygrometer is also a valuable instrument. It consists of two thermometers arranged side by side as in the figure. The dry bulb gives the temperature of the air at the time of observation; and the bulb *e*, which is covered with muslin, and kept moist by filaments of cotton carried from it into a small cistern of rain or distilled water, reduces the height of the mercury in its tube in proportion to *the capacity of the air for drying, or taking up additional vapour*. This instrument does not give the dew-point *directly*. The difference between the readings of the two thermometers is multiplied by a special factor for every temperature of the dry bulb. This factor may be obtained by means of a formula for the purpose, or may be found in Glaisher's Hygrometrical Tables.

The illustration shows the thermometers not strictly identical; but it is a great convenience when the two have a common scale.

HYKSOS. See Hycsos.

HYLAS, in Greek mythology, a beautiful boy, the favourite of Hercules, who took him with him on the Argonautic expedition. When they landed on the coast of Mysia, he went out to fetch water for Hercules, and the Naiads, enraptured with his beauty, drew him down into their grottoes, and he was never seen again.

HYMEN, HYMENÆUS, the god of marriage in Grecian mythology. The common legend is that he is the son of Apollo and a muse, but which muse is uncertain. No marriage took place without his being invoked to sanction it. He is described as having around his brows the flower of marjoram, in his left hand the flame-coloured nuptial veil, in his right the nuptial torch, and on his feet golden sandals. He is a taller and more serious Eros.

HYMENOPTERA (Greek, *membrane-winged*), the name of a very extensive order of insects. They have four minutely-veined membranous wings, which are very seldom wanting, the upper being always larger than the lower. They undergo a complete metamorphosis. The females possess either an auger, with which they pierce or saw through the skin of plants and animals, to deposit their eggs, as in the ichneumons; or, as in the bees and wasps, this ovipositor is reduced to a sting, with which they can make a very sharp puncture, and at the same time deposit in it a portion of venom, contained in a bag which communicates with the sting. If the Hymenoptera fail in brilliancy of colour and large size, numbers of them are distinguished by remarkable instinct and well-ordered households, which they maintain by living in common. Many are very destructive, by injuring the bark of young trees, devouring fruit, inflicting severe stings, robbing honey, and putting the honey-bees to death; others of them are very useful, as the honey-bees, by their honey and wax; the oak-gall wasps by their gall-nuts, and the ichneumons by the destruction of many pernicious insects. The larvæ of the Hymenoptera are usually white and soft, and without feet, though in some the number of feet is six or eight, and in others varies from eighteen to twenty-two. The larvæ of the flower Vespæ or Melittidæ live in skilfully-constructed cells, formed of the pollen of flowers; the larvæ of the robber-wasps live on animal and vegetable substances, those of the gall-wasps on gall-nuts, those of the wood-wasps in the heart of trees, those of the leaf-wasps at liberty on leaves, and those of the ichneumons in the interior of other insects. The number of known Hymenoptera is very great. Some authors divide the order into the two sub-orders, Sessiliventres, in which the abdomen is united to the thorax by a broad connection, and Petiolata, in which the abdomen unites with the thorax by a narrow stalk. The first group comprises only the Tenthredinidæ (saw-flies) and the Siricidæ (wood-borers). See Ant, Bee, Wasp, and other articles.

HYMETTUS, a mountain in Attica, now called *Trelovouni*, south-east of Athens, in ancient times distinguished for the quantity and excellence of its honey, which the bees here collect, and which is still in repute. Hymettus was also famous for its marble. Its highest peak is about 3300 feet above the sea-level.

HYMN, anciently a song of praise sung in honour of gods and heroes on festivals, with the accompaniments of music and dancing. Afterwards every song of praise or ode, wherein anything elevated or sublime was sung, went by this name. In this respect many of the Hebrew psalms are to be called *hymns*. These breathe a more fervid spirit of devotion than those of the Greeks, which were anciently almost entirely epic, like those ascribed to Homer, and recounted legends of the gods as well as the deeds of men. Those of later times, of Callimachus and Pindar, for instance, are almost entirely lyric. The early Christian hymns are, in a great measure, lyric, and are full of devotional feeling. Their use dates from the first days of the church; but we have no reliable information as to their authors. The names of the authors even of the more modern hymns cannot be discovered with certainty, though Prudentius, Paulus Diaconus, and Thomas Aquinas are known to have composed some of the most esteemed. In the Greek and Latin Church, certain songs are called *hymns* (in the latter ninety-six in number), which at certain periods are sung in the churches standing, the psalms being sung sitting. The first of these hymns are said to have been composed

in the Greek Church by Bishop Hierotheus, in the Latin Church by St. Hilarius, bishop of Poitiers, and after him by St. Ambrosius, bishop of Milan. Some of them must be ranked among the first productions of sacred poetry. The fervent hymn by which the Franciscans greet the first rays of the sun is one of the most celebrated. These old hymns are written in iambics, trochees, &c., often in irregular metre, also in rhymes. The use of hymns was sanctioned by the fourth council, at Toledo, in 633. They are sung in the canonical hours. Several of them have particular names, as Hymni Epistolici, sung in the mass before the reading of the epistles; Hymni Evangelici, sung before the reading of the gospel; Hymnus Ambrosianus, or Te Deum laudamus; Hymnus Angelicus, the same with Gloria in Excelsis Deo; Gloria Patri (see DOXOLOGY); Hymnus Marianus, the same with the Magnificat, &c.

HYPATIA, a female philosopher of the eclectic school, the daughter of Theon, a celebrated astronomer and mathematician, who was at the head of the Neo-Platonic school in Alexandria towards the close of the fourth century, at which period she was born. As she early exhibited proof of extraordinary capacity, her father made her mistress not only of the different branches of polite learning, but of geometry and astronomy as then understood. She finally studied philosophy, and such was her reputation that she became a preceptress in the school of Plotinus at Alexandria, and expounded the principles of his system to a numerous auditory of students from all parts of the East. Her ready elocution and graceful address, united with deep erudition and sound judgment, procured her the admiration of all her hearers. She showed none of the vanity or pride of learning, and although eminently beautiful, was equally virtuous. Her house became the resort of all the persons of learning and distinction in Alexandria, and, among others, of Orestes the Prefect, with whom she was falsely accused of being on too familiar terms. At this time the Patriarch of Alexandria was Cyril, a prelate in the highest degree intolerant and haughty, who was guilty of encouraging the populace to plunder the Jews. Orestes laid this affair before the emperor, who, declining to interfere, Alexandria became a frequent scene of tumult between the partisans of the governor and of the bishop. The intimacy of the governor with Hypatia aroused the anger and jealousy of Cyril; and in consequence she was much calumniated by the lower clergy, and by certain savage monks from the Nitrian deserts. Their blind resentment at length led them to a conspiracy against her life, and a number of them, headed by a reader named Peter, seized her as she was returning from the schools, dragged her through the streets of Alexandria, stripped her naked, and finally murdered her with circumstances of the greatest barbarity, and committed her mangled members to the flames at a place called Cinaron. This infamous transaction took place in 415, during the reign of Theodosius II. The Rev. C. Kingsley has chosen the story of Hypatia as the subject of a romance.

HYPERBOLA, in geometry, a curve of the second order, or one of the three conic sections. In forming it two cones are supposed to be united at their apexes, and the plane which cuts the upper cone has such an inclination to its axis that when continued it produces a similar section of the lower cone, thus producing two symmetrical branches, which, though separate and distinct, bear certain relations to each other. These two branches are usually called opposite or conjugate hyperbolas, and each of them has two symmetrical arms, which never meet how far soever produced. The two points where the branches approach nearest to each other are called the vertices, the straight line which joins them is called the major or transverse axis, and its middle point the centre of the hyperbola. A line of a certain definite length drawn through the centre, and continued both ways at right angles to the major or transverse axis, is called the minor or conjugate axis; but has merely an imaginary existence, and is of no practical importance. When the major axis is produced beyond the vertices two points occur at equal distances from the centre, which are called *foci*, and have this remarkable property, that the difference of their distances from any one point of the hyperbola is always equal to the major axis. This property suggests a simple process for constructing the hyperbola. Every line drawn from any part of the hyperbola to one of the *foci* is called a *radius vector*. If at one of the vertices a perpendicular to the major axis be erected, so as to be bisected by this axis and made equal in length to the minor axis, and if through the extremities of this perpendicular and the centre of the hyperbola two indefinite straight lines be drawn, these form what are called the *asymptotes*, and possess the remarkable property, that, though they lie entirely outside the hyperbola, they are always drawing nearer and nearer to it, but never actually reach it. If the hyperbola is what is called *equal sided*, in other words, if its major and minor axes are equal the asymptotes intersect each other at right angles. Besides the hyperbola above described, to which, by way of distinction, the name of Apollonian hyperbola is given, there are others of a higher order, consisting of curves formed in a similar way by the section of a conoid.

HYPERBOLE, meaning in Greek 'overshooting,' from *hyper*, over, and *ballein*, to throw, is a rhetorical figure, in which the highest expression of its kind is used for the purpose of giving emphatic utterance to some idea, asserting of it more than is really meant. It can only be properly employed when the thing to be expressed is extraordinary, and transcends the ordinary course of things, as when it is said, 'his fame reaches to the stars;' it also serves to express the ridiculous, and is often the basis of a metaphor. Hyperbolical is frequently applied as a general term to all kinds of exaggeration.

HYPERBOREANS (those who dwell beyond the domain of Boreas, or the north wind), the name given by the ancients to the unknown inhabitants of the north and west. They were reported always to enjoy a delightful climate; for, dwelling beyond the Rhipæan Mountains, supposed to be the Urals, they were protected from the cold north wind, which was sent to more southern regions. Hence they were imagined to be people enjoying perpetual health and everlasting youth, and who, being the especial favourites of Apollo, worshipped him with music and sacrifices, on plains rich in fruit, under a bright sky, and with a perpetual spring. As the West gradually became better known, the name of *Hyperboreans* was applied exclusively to the North.

HYPERION, one of the Titans. See TITANS.

HYPERMNESTRA, one of the fifty daughters of Danaus, who married Lynceus, son of Ægyptus. She disobeyed her father's bloody commands, who had ordered his daughters to murder their husbands the first night of their nuptials, and suffered Lynceus to escape unhurt from the bridal bed. Her father kept her in strict confinement, but afterwards he was reconciled to her and her husband, to whom he left his kingdom at his death. Lynceus and Hypermnestra were revered at Argos as heroes, and had there a common sanctuary.

HYPERTROPHY, meaning overnourishment, is the term applied to indicate increase in the size of a part, or in the amount of a tissue, above the nor-

mal, such increase being due to abnormal increase of the normal elements of the part, and not to any addition of some new form of tissue or morbid growth. Such an undue increase is quite a common result of an excessive supply of blood, that is of nourishment, reaching the part for a prolonged period. For example, if an ulcer has existed for any time on a persons leg, it will have caused a determination of blood not only to its own site, but to neighbouring parts. The result is that the skin for a considerable distance round is much thicker and more brawny than on the corresponding place of the other leg, and the hairs in the neighbourhood are of an unusual size. The enormously developed muscles of the blacksmith's arm result from constant exercise creating an increased blood supply. Hypertrophy often becomes positive disease, more or less serious according to the tissue or organ involved.

HYPNOTISM (Greek *hypnos*, sleep), an artificial sleep that may be brought on by a brilliant object held at some distance from the eyes, which the person operated on is required to look at fixedly. The nervous phenomena exhibited in hypnotism resemble those induced by animal magnetism, though they arise solely from the condition of the patient, and not from any influence proceeding from others. Mr. Braid of Manchester brought this subject prominently before the public in the seventeenth vol. of The Monthly Journal of Medical Science (1853), but it has been long known in India. To induce hypnotism Mr. Braid directs the operator to take some brilliant object, as a piece of silver money, and hold it up between the thumb and forefinger at from 8 inches to 1 foot somewhat above the forehead of the patient, engaging him to regard it fixedly, and to concentrate his attention on the object. A series of physical and psychical phenomena will soon be observed, such as watering of the eyes, the contraction, dilatation, and recontraction of the pupil as in ordinary sleep, and the complete insensibility of the eye to light. Hypnotism commences with the second contraction of the pupil. The pulse is accelerated or retarded, and the limbs become rigid as in catalepsy. There supervenes at the same time a heaviness of the head, a confusion in the ideas, and a loss of consciousness more or less complete, followed by absolute unconsciousness. Reason and memory are temporarily suspended, the will is paralyzed, and the patient is irresistibly impelled to act in accordance with suggestion. If the arms and legs are gently moved they remain in the position in which they have been put. Suggestion will make an individual under the influence of hypnotism fancy that he is some one other than himself, and he will feel, act, and speak like the person he imagines himself to be. These facts have been fully established, together with the existence of hallucinations in the hypnotic state, such as the belief of the patient in the presence of one who is absent, and his assigning a false position and dress to one actually present. He can be persuaded that he hears the sounds of a musical instrument though perfect silence prevails. The senses of smelling and taste can be similarly deceived. Notwithstanding the thoroughness with which Mr. Braid investigated these phenomena, and the interesting nature of the facts themselves, hypnotism fell for a time almost entirely into neglect, and it is only in quite recent years that the subject has again received attention, especially in Germany and France. As a therapeutic agent hypnotism has been successfully employed in numerous forms of disease, especially such as have a nervous origin, and many surgical operations of the minor class have been performed without pain on persons who have been previously thrown into the hypnotic state. It has frequently been beneficially employed in cases of nervous irritation and sleeplessness, and it is said that when a few hours' sleep have been obtained by its agency the patient sleeps longer the following night. Still there is by no means general agreement among medical men as to whether hypnotism, like electricity, should be admitted to a recognized place as a therapeutic agent in medical practice. See MAGNETISM (ANIMAL).

HYPOCHLORITES, salts derived from *hypochlorous* acid (see CHLORINE) by the addition of oxides, hydrates, or carbonates, or by double decomposition. The pure salts are of no special interest; they are soluble in water, are rather unstable, and are readily decomposed by acids. Their chief importance, chemically and commercially, depends upon their being powerful oxidizing and bleaching agents. Those, however, which are most largely used for these purposes are not pure hypochlorites, but contain some chlorides as well. The chief hypochlorites, or at least the complex substances which contain hypochlorites, are bleaching-powder, for an account of which see LIME, and the bleaching liquors made with potash and soda. These substances are prepared by bringing chlorine gas in contact with slaked lime, and with the alkalies or alkaline carbonates. The alkaline salts have been used for disinfecting purposes, that of soda under the name of Labarraque's fluid, and of potash under the name of Eau de Javelle. Besides these there have been proposed and employed of late years several other hypochlorites prepared from the preceding by double decomposition. Thus, by adding sulphate of magnesium to bleaching-powder a solution of hypochlorite of magnesium is obtained called Grouville's liquid, and the hypochlorite of zinc (Varrentrapp's liquid) and hypochlorite of aluminium (Wilson's liquid) can be similarly prepared. See DISINFECTANT.

HYPOCHONDRIASIS (from the Greek *hypo*, under, and *chondros*, the cartilage; hence *hypochondrium*, the region of the abdomen, which lies under the short ribs), one of the most troublesome of nervous complaints. It is characterized by a morbid anxiety about the state of health, and an undue attention to every little ache or pain, or the slightest disturbance of function. There are few diseases of which the hypochondriac does not at some time or other complain, or fear he is the victim of. He feels a pressure on the right side, and thinks it is owing to a complaint of the liver; he has pains in the breast, and immediately apprehends inflammation of the lungs; his head feels heavy, and nothing is more certain than an approaching apoplexy; he sees specks before his eyes, and a cataract is unavoidable; if there is the slightest palpitation of the heart, as is quite likely to occur, because disturbance of digestion, flatulence, &c., are frequent accompaniments of the condition, and are quite likely to produce occasional functional irregularity of the heart's action, he suffers from heart disease—he is sure of it, and so on. There is generally some disturbance of the digestive functions, obscure pains referred to the abdominal organs, flatulent distension, and so forth. The old idea that the abdominal organs were the seat of the disease lead to the term hypochondriasis, though the disorder is in reality a nervous one. The discomfort which the hypochondriac experiences is magnified by his attention to it into the symptoms of a serious disorder; but it is to be noted that the mere hypochondriac fears he is the victim of a disease whose existence is possible. If a person imagines he is the victim of a disease which is of an impossible kind, impossible from its nature or from its existence being incompatible with continued life, that he has no stomach and consequently cannot eat, that half his brains have disappeared, and so on, this

is of the nature of delusion, insane delusion, and is not hypochondriasis in the ordinary use of the term. Hypochondriasis is, however, closely allied to melancholia, of which indeed it may be considered a mild form, and of which at any rate it is often the early stage. In estimating whether it may not gradually pass into a positive state of mental unsoundness, one must consider carefully the person's antecedents. Its hereditary tendency is well marked, and it is apt to appear in those in whose family history insanity has occurred. It is between the ages of twenty and forty that it most frequently occurs; and it is commoner in males than in females. In a person whose temperament or whose hereditary tendencies render him prone to hypochondriacal notions, any circumstances which specially direct his attention to any particular disease are likely to set him off on the search for symptoms in himself which might conceivably be due to a similar cause. A friend has died of cancer of the stomach, for example, and immediately he sets himself to compare all his feelings of discomfort, referred to his digestive organs, to the symptoms of that disease which he sets himself to study. He consults physician after physician, and tries one kind of treatment after another. If latterly someone has carefully examined him, and has been able to convince him that his fears are groundless, he is convinced only for a brief season. Some new symptom arises, or some point has been overlooked, which, if the physician had known at the time, would, in the sufferer's opinion, probably have changed his view; and so the whole question is reopened. Mental strain often plays a prominent part in inducing hypochondriacal tendencies. In such cases the attention of the person is engrossed with head symptoms, obscure sensations of weight on the head, pressing in on his brain, throbbing, pricking sensations, or sensations of heat, and if these are associated with feelings of intellectual weariness, the patient distresses himself by fears of his intellectual powers giving way. He cannot give the attention to business he used to; he is not so alert in meeting customers or in attacking business difficulties, or he thinks so. He is distressed lest those with whom business brings him into relations observe his failing. He fears his inattention is taken note of, and so on.

Among some of the causes which may determine the appearance of this condition of mind, or may seriously aggravate the symptoms, excesses of various kind, especially alcoholic excess or sexual excess, play a very prominent part. The depression which accompanies the condition inevitably leads to less active bodily habits, and to lessened interest in business as in every other department of activity. Thus, the hypochondriac devotes more and more time to watching his symptoms and to habits of introspection. The inaction thus induced aggravates any digestive or intestinal derangement, and in consequence any symptoms arising therefrom become more and more accentuated.

Such cases are necessarily very difficult of treatment. Once and for all a very careful examination of the patient ought to be made, so that any actual disorder from which he suffers may be, if possible, accurately determined and got rid of. At the outset, therefore, his complaints are not to be laughed at. But when this has been properly done, it is a mistake to treat symptom after symptom as they may arise. The remainder of the treatment ought to be of a moral kind, such as is obtained by cheerful companionship, travel in the company of a judicious friend, and so on. Finally, it is to be noted that the hypochondriac, as distinguished from the melancholiac, has no tendency to suicide.

HYPODERMIC INJECTION (Greek, *hypo*, under; *derma*, skin), a method of introducing medicines into the body when the condition of the stomach or other organs renders their introduction by the mouth objectionable or impossible, or when rapidity of action is desired. The medicine is introduced by means of a *hypodermic syringe* of glass, fitted with a long, hollow needle-shaped point of steel. Morphia is frequently administered in this manner in order to relieve pain rapidly or to calm nervous excitement.

HYPOTENUSE. See HYPOTHENUSE.

HYPOTHEC, a Scottish law term, corresponding to *lien* in England, denoting the legal security over goods in favour of a creditor while the goods remain in the debtor's possession. The Roman law recognized many hypothecs over movables, but the law of Scotland admits of only a few, which may be classed under the two heads of hypothec for rents and maritime hypothec. Thus, a landlord has a hypothec over his tenant's furniture for house rent, and until 1880 agricultural landlords had a hypothec over the crop and stock of their tenants—a right abolished partly because it gave them an undue advantage over other creditors. Seamen have a tacit hypothec over the freight of a ship in security of their wages, and if no freight be earned they have a claim against the ship itself. Freighters hold a hypothec over the ship for loss by improper delay or interruption of the voyage, or for damage done by improper storage.

HYPOTHENUSE, more correctly HYPOTENUSE (Greek, *hypoteinousa*, subtending), the name of that side in a right-angled triangle which subtends, or is opposite to, the right angle. One of the most important propositions of Euclid's Elements is the forty-seventh of the first book, which proves that the square described on the hypothenuse is equal to the sum of the squares described on the other two sides. Pythagoras, on his discovery of this proposition, was so overjoyed that he is said to have sacrificed a hecatomb to the Muses, though, from his holding the doctrine of the metempsychosis, and for other obvious reasons, this may be fairly doubted. The forty-seventh proposition is of much practical value, and is still sometimes called the *Pythagorean problem*. The hypothenuse is also a diameter of the circle which passes through the three corners of the right-angled triangle.

HYPOTHESIS, etymologically a supposition, is a proposition or principle which is taken for granted in order to draw a conclusion to prove some point in question, and is popularly used to denote something not proved, but assumed for the sake of argument. In mathematics the term denotes what is assumed in order that the conclusion may follow from it as a consequence. It has sometimes been applied in a disparaging sense to suppositions that have been made for the purpose of drawing foregone conclusions, and not with the view, as has been generally the case in physics, to supply probable antecedents to conclusions which have already been experimentally established. In endeavouring to account for natural phenomena we often gratuitously assume some cause, which may ultimately be established as the real cause if it fully explains the phenomena inquired into. In some cases the hypothesis may only acquire a certain degree of probability; in others it may account for all the known circumstances, and it then acquires the name of a theory; and if subsequent observation reveals no exceptions to its application, it gradually amounts to certainty. The conjecture of Newton that the force of gravity, as exemplified on the earth, might extend to the moon was at first a hypothesis; but when it was found that it accounted for all the facts

it became a theory. Copernicus assumed the diurnal rotation of the earth, and its translation in the ecliptic, that he might explain the planetary phenomena, and continued astronomical observation has pronounced his assumption a certainty. Subsequent discoveries and calculations have fully confirmed Kepler's hypothesis that the planets move in elliptic orbits, and this is now accepted as an established law of nature. There has an attempt been made to institute a distinction between a hypothetical cause and a true cause, but it is practically of no value. A more rational inquiry is as to what constitutes a legitimate hypothesis, for a mere imagining of possible causes may introduce error instead of establishing truth in our endeavours to account for natural phenomena. A case in point is the celebrated undulatory theory of light. The existence of an ethereal substance whose undulations are supposed to constitute light in its passage from the sun to the earth is meanwhile a mere assumption or hypothesis; but such a weight of analogy and probability has been accumulated in its defence that we must either acknowledge that it states what is a fact or that the fact is so much akin to the hypothesis that there is a mode of expression common to both, so far as the phenomena that have as yet been observed are concerned. So far as the facts are yet known the undulatory theory of light explains them, and it has also led to the discovery of new facts by way of inference. Many curious contrivances and many useful experiments have been thus suggested, which have augmented our knowledge and improved the arts of life. M. Auguste Comte and Mr. J. S. Mill maintain that there can be no sound scientific hypothesis unless the cause assumed to account for the phenomena is either a true cause, a *vera causa*, or capable of being proved such. Dr. Whewell, on the other hand, asserts that a certain amount of agreement with observed facts is sufficient to establish a hypothesis, in the absence of any discordant facts.

HYPSIPYLE, daughter of Thoas, king of Lemnos. When the Lemnian women murdered their husbands in their sleep, because they had taken Thracian slaves for concubines, she alone preserved her father, and concealed him in the island of Chios. Hypsipyle received the Argonauts, who had landed on Lemnos, with great kindness, and bore Jason two sons, Euneus and Nebrophonus, or as he is otherwise named Deiphilus or Thoas. When the Lemnian women discovered that Hypsipyle had preserved her father they attempted to murder her, and would have accomplished their purpose had she not saved herself by a timely flight; but she was seized shortly after by pirates, who sold her to King Lycurgus of Nemea, who intrusted her with the education of his son Opheltes. When the army of the seven princes passed through the territories of Lycurgus, on their way to attack Thebes, they found Hypsipyle alone in a wood, with the boy at her breast. They begged her to show them a fountain, and while she conducted them to one in the neighbourhood, during her short absence the boy, whom she had put down, was stung by a serpent and died. In remembrance of him the Greeks instituted the Nemæan games. Hypsipyle was thrown into confinement, and would have atoned for her misfortune with her life had not her sons rescued her.

HYRAX. This small rabbit-like animal is believed to be 'the coney, the feeble folk' of Scripture. The body is long and covered with thick soft fur, which conceals the short rounded ears. There are two species, not very sharply defined, the Daman (*H. Syriacus*, Schreb.), which spreads from the African shores of the Red Sea to Syria, and the Klipdas (*H. Capensis*, Schreb.), which ranges from Abyssinia to the Cape of Good Hope. They are gregarious, and frequent the rocky parts of the country, or take advantage of ruinous places, since they are incapable of burrowing. They are of a mild disposition and active habits. The zoological position of this animal has been the subject of great discussion. It has been placed among the Pachyderms and the Rodents, but it now appears that it should be regarded as the type of a distinct order, *Lamnungia* (Illiger) or *Hyracoidea*. The dentition is peculiar; the incisors are $\frac{2}{2}=\frac{2}{2}$; canines, $\frac{0}{0}$; premolars, $\frac{4}{4}=\frac{4}{4}$; molars, $\frac{3}{3}=\frac{3}{3}$: the two outer incisors of the upper jaw drop out early, and the curved median incisors have a thick outer layer of enamel, and grow throughout life as in Rodents, whom they also resemble in having the muffle or snout divided. The pattern of the molar teeth resembles that of the rhinoceros. The fore limb is four-toed, the hind limb three-toed; and the femur has, as in the horse, a third trochanter. The digits are soft and have flat nails, which do not cover the tips; but the nails of the inner toes of the fore limbs are longer and curved. The dorso-lumbar vertebræ are twenty-nine to thirty-one, a number greater than in any other land mammal except the sloths. The urinary organs are in type like those of the Rodents. The placenta forms a broad zone. No member of this order is found fossil.

HYRCANIA, a province of ancient Asia, bounded on the N. by the Caspian, on the E. by the Oxus, on the S. by the northern spurs of the Montes Sariphi (now Hazari), and on the W. by Media. Its boundaries varied at different periods of history, but it corresponds with the northern half of Khorasan, and the southern portion of Mazanderan, along the Caspian Sea. The districts on the coast and the valleys among the hills were fertile in wine and fruit, but the rest of the region was comparatively sterile. The inhabitants of Hyrcania were probably descended from the northern Scythians. As early as the first century Hyrcania possessed independent sovereigns, who were often formidable to the Parthian monarchy.

HYRCANUS, the name of two Jewish high-priests and rulers of the Asmonean family:—JOHN HYRCANUS, the son and successor of Simon Maccabæus, who ruled B.C. 136–106, was at first dependent on the Syrians, but succeeded in throwing off their yoke, and also in subjugating the Samaritans. He next overcame the Idumæans, and obliged them to submit to Judaism. He afterwards confirmed his power by an alliance with the Romans, built a strong castle on the north-east corner of Mount Moriah, and extended his dominions almost to the ancient limits of the kingdom of David. He appears also to have been the founder of the Sanhedrim. He was originally a Pharisee, but ultimately became a Sadducee. The violent dissensions of these powerful sects somewhat disturbed the tranquillity of his latter years, but he ultimately ended his long reign in peace, leaving five sons, two of whom, Aristobulus and Alexander, afterwards governed with the title of kings.—HYRCANUS II., grandson of the former, and son of Alexander, was appointed king in Jerusalem on the death of his mother, Alexandra, B.C. 69, but being attacked and vanquished by his brother Aristobulus, withdrew into private life. Being afterwards worked upon by the artifices and intrigues of Antipater, prince of Idumæa, he endeavoured to regain the throne by the help of Aretas, king of Arabia Petræa, but had no success till Pompey (B.C. 63) appointed him high-priest and ethnarch. Hyrcanus now presided over the temple, but Aristobulus held the government till he was poisoned by the partisans of Pompey (B.C. 49). Julius Cæsar made his dignity of high-priest hereditary, and in B.C. 47 appointed Antipater procurator. When Antigonus, the son of

Aristobulus, made himself king and high-priest by the help of the Parthians, he caused the ears of Hyrcanus to be cut off in order to make him unfit for the priestly office. The Parthians afterwards, about B.C. 40, carried Hyrcanus along with them to Seleucia, on the Tigris. Here he remained till he was invited to Jerusalem by Herod, son of Antipater. Being suspected of plotting against Herod he was put to death, B.C. 30.

HYSSOP (*Hyssopus*), a genus of plants of the natural order *Labiatæ*, with four straight diverging stamens, and a fifteen-ribbed calyx. The common hyssop (*Hyssopus officinalis*) is a perennial shrubby plant rising to the height of 2 feet. The leaves, which are elliptical and of a deep-green colour, stand in pairs without footstalks. The flowers, which are of a blue colour, are produced chiefly on one side, in short verticillated spikes, in which the branches terminate. It is a native of the south of Europe and the East, and is found in Siberia and on the Austrian Alps. It flowers from June to September. Gerard first introduced the hyssop into England in 1596, and it is now a common garden plant. The leaves have an agreeable aromatic odour, and a slightly bitter and somewhat warm taste. An extract from them is produced by two agents, water and spirits. The watery distillation yields an essential oil which was formerly held in much estimation for its medicinal properties, but has now fallen out of use. It is aromatic and stimulating. The young leaves and shoots are sometimes used as a culinary seasoning, but oftener in a dried state as a stomachic and carminative. The hyssop of Scripture (that is, the plant whose Hebrew name *ezōb* has been translated 'hyssop') has not been ascertained. As it 'grew out of the wall' it must have been a diminutive plant, and may have been one of the mosses. The most probable and most widely accepted view is that it was the caper-plant (*Capparis spinosa*), but it is not unlikely that the name was applied to several plants of somewhat similar properties. The name of *hedge-hyssop* is applied to species of plants of the genus *Gratiola*, belonging to the natural order Scrophularineæ. *G. officinalis*, a powerful purgative and emetic, and in larger quantities a poison, is common in European meadows.

HYSTERIA is a nervous affection, commonest in women, akin to hypochondria, which is most frequent in males. It arises from a morbid excitabilty of the nervous system and a diminution of the usual control exerted by the higher over the lower nerve centres. At one time it was supposed to be due to some cause originating in the womb, hence the term, hysteria (Greek, *hystera*, the womb); but its occurrence, though much less frequently, in men, disproves this view. Nevertheless, it is not to be forgotten that hysteria is often due to some affection of the womb or the ovarian appendages. Hysteria shows itself in emotional excitability, in disturbances of the sense organs and organs of motion, and in irregularities connected with the circulatory system. Added to this are, in well-marked cases, some degree of moral perversion and want of intellectual vigour. Thus, the hysterical woman is prone to go off, on slight reason, into a fit of laughter, which becomes uncontrollable and ends in tears. As illustrations of sensory disturbances are hysterical pains, simulating neuralgia, spinal tenderness, pain in the head; or there may be diminution of sensibility, and patches of skin may seem devoid of sensation, so that pins may be driven in without any appearance of suffering. Muscular spasms of various kinds, convulsions, paralysis, loss of voice, may all be of hysterical origin, and so also may palpitation of the heart and fainting fits. Hysterical vomiting is not uncommon. An indolent life, ill-directed education, luxurious habits, as well as long-continued trouble and anxiety, predispose to the attacks. Hysterical complaints are best prevented by a judicious care of the moral and physical education of girls, who are most likely to exhibit this troublesome affection from the age of fifteen to that of twenty.

HYTHE, a parliamentary and municipal borough and market town of England, and one of the Cinque Ports, situated in the county of Kent, 11 miles w.s.w. Dover, to the west of Folkestone, at the foot of a steep hill or cliff. A branch line of the South-Eastern Railway goes to it and Sandgate. In the centre of the town are the town-hall and market-place. The church, which occupies the slope of a hill, is an elegant cruciform structure in the early English style, which was restored in 1875 and 1886. In a crypt under the chancel there is a large quantity of human bones, said to be those of Britons and Saxons killed in a battle here in 456. There is here a government school of musketry. Hythe was anciently a place of great importance; but its harbour has been entirely silted up. It has become a fashionable resort for sea-bathing. A promenade over 5 miles along the coast was opened in Oct., 1881. The parl. bor., which includes the municipal bor., the parishes of Folkestone, Sandgate, Cheriton, Saltwood, &c., returns one member to the House of Commons. Population of parl. bor. in 1881, 28,239; in 1891, 35,547; mun. bor., 4347; in 1901, 46,663 and 5557 respectively.

I.

I, the ninth letter in the English alphabet, and the third vowel. The English language is the only one which denotes, by this same character, the two totally different sounds of *i* as in *pine* and *i* as in *pin*. In all other languages of Western Europe the letter has the sound of *i* in *pin* (nearly) and *ee* in *beef*, which is practically the same vowel, only in the former case short, in the latter long. Those languages which have the sound *i* in *pine* express it by a diphthong; for instance, the German by *ei* and *ai*; the Dutch by *ij*; and it is, in fact, a real diphthong. In Latin the characters *i* and *j* were used interchangeably, both having the same vowel sound. The sound of our *j* did not exist in Latin, though sometimes the character had almost a consonantal force, as in *Ianus* (*Janus*), *Iulius* (*Julius*), *coniicio* *conjicio*). With the propagation of Christianity the Latin alphabet became, in many respects, the model of others, and this peculiarity of *i* was also adopted by most of them; so that, even after two different signs (the *i* and *j*) had been adopted for the two different sounds, words beginning with *i* and *j* nevertheless long continued to be mixed together in dictionaries; but the fact that they are distinct in nature (though nearly akin) and have distinct characters, sufficiently authorizes us to separate them.

In many languages *i* is found as the final vowel of several diphthongs; as in German, *ei, ai;* in French, *ai, oi, ui,* &c.; and these sounds at last actually become one. In the Greek, the *i* (*iota*) was always a vowel. It derived its name from the Hebrew *Jod,* which, as it was the smallest letter in the alphabet, came to be the synonym for a trifle. The term *iota* is also used in the same sense. As a numeral, *Iota* signified *ten;* with a little line under it (ι), *ten thousand.* The Romans used I to signify *one,* and they continued to count with it up to four (I, II, III, IIII). The Roman I, put before a V, takes away the value of one; hence IV is equal to four; and placed after V it adds one; hence VI is equal to six. The dot over the *i* originated in the fourteenth century. I, on Roman coins, was the mark of the *as* in value and weight. As an initial letter it stands for *infra, imperator, imperii, indulgentia, invictus,* &c. There is a French proverb of a person occupied with trifles—'Il met les points sur les i' (he is dotting his i's).

I, used not as a letter of the alphabet, but as a personal pronoun, denotes, in its more immediate sense, the subject which, in all the varieties and changes of the mental states, remains ever the same —the personal identity, the individual person whose state and activity is all that every one finds in his own consciousness. It makes itself known as the real and active agent in the multiplicity of the mental phenomena; and this kind of self-apprehension is so natural to man, that the expression 'As sure as I live,' is regarded as one of the strongest asseverations of reality; it is besides so familiar, that the idea of self or self-consciousness is never lost, and never requires to be suggested. The popular psychology has accordingly been long contented to explain it after the analogy of the external senses, by assuming the existence of an inner sense, by which we perceive our individual circumstances and actions to be truly our own; and even in Kant, what he calls the 'synthesis of apperception,' or, in other words, the activity of the inner sense, is regarded as an act or rather function of self, into which consciousness always enters as a condition. The more recent philosophy has made the idea of personality the subject of very profound investigations, and the philosophy of consciousness has been treated with much subtlety by Professor Ferrier. If the answer to the question, What am I? is borrowed from empirical consciousness, it tells us of a subject temporarily existing, changeable, and susceptible of new additions and transformations; the I is this definite individual existence, with these definite opinions, inclinations, characteristics, &c., and this I is different for each. Every one ascribes to himself this share in the I, and the true idea of what is contained in it cannot lie in those manifestations of individual personality. It is necessary therefore to separate the pure and simple I, or Ego—in other words, the idea of I cleared of all foreign additions—from what is merely empirical. The merit of having brought out this distinction is due to Kant, and the distinction holds a very prominent place in the system of J. G. Fichte.

IAMBLICHUS, an eminent philosopher, a native of Chalcis in Cœle-Syria, who flourished in the beginning of the fourth century. He was the pupil of Anatolius and of Porphyry, and having become perfect in the mysteries of the Plotinian school, he taught with vast reputation. He professed to perform wonders by the aid of invisible beings. His writings discover extensive reading, but his style is inelegant, and he borrows freely, especially from Porphyry. The school of Iamblichus produced many eclectic philosophers, who were dispersed throughout the Roman Empire. The philosophical works of Iamblichus now extant are, the Life of Pythagoras, evidently written against Christianity; an Exhortation to the Study of Philosophy; Three Books on Mathematical Learning; a Commentary upon Nicomachus' Institutes of Arithmetic, of which the fifth and sixth books are lost; and a Treatise on the Mysteries of the Egyptians, Chaldeans, and Assyrians. His authorship of the Mysteries has been disputed, but not on sufficient grounds. St. Jerome states that he also wrote a copious commentary on the golden verses of Pythagoras. He died at Alexandria about 333. This Iamblichus must be distinguished from the person of the same name to whom the emperor Julian dedicates his epistles, for Julian was scarcely born when the successor of Porphyry died. English translations of the Treatise on the Mysteries, and of the Life of Pythagoras, by Th. Taylor were published, the former at Chiswick in 1821, and the latter at London in 1818.

IAMBUS, in prosody, a foot of two syllables, a short and a long one (⏑ —). In Latin the iambic verse consists of four, six, or (in the comic writers) even of eight feet. The odd feet, that is, the first, third and fifth, may be iambuses, spondees, anapæsts, dactyles, or tribrachs (but never trochees). The even feet, however, or the second, fourth, and sixth, must be iambuses. The more iambuses there are in the verse the more beautiful it is considered. An iambic verse of four feet is called a *quaternarius;* one of six a *senarius;* one of eight an *octonarius.* The German language, having a prosody, has, of course, the iambus, and makes great use of it in poetry. The iambic metre is also the fundamental rhythm of many English verses, as our language runs easily and naturally in iambics.

IBARRA, a town, South America, Ecuador, capital of the province of Imbabura, at the northern foot of the volcano of the same name, in a beautiful plain 60 miles N.E. of Quito. Previous to the earthquake of 1868 it was a well-built town, having spacious streets with handsome houses and public buildings; manufactures of cotton and woollen goods, laces, hats, brandy, cordials, salt, &c., and a population of about 13,000, but that terrible catastrophe wrecked the town, and about 10,000 of its inhabitants are estimated to have perished, The surrounding country is very fertile, and the inhabitants are mainly engaged in the cultivation of cotton, wheat, and sugar. The population is now estimated at 10,000.

IBARRA, JOACHIM, printer to the King of Spain, was born at Saragossa, 11th July, 1726, and died at Madrid, Nov. 23, 1785, fifty-nine years old. He raised the art of typography to an excellence before unequalled in Spain. From his press were issued magnificent editions of the Bible, the Mozarabic Missal, Mariana's History of Spain, Don Quixote (1780), and the Spanish translation of Sallust. The latter, which appeared in one folio volume in 1772, was made by the Infant don Gabriel, and is very rare, as the prince distributed the whole edition among his friends. Ibarra also invented an ink which could be made thicker or thinner at will.

IBEA, a word made up of the initial letters of the words 'Imperial British East Africa', and designating the territory formerly held by the Imperial British East Africa Company, now British East Africa.

IBERIA, in ancient geography:—1. A very fertile district in Asia, between the Euxine and Caspian seas, which consisted of a large plain, surrounded on all sides with mountains, a part of the present Russian Georgia. Strabo says there were only four passes known over the circumscribing mountains. In ancient times this country probably belonged to the Persian monarchy; at least this seems to be intimated by the name of the river Cyrus. Alexander and his successors did not penetrate into Iberia. The Iber-

laus probably therefore remained independent till Pompey and Trajan reduced them to the Roman dominion, under which they remained till after the time of the Emperor Julian. They were afterwards subject, sometimes to the Turks, sometimes to the Persians, or had their own princes. Iberia is now a province of Russia. 2. Spain was anciently called *Iberia*, and the principal river *Iberus* (Ebro). The Iberi or Iberians, probably the most ancient European nation, driven towards the west, formed the basis of the population of Italy, Gaul, Spain, and Lusitania. Their language still lives in the Basque. What position they held in the human family, whence they came, and what has become of them in the subsequent movements of races, are problems that have not yet been satisfactorily solved. The Celts, who entered the country later, were intermingled with them, and have been considered as the original inhabitants of Spain. See CELTIBERI.

IBERUS. See EBRO.

IBEX (*Capra Ibex*). This animal, which is also called *bouquetin*, is a species of goat, and is distinguished by large knotted horns, reclining backwards, and compressed from side to side; a small head; large eyes; a thick, short, strong body; strong legs; very short hoofs; and a short tail. Its body is of a deep brown colour, with a mixture of hoary hairs; its belly is of a tawny white; its legs partly black, partly white; the space under the tail, in some individuals, is tawny, in others white. The hair is harsh, and the male is furnished with a beard. These animals inhabit the most precipitous and inaccessible heights of lofty mountains, where they assemble in flocks, sometimes consisting of ten or fifteen individuals. During the night they feed in the highest woods, but at sunrise they again ascend the mountains, till they have reached the most perilous heights. They are remarkably swift, and display amazing agility and dexterity in leaping. They are objects of the chase, but, from the inaccessible nature of the places to which they generally resort, their dexterity in leaping, and the danger attendant on a pursuit of them, the ibex hunter must have a head that can bear to look down from the most tremendous precipices without terror, address and surefootedness in the most difficult passes, and also much strength, vigour, and activity. Another danger attendant on this chase is, that the ibex, when close pressed, will sometimes turn on his pursuer, and tumble him down the precipices, unless he has time to lie down, and permit the animal to pass over him. The ibex will mount an almost perpendicular rock of fifteen feet, at three successive bounds, appearing merely to touch it, and to be repelled, like an elastic substance striking against a hard body. The fore-legs being considerably shorter than the hinder, enables these animals to ascend with more facility than to descend, and hence, when pursued, they always attempt to gain the summits of the mountains. The ibex is still found in the lofty mountains of Savoy and Piedmont, as well as in the Pyrenees, the Sierra Nevada, and other mountains of Spain. The ibex of the Caucasus is regarded as a separate species (*C. Caucasica*). The season for hunting them is during August and September, when they are usually in good condition. The old males haunt more elevated spots than the females and younger animals. Their voice is a sharp, short whistle, not unlike that of the chamois, but of shorter duration; sometimes, and especially when irritated, they make a snorting noise. The female seldom has more than one young one at a time: to this she pays great attention, defending it with courage and obstinacy. The stories of their throwing themselves down the steepest precipices, and contriving to fall on their horns, when closely pursued, or hanging by these appendages over gulfs from a projecting tree till the danger be passed, are absurd. (See illustration at UNGULATA.)

IBIS, a family of birds found in the warmer parts of Europe, Asia, Africa, and America. Family characters:—beak arched, long, slender, thick at the base, and quadrangular, rounded at the tip, which is obtuse; nostrils linear, extending from the root to the tip of the beak, and dividing it into three portions, of which the upper is the broadest, and flattened; forehead and round the base of the bill bare; legs longish and fourtoed, the front webbed at their base as far as the first joint, the hind toe very long, all provided with claws; that of the middle toe, in some, smooth, in others, serrated on its inner edge. The ibises perform a powerful and elevated flight, extending their neck and legs, and uttering a hoarse croak. The genus *Ibis* has been divided into several sub-genera, and these fall into two groups according as the integument of the foot is reticulated or covered with tabular scales. To the latter belong the genera *Ibis* (Gray) and *Falcinellus* (Bechst.) The scarlet ibis (*Ibis rubra*, Vieill.) is found in the hottest parts of America in large flocks, and frequently the old are separated from the young birds. They fly rapidly but rarely, except at morning and evening, in search of food. The plumage is scarlet; beak naked; part of the cheeks, legs, and feet, pale red. Before the scarlet ibis reaches its full age its plumage varies remarkably. It is a very splendid bird. It sometimes appears in the Southern States of the Union. The glossy ibis, or green ibis (*Falcinellus igneus*, Gray) is nearly 2 feet in length, and varies much in its plumage at different ages. This species builds in Asia, and is found on the streams and lakes in flocks of thirty or forty. They migrate periodically to Egypt, and, arriving there later than the white ibis, stay also later. In their passage they are numerous in Poland, Hungary, Turkey, and the Greek Archipelago. They occasionally visit the banks of the Danube, Switzerland, and Italy, and, more rarely, England and Holland. To the group with reticulated integument belong the genera *Threskiornis* (Gray), *Geronticus* (Wagl), and others. The sacred ibis or white ibis (*Threskiornis religiosa*), called by the natives *Abu Hannes*, that is, Father John, arrives in Egypt about the time that the inundation of the Nile commences, its numbers increasing or diminishing with the increase or diminution of the waters; and it migrates southwards about the end of June. It is illustrated at ORNITHOLOGY. This species does not collect in large flights: usually not more than eight or ten being observed together. They are about the size of a fowl; the head and neck bare; the body white; the primaries of the wings tipped with shining, ashy black, among which the white forms oblique notches; the secondaries bright black, glossed with green and violet; the quill-feathers of the tail white. The two species last named, but especially the latter, are the birds which were adored by the ancient Egyptians, and of which numerous mummies are found. It is remarkable that, with the excellent description of the white ibis given by Herodotus before their eyes, naturalists so long gave the name of that bird to individuals which are totally different. The ibis feeds upon insects, worms, testaceous animals, and sometimes on small fish, and not, as has been said, on snakes. Other species are found in India, Madagascar, Cape of Good Hope, Mexico, and Australia. The Greek and Roman writers contain many fabulous stories relating to the ibis, which it would be superfluous to repeat. Savigny, in his learned work —Histoire Naturelle et Mythologique de l'Ibis—examines all the questions connected with this subject. His chief hypothesis is, that the ibis did not, in point

of fact, destroy snakes, but that the reverence attached to it by the Egyptians arose from its return into their country at the same time as the Nile began to rise, the commencement of the season of abundance.

IBRAHIM, the Turkish for *Abraham*, and the name of many sultans and grand-viziers distinguished in Ottoman history. Among them was Soliman's grand-vizier, born in Genoa, of the family of the Giustiniani, and carried by pirates to Constantinople. He was strangled in 1536 at the instigation of Roxalana.

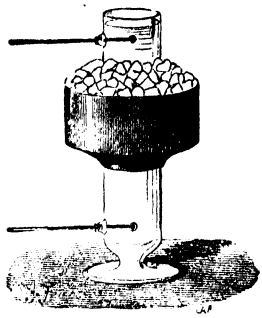
IBRAHIM PASHA, an adopted son of Mehemet Ali, viceroy of Egypt, born in Albania in 1789, first gave signal proofs of his courage and military talents in the war with the Wahabis, whom he completely defeated, and in the subjugation of Sennaar and Darfur. In 1825 he invaded the Morea at the head of an Egyptian army, with the view of conquering Greece for his father; but in 1828, in consequence of the interference of the great powers, was obliged to abandon the attempt, and evacuated Greece on 16th September of that year. When, after the Peace of Adrianople in 1829, his father's design of making Syria a bulwark to his new Egypto-Cretan Kingdom was opposed by Abdallah Pasha of St. Jean d'Acre, Ibrahim was commissioned to effect it by the sword. He accordingly, in 1831, crossed the Egyptian frontiers with an army, in a short time overran Palestine, took St. Jean d'Acre by storm, made himself master of all Syria, defeated the Turks first at Homs, then at Beilan, and then at Konieh, and was proceeding in his victorious career when it was stopped by the landing of the Russians in the Bosphorus. By the intervention of the great powers the campaign terminated by an arrangement in which the Porte ceded the whole of Syria, and conferred the district of Adana, with the title of a pashalic, by a kind of lease, personally on Ibrahim, who now turned his attention to the organization of the newly acquired possessions; and though his procedure was too often marked by oriental despotism, succeeded in restoring order and giving considerable security both to person and property. In Syria, however, the rigour substituted for the comparative mildness of the former government led to a rebellion in 1834, and Ibrahim was so hard pressed that his father was obliged to come to his aid. Tranquillity was apparently restored, but only after important concessions had been made to the people. Meanwhile a kind of diplomatic war had been carried on between Mehemet Ali and the sultan Mahmood II., and led to an open rupture in 1839. Ibrahim commenced a retreat, followed by the Turks, but at last both armies met at Nisib on June 24th, and victory declared so decidedly for Ibrahim, that the Turkish army was almost annihilated. Ibrahim was again stopped in his career of victory by the interference of the great powers, who desired to make an amicable arrangement. The extravagance of Mehemet Ali's demands rendered diplomacy unavailing, and in 1840 an English and Austrian fleet having appeared upon the coast, took possession of the principal sea-ports, stirred up the opposition of the people, and drove Ibrahim from all his maritime possessions back to Damascus. Here he found his position untenable, and was obliged, after retiring from all his Syrian conquests, to return to Egypt, marching across the desert from Damascus in three columns, with great loss and suffering. From this time he appeared very seldom in public life, and employed himself chiefly in the agricultural improvement of his own estates. In 1846 he visited England and France. Mehemet Ali had long before, by stipulation with the Porte, obtained the nomination of Ibrahim to be his successor. The event, however, did not realize his hopes. In 1848 indeed, Ibrahim, after his father had become superannuated, proceeded to Constantinople, and was nominated Viceroy of Egypt 1st September, but he had for some time been labouring under a mortal disease, and died 9th November of the same year at Cairo, while Mehemet Ali was still alive. He was succeeded by Abbas Pasha, the favourite grandson of Mehemet Ali.

IBYCUS, a Greek lyric poet, contemporary with Anacreon, in the middle of the sixth century before the Christian era, and according to the general account a native of Rhegium in Italy. He went to Samos during the reign of Polycrates over that island, and passed the rest of his life there. Nothing further is known of him except the well-known story about the manner of his death, and even about this doubts have been raised. It is related, that while on a journey he was surprised and murdered by robbers in a desert place near Corinth. Finding escape impossible, he declared that the cranes, which happened to be flying over their heads, would revenge his death. The robbers afterwards, in Corinth, seeing a flock of cranes, one of them said involuntarily, 'Behold the avengers of Ibycus.' These words were heard by a by-stander, who reported them to the magistrates. The robbers were in consequence seized, and, after confessing their crime, were executed. Hence the phrase, 'the cranes of Ibycus,' passed into a proverb. Ibycus is said to have left seven books of lyric poetry, in the Doric dialect, and to have invented the musical instrument called the *sambuca*, with a kind of poetry, in which he sung his own life, and which was called after him *Ibycan*. Only a few fragments of his works have come down to us. His poetry was chiefly erotic, though some of it was of a mythical and heroic character. The best edition is that in Bergk's Poetæ Lyrici Græci (4th edn., 1882). The death of Ibycus is the subject of Schiller's ballad, Die Kraniche des Ibykus.

ICARUS. See DÆDALUS.

ICE. Water freezes when its temperature is reduced below a certain point, which is by universal consent made a fixed point on thermometers. That point is called Zero on the Centigrade and Réaumur scales, and 32° on the Fahrenheit scale. (See THERMOMETRY.) The process of the freezing of water is very remarkable, and has been examined with great care by many naturalists. Freezing of water and melting of ice are accompanied by the usual thermal phenomena. (See HEAT and LATENT HEAT.) During the freezing of water 79 thermal units Centigrade per unit of mass are given out, and the same quantity of heat is taken in during the reverse process of melting. The following are the other physical phenomena that accompany the process. Water near to the freezing-point presents the curious anomaly of expanding instead of contracting as the cooling process goes on. At 4°·1 water has its maximum density-point. At temperatures above 4°·1 Centigrade its volume increases as the temperature rises, and decreases as it falls: at temperatures below 4°·1 the volume of the water increases as the temperature falls, and decreases as the temperature rises; and at the moment of solidifying the volume of the mass suddenly increases to a very considerable extent, so that ice at the temperature of freezing is one-ninth greater in volume than the water from which it is formed is at 4°·1. It is on this account that water freezes at the top first, and that ice when frozen floats at the top of the water. The process of freezing is beautifully shown by Hope's experiment (see fig.), which shows on a small scale what naturally takes place in lakes and pools in winter. In a tall vessel of water two thermometers are placed, one at the bottom and the other at the top. The water, which is taken at a temperature above 4°·1, is surrounded about the middle with a freezing mixture,

and the following phenomena may then be observed by means of the thermometers. The water about the middle begins to fall in temperature; the colder water being the more dense falls down to the bottom, and the lowest thermometer is seen to fall. This goes on till all the water in the lower part of the vessel is reduced to 4°·1, the maximum density-point. Then the upper thermometer, which has hitherto remained unaffected, commences to fall in its turn. The water which has been reduced *below* 4°·1 is seen, by the thermometer, to be rising to the top; and the lowest thermometer remains indicating 4°·1 till the top is reduced to the freezing-point, and ice commences to form then. Thus water below 4°·1 is seen to have a less specific gravity than water at that point. It does, however, occasionally happen that ice forms below water. This generally takes place in very clear streams, when there is also a clear sky overhead, and it is caused by the rocks below losing heat by radiation upward through the water. They thus become cooled below the freezing temperature, and the water in contact with them becomes frozen and adheres to them.



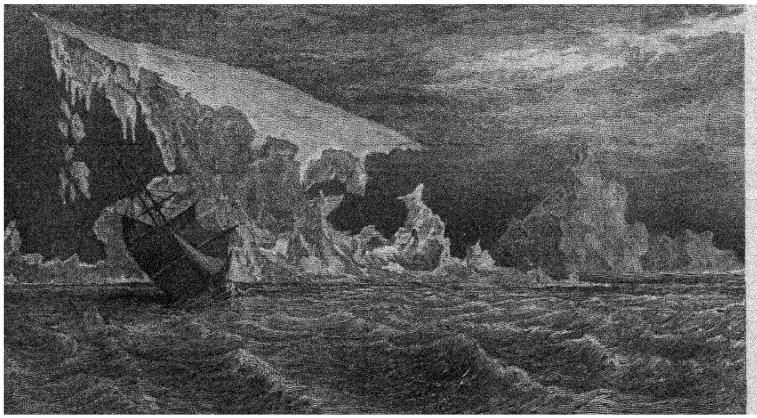
Hope's Experiment.

The temperature at which pure water becomes ice is very nearly constant under ordinary circumstances; and it is this fact, along with the ease of procuring water at the freezing temperature, or rather ice at the point of liquefaction, that has given rise to the universal convention of adopting that temperature as one of the fixed points in thermometers. The freezing-point is, however, slightly influenced by pressure. Increase of pressure lowers the freezing-point, and the removal of pressure raises it. This was discovered by Professor James Thomson theoretically, and has been verified experimentally by Lord Kelvin; and though there has been much discussion of the question, there can be no doubt that the plasticity of ice, which will be referred to immediately, is to be accounted for by this fact. The temperature of the freezing-point of water may also be influenced by the circumstances to which the water is exposed. Freezing is generally supposed to be retarded or prevented to a certain extent when the water is kept in a state of brisk agitation; but this can scarcely be held to be thoroughly confirmed by experiment. Water may, however, be reduced far below the freezing-point of temperature by keeping it in perfect stillness, and by avoiding the introduction of anything that can give rise to the commencement of crystallization. Thus if water that has been carefully freed from air by boiling is inclosed in a fine tube and kept at rest carefully its temperature may be reduced many degrees below the freezing-point before freezing takes place. Or even without the precaution of inclosing it in a fine tube the same may be done by keeping it perfectly at rest, and carefully preventing particles of solid matter such as dust from falling into it. But if, under these circumstances, the slightest particle of ice is introduced into the cooled water, freezing instantly takes place, and as much ice is formed as corresponds to an evolution of latent heat sufficient to raise the temperature of the whole mass of water and ice to the ordinary freezing-point of water. The presence of impurities also prevents freezing. Thus the temperature at which sea water freezes is much lower than the freezing-point of pure fresh water.

It has been mentioned above that water, at the moment of its conversion into ice, suddenly undergoes very considerable expansion. This expansion often gives rise to the exhibition of very great force, and it produces very remarkable effects in nature. Much of the disintegration observed in rocks and stones during or immediately after frost is due to it. A somewhat porous rock absorbs, into every interstice, small quantities of water during the rains in the beginning of winter, and when frost sets in freezing of the water thus inclosed commences. It cannot go on without expansion; and the forces exerted during the formation of ice are sufficient to crack up the stone, and leave it ready to be washed away when a thaw and succeeding rain come on. There can be no doubt that this is the cause of the destruction of porous stones often employed for building purposes; but as an agent in geological transformations it is even more important.

Ice possesses some very curious properties when considered in comparison with other common solids. It is a very hard crystalline substance. It may be obtained in beautiful crystalline forms under favourable circumstances, these forms being combinations more or less complicated of a hexagonal system. The forms that are seen in snow, in the spicules that span a small pond or pool just commencing to freeze, and in the patterns that may be observed on a window-pane, afford examples of the shapes it may produce. Curious figures may also be produced within a block of ice during melting by passing a beam from the sun or from an electric light through it. Ice is an exceedingly brittle substance. When a needle or a knife is struck briskly into a mass of ice it shivers the ice to pieces. This is the common way employed for breaking ice into small fragments. But at the same time ice possesses the property of plasticity to a very remarkable degree. It can be moulded into any form by the application of pressure. Ice is not the only body that possesses this curious combination of two properties, at first sight, perhaps, directly contradictory. Common shoemakers' wax, for instance, while it is so brittle that a fall on the ground may shatter it into a thousand pieces, yet if time enough be given it flows down like tar or treacle. The plasticity of ice is a property of very great importance. It was discovered by Forbes, who explained completely the motion of glaciers by it. Forbes was not successful in accounting for the plasticity which he observed. This was done by Professor James Thomson, who showed the plastic yielding under stress to be a consequence of the lowering of the freezing-point under pressure, which, as was mentioned above, he had discovered. These discoveries have been the occasion of a scientific controversy of unexampled bitterness, which has already been referred to in the article GLACIERS (which see). The merit of the claims of Forbes and Thomson are now all but universally admitted by the scientific world.

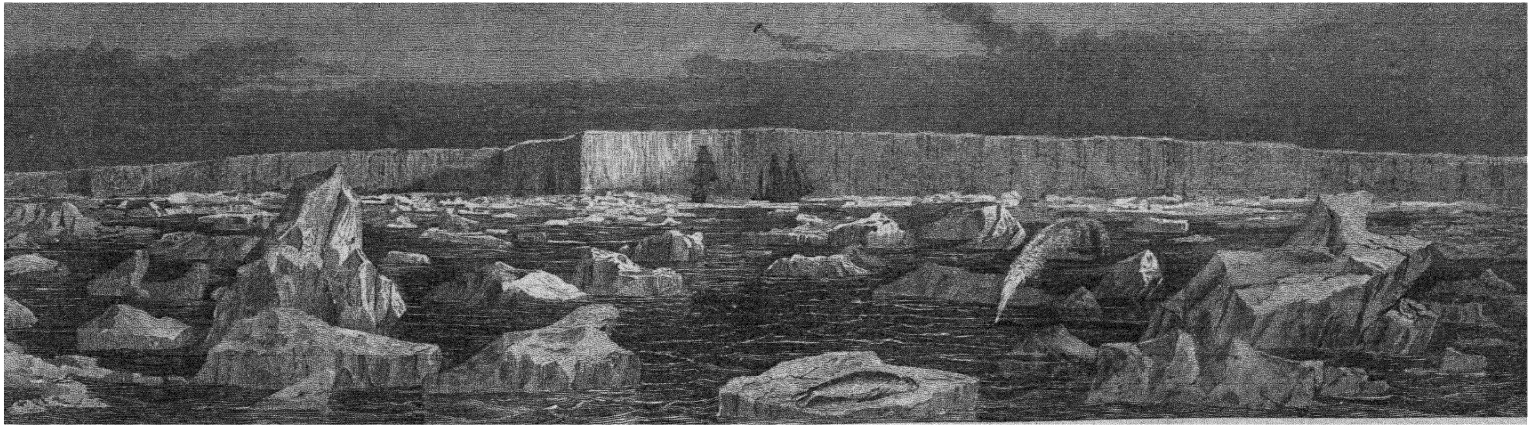
Ice is now an article of considerable importance from a commercial point of view, large quantities of it being shipped to warm climates from countries where it is naturally produced in abundance in winter. It is long since the ice and snow collected from Mount Etna and the loftier Italian mountains were sold in the neighbouring cities (such as Naples and Catania) for the cooling of water and other liquors, but the ice trade of these places is insignificant when compared with that of the United States or Norway. The fresh-water lakes of the States of America being deeply frozen in winter, ice is obtained from them in vast quantities, and either exported at once, or stored up in ice-houses till required. Wenham Lake, about



ICEBERGS, From Kanes N.Polar Expedition.



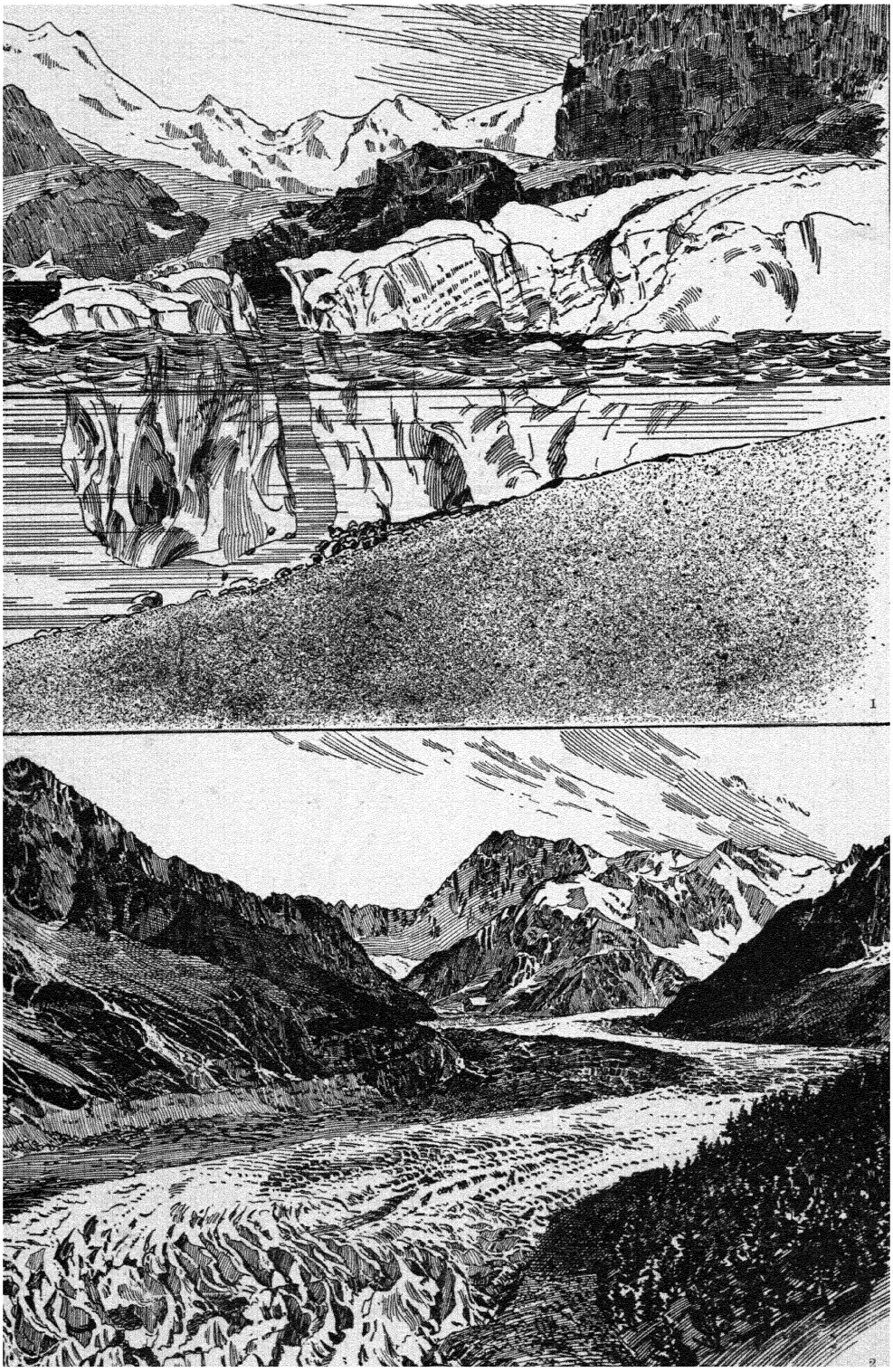
PACK ICE, A Gale. January 1842. Antartic Expedition.



Engraved by J H Smith.

PART OF SOUTH POLAR ICE BARRIER. Lat. 78° 15' 8" Total Length 450 Miles, Thickne

ICE.—II.



1. Iceberg breaking off from a Glacier. 2. Glacier (Mer de Glace, Chamounix, Switzerland).

18 miles from Boston, has obtained a great celebrity for the ice obtained from it. In summer the States of course consume a great deal of ice themselves. Large quantities of ice are imported into Britain from Norway, which has only become an ice-exporting country in recent times. The value of the ice brought from that country to Britain various from about £250,000 to more than £300,000 per annum. Notwithstanding the increasing use of ice, more especially for the preservation of beef, mutton, game, fish, milk, butter, fruit, &c., it is probable that the import of ice into Great Britain will not increase, as ice can now be made cheaply by certain processes and apparatus which we shall describe in the article REFRIGERATING MACHINES. Establishments have been started in many places for the purpose of making ice artificially, and a very pure and excellent article is produced in them. Latterly, it is said, the manufacture of artificial ice has led to a diminution of the American trade in the natural product.

Large masses of ice often become detached from the shores of the Arctic regions, and float about in the ocean at the mercy of the winds and currents. These are known under the name of *icebergs*, and are in fact pieces of glaciers detached from the parent mass by the action of the sea and by their own accumulating weight. They present the strangest and most picturesque forms. They are sometimes miles in length, and rear their heads to a height of perhaps 250 feet above the sea, the portion above water being calculated at about an eighth of the whole. The icebergs consist of clear, compact, solid ice, with a bluish-green tint. Their cavities contain pure fresh water, from the melting of the ice. They are frequently encountered in the North Atlantic (of course in the southern seas as well), and have caused many a wreck, especially during foggy weather or at night. Kane, the Arctic voyager, nearly perished in this way. His people had attached their vessel to a great iceberg, but, hearing threatening sounds, cast off, and had hardly done so when the face of the berg fell with a tremendous crash. In the Antarctic Ocean a great ice-barrier was met with by Sir James Ross in 1841, presenting the appearance of a solid wall of ice for hundreds of miles. The ice that forms on the surface of the sea, called *field-ice*, is porous, incompact, and imperfectly transparent. The field-ice forms in winter and breaks up in summer. A small field is called a *floe*; one much broken up forms a *pack*. Vessels in a pack during a gale are often in serious danger. An account of glacier ice and phenomena has been given under GLACIER.

ICELAND (German, *Island;* French, *Islande*), by many supposed to be the *Ultima Thule* of the Romans, an island belonging to Denmark, situated between the North Atlantic and the Arctic Oceans, and in respect of proximity more properly part of the western than of the eastern hemisphere, being only 250 miles from the south-east coast of Greenland in the former, and about 600 miles west of Norway in the latter; between lat. 63° 24′ and 66° 33′ N., and lon. 13° 31′ and 24° 17′ W.; greatest length, east to west, 301 miles; central breadth, about 200 miles; area, with adjacent isles, 40,459 square miles. In shape it somewhat resembles a heart with its narrowest point turned south. The coast-line for a considerable extent on the south-east is almost unbroken, but in all other directions presents a continued succession of deep bays or fiords and jutting promontories. One of the most remarkable of the latter is in the north-west, where a large peninsula stretches out between the Hunafloi and Breidafiord, and is attached to the main part of the island by an isthmus scarcely 5 miles wide. Other two peninsulas project from the west coast, separated by the Faxafiord, in which lies Reikjavik, and which measures about 50 miles across, and stretches 25 miles inland. The water along the coast is generally very deep, and the bays furnish a great number of natural harbours, with good anchorage and complete shelter; but the navigation is rendered dangerous by vast numbers of rocky islets which line the shores. The best and most frequented harbours are those of Reikjavik and Eyarbacke on the south-west, and of Eya on the north. The interior of the island has for the most part a very wild and desolate appearance. It is covered by lofty mountain masses of volcanic origin, many of them crowned with perpetual snow and ice, which, stretching down their sides into the intervening valleys, form immense glaciers. Glaciers cover a surface of upwards of 4000 square miles, and exist in all the mountains above 4000 feet in elevation. These icy mountains, which take the common name of Jökul, have their culminating point in Öräfajökul, which is situated near the south-east coast, and has a height of 6409 feet. Next to it in height are the Snäfell, near the east coast, 5965 feet; and Eyjafjallajökul, in the south, 5579 feet. Not only is the structure of these mountains volcanic, but in several of them the volcanic agency is still active, and eruptions of the most fearful description have repeatedly occurred within the last four centuries. Lava covers a large portion of the island. Other remarkable specimens of volcanic agency are still witnessed in the numerous hot springs or geysers scattered throughout the island, but found more especially in the south-west, to the north-east of Reikjavik, where, from one of the principal geysers, jets of water, stones, and mud are thrown up at intervals to heights varying from 100 to 200 feet. (See GEYSERS.) The general effects of the volcanic agency and the geological formations produced by it are nowhere exhibited on a more magnificent scale than in Mount Hecla, 5095 feet high; lat. 63° 59′ N.; lon. 19° 44′ 15″ W. The hot springs are sometimes used for economical purposes; food is dressed over them, and in some places huts are built over small fountains to form steam-baths.

The immense reservoirs of snow and ice furnish inexhaustible supplies to numerous lakes and rivers. Of the former the most important are the Thingvallavatn, Hvitarvatn, and Arnarvatn in the south-west, and the Myvatn in the north-east. The rivers, owing to the rugged nature of the surface and the mountain barriers which stretch across it, are more remarkable for their number than their length. Every valley opening to the coast has its stream; but the largest of them, following the general slope of the island, have a north or N.N.E. direction. The most deserving of notice are the Skjalfanda and the Jökelaue or Jökulsa i Axarfirdi on the north coast, which have each a course of above 100 miles; two streams, the Jökuldalr and Lagarfljot, proceeding north-east from Snäfell, on the east coast, both with a course of upwards of 80 miles; and the Thjorsa, on the south-west coast, with a course of above 100 miles. The most valuable mineral product is sulphur, of which the supply appears to be inexhaustible, and surturbrand or lignite is also worked to some extent. The other minerals deserving of notice are chalcedonies, rock-crystals, and the well-known double-refracting spar, for which the island has long been famous. On many parts of the coast, particularly the west, basaltic caves occur; that of Stappen is not unworthy to be compared with Fingal's Cave in Staffa.

The climate is mild for the latitude. At Reikjavik, on the south-west coast, the mean temperature of the year is 40°, that of summer 56°, and that of winter about 29° 30′. The air is damp and misty, the weather is extremely variable, and storms and hur-

rioanes are not unfrequent. The prevailing winds are the north and the north-east. In the southern part of the island the longest day is twenty hours, and the shortest four hours, but in the most northern extremity the sun at midsummer continues above the horizon a whole week, and of course during a corresponding period in winter never rises. The average duration of human life in Iceland is shorter than in Denmark. The probable length of life in Denmark at birth is—for males, 47; for females, 50; in Iceland, for males, 37; for females, 48. This excess of longevity of the female population over the males is owing to the greater hardships to which the latter are exposed. Typhus fever prevails yearly, arising mainly from defective sanitary arrangements. Scurvy is a common disease, and there are frequent cases of elephantiasis. A severe epidemic appears to occur about every five years; and so great are the risks connected with the fisheries that one-fourth of the deaths among the males from fifteen to sixty years of age occurs by drowning, being nearly 2 to 1 of the number drowned in the Färoe Islands, and 5 to 1 of those drowned in Denmark.

Vegetation is confined within narrow limits. Almost the only tree is the birch, which has a very stunted form, the loftiest hardly exceeding 10 feet. Heath and bilberry cover large stretches of the surface. Among flowering plants are saxifrages, sedums, &c. The want of fuel, which is severely felt, is sometimes supplied by drift-wood floated to the northern shores by the Gulf Stream and the polar currents; and the island furnishes a fine white turf. Grain appears to have been at one time very partially cultivated, but is not now attempted to be grown; cole, potatoes, turnips, radishes, and similar roots thrive tolerably well. But by far the most valuable crop is grass, on which considerable numbers of live-stock are fed. They have been estimated at 750,000 sheep, 20,000 cattle, mostly hornless, and 40,000 horses. The last, though small, are strong and active, and numbers of them are exported to Great Britain. Some of the sheep are four-horned. Reindeer were introduced about 1770, but all of them that now remain are a few herds living in a wild state. Wild fowl, including the eider-duck, whose down forms an important article of commerce, are very abundant; the streams are well supplied with salmon, and valuable fisheries of cod, haddock, herrings, &c., are carried on around the coasts.

Manufactures are entirely domestic, almost every family possessing within itself the means of supp y ing its most necessary wants, and occasionally f urnishing a surplus, chiefly of coarse woollens, mittens, stockings, &c., to be disposed of at the markets of the principal villages. The principal exports are wool, oil, fish, horses, feathers, worsted stockings and mittens, sulphur, and Iceland-moss. The inhabitants are of Scandinavian origin, and speak a Scandinavian dialect, the original Norse, which is still maintain ed in great purity. They have a tall manly form, o pen countenance, florid complexion, and flaxen hair. Tl ey are simple in their manners, having no distinctions of rank, pure in their morals, strongly attached to their homes, and very hospitable. Their houses are low structures, chiefly composed of drift-wood and lava; butcher-meat and bread seldom appear at th eir tables, fish, some butter, milk, and preparations of milk constituting their staple food. Their in ellectual capacity is of a superior order; education is generally diffused, and it is rare to meet with an individual who cannot both read and write. Far higher attainments are not uncommon; various learned societies exist, and travellers have sometimes been surprised by their guides addressing them in Latin. The Reformation early took root in Iceland, and has nowhere produced nobler fruits. Almost all the inhabitants hold its doctrines in their primitive purity and simplicity. In external profession they are Lutherans, the whole island forming a single bishopric. The civil division is into three bailiwicks—Süderamt, Westeramt, and Norderamt with Osteramt—subdivided into twenty smaller districts called Sysler. The principal governor takes the name of Stiftsamtmann, and presides over the *althing* or parliament (from *thing*, a public assembly), which meets twice a year at Reikjavik, the capital and only town in the island, and consists of 36 members, of whom 30 are chosen by popular suffrage, and 6 (2 spiritual and 4 temporal) are nominated by the king. To do away with the complaints that had long been made by the Icelanders, with regard to the position in which their country stood to Denmark, a new and liberal constitution was granted in the beginning of 1874, to take effect from the 1st August of that year. By this constitution Iceland has the entire management of all matters concerning the island particularly. A minister for Iceland, nominated by the king, is at the head of the administration, but the highest local authority is vested in the governor.

Some settlements of Irish monks had been made in Iceland about the end of the eighth century, but the island received by far the greatest proportion of its population from Norway, to which country it became pretty well known between 860 and 870 by the voyages of Nadd-Odd, Gardar, and Floeke. The last-named gave it the name of Iceland from the quantities of drift-ice that he found choking up its fiords and bays. The first Norwegian settlement was made in 870 by Ingolf on the south coast, but was established permanently in 874 at what is now Reikjavik. Other settlers from Norway soon followed. At this time Harald Haarfager had made himself supreme in Norway, and as he treated the landed proprietors oppressively, numbers left the country and went to Iceland. In the course of sixty years all the habitable parts of the coast were settled. The circumstance that it was to a great extent the men of standing at the head of their households that settled in Iceland, and the tendency to continue the same way of life they had been accustomed to in their native country, had a considerable influence on the development of the form of government that sprang up in Iceland. The government was at first of a hierarchic-aristocratic cast, being in the hands of the overseer of the temple in each settlement; latterly, when the separate jurisdictions were conjoined, Iceland formed a kind of aristocratic republic. In bringing this about much was done by Ulfliot, who in 927 published laws for the whole island, and established the Althing, an assembly consisting of the most experienced and prudent men of all the districts. The althing met each summer for fourteen days on the plain of Thingvalla, to deliberate on the affairs of the country, and served as the supreme court. In 962 similar district assemblies were instituted, to which was added in 1004 a supreme court distinct from the althing. Christianity was introduced in 981, and adopted by law in 1000; and schools and two bishoprics, those of Holar and Skalholt, established. The Latin language and the literature and learning of the West, introduced by Christianity, were all the more warmly received in Iceland that poetry and history had already been cultivated here more than elsewhere in the Germanic north. Previously to this time the Icelanders had discovered Greenland (983) and part of America (about 1000), and they were now led to make voyages and travels to Europe and the East. Politically and ecclesiastically the most flourishing period of Iceland—the period too when its intercourse with

the world abroad was most active—was from the middle of the twelfth to the beginning of the thirteenth century. In 1264 Magnus VI. of Norway united Iceland with his own kingdom, with which it passed to Denmark in 1380, remaining with the latter in 1814, when Norway was joined to Sweden. Towards the end of the fourteenth century science and art, which had begun to decay with the introduction of the Norwegian rule, sank to the lowest ebb, but they gradually recovered their position after the introduction of the Reformation, which was completed in 1551. In the seventeenth century the island was ravaged by Algerine pirates, who in 1627 murdered or carried off a large number of the inhabitants. In the eighteenth century the island suffered from forty-three years' failure of crops and eighteen famines. In 1707 about 18,000 persons died of small-pox. Between 1783 and 1785 volcanic eruptions, failure of crops, and famine reduced the population from 48,668 to 38,142. Famine raged again in 1824–25, principally through violent volcanic outbreaks; and a deadly epidemic scourged the country in 1827. In the beginning of the last century the althing, which had existed for about 900 years, was abolished, but it was reorganized in 1843. As already mentioned, a new constitution was granted in 1874, and in August of the same year the 1000th anniversary of the colonization of the island was celebrated, the King of Denmark being present.

The Icelandic language is the most northerly of all cultivated tongues. It is rich in roots and grammatical forms, soft and sonorous to the ear, being free from gutturals and excess of hissing sounds. There are twenty-eight letters, namely, all the English except *w;* also *æ*, *ö* (the German *ä* and *ö*), and a character for English *th*. Icelandic literature may be divided into an ancient period, extending to the fall of the republic, and a modern, extending from that date to the present time. Poetry was early cultivated, and among the most important works in Icelandic literature is the collection of ancient heathen songs called the elder or poetic Edda, compiled soon after the introduction of Christianity. (See EDDA.) Many other poems, especially songs of victory, elegies, and epigrams, belong to the ancient period of the literature. Histories and romantic works, known by the name of Sagas, were also numerous. Among these we may mention the Völsunga Saga, the Vilkina Saga, the Saga of Hrolf Kraka and his companions, the Saga of King Ragnar Lodbrok, Frithiofs Saga, and the younger or prose Edda. Some of these are partly historical, but there is a larger and more valuable class that are altogether historical in their character, consisting of local and family histories and biographies. Among these we may mention the Islendingabók; the Landnamabók, an account of the settlement of the island; the Kristni Saga, an account of the introduction of Christianity; Njáls Saga (translated into English by G. W. Dasent); Viga Glums Saga; Egils Saga, the biography of a well-known poet and chief; Eyrbyggja Saga, an abstract of which was published by Sir Walter Scott; the Sturlunga Saga, a history of the important Icelandic race of the Sturlungar; the Orkneyinga Saga, a history of the jarls of Orkney (an English translation of which was published in 1873); the Færeyinga Saga, on the Färöe Islands; the Knytlinga Saga, a history of the Danish kings from Harold Blaatand to Canute VI.; and lastly, the famous Heimskringla or Chronicle of the Norwegian Kings, by Snorro Sturleson. Many of these works are master-pieces of style, and are still read with delight by the people of Iceland. The early portion of the second period was barren of anything worth mention in the way of literature, nor can the modern period boast at all of works possessing the interest of those belonging to the ancient. In the seventeenth century there was a considerable revival of literary activity, the principal names being those of Arngrimur Jonsson (1568–1648), Gudmundur Andræ (died 1654), Runolfur Jonsson (died 1654), Arni Magnusson (died 1730), and Thormodur Torfason or Torfæus. The first complete edition of the Icelandic Bible was issued under the direction of Gudbrandur Thorlaksson (died 1627). The true revival of letters may be said to date from the middle of the eighteenth century, since which time there is scarcely a department of literature in which Icelandic writers have not done something, not to mention works on various branches of science. Many of the most valuable works of Europe have been translated into Icelandic, and even the poems of Milton are read at many a cottage fireside. Pop. in 1890, 70,927; in 1901, 78,470.

ICELAND-MOSS. See LICHENS.

ICELAND-SPAR is a name given to the transparent variety of calc-spar, or rhombohedral calcium carbonate. The primary form of this mineral is an obtuse rhombohedron, in which the length of the principal axis to that of the secondary axis is as ·8543 to 1, and the angle of the terminal edges is 105° 5′. Iceland-spar exhibits the ground form R, being really fragments of larger crystals. The specific gravity of the purest crystals of calc-spar is 2·721. The hardness is = 3. Iceland-spar is most noted for its property of exhibiting in a remarkable degree the double refraction of light. See LIGHT.

ICE-PLANT (*Mesembryanthemum crystallinum*). This singular plant has received the above appellation from the little transparent vesicles which cover its whole surface. This watery fluid has been found on analysis to consist of chloride of sodium (common salt), potash, magnesia, and sulphuric acid, together with albumen, malic acid, &c. The stems are herbaceous, spread upon the ground, and much ramified; the flowers are white, and as in the rest of the genus furnished with a number of linear petals. It is a native of the sea-coast of South Africa, the Canaries, and is also found in the vicinity of Athens. *M. edule* is the Hottentot fig, the leaves of which are eaten. The species of Mesembryanthemum, upwards of 300 in number, are with few exceptions confined to South Africa.

ICHNEUMON (*Herpestes*). These animals belong to the civet family, and are distinguished from their kindred genera by their narrower and more pointed muzzle; by the shape of their lower lip, and more especially by the absence of the double cavity beneath the tail, which is replaced by a single pouch of considerable size, but destitute of secreting glands. Their hair is long, brittle, and generally variegated in colour. The ordinary colour of its coat is chestnut brown and fawn; nose and paws deep chestnut or black. It is about 18 inches from the snout to the root of the tail. The habits of the ichneumon are very similar to those of the ferret. In the countries where they are found their sanguinary disposition and predatory habits render them a great annoyance to the inhabitants from the destruction they cause among the poultry. This is, however, compensated, in some degree, by the incessant war they wage against reptiles, the eggs of which they devour with great avidity. The most celebrated species inhabits Egypt and the adjacent countries, where it is called *Pharaoh's rat* (*H. Ichneumon*). It is very common in the northern parts of Egypt. It is of a gray colour, and has a long tail, terminated by a black tuft; it is larger than a cat, but formed like the weasel. This species was ranked by the ancient Egyptians amongst their numerous divinities, on account, it is supposed, of the benefits which it confers on man by the destruction

of crocodiles, whose eggs it digs out of the sand and sucks. The story of its overcoming these formidable reptiles themselves, by gliding down their throats, is, of course, a mere fable. Many other fabulous stories are related of the ichneumon by the Greek and Roman writers, Herodotus, Ælian, Diodorus, Pliny, &c. The ichneumon is exceedingly expert in seizing serpents by the neck in such a manner as to avoid any injury to itself. Lucan alludes to this (in lib. iv. 724) when speaking of the asp. The ichneumon is domesticated and kept in the houses in Egypt, and is more useful than a cat in destroying rats and mice. They grow very tame, are exceedingly active, springing on their prey with great agility. They often squat on their haunches, and feed themselves with their fore-paws like a squirrel. They are great enemies to poultry, and will often feign themselves dead till their prey comes within reach. Like the cat, they are great lovers of fish. When they sleep they bring their head and tail under their belly, and appear like a round ball. Their voice is very soft, somewhat like a murmur, and, unless they be struck or irritated, they never exert it. Their great disadvantage, as domestic animals, is their unconquerable predilection for poultry, which they destroy whenever they have an opportunity, for the purpose of sucking their blood. In a wild state they swim and dive in the manner of an otter, continuing beneath the water for a great length of time, and support themselves by fishing. These animals are short-lived, but grow very rapidly. The mongoose, mangouste, or mungus (*H. griseus*), the Indian ichneumon, is another species of this genus. It is not so large as the Egyptian species, which it much resembles in habits, being kept in many families as a useful domestic animal. We may also mention the garangan or Javanese ichneumon (*H. Javanicus*), and the Urva or crab-eating ichneumon (*Urva cancrivora*). See CARNIVORA.

ICHNEUMON is also the name of a large family of insects, belonging to the great order of *Hymenoptera*. As the species of this family are very numerous, so their manners are extremely diversified; but, in the general outlines of their character, they all agree, particularly in their depredations among the insect tribes. In some the female has a wimble attached to her abdomen, and with this instrument, delicate as it appears, she is capable of perforating the hardest substances. The larvæ of wasps are the devoted prey of these insects, who no sooner discover one of their nests than they perforate the clay of which it is constructed, and deposit their eggs within it. Others glue their ova to the skin of a caterpillar, whilst others again penetrate through it, and lay their eggs in its body. In all these cases the young, as soon as they are hatched, prey on the caterpillar or larva, without, however, destroying it at once, as upon the life of its victim that of the spoiler appears to depend. The caterpillar, in fact, seems healthy until the larvæ of the ichneumon have spun their cocoons, and entered the chrysalis state. We often see caterpillars fixed to a leaf or branch by the threads spun by the ichneumon. These carnivorous insects are of various sizes; some are so small that the aphis, or plant-louse, serves as a cradle for their young; others again, from their size and strength, are formidable even to spiders, destroying them with their stings.

ICHTHYODORULITE, the general name for the fish defences found in the older strata, and which are now recognized as the fin spines of Elasmobranchs or Acanthodian Ganoids.

ICHTHYOLITE (Greek) means in mineralogy a petrified fish, or a stone with the impression of a fish.

ICHTHYOLOGY. The lower we descend in the vertebrate series the less sharply are the groups marked off from each other; and natural as the group of fishes in many respects is, the limits between it and the amphibians, and even the reptiles, are at one or two points confused. In all fishes median fins, supported by fin rays, are present: the bones of the limbs are not capable of being grouped into equivalents of the upper and fore arm and hand, as in other vertebrates. The head in nearly all, and the lateral line in the majority of fishes are provided with sensory organs, the so-called mucous canals and pores. These characters separate the fishes from the amphibians, with which they have in common the characters enumerated in article ICHTHYOPSIDA.

The body is in general fusiform and laterally compressed as in the herring and salmon; it is cylindrical and elongated in the lamprey and eel; flattened from above downwards in the rays, frog-fish, and other mud-frequenting forms; while in the group of so-called flat-fishes we have an animal only differing from a haddock in the twist which the bones of the head have undergone. The epidermis is chiefly represented by a slimy secretion. The true skin contains pigment cells, and is projected in a series of overlapping folds, within which the scales are developed in sacs, just as their homologues, the hair and feathers, of other vertebrates are developed. The scales vary in form and structure, from the thin, flexible, scarcely calcified plates of a smelt, to the true bone of a sturgeon or skate. Four leading forms of scales were recognized by Agassiz, and made the basis of a classification, now abandoned on account of the many exceptions which it contained. Cycloid scales are of rounded form, and show clearly the concentric and radial markings, answering to the dermal papillæ on which they were formed. Ctenoid scales, like those of the perch, have spinous projections from the posterior margin. Ganoid scales are, like those of the stony pike and fossil fishes, thick, bony, and covered with a glossy enamel-like investment. Placoid scales are, like those of the skate, composed of an outer enamel-like substance, of a compact body which closely resembles dentine, and of an inner or inferior bony layer, which is comparable to the cement of a tooth. The whole structure, in fact, illustrates the close resemblance between scale and tooth development, both in process and results. The skeleton presents great variations, from the Amphioxus, in which vertebræ are only foreshadowed, to the well ossified skeleton of teleosteans, or the still more massive skeleton of some extinct forms. The vertebræ are biconcave or 'amphicœlous,' the opposed surfaces forming cups, in which are lodged the remnant of the chorda dorsalis or primitive fibro-cartilaginous axis, around which ossification took place. A still lower condition is presented when the vertebræ are pierced by a central foramen, which places the cups in communication. The vertebræ vary in number from seventeen to more than 200, and are divisible into only two regions—the caudal, which commences at the posterior limit of the abdomen, and those in front of that point; the inferior arches of the former inclosing a canal for the blood-vessels, but diverging in the latter, their direction being maintained by the ribs, which in most fishes surround the abdominal and thoracic viscera. The spinal column is prolonged into the tail, the vertebræ in this region being represented only by the centres; in some, however, the centres are replaced by the persistent notochord or primitive axis of the column. This either continues the direction of the column, whereby the tail is divided into two equal portions, an arrangement known as diphycercal, or it is prolonged more or less upwards, so that the tail consists chiefly of the inferior spines of the vertebræ. When the prolongation is extreme, the *inequilobate heterocercal* tail of the shark and sturgeon is the result; but

the tail of the salmon is also *heterocercal*, the rays, however, forming an *equilobate* extremity. This latter type is the homocercal of Agassiz, a term now disused, since it implied the straightness of the spinal column. The skull varies greatly in condition. It may be ossified throughout as in the cod-fish, or the cartilaginous cranium may persist, as in the lamprey, sharks, and rays; or it may have, in addition, membrane bones as in the sturgeon, pike, salmon, &c. To the side wall of the skull a common suspensor (hyomandibular) is articulated, and gives attachment distally to the mandibular and hyoidean apparatus. The former consists of the articular, angular, and dentigerous pieces, the articular being that which receives the head of the quadrate bone, and thus allows the vertical movements of the jaws. The quadrate is moreover connected with the palate bones, which stretch forward and are indirectly connected in front with the axis of the face. The middle of the arch is moreover connected with the skull by means of the prefrontal bone, which is immediately in front of the orbit. The premaxilla and maxilla are attached on either side of the facial axis at its extremity, and the latter is in most cases retained in place by the integument. The roof of the mouth is thus composed partly of bone, partly of integument, and as the suspensors of the lower jaws may be pushed outwards at their lower ends, the cavity of the mouth may undergo very considerable variations in size. Such at least is true for osseous fishes, but in the cartilaginous and in those ganoids in which the bones of the palate and upper jaw are more firmly united, the movements are more restricted. The teeth may be borne by the maxillary and lower dentary bones, the premaxillaries, the palatines, the vomer, and the tongue. This latter is the anterior end of the row of bones to which the branchial arches on either side are connected. These arches in the teleosteans and ganoids are four in number, and form the perforated walls of the pharynx, being connected above with the under surface of the skull. They consist each of several pieces articulated together, and thus forming a movable framework, on which are supported the gills or branchiæ, five folds of mucous membrane projecting outwards and affording an extended surface, on which, supported by delicate cartilaginous plates, the blood-vessels are extended. The mouth and pharynx are closed in below by two folds of membrane stretched on the branchiostegal rays, which are loosely attached to the hyoid bone. The hyoid lies within and parallel to the lower jaw, along with which it is attached to the common suspensor. The rays are, in some of the ganoids, replaced by flat bony plates. The gill arches are five in number, but the fifth does not carry gills, is a dentigerous plate—the inferior pharyngeal bone—and is opposed by the superior pharyngeal bones, which are the plates whereon the gill arches meet above. The pharyngeal chamber is partially closed at the sides by the opercular apparatus, a series of thin bony plates articulated to the common suspensor, and capable of being elevated and depressed, as water rushes out of the mouth through the intervals of the gill arches. The skull is small compared to the size of the fishes, and not all of the cavity is occupied by the brain, which is surrounded by gelatinous fluid. The number of bones in the skull varies in different groups. But when all are present as distinct bones they are as follows:—*Occipital segment:* supraoccipital, 2 exoccipitals, and basioccipital. *Parietal segment:* 2 parietals, 2 alisphenoids, and basisphenoid. *Frontal segment:* 2 frontals, 2 orbito-sphenoids, and presphenoid. The squamosal and postfrontal pass between the parietal and supraoccipital, and to the former is articulated the mandibular suspensorium, consisting of hyo-mandibular and quadrate, while along their posterior edge is attached the symplectic. From the point of meeting of the quadrate and hyomandibular is suspended the hyoid. The operculum, suboperculum, interoperculum, and preoperculum constitute the opercular apparatus. The bones which inclose the essential parts of the organ of hearing are the prootic, opisthotic, and epiotic; they are inserted between the occipital and parietal segments, and by alterations in the relative sizes of adjacent bones may come to occupy unexpected positions, as when the epiotic forms the outer and upper angle of the skull. The facial bones are the vomer and ethmoid, the axial bones of that portion of the head which lies in front of the brain-case, and on either side of these are the prefrontal, nasal, lachrymal, premaxillary, and maxillary bones, while between the quadrate and the premaxillary is the arch formed by the outer and inner pterygoids and the palatine bones. Lastly, the base of the cranium has a parasphenoid, which passes like a splint beneath the axial bones of the brain cavity, this splint being peculiar to the Ichthyopsida. The limbs, when present, are four in number, the anterior pair or pectoral fins consisting of a suprascapular, a scapular, and so-called coracoid, to which are attached the fin-rays. The limb is attached by the suprascapular to the upper and outer angle of the occipital region, and the fin-rays are at or a little below the middle of the opercular region. The bones above mentioned may be replaced by a single cartilaginous plate, as in the sharks. The ventral fins, or second pair of limbs, are variable in position, and not always present: they may be beneath the pectorals, when they are jugular; behind the pectorals, when they are thoracic; or farther back, abdominal. The pelvis is represented by two triangular bones, which have no relation to the spinal column, and to which the fin-rays are directly attached. The median or vertical fins, characteristic of fishes, may extend nearly from the back of the head continuously to the anal aperture, as in eels and lepidosiren; they may be broken up into several dorsals, caudal, and one or more anals, as in the cod; or the number of dorsals may be increased greatly, as in mackerel. The fins may be wholly soft and flexible, or they may be in part rigid spines; or a series of soft fin-rays may be preceded by rigid, often formidable spines, which sometimes, as in clarias, may have a beautiful mechanism for elevation and depression. The spines of the dog-fish are found in front of both dorsal and pectoral fins; they are, like those of the carboniferous plagiostomes, deeply buried in the body and moved by special muscles, so as to form very important defences. The fin membrane is stretched from ray to ray and is usually delicate, but in one group, the squamipennes, a large part of its surface is covered with scales. The mort fin, or dead or fat fin of the Salmonidæ, is a fold of integument inclosing adipose tissue, but neither muscles nor rays. The teeth are, except in the lamprey, truly dermal follicular developments, and are not embedded in sockets, but either sit loose on the mucous surface or are fixed on the bones, or are, as in the angler (*Lophius*), movably connected with the jaw. The horny teeth of the lamprey are epidermal thickenings. In the sharks the succession of the teeth is from behind forwards, the new rows being developed within the cavity of the mouth, and the old used ones dropping off in front, the process being hastened by partial reabsorption of their bases. The muscular pharynx and œsophagus lead into a stomach usually well defined, but sometimes only slightly differing in calibre from the intestine; at its pyloric end is a variable number of delicate cœcal glandular tubes, the 'pyloric cœca.' The length of the intestine accords with the diet of the fish, being least in carnivorous, greatest in the

plant-eating species. The rectum has in ganoid and elasmobranch fishes a spiral valve, a fold of mucous membrane which passes round the intestine like the stair of a turret, and which increases the absorptive area of the intestine. There are no salivary glands; the pyloric cœca are perhaps pancreatic, though a distinct pancreas is found in many fishes, whether the cœca are present or not. The liver is proportionally large, and has usually a gall-bladder. The heart consists of a single auricle and ventricle, which is continued forwards on the under surface of the branchial framework by a dilated vessel, or arterial bulb, which in some fishes (for example Ganoids, sharks, &c.) has several rows of valves. From this vessel the blood is sent right and left along the gills, and the aerated fluid passes to the upper or cranial side of the pharynx, where the union of the branches forms an aortic trunk which passes back through the body, supplying chiefly the body walls, the intestinal arteries coming off from the first part of the vessel. The venous blood is returned by a dorsal trunk, a cephalic trunk on which a cervical sinus occurs, and an intestinal trunk, all these pouring into a venous sinus which forms a vestibule to the auricle. The circulation is thus simple, the aerated blood going direct from the gills to the body. The respiratory organs are chiefly branchiæ or gills, which are either free on one margin, as in ordinary fishes, or attached at both extremities, as in the elasmobranchs. The primitive clefts of the pharynx of the embryo are more numerous than those of the adult branchial system, which in a teleostean consists of the second cleft (the first being closed), and on the anterior side of this cleft is the pseudo-branchia or rudimentary branchia, a structure whose meaning is clear when we find it in the shark, on the wall of the spiracle or funnel opening to the top of the head, this being the second cleft opening not under a gill-cover, but to the surface. The third, fourth, and fifth clefts have gills on both sides, and the sixth only on the anterior margin. Thus there are on each side eight gills and the pseudo-branchia P.B., as follows: (1.) P.B. 2. B.*a*.B. 3. B.*a*.B. 4. B.*a*.B. 5. B.*a*.B. —(1) being the closed cleft; 2, 3, &c., those open in the adult; *a* the gill arches, B the branchiæ. In the Lepidosiren another structure appears, the lungs, which stretch through great part of the body and open by a glottis on the posterior wall of the pharynx, their blood supply being derived from an eighth aortic arch. The air-sac or swim-bladder, or sound of many fishes, is not strictly a lung; its blood supply is from the trunk vessels, and it is not always in communication with the exterior. Anatomically its origin is identical with that of a lung, namely, a cœcal prolongation of the pharyngeal mucous membrane; and the relation is curiously illustrated by the sacculate character of this organ in the ganoid genus *Amia*. In some genera the air-sac, in addition to its probably mechanical function as an aid in rising and sinking, is prolonged so as to approach or even come in contact with the internal organs of hearing, so as to act perhaps as an organ of resonance. External gills are found in the Lepidosiren, in young sharks and young Polypteri; the gills of the pipe-fish (*Syngnathus*) are in tufts, and in the climbing perch accessory respiratory organs are found in the plaited lamellæ which replace the upper part of the first gill-arch, and retain the moisture needed to keep the gill-surface in action during the fish's absence from the water. The renal organs are persistent Wolffian bodies, these organs being properly embryonic. The reproductive organs consist of glands which arise on the inner side of the Wolffian bodies. In the female their contents, the ova, are either discharged into the peritoneal cavity, whence they escape by the abdominal pore, an orifice opening directly to the exterior; or the ovary is prolonged so as to form a duct, which terminates at the surface behind the anus. The relations of the male organs are generally similar. The ova are fertilized outside the body, except among the Plagiostomi, and the hatching process is usually left to take place without aid, the ova not being always deposited, as are those of the salmon, in shallow grooves of shingle. The eggs are, in most cases, in enormous numbers, as are the roe of the herring and salmon. But among the elasmobranchs the number is much less, and each ovum acquires, before exclusion, a horny sheath of various shape, but usually provided with cirri, by which it moors itself to some fixed object. In the pipe-fishes the male has a marsupium or pouch formed by symmetrical folds of the abdominal integument, and in this pouch the eggs, transferred thither on exclusion, are hatched. The Indian genus *Arius* likewise gives the male the care of the offspring, the ova being hatched in his mouth. Development is usually simple, the young differing from the adult only to the same extent as in man; but Dr. Günther has recently discovered that the young of some Squamipennes differ so much from the adult as to justify the use of the term metamorphosis. The nervous system of fishes presents considerable variety. The Amphioxus has no enlargement of the nervous trunk comparable to a brain; but in all the others the division into fore, mid, and hind brain is clearly marked. Anterior to these is a fourth vesicle, the olfactory lobe, whose great relative size makes it here obviously a brain lobe, not, as its small proportions in man suggest, a nerve trunk. The cerebrum is smaller than the corpus quadrigeminum, the reverse of the relations in man; and the cerebellum is represented by a small prominent lobe. On the whole the brain presents an embryonic condition, both as regards its vesicular character, the conspicuousness of the canals by which the cavities communicate, and the linear order in which the divisions succeed each other, so as to appear like a chain of ganglia. The olfactory organs are, in most cases, cœcal pits, on whose walls the olfactory filaments are spread out. Only in the hag-fish and Lepidosiren are there internal apertures of the nostrils. The gustatory sense seems less provided for, the tongue and palate being mostly firm, and often set with teeth; the soft tissues of the lips and jaws are the only structures by which taste can be exercised. There is no external ear, and the internal apparatus is not wholly inclosed in bone, as in the higher vertebrates, but is partly free in the cavity of the skull. The otoliths, or calcareous concretions by which the sound vibrations are intensified, are of value in classification, the forms being generically different. Resonance is further increased by contact of the internal apparatus with prolongations of the swim-bladder. And in some plagiostomes the cartilaginous labyrinth is in communication with a chamber from which two or three ducts open externally. The eye is, in most cases, relatively large and flattened on its corneal surface, with which the lens is in contact, the anterior chamber being very small; in these respects the eye resembles that of the Batrachia and aquatic reptiles. The sclerotic has a thin cartilaginous lamella in the rays, in some osseous fishes two such plates; in the sword-fish the sclerotic support is bony. The choroid, which is a vascular network (*rete mirabile*), is prolonged into the posterior chamber by the pecten or falciform process, a vascular and pigmentiferous fold which is connected with the posterior face of the lens. The optic nerves either cross simply, or, as in plagiostomes, form a chiasma in which the filaments decussate. 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visible at the surface. Special tactile organs are wanting for the most part, the soft, often protrusible lips, and the labial filaments, as in the cod, whiting, loach, mullet, and sturgeon, being the only outward processes. The follicles or canals of the lateral line, in which nerve filaments end in tufts, are regarded as tactile, but it is difficult to understand their action. The Gymnotus, Malapterurus, Mormyrus, Torpedo and several other rays, possess organs which, in the four first genera, are electric apparatus. The structure of these organs is simple; cellular plates, on one side of which nerve filaments are distributed, are lodged in chambers formed by laminæ of connective tissue. These chambers are horizontal in the Torpedo, vertical in the others; the nerves are, in the Torpedo, from the fifth cerebral pair, and from the electric lobe of the medulla oblongata; in the others they are derived from the spinal trunks. The Torpedo has its batteries placed on either side of the head; the anatomically similar apparatus in the other rays is lodged on either side of the tail. The instincts of fishes are remarkable. The care of the offspring by the male, the nest-building of the stickleback, the dexterity with which sharks and sword-fish pursue and master their bulky victims, the success with which something like familiarity has been established between fish in captivity and their guardians, these and similar instances are cited in proof of intelligence. But domestication or its semblance is only accomplished after long years, and even then is strictly limited to feeding. Fishes are peculiarly sensitive to external influences, and as we have few means of determining the character, far less of estimating the intensity of these influences, their actions appear often less regulated than they in reality are. The periodic migrations of some fish, as the salmon and sturgeon, from salt to fresh water, and the precision with which they return to the same streams, are even more remarkable than the similar movements of the birds, since these have the help of a wide range of vision to guide their movements. Where the migrations are altogether marine, as with the herring, we are utterly without a guide as to the cause or order of the movements; and the importance as well as uncertainty of this fishery is testified by the variety of hypotheses, 'judgments' on particular localities, use of certain kinds of apparatus, pollution of streams, failure of certain kinds of food, these and many more being appealed to without evidence to explain the eccentricities of the fish. The majority of fishes are not, however, thus migratory. The fresh-water fishes are strictly limited to certain localities, and, as might be expected, local varieties are most abundant. But even in the sea there is as much definition of local faunas as among mammals and birds on land and in the air; and it is often exceedingly difficult to recognize the nature of the barrier which limits the movements of closely-allied species, so that they shall not mingle in the same area.

Classification.—Cuvier recognized the broad distinction between cartilaginous and osseous fishes; the former of which includes those with free gills, as the sturgeons; and those with fixed gills, as the Selachians and Cyclostomata. The osseous fishes he grouped in six orders:—1. Acanthopterygians. 2. Malacopterygians abdominal. 3. Malacopterygians sub-brachial. 4. Malacopterygians apodal. 5. Lophobranchs. 6. Pectognathi. Agassiz proposed in 1833 the following orders founded on scale characters:—1. Ganoid. 2. Placoid. 3. Cycloid. 4. Ctenoid. The first order included with the true Ganoids, Lepidosiren, the Lophobranchs, the Siluroids, and other osseous fishes. The second included with the sharks and rays, the Cyclostomata. The third and fourth orders embraced only osseous fishes. In 1844 Milne Edwards placed the Lepidosiren among the amphibians, and grouped the ganoids with the cartilaginous fishes, the other three groups being the osseous fishes, the Cyclostomata, and Amphioxus. Johann Müller proposed in 1844 a classification which is in all important respects that now adopted, its six sub-classes being those given below. The only important modification proposed since Müller's time is that of Haeckel, who would separate Amphioxus under the designation of Leptocardia, and place this small group in opposition to the Pachycardia, which should include all other vertebrates, a suggestion for which there is much support in the development of Amphioxus and its curious relations to the Ascidians.

Sub-class I. *Pharyngobranchii.*

Amphioxus, the Lancelet, is the only member of this group. (See Plate III., fig. 25.) The characters are largely negative. There is no cranium, no vertebræ, no cerebral dilatation of the spinal chord, which extends beyond the mouth. The mouth is surrounded by a labial fringe, and the opening of the pharynx is guarded by ciliated lobes. The walls of the pharynx are perforated by vertical slits, which are ciliated, and the water entering the pharynx passes through these apertures into a cavity, from which it escapes by the abdominal pore, an opening a little way in front of the anus, just as in the Ascidians the water escapes by the atrial chamber, which intervenes between the integument and the pharynx. The liver is a saccular projection from the intestine. The heart is simply tubular, and at the base of each branchial septum the artery has a pulsatile dilatation by which the circulation is aided. An animal so simple might well be mistaken for an invertebrate, and it was indeed put by Linnæus among the Limaces or Slugs.

Sub-class II. *Marsipobranchii.*—The gills are without arches and saccular. The nasal sac is single.

This sub-class is equivalent to the Cyclostomata of other systems. It includes the Hag (*Myxine*, fig. 24) and the Lampern (*Petromyzon*, fig. 23); in the former the nasal sac opens into the mouth, in the latter it is cœcal. The skeleton is cartilaginous, no distinction of parts being recognizable in the skull, which is partly membranous. The circular mouth is armed with epidermic horny plates; there are no paired fins, only a long vertical fin surrounding the posterior half of the body. The reproductive organs are not symmetrical, and the branchial clefts have one common opening in *Myxine*, six or seven in *Bdellostoma* and *Petromyzon*. The Lamperns, which migrate from river to sea, undergo a slight metamorphosis during development.

Sub-class III. *Elasmobranchii*, or *Selachii*.—Fishes with cartilaginous skulls and cartilaginous or ossified vertebræ. Outer margins of gills adherent to integument. Arterial bulb with several rows of valves. Rectum with a spiral valve. Two orders are included in this division, the Chimæroid fishes, and the Sharks and Rays.

The Chimæroids, of which the Arctic Chimæra (*Chimæra Arctica* or *monstrosa*) or Rabbit-fish is the type, have the palatine arch and the suspensorial apparatus in one piece with the skull, and the upper and lower jaws support two huge cartilaginous plates in the lower, and four in the upper jaw, these representing teeth. We give an engraving in the first plate of a member of the allied genus *Callorhynchus* (*C. Peronii*, fig. 8), to which the southern chimæra belongs. Representatives of this group, *Ischiodus* and *Edaphodon*, are found in secondary strata.

The Plagiostomi include the two families of Sharks and Rays, in which the jaws and palate are not united with the skull, but are free from it. The spinal column is often well ossified. The gills, attached to the integument, form the partitions of five,

rarely six or seven, pouches, which have as many openings in front of the pectoral fin. The placoid armature of the skin takes the form of denticles, the fine shagreen of trade, or of large prominent spines, the structure of all being, as formerly stated, closely similar to that of teeth. The peculiar form of the well-known Rays, as seen in the common Skate (see Plate I., fig. 2) is due to the large size of the pectoral arches, and the enormous number of fin rays which they support. In one group the tail is slender. The Eagle Rays (*Myliobatis*) are of great expansion. In the Sting Rays (*Trygon*) the pectorals unite and form an angle in front of the head. These two groups are viviparous. The true Rays (*Raia*) are oviparous; their pectoral fins commence behind the muzzle, and the tail carries dorsal fins. A second group consists of those having a robust tail. The Torpedoes (fig. 3, plate last mentioned) have been already spoken of as possessed of electric apparatus. The upper surface of the plates is positively, the lower, by which the nerves enter, is negatively electrical. These animals were known to the ancients, who believed them capable of curing neuralgic pains; even to the dried flesh curative virtues were ascribed. The Torpedo is marine, but the allied genus *Narcine* is found in the rivers of Brazil. The Saw-fish (*Pristis*, fig. 4), of which one species, *P. Perotteti*, is only found in the Senegal River, has an elongated snout, on either side of which are planted twenty to thirty teeth.

The Sharks (*Squalida*) are characterized as a family by their elongated bodies, which are admirably adapted for speed or for powerful efforts. They are mostly carnivorous and predatory, and the teeth are usually conical and trenchant. The habits of these animals are highly predatory, their voracity, strength, and persistence being great. The number of fins furnishes a convenient means of grouping the genera. A. Sharks with two dorsal fins and no anal. 1. Squatinida. The Monk-fish or Angel-fish (*Squatina*) approaches the Rays in the breadth of the body, which is due to the great size of the pectoral fins. 2. Spinacida, the Picked Dog-fish, every fin being preceded by a spine. 3. Scymnida, the Greenland Sharks, in which only dorsal spines are present. B. Sharks with two dorsal fins and one anal. 4. Lamnida, a family which includes the giants of the class, *Carcharodon Rondeletii* attaining nearly 40 feet in length; the *Selache maxima* about 30 feet. The Port Jackson Shark, *Cestracion Philippi*, represents at the present day the Carboniferous Selachians; the median teeth are broad, flat, with ridged crowns; the lateral are obtusely pointed. 5. Galeida, the Topes. To this family belongs the *Mustelus lævis*, in which the outer surface of the umbilical sac adheres by external tufts to the uterine wall, forming a kind of non-deciduate placenta. 7. Carcharida. In *Carcharias*, the Blue Shark, a similar arrangement exists. In this family there is a nictitating membrane, or third eye-lid, which is moved as in birds. The Hammer-headed Shark (*Sphyrna*, fig. 7) belongs also to this sub-family. 8. Scyllida, the Dog-fishes (fig. 5).

Sub-class IV. *Ganoidei*.—Fishes with cartilaginous or osseous skeleton. Gills free, protected by an operculum. Arterial bulb muscular and valvular. Intestine with spiral valve. Scales enamelled and osseous. Optic nerves form chiasma. Swim-bladder with open pneumatic duct. No cloaca.

The limits of this group are not sharply defined on the side of the next sub-class (*Teleostei*), nor are the characters above given universal. Thus the intestinal valve is rudimentary in *Lepidosteus* (Bony Pikes, fig. 9); *Spatularia* has the skin naked. The sub-class falls into two groups, determined by the condition of the skeleton.

Skeleton Cartilaginous.—1. Chondrosteida. The body is naked, as in *Spatularia;* or covered with bony plates and scutes, as in the Sturgeon (figs. 11, 12). The skull is destitute of cartilage bones; but the roof is covered with membrane bones, which coalesce with dermal plates of the neck to form a large shield. The branchiostegal rays are very few, chiefly absent. Teeth minute or none. Tail markedly heterocercal. These fishes are confined to the northern hemisphere, *Spatularia* and *Scaphirhynchus* to North America. The sturgeon is migratory, and does not usually ascend beyond the muddy reaches of rivers, its tubular mouth being specially adapted for life in such material. The fossil representative of the group is the Mesozoic *Chondrosteus*. 2. Cephalaspida. These fishes, whose remains are confined to the Upper Silurian and Lower Devonian or Old Red Strata, had a cephalic shield like that of the sturgeon, bony in *Cephalaspis*, more like fish-scale in *Pteraspis*. The trunk skeleton was cartilaginous, the pectoral fins were large in Cephalaspis, whose scales were also bony. Nothing is known of these structures in Pteraspis. 3. Acanthodida. These fishes do not occur later than the Carboniferous strata. They had shagreen-like armature of the skin and spines in front of the fins; were in fact intermediate between ganoids and elasmobranchs.

Skeleton Osseous.— 4. Placodermi. These, like the preceding, disappear with the Carboniferous times. The bucklers of the Berrybone (*Coccosteus*), the *Pterichthys*, and *Asterolepis*, were complex, and the pectoral fin of *Pterichthys*, likewise encased in bony plates, was articulated to the trunk by a singular mechanism. The body of *Pterichthys* was covered with scales, that of *Coccosteus* was naked. These fishes have been compared to certain living Siluroids, and their position is, it has been suggested, intermediate between ganoids and true osseous fishes. 5. Amiada. The Missouri Mud-fish, *Amia*, is the only member of this sub-order, which is characterized by its cycloid scales, single median jugular plate, along with branchiostegal rays, and by its fins being non-lobate. The Carboniferous *Cycloptychius* perhaps represented *Amia*. 6. Lepidosteida. These fishes have rhombic scales, thickly enamelled, and heterocercal tails. The Bony Pikes (fig. 9) of the North American lakes are the living forms, the Devonian forms being *Cheirolepis*, the Carboniferous *Palæoniscus*, while the Mesozoic genera are very numerous, *Æchmodus*, *Lepidotus*, &c. In all these the vertebræ are well ossified, and have a posterior cup and anterior rounded head (opisthocœlous) as in some amphibians. 7. Crossopterygida. In this extensive group the fins are conspicuously lobate; that is, the fin-rays are a fringe to a central scaly mass, in which are inclosed prolongations from the pectoral arches, and pelvic representatives probably of the limb-bones. The branchiostegal rays are replaced by two large and several smaller jugular plates. The air-sac of *Polypterus* (fig. 10) is double and lobulate, while the opening of its duct on the ventral wall of the pharynx increases its resemblance to a lung; but as already said, even here the vascular supply is not direct from the heart. The air-sac of the Cœlacanthini was ossified and their vertebral centra were cartilaginous. *Holoptychius* in the Upper Old Red Sandstone, *Dipterus*, *Osteolepis*, &c., in the Lower, *Megalichthys*, *Rhizodus*, *Phaneropleuron* in the Carboniferous are the principal members of a group which was feebly represented in Mesozoic times, and is now reduced to two genera, both inhabitants of African rivers, *Polypterus* in the Nile, and *Calamoichthys* of Calabar. The young Polypteri have external gills. The highly ossified skulls and skeletons of fossil and living genera present amphibian characters. A curious group, the Pycnodonts and their allies, are not certainly refer-

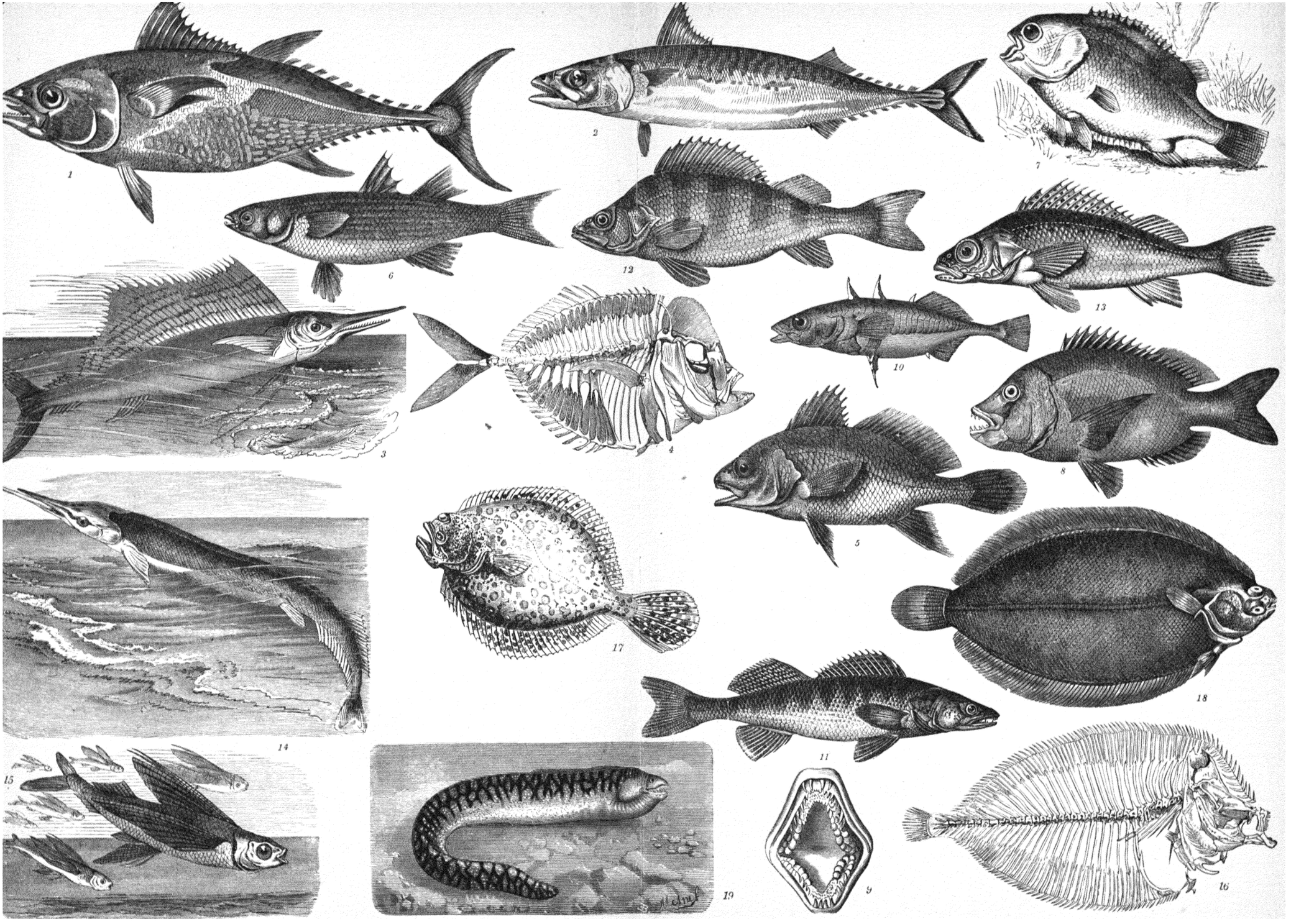


Fig. 1. Tunny. 2, Mackerel. 3, Fan fish or Sail-fish. 4, Skeleton of Albacore. 5, Scisena. 6, Mullet. 7, Climbing Perch. 8, Braize. 9, Mouth of do. 10, Stickleback. 11, Giant Perch. 12, Common Perch 13, Ruff or Pope. 14, Gar-fish or Sea Pike. 15, Flying-fish. 16, Skeleton of Sole. 17, Turbot. 18, Flounder. 19, Murœna.

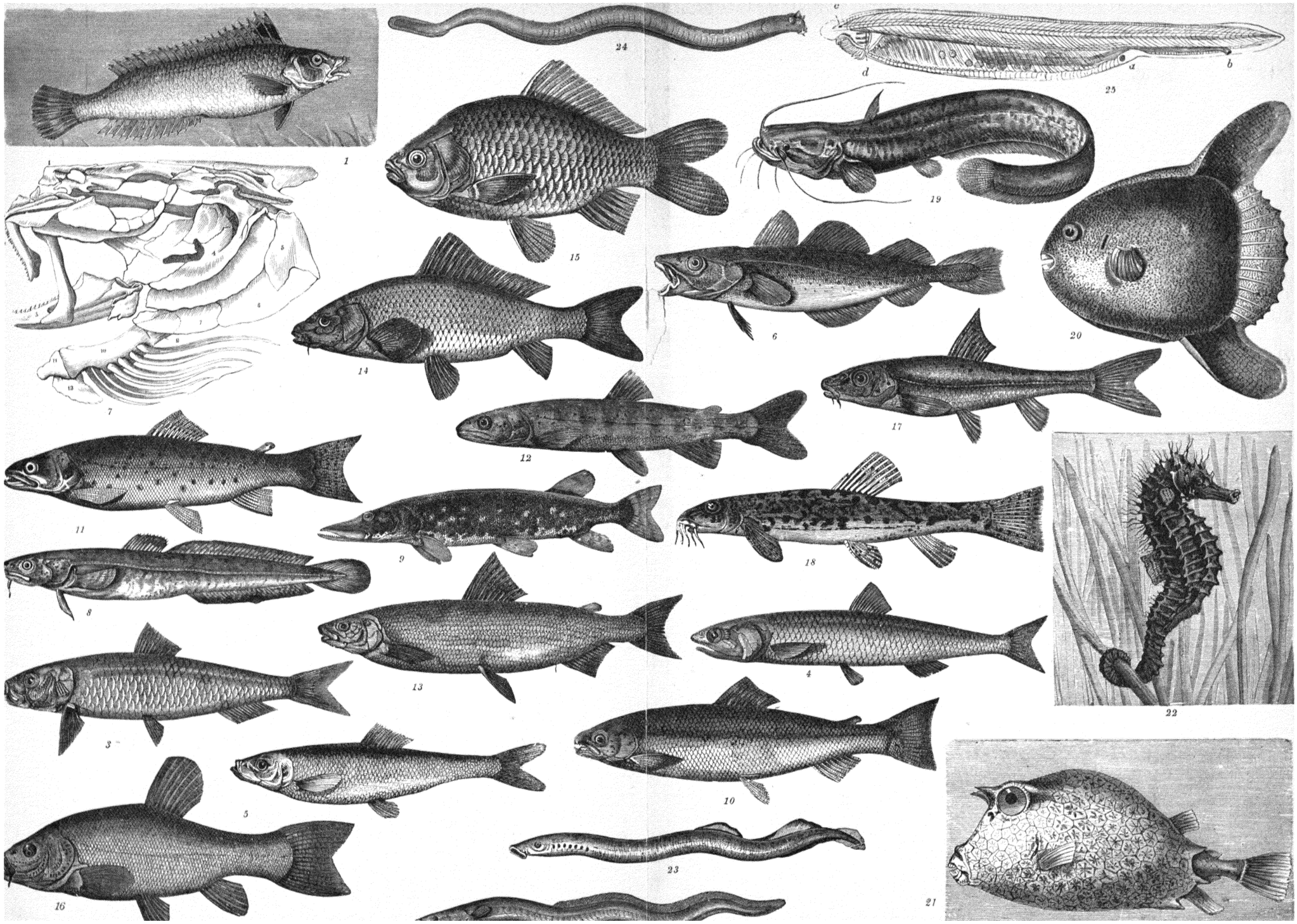


Fig. 1, Rainbow Wrasse. 2, Eel. 3, Pilchard. 4, Anchovy. 5, Herring. 6, Cod. 7, Skull of Cod. 8, Burbot. 9, Pike. 10, Salmon. 11, Trout. 12, Parr or Samlet. 13, Coregonus Marœna. 14, Carp. 15, German or Crucian Carp. 16, Tench. 17, Gudgeon. 18, Loach. 19, Sly Silurus. 20, Young Sun-fish. 21, Horned Trunk-fish or Coffer fish. 22, Hippocampus. 23, Lampern. 24, Hag or Myxine. 25, Lancelet or Amphioxus.

able to any of the preceding groups. The flat teeth situated on the jaws and palate, the great depth and lateral compression of the body, and the singular series of spines by which the thick scales are locked together: these with other details of their structure render them as anomalous among osseous as among ganoid fishes.

Sub-class V. *Teleostei.*—Fishes with ossified skeleton and cartilage as well as membrane-bones in the skull; no spiral valve in the intestine, and the arterial bulb not muscular nor provided with more than one row of valves.

The integument is naked, as in Eels, or set with spines as in the File-fishes; but these only resemble shagreen; they are structurally different. The most frequent investment is with overlapping scales, which want the canals characteristic of true bone. The ossified vertebræ are biconcave, or, as in some Eels, nearly flat, while in others the opisthocœlous condition is faintly indicated. The cartilaginous skeleton of the cranium sometimes persists, as in the pike and salmon, and the membrane-bones may be stripped off after a short immersion in scalding water, the cartilage bones remaining with the cranium. The branchiostegal rays are replaced partially by plates only in *Thrissops* and one or two forms which may be after all ganoid. The paired fins may be wholly absent; but the ventral are more usually the only pair wanting. In the Flat-fishes the fins of one side may be the larger. The ordinal groups are of very unequal value. In fact, it is doubtful if a useful principle of classification has been invented. The following divisions present the leading differences among the sub-class:—

1. Lophobranchii. The body, often angular, is covered with solid plates, and the mouth is tubular. The pipe-fish and Hippocampus or sea-horse (see third plate, fig. 22) are the best-known members of this curious group, in which the male acts as nurse to the young. The ordinal name refers to the greater size of the gill processes at the free end.

2. Plectognathi or Pectognathi. The File-fishes, Balistidæ, the Trunk-fishes, Ostraciontidæ (see Plate III., fig. 21), and the Globe-fishes, Gymnodonta (see Plate I., fig. 18), agree in having the maxillæ and premaxillæ united. The air-bladder is large, but there is no duct. Ribs and ventral fins are usually wanting. The solid boxes in which the Ostracionts are encased resemble those of Pterichthys, while the curious spines into which the angles are produced give an odd resemblance to some of the smaller crustaceans. Their vertebræ are anchylosed, movement of the trunk being impossible, as in the tortoise. The File-fishes have a shagreen-like dermal covering, and the abdomen has a strong bony keel. The remarkable spine of the dorsal fin gives its name to the family. The family includes some of the most beautifully coloured of tropical fishes. The Globe-fishes have a tough skin set with strong spines. In calm weather the integument may be inflated by means of a sac communicating with the pharynx. The Sun-fish, *Orthagoriscus mola*, is of peculiar form, as seen in the figure (fig. 20 of third plate). The skin is shagreen-bearing, and the compressed body, the axis of which is greatly shortened, is more unfavourable to rapid locomotion than might be expected from the great size the body often attains.

3. Physostomi, or Malacoptera. The fins of this order are soft, and the ventral pair, when present, is abdominal. The air-sac has a pharyngeal opening. The Apodal group, those namely which have no ventral fins, include the Eels (*Anguilla*, see Plate III., fig. 2), of which there are several varieties, according to the relative breadth of the snout. These fishes, mostly fluviatile, wander in search of water when the streams run low, and migrate periodically seaward. They are a very important family of food-fishes. The Conger, or sea-eel, is little prized; nor is the Muræna (second plate, fig. 19) now the object of that careful cultivation which it enjoyed in the Roman days of luxury. The *Symbranchus*, in which the branchial clefts unite below the throat, is a tropical genus. The Electric Eel (*Gymnotus*) is a South American form. Those with abdominal fins include the Siluroid group, among which may be mentioned the Sheat-fish, or Hungarian Horsa (*Silurus*, third plate, fig. 19), with four or six labial cirri; the Saccobranchus of East India, with the branchial chamber continued under the skin of the trunk; the Electric Malapterurus of the Nile and Senegal; the Characini; the Cyprinoidei, the most abundant group of fresh-water fishes. The Cyprinoids have one or several rows of pharyngeal teeth. To the latter division belong the Carp (*Cyprinus*) and Barbel (*Barbus*), which have four labial filaments; the Tench (*Tinca*), a mud feeder, and the Gudgeon (*Gobio*), with two filaments; and among those without labial filaments the German Carp (*Carassius*), River-bream (*Abramis*), the Bleek (*Blicca*), the Rud (*Scardinius*), &c. (figs. 14, 15, 16, 17, and 18 on third plate) are Cyprinoids. Among those with one row of pharyngeal teeth are the Loach (*Cobitis*), the Cyprinodonts, including the strange *Anableps tetrophthalmus*, in which the cornea is divided by an opaque transverse band into two transparent portions. Other important malacopterous families are that of the Pikes (*Esox*); that of the Herrings (Clupeidæ), including Sprat, Shad, Pilchard, Anchovy, Sardine; of the Salmonidæ, including Powan, Coregonus, Sparling, Smelt, and Grayling, Salmon, Trout, and Galaxias, which alone wants the fat fin. Lastly, the Heteropygia, to which viviparous family the *Amblyopsis spelæus*, or Blind-fish of the Mammoth Cave, Kentucky, belongs.

4. Anacanthi. The fin rays are all soft; the swim-bladder seldom absent, or ductless; the inferior pharyngeal bones are separate, and the ventrals when present are jugular. The Launce (*Ammodytes*), the *Ophidium*, or serpent-like fishes, the Cod-fishes (Gadoidei), and the Flat-fishes (Pleuronectidæ) illustrate the group, including the Cod, Haddock, Ling, Hake, Turbot, &c. (See the second and third plates.) The importance of the gadoid fishes as articles of food and commerce is greater than that of almost any other group of fishes. But their interest anatomically is inferior to that of the Flat-fishes, which are in truth ordinary deep-bodied, laterally-compressed fishes, whose eyes, however, have come to be on the same side of the head, the want of symmetry, the twist, not affecting the basal bones of the skull. The Turbot, Flounder, Plaice, Holibut, have the dorsal, caudal, and anal fins distinct; in the Sole they are confluent.

5. Pharyngognathi. The inferior pharyngeal bones are united into one dentigerous plate. The fins are sometimes solid, sometimes wholly articulated (soft); the ventrals thoracic or jugular.

The families with spinose or non-articulated anterior, dorsal, and ventral fin-rays are the Labroidei, a group of large cycloid-scaled fishes most abundant in the Indian Ocean, and including several gay species, which contrast with the duller-coloured wrasses of British seas; the Chromida, of which species live in the Saharan Oases, while others in Brazil hatch the young in a pharyngeal pouch. To the Scomberesocida belong the gar-pike or green-bones (*Belone*); *Hemirhamphus*, with elongated lower jaw; the Flying-fish (*Exocœtus*), whose pectoral fins are so elongated that they can, parachute-like, sustain the fish for a short distance in the air when it

jerks itself out of the water to escape a foe. (See the second plate, figs. 14, 15.)

6. Acanthopteri. The pharyngeal bones are distinct. Some of the anterior rays in some or all of the fins are spinous (non-articulated); swim-bladder when present without a duct; ventral fins thoracic or jugular. The Sea-snipe (*Centriscus*), the Trumpet-fish of China (*Aulostoma*), and the Pipe-fish (*Fistularia*), which resembles the Syngnathus in the elongation of its snout, represent the family Aulostomida. The Cataphracta have strong facial plates and spines in the gurnards (*Trigla*), and *Peristedion*, the fresh-water *Cottus*, or, like the Stickleback (*Gasterosteus*), have side plates and powerful dorsal spines. The great family of Percoid fishes includes the Surmullets (*Mullus*), with two cirri on chin, and four branchiostegal rays; the *Trachinus vipera* (weever), the only fish whose spines have poisonous properties; *Beryx*, a genus which first appeared in cretaceous strata, the River Perch (*Perca*), the *Serranus*, the Sea-perch (*Labrax*), &c. The Scaroidei include a large number of genera, of which Sea-bream is the general designation; as *Pagellus*, *Sargus*, *Dentex*, &c. In the Squamipennes the scales encroach on the dorsal fin; the body is high, laterally compressed, and the head relatively small. They are mostly tropical, and include some interesting forms; thus, the Brazilian *Toxotes* has a protrusible snout, and squirts water on insects with unerring precision so as to bring them within its reach. The teeth of *Chætodon* are subdivided so as to resemble tufts of bristles; *Platax*, now an Indian genus, lived in the British area during the Crag period. Among the Teuthyes the singular Surgeon-fish (*Acanthurus*) has a spine on either side of the tail, which may be raised or folded down into a deep groove of the lateral line. The Mackerel family, Scomberoidei, have the dorsal and anal fins subdivided into seven or more tufts, and the thoracic scales on the lateral line large and plate-like. The Tunny (*Thynnus*), Mackerel (*Scomber*), Bonito (*Pelamys*), Sword-fish (*Xiphias*), Pilot-fish (*Naucrates*), &c., are well-known examples of those with non-protrusible mouths; the Dory (*Zeus faber*), the Boar-fish (*Z. aper*), &c., of those with protrusible mouths and deep bodies. The Tænioid fishes (*Cepola*), the West Indian *Baracuda*, *Notacanthus*, the Mullet (*Mugil*), and Atherines (*Atherina*); the Gobioid fishes, as the river Goby, the Lump-fish (*Cyclopterus*), the Remora; the Blennioid family, as the Blenny or sea-butterfly; the Cat-fish, or Wolf-fish (*Anarrhicas*); the Frog-fish (*Lophius*), and its kindred *Chironectes*: lastly, the Labyrinthoid family, already referred to as possessing the respiratory folds of the walls of the branchial chamber, are among the more important examples of this order. (Acanthopterous fishes are represented on Plate II., figs. 1–13; also Plate III., fig. 1.)

Sub-class VI. *Dipnoi.*—The Mud-fishes (*Lepidosiren*, shown on Plate I., fig. 1) of the southern continent of Africa, Australia, and America, are eel-like in form, and have a low median fin round the pointed posterior half of the body. The pectoral and ventral fins have the simple form of a cartilaginous rod, along the margins of which a fringe of rays is disposed. The skull is cartilaginous, with membrane bones; the ethmoid bears teeth, and the palate dentary plates, which correspond to those of the mandible. The vertebræ are not ossified, the bony ribs and spinous processes being embedded in the sheath of the holochord. The Dipnoi are intermediate between fishes and amphibians; but they do not connect the highest fishes and lowest amphibians; Lepidosiren recalls rather the extinct ganoids on the one hand, and the Labyrinthodonts on the other. See LABYRINTHODON.

[We subjoin a few particulars explanatory of some of the figures on the plates of Ichthyology. Plate I., fig. 5: *n*, upper spinous processes, *pl*, lower do.; *a*, frontal part of skull; *b*, prefrontal part; *c*, hyoid bone, with branchial rays; *d*, mandible or lower jaw; *e*, upper jaw; *g*, labial cartilage; *k*, pectoral fins; 1, 2, 3, 4, 5, branchial arches. Fig. 12: A, anal fin; C, caudal fin; D, dorsal fin; *v*, one of the ventral fins; *p*, one of the pectoral fins. Plate III., fig. 7: 1, frontal bone; 2, intermaxillary bone; 3, mandible; 4, preoperculum; 5, operculum; 6, subopercullum; 7, interoperculum; 9, branchiostegal rays; 10, ceratohyal bone; 11, basihyal; 13, urohyal. Fig. 25: *a*, abdominal fins; *b*, anus; *c*, brain; *d*, pharynx.]

ICHTHYOPSIDA, a great division of the vertebrates, including the Fishes and the Amphibians, classes formerly thought very distinct, but now recognized as presenting so many gradations that a sharp line cannot be drawn between them. They agree together and differ from all other vertebrates in having, while in the egg, no amnion, and at best only a rudimentary allantois, in breathing by means of gills or branchiæ for the whole or a part of their life, and in having throughout life, or only at an early period, vertical folds of integument projecting along the middle line of the body, and capable of being used as locomotive organs. The lower jaw is not articulated to the skull directly, but by means of a complex chain of bones. The vertebræ, even when distinct and ossified, have no cartilaginous epiphyses. The urinary organs are the equivalents of embryonic Wolffian bodies, and the cerebral hemispheres, when present, are not united by a corpus callosum. The *Amphioxus*, or simplest of the fishes, has neither skull, heart, brain, nor renal organs; the skeleton consists of the notochord, or that cartilaginous rod which in higher forms is replaced by distinct vertebræ during an early stage of development; and the branchiæ are represented by the ciliated partitions which divide the side walls of the pharynx vertically. The other orders of fishes have better, some very highly developed, skeletons; the heart has an auricle and ventricle. Some have an air-bladder; but in the order *Dipnoi*, as in *Lepidosiren*, true lungs are present, and the heart has two auricles. The Amphibians are, in their lowest representatives, as *Proteus*, very fish-like in form; and the gills are persistent; while in the frog these appendages, as well as the long tail, disappear early, and the heart has two auricles and a ventricle.

ICHTHYOSAURUS (from the Greek *ichthus* or *ichthys*, a fish, and *sauros*, a lizard), one of the extinct reptilian animals whose remains have been found in the rocks of the lias and oolite of England, France, and Germany. It has been described as a creature having the beak of a porpoise, the teeth of a crocodile, the head and sternum of a lizard, the paddles of a whale, and the vertebræ of a fish. There are more than thirty different species known, several of them of great size; some are of a magnitude equal to that of young whales; one specimen in the British Museum indicates an animal which, in its complete state, must have been upwards of 24 feet in length. The structure of the ichthyosaurus shows it to have been a marine animal, the shortness of the neck, and the equality of the width of the back of the head with the front of the chest, point out the resemblance of the animal to the whale tribe and to fishes; the vertebral column consisted of as many as a hundred and forty joints, which were prolonged into a tail which probably terminated in a fin placed vertically, like the fin-tail of the fish. The vertebræ are flattened biconcave discs, as in fishes. The paddles differ essentially in structure from those of the whales.

The magnitude of the eye exceeds that of any animal known, past or present. In the collection of the Geological Society of London there is a skull in which the longer diameter of the orbital cavity measures 14 inches; in other specimens the long diameter of the orbit is 4 inches; it is thence inferred that the creature had great power of vision, especially in the dark. The eye was surrounded with a ring of bony sclerotic plates. The animal had four paddles, consisting of numerous bones invested with the same integument, so as to form one entire fin. It must have been a predatory and voracious animal, judging from its powerful construction, its crocodilian jaws and teeth, and the remains of its food as seen in the crushed and half-digested fish-bones, scales, and teeth composing its fossilized excrement known as coprolites, many of which retain the marks produced by their passage along the intestinal canal, and which occur in such quantities in England as to have become of economical value for manuring and chemical purposes. The intestine had a spiral valve, which impressed on the flattened fæces a spiral form.

ICHTHYS (Greek for fish), a word found on many seals, rings, lamps, urns, and tombstones, belonging to the earliest Christian times. Each character forms an initial letter of the following words, Ἰησους Χριστὸς, Θεοῦ Υἱὸς, Σωτὴρ (*Iēsous Christos, Theou (H)yios, Sōtēr*); that is, Jesus Christ, the Son of God, the Saviour. The picture of a fish is also sometimes engraved in similar works, having a mystical meaning.

ICOLMKILL. See IONA.

ICONIUM. See KONIEH.

ICONOCLASTS (image-breakers), that Christian party which would not tolerate images in the churches, much less the adoration of them. This dispute began in Greece, and extended from thence over Europe; it was most violent in the eighth and ninth centuries. In the first three centuries after Christ the Christians had no paintings or images in the churches. The first cause of the Christian worship of images was partly the custom of erecting columns in honour of the emperors with their statues, partly the attempt to preserve the memory of the bishops and the martyrs by images. In the fourth, and still more in the fifth century, they were placed in the churches, yet without receiving any adoration; but in the sixth century people began to kiss the images in token of respect, to burn lights before them, to offer incense in honour of them, and to ascribe to them miraculous power. Some bishops endeavoured to dissuade Christians from this worship of images. The images themselves were tolerated by some as becoming decorations of the church, while others in their reverence for them approximated to complete idolatry. The eastern emperor Leo III., the enemy of superstition and the worship of the images, issued an edict in 726 ordering the people to abstain entirely from the worship of statues, as well as paintings and mosaics, and this edict was soon after followed by another ordering the destruction of the images. This order occasioned commotions, first in the islands of the Archipelago; and as the Popes Gregory II. and III., as well as Germanus, the patriarch of Constantinople, admitted of the worship of images, and the Emperor Leo refused to recall his edict on their command, they excommunicated him, and his subjects in Italy threw off their allegiance. Thence arose two parties in the Christian church, namely, the *Iconolatræ* (image-worshippers) and the *Iconoclasts*, who each in turn persecuted the other even to death. Leo's son and successor, Constantine Copronymus, held the same views as his father. He convened a council at Constantinople (754), in which the use as well as the worship of images was condemned. Constantine's son, Leo IV., who ascended the throne 775, followed the same course, but proceeded with more clemency and moderation. On the death of Leo IV., in 780, he was succeeded by his son Constantine, under the guardianship of Irene, mother of the latter, and widow of Leo. Irene favoured the image-worshippers, and on attaining this position of authority openly avowed her sentiments, and summoned a council to be held in 787, under her protection at Nicæa (Nice) in Bithynia, the majority of the members of which were image-worshippers. This council restored the worship of images, and inflicted punishment upon those who maintained that nothing but God ought to be worshipped. Although the Greeks and Italians were addicted to the worship of images, yet most Christians of the West, as the Britains, Germans, Gauls, did not follow their example; on the contrary, they asserted that it was lawful to retain images and expose them in the churches, but that they could not be worshipped without offending God. Charlemagne, probably assisted by Alcuin, wrote against the worship of images, and a council which he caused to be held at Frankfort-on-the-Main (794) confirmed his opinion, notwithstanding the opposition of Pope Adrian. Among the Greeks the controversy concerning images broke out anew after the banishment of Irene (802), and lasted about half a century. Her successor, Nicephorus, did not indeed remove the images from the churches, but he forbade the adherents of the images from persecuting their adversaries. Finally the Empress Theodora, by a council held at Constantinople (842), restored the worship of images among the Greeks, which was confirmed by a second council, held 869–870, in the same place. In the Western Empire images were at first retained only to preserve the memory of pious men, but the worship of them was forbidden. This use of them was confirmed by a council summoned by Louis the Debonnaire in 825; but this opinion was gradually abandoned, and the decision of the pope, which allowed the worship of images, finally prevailed in the Western Church. See ICONOLATRY.

ICONOGRAPHY, or ICONOLOGY, was a term applied at first, in accordance with its literal meaning, to catalogues, descriptions, and histories of the likenesses of the distinguished persons of antiquity as exhibited in statues, busts, coins, cameos, paintings, &c. Michael Angelo and Fulvius Ursinus were, in the sixteenth century, the restorers of this art, which was further improved by Giovanni Angelo Canini in his Iconografia, completed and published by his brother Mario Antonio Canini (Rome, 1669; translated into French by de Chevrières, Amsterdam, (1741). Visconti's Iconographie Grecque appeared in 1808. His Iconographie Romaine, completed by Antoine Mongez, was published between 1817 and 1825. More recently iconography was extended to the art of ideal types of deity, the saints, or abstract qualities; and accordingly the Christliche Kunstsymbolik und Ikonographie (Frankfort, 1839), by J. von Radowitz, contains representations of all the more essential ideal types of older Christian art. In France L. J. Guénebault published two Dictionnaires Iconographiques, one of the monuments of Christian antiquity and the Middle Ages (1844), and the other of the figures of biblical persons. Other important works are Didron and Durand's Manuel d'Iconographie Chrétienne (1845); Didron's Christian Iconographie (from the French, in Bohn's series); Bernoulli's Römische Ikonographie; Barbier de Montault's Traité d'Iconographie Chrétienne; Lord Lindsay's Sketches of the History of Christian Art; Palmer's Early Christian Symbolism; Lundy's Monumental Christianity; Allen's Christian Symbolism in Great Britain and Ireland, &c.

ICONOLATRY, the worship or adoration of images. The article ICONOCLASTS shows what dissensions the worship of images has produced in Christendom. To Protestants the respect (whatever it may be called) which the R. Catholics pay to images is an object of great dislike: they consider it the breach of one of the first commandments of Christianity—to worship in the spirit and in truth; whilst, on the other hand, the R. Catholics say that malice or ignorance only can ascribe to them the heathen custom of adoring images. Everything, say they, depends upon the meaning given to the word adore. 'In vain,' says the Catholic writer in the Dictionnaire de Théologie, article Adoration, 'do they (the Protestants) maintain that God alone shall be adored; if they mean by it, honoured as the Supreme Being, it is true; if they understand by it that he is the only being to be honoured, it is a falsehood.' He thus continues: 'We respect their (the saints') images, because they represent them, and their relics, because they belonged to them; but we do not adore them, if by adoring is understood worshipping them like the Supreme. If some Catholic authors, from a careless use of language, have improperly applied the expression adoration, this proves nothing, as our creed is clearly exposed in all our catechisms.' The Protestants maintain, first, that 'none is holy but the Father;' and no gradation in worship can exist; that the mass of men, always being inclined to take the form or sign for the essence, do so also among the R. Catholics (if we are to suppose the images were not intended for real worship by the church), as all R. Catholic countries sufficiently prove by the unrestrained worship and miraculous powers ascribed to images; and thirdly, that there is a vast difference between the 'respect' paid by R. Catholics to images and that shown to them by Lutherans, and to some extent by members of the Anglican Church, who undoubtedly respect the religious paintings, sculptures, &c., in their churches on account of the subjects represented, but neither pray before them, nor ascribe any special virtue to them. In Protestant churches generally even religious paintings are little known.

ICTERIDÆ. This family of Passerine birds peculiar to the American continent differs from the Sturninæ, or Starlings proper, with which it is usually grouped, in the invariable straightness of the bill, the presence of nine (not ten) primaries in the pointed wings, in the rounded (not squared or graded) tail, and in the great relative strength of the hind toe. The colour, moreover, is mostly black, with yellow or orange. The type genus, the Yellow Starling, *Icterus*, belongs to the first sub-family *Icterinæ*, which includes the genus *Cassicus*, the Japu or Cassican of Brazil, and the Baltimore Bird, *Hyphantes*, which builds its pendulous nests from the branches of tall trees. The Cassicans, about the size of a jackdaw, seem to represent the crows in the American system of bird life. They are brilliant in colouring, but though gregarious are not social; nor are they prolific. The second sub-family includes the Troopials, *Trupialis* and *Agelaius*, and the Rice-birds, *Dolichonyx*, the latter comprising the well-known Bobolink. The Marsh Troopials, *Agelaii*, are about the size of a finch; they migrate in large flocks, the males and females apart, and have the merits and demerits of the Rice-birds in the eyes of the agriculturist. The Cow-bunting (*Molothrus*) and the Boat-tails (*Quiscalus*) form the third sub-family, the former genus being remarkable for its cuckoo-like habits as regards the eggs, the latter for the peculiar upward set of the lateral tail-feathers, the broad tail becoming thus scoop-like.

IDA, in ancient geography, a mountain range in the north-west of Asia Minor, at the foot of which lay the city of Troy. Its highest peak was called Gargarus, and is 5750 feet above the level of the sea. Mount Ida was the scene of many Grecian fables. It produced a great number of pines, and was famous for its pitch; it is now called Kaz-Dagh. The same name was also given to the middle and highest summit of the mountain chain which divides the Island of Crete from east to west. (See CANDIA.) Zeus (Jupiter) was brought up here by Amalthea.

IDAHO, one of the United States, organized as a territory in 1863, and in 1890 admitted as a state. Originally it was of much greater area than it is at present, being now mainly comprised between the 42nd. and 45th parallels of latitude, and 111th and 117th meridians of west lon., a long irregular prolongation extending north as far as the Canadian frontier. It has Montana and Wyoming on the east, Washington and Oregon on the west, Utah and Nevada on the south. Area, 84,800 square miles. The surface, especially in the north and east, is formed by ranges belonging to the Rocky Mountains, in the south it is more level. The Snake River crosses the state in the south, and forms part of the western boundary, and the greater part of the drainage is carried to the Columbia. The state owes its rise to the rich gold fields of the Salmon River, previous to the discovery of which, in 1861, it was inhabited only by Indians. Gold has also been obtained in other localities, but silver now yields a greater yearly value. Idaho is now an important lead-producing state, and smaller quantities of copper, iron, coal, platinum, salt, sulphur, soda, &c., are obtained. The higher mountain ranges are bleak and barren, but the lower hills are generally well wooded, and the soil of the valleys is productive. The forests are extensive and valuable. In general Idaho is better adapted for grazing than for farming. Irrigation is necessary in many parts of the south. Boisé City (pop. 5000) is the capital. Pop. of the state in 1880, 32,610; in 1890, 84,385; in 1900, 161,771.

IDDESLEIGH, EARL OF, SIR STAFFORD HENRY NORTHCOTE, an English statesman, member of an old Devonshire family, was born 27th October, 1818. He was educated at Eton and at Balliol College, Oxford, where he gained high honours. He became private secretary to Mr. Gladstone in 1843; was called to the bar in 1847, and in 1851 succeeded his grandfather in the family baronetcy. He entered parliament in 1855 in the Conservative interest as member for Dudley, in 1858 was elected member for Stamford, and in 1866 for North Devon, a constituency that he represented till 1885. In 1862 he published a work entitled Twenty Years of Financial Policy. In 1866 he became president of the Board of Trade; in 1867–68 he was secretary for India; in 1871 he was appointed a special commissioner to America to make arrangements regarding the *Alabama* difficulty; and in 1874–80 he held the office of chancellor of the exchequer in the ministry of Mr. Disraeli. After the Liberals returned to power in 1880, and Mr. Disraeli entered the Upper House, Sir Stafford became Conservative leader in the Commons, a post in which he gave great satisfaction. When Lord Salisbury became premier in 1885, Sir Stafford was raised to the peerage, and appointed first lord of the treasury; in Lord Salisbury's second cabinet (1886) he was foreign secretary. He died suddenly 12th Jan. 1887. A collection of lectures and essays by him was published the same year. A biography of him by Andrew Lang appeared in 1890.

IDEALISM is the philosophical term which, in contradistinction to realism, expresses the view that subjective or ideal existence is not only the original but the only true being, and according to which there is allowed to sensible objects merely a phenomenal

existence dependent upon the mind of a thinking subject. The oldest system of idealism is that of Plato. In Plato all true being is placed in the divine ideas, of which sensible objects are only copies in the element of the non-existent, and accordingly have in themselves merely a phenomenal or apparent existence. In modern times idealism has been revived by Descartes, Berkeley, Kant, Fichte, Schelling, and Hegel. Some of these, as Descartes and Kant, are not, however, pure idealists, inasmuch as they allow at least a problematical existence to sensible things independent of the thinking subject. These are classed by Sir William Hamilton as Cosmothetic Idealists, because, while they deny the independent and objective existence of what is immediately perceived by the senses, and are therefore, as far as our immediate perceptions are concerned, idealists, they are yet realists in so far as they do not deny the existence of a real world beyond the world of sense, and thus in a manner create a world outside of what is given in experience. Descartes was followed, with some modifications, in this theory by Malebranche and the other philosophers who are considered as belonging to the Cartesian school. It was in opposition to this theory that Berkeley came forward with a more decided sort of idealism, holding that what is called matter consists merely of what he calls ideas, that is, appearances produced in the mind by the direct influence of the Deity. This dogmatic idealism of Berkeley differs from the critical or transcendental idealism of Kant. This consists in the doctrine that all the material of experience is given in sensation, but, on the other hand, the forms of the experience (space, time, and the categories of the understanding) arise in ourselves *à priori*, and that accordingly sensible objects are known only as they appear to us and not as they are in themselves. Fichte, on the other hand, rejected the notion of things in themselves as untenable and self-contradictory, and created the system of so-called subjective idealism, according to which the I, or thinking subject, produces the appearance of a sensible world by a mode of activity grounded upon its essential nature. The theories of Schelling and Hegel are developments of the Fichtean doctrine.

IDELER, Christian Ludwig, a German astronomer and chronologist, born in 1766; died at Berlin in 1846. From 1816 to 1822 he was tutor to the princes of the Prussian royal family. In 1821 he became a professor at the University of Berlin. His chief work is his Handbuch der mathematischen und technischen Chronologie (2 vols., 1825–26; 2nd edn., 1883), which he also issued under the title Lehrbuch der Chronologie (Berl. 1831), an excellent work which affords the historian as well as the astronomer a clear view of the different modes of reckoning time among ancient and modern nations. Die Zeitrechnung der Chinesen (Berl. 1839) forms a continuation of this work. His other works include Historische Untersuchungen über die astronomischen Beobachtungen der Alten, and Untersuchung über den Ursprung und die Bedeutung der Sternnamen.

IDENTITY, System of. See Schelling.

IDES, or Idus, with the Romans, the fifteenth day of March, May, July, and October. In the other months the thirteenth was the ides. The *ides* of March, on account of Cæsar's assassination having taken place on that day, was an *ater dies* or black day, and was called *parricidium*. The senate was not allowed to sit on that day. See Calendar.

IDIOT (Greek *idiōtēs*, originally a private person, hence a non-professional, a layman, a rude, ignorant, awkward, stupid person). In medicine, Idiocy, Imbecility, and Feeble-mindedness are generally classed together and in this order, implying different degrees of mental incapacity, idiocy being properly, but not always exclusively, applied in the case of those who are absolutely incapable, from whatever cause, of acting in any way for themselves. The gradations between the three conditions are of course infinite, and they considerably overlap each other. Varying degrees of capacity are met with, from the mindless, almost instinctless, being who cannot help himself in any way, who does not react to any kind of sensation or emotion, and who leads a mere vegetable existence, through the ranks of the Imbeciles who can take some little care for and interest in themselves, who can be taught a varying amount with patience, can feel some slight emotion, and recognize those who are kind to them, up through the class of the Feeble-minded, who are capable of further development still, and who form a large proportion of the useful drudges of homes and institutions, and who are to be met with in many villages and scattered places, and so by gradations to the normal state of intelligence. In connection with the latter two classes it is perhaps worthy of note that many examples are met with in the isolated farms of South Africa. Modern writers classify the causes of idiocy under prenatal and postnatal causes, the former including heredity, injury, protracted and premature labour, maternal shock, and acquired diseases, as syphilis, alcoholism, or gout; the latter, such causes as convulsions, injuries to the head, shock, overwork, epilepsy, or even actual attacks of insanity. There are many subdivisions, chiefly named after the causes, or some special symptoms or characteristics of the cases. All, or nearly all, idiots present some sort of abnormality, large heads, small heads, high palates, large ears, receding chins, faces lacking in expression, or marked with ferocity, apathy, cunning, or vindictiveness. Many suffer from various kinds of paralysis, many are deaf, many dumb, and some blind. Many sit passively and are almost insensible to heat and cold, are deficient in the principal senses, and the worst cases are dirty in their habits, cruel to those weaker than themselves, and incapable of affection. Idiots are not as a rule long-lived. Their brains are seldom found to be normal—softening, irregular hardening in patches, excess of fluid, alterations of convolutions, and tumours being the chief *post-mortem* characteristics.

The question of the education of these afflicted ones has been attracting much attention of late. It has been found in various idiot homes and establishments that if cases are carefully selected, great benefit may be done to many children that at first sight seem almost hopeless. Much has been done in many of these, and more is being attempted. The simple exercises of the kindergarten and the small lessons that may be taught in form, colour, notation, &c., with simple apparatus, almost without the child knowing that it is learning, are very useful, while music, musical drill, and singing are also of great value. The initial difficulty apparently is fixing the attention of these children. This once gained, a system of small rewards and encouragements often serves to keep it up, and the results obtained are often most satisfactory, or comparatively so. Idiots are classed in law as infants.

IDOLATRY is the worship of the Deity or of a deity under a visible form, and from the point of view of the Christian or any other religion which rejects the worship of images, consists in worshipping as God what is not god. With regard to the origin and character of idolatry, the views of theologians naturally differ from those of philosophers and historical inquirers. The Christian religion conceives idolatry as a declension from the one true God, sees in the various forms of heathen worship only more or

less complete degradations of an original revelation, and ascribes to it the same origin as to sin. Philosophy and historical science, on the other hand, see in idolatry an innate searching after God, and accordingly the first stage of human development, the necessary beginning of a knowledge of God. Idolatry may assume various forms. One nation seeks its god in the powers of nature, worships the heavenly bodies and the elements, and creates for itself a nature-worship; another develops a hero-worship, and a third has merely an animal and image worship, the lowest form of which is Fetichism (see FETICH). It is to this last and rudest form of idolatry, that consisting in animal and image worship, that the name of idolatry is sometimes confined. The worship of images which is practised in some Christian churches cannot be called idolatry, since there, though a kind of worship is paid to the images as representing saints and martyrs, the worship is not such as is paid to God. See ICONOLATRY.

IDOMENEUS, son of Deucalion, and grandson of Minos, king of Crete. He was remarkable for his beauty, and was one of the suitors of Helen; he, however, continued a friend of Menelaus, and often visited him in Lacedæmon. With Meriones he led the Cretans, in eighty ships, to Troy, and distinguished himself by his valour. After the conquest of Troy he embarked with Nestor, among the first of the Greeks, and according to the first Homeric tradition was assailed during the voyage by a violent tempest. To escape from it he made to Poseidon (Neptune) the rash vow that he would sacrifice to him the first person whom he should meet. The storm abated, and he arrived happily at the port; but the first person he met was his only son, who had heard of the arrival of his father, and came to welcome him. Nevertheless, Idomeneus sacrificed him. His subjects, who feared the vengeance of the gods upon their land for such a deed, rebelled, and drove him from the island. He went to Italy and founded the city of Salentum, where he introduced the laws of Minos, and was honoured as a god after his death. According to other historians, he was driven from Crete by Leucus, and went to Colophon, where he died, and was buried on Mount Cercaphus. Homer, however, knows nothing of the vow, but makes Idomeneus return safely to Crete, and Diodorus adds that he died there quietly, after a long and peaceful reign; that he was buried near Gnossus, and received divine honours.

IDRIA, a town in Austria, in the Duchy of Carniola, and the circle of Adelsberg, 21 miles southwest of Laibach, in a basin hemmed in by wooded mountains. It has manufactures of linen and silk goods, and lace, but its chief claim to notice is its mines of quicksilver, which, directly or indirectly, furnish employment to the greater part of the inhabitants; and, after those of Almaden in Spain, are the richest in Europe, yielding annually about 500 tons of mercury and about 25 tons of cinnabar (red sulphuret of mercury). The mines were discovered in 1497 and first worked in 1510. The rock in which the quicksilver occurs is Jura limestone, and the seam consists of a black schist, in which the metal is found both in the state of cinnabar and of native quicksilver, which may be seen in glistening drops among the schist. The mines are easily visited, the descent being by stone steps; the depth is about 240 fathoms. The furnaces are about a mile from the town, and the whole process of extracting, roasting, and smelting the ore is very curious. Unfortunately, it is very prejudicial to health, and few of those employed in it reach the natural term of human life. The number of miners is about 600. Pop. (1900), 5772.

IDUMEA. See EDOM.

IDUNA. See NORTHERN MYTHOLOGY.

IDYL, derived from a Greek diminutive, meaning a 'little picture or image,' is the name originally and still most usually applied to a short and highly finished descriptive poem, especially if it treats of pastoral subjects. This last circumstance is not, however, an essential character of the idyl. All that is necessary to constitute a poem of this class is that it presents to view a complete picture in small compass, and accordingly the idyl may refer to a great variety of subjects, and the fact that the subjects of idyls are usually pastoral is due to this, that pastoral life, at once simple and picturesque, affords the best material for such short descriptive poems. The term idyl is sometimes used even more extensively but in a manner so capricious as to be incapable of definition.

IEISK, YEISK, or EISK, a seaport of Russia, in the Kuban territory, on a tongue of land projecting into the Sea of Azoph. The town was laid out only in 1848, but has rapidly increased, and now has nurseries, tanneries, tile-works, oil-mills, soap-works, &c., and a considerable trade. Pop. (1897), 35,446.

IEKATERINBURG. See EKATERINBURG.

IEKATERINODAR. See EKATERINODAR.

IEKATERINOSLAV. See EKATERINOSLAV.

IELETZ, or YELETZ, a town of Russia, in the government of Orel, at the confluence of the Ieletz and Lutchka. It is old, but is regularly built, and has flourishing manufactures, and an extensive trade. Pop. (1897), 37,445.

IFERTEN. See YVERDUN.

IFFLAND, AUGUST WILHELM, a celebrated German actor and dramatic writer, born at Hanover, April 19, 1759. His taste for the theatre manifested itself in his infancy, and he was so much affected by the representation of the Rodogune of Corneille, that his parents would suffer him to be taken to the theatre but very rarely. Nothing, however, could prevent him from indulging his natural inclination; and his father having declared that he would never permit him to be an actor, he left home privately, and made his debut at Gotha in 1777. When this theatre was dissolved he went to Mannheim in 1779, and in 1796 was invited to Berlin to take the direction of the theatre there, and in 1811 was appointed general director of all the royal plays. He died Sept. 22, 1814. As an actor Iffland was characterized less by poetic interpretations or by fire and strength of imagination than by a careful attention to details arising from a minute and critical study of his parts. In this respect Madame de Staël said of him, that there was not an accent or a gesture for which he could not account as a philosopher and an artist. He was no less famous as an author than as an actor. His writings are chiefly dramatic pieces—domestic comedies. In these he exhibits himself as an able and attractive painter of manners, and shows great knowledge of human nature, and above all, skill in adapting his pieces to the stage. Of his numerous comedies, Die Jäger, Dienstpflicht, Die Advocaten, Die Mündel, and Die Hagestolzen, may be mentioned among those which still find a place in theatrical repertories. An edition of Iffland's works was published under his own direction, with an autobiography, at Leipzig, between 1798 and 1802. Two additional volumes were published in 1807 and 1809. Selections from his works have been published on several occasions.

IGLAU, a town in Moravia, on a height above the right bank of the Iglawa, 49 miles W.N.W. of Brünn. It is the second largest town in Moravia, consists of the town proper, and of three suburbs; and though the streets are somewhat uneven, is tolerably well built. The principal edifices are the handsome Gothic church of St. James, with a fine altar-piece; the church of St. Ignatius, with fine frescoes; the Jesuit

church; the town-house, courthouse, gymnasium, and other educational institutions. The cemetery of Iglau, intersected by rows of old lime-trees, is well laid out, and contains many remarkable monuments. The staple manufacture is woollen cloth, which employs numerous hands both in the town and vicinity. Before the town stand two granite columns, one of which marks the boundary of Moravia, and the other the spot on which Ferdinand I. in 1527 took the oath to the estates of Bohemia. Pop. (1900), 24,387.

IGLESIAS DE LA CASA, José, one of the best Spanish eighteenth-century poets, born in 1748 at Salamanca, pursued his studies at the university there, along with his friend Melendez, and other youths distinguished by poetical talent, who formed what is called the Salamantine School, and modelled themselves almost exclusively on the classic poets of their native land, and more especially on Balbuena and Quevedo. After leaving the university he took orders, and performed the duties of a country curate in the bishopric of Salamanca till his death in 1791. His poems were first collected and published in 1798. They have since been often reprinted, and many of his pieces have become like ballads in the mouths of the people. His style is remarkable for its classic purity, his versification is light and easy, and his whole spirit is so completely national that Spanish critics have given him, not without cause, the surname of the modern Quevedo.

IGNATIUS, St., Bishop of Antioch, said to have been a disciple of the apostle John, and on that account reckoned among the number of the apostolic fathers. He was surnamed Theophorus, or Deifer, which he himself explained as meaning, 'bearing God in his heart.' His life and death are wrapped in fable. According to the most trustworthy tradition he was appointed Bishop of Antioch A.D. 69, and was thrown to wild beasts in the circus of Antioch by the command of Trajan, about the time of that emperor's expedition against the Armenians and Parthians. Another account places his execution at Rome. The year of his death is variously stated; by some A.D. 107 is given as the date, by others it is placed so late as A.D. 116. By the Greek Church his festival is celebrated on the 20th of December, by the Latin on the 1st of February. In the literature of the early Christian church Ignatius holds an important place as the reputed author of a number of epistles. These have come down to us in three forms. In the longest text they are thirteen in number, but since the discovery of a shorter text containing only seven (addressed respectively to the Ephesians, Magnesians, Philadelphians, Trallians, Smyrnæans, Romans, and to Polycarp), the first has been universally recognized as in great part spurious, some of the letters entirely so, and others containing interpolations. But even in this shorter form the genuineness of the Ignatian epistles has been disputed by numerous scholars. Both of these texts are in Greek, but a still shorter text in the Syriac language, containing only three letters (to the Romans and the Ephesians, and to Polycarp), and even these in a shorter form, was published in 1845 by Cureton, and again, with a greater abundance of editorial aids, in the Corpus Ignatianum (London, 1849). There has been much discussion as to the genuineness of these shorter collections. Some scholars maintain the Syriac text to be the earliest, and regard the Greek text of the seven epistles as an expansion of the Greek originals of the Syriac. At present the prevalent belief is that the seven are genuine, and the Syriac an abridgment of them. An edition of the Greek text of the seven epistles was published at Amsterdam by Isaac Voss in 1646, a Latin translation of the same having been published at Oxford in 1644, with a dissertation by Archbishop Usher. An English translation by Archbishop Wake was published in 1693. Bishop Lightfoot's edition of the Greek text in his Apostolic Fathers, Part II. (S. Ignatius and S. Polycarp, 1889), supersedes all others, and gives a full discussion of the subject.

IGNATIUS LOYOLA. See LOYOLA and JESUITS.

IGNEOUS ROCKS. See GEOLOGY.

IGNIS FATUUS, a luminous appearance seen floating over marshy places, and sometimes, it is said, in churchyards. It is probably due to some phosphorescent gas, but it has never been satisfactorily explained.

IGNITION (glowing heat) denotes that state of certain bodies in which, from being exposed to a high temperature, they appear luminous. Two kinds of ignitible bodies are distinguished; namely, such as become entirely changed by ignition, as charcoal, sponge, &c., and such as retain their former state, as iron, for example. The first is a regular combustion, in which, however, no flame rises from the bodies. The second is a mere heat. Of the metals, many liquefy before they become ignited; for example, lead and tin. Iron, on the other hand, becomes ignited long before it melts. Three stages of ignition may easily be distinguished. Iron, at about 770° of Fahr., becomes brownish red, which is the commencement of ignition. At a higher temperature it becomes red hot; at about 1000° of Fahr. it becomes white hot, and emits a very white, brilliant light. If gradually cooled ignition diminishes in the same inverse order. In this gradual transition we perceive all the different colours of light.

IGNITION, SPONTANEOUS. See COMBUSTION (SPONTANEOUS).

IGNORANCE OF THE LAW. This is held to be no excuse for any breach of the law. Ignorance of *facts* may be pleaded in excuse of any such breach, but not ignorance of the law, and this applies both to civil and criminal cases. Thus if any one acting under a mandate continue to act after the death of the person from whom the mandate was received, not knowing the facts of his death, then the acts performed under the mandate are valid, just as if the death had not taken place, but if the person so acting was aware of the death of the other, and continued to act under the mandate in ignorance of the fact that his powers ceased at the death of the mandant, then the acts which he performed under the mandate are invalid. Again, in a criminal case, where, for example, a man kills a member of his own family in his own house by mistake for a housebreaker, that is mistake of the fact not of the law, and the action is not a criminal one; but it is criminal if he kills an excommunicated or outlawed person under the idea that he has a right to do so. In petty offences, however, punishable by justices, the principle of *bona fides* is often applied to modify the strictness of the principle that ignorance of the law is no excuse, and when the ignorance of the criminal with regard to the law has been satisfactorily shown, the judge will usually take this into account in passing judgment.

IGNORANTINES, or FRÈRES DES ÉCOLES CHRÉTIENNES, a religious congregation devoted to the education of children. It was founded about 1680 by the Abbé de La Salle. The statutes of the order, approved by Benedict XIII. in 1724, impose on its members vows of chastity, poverty, obedience, and steadfastness, and also require of them the giving of instruction gratuitously. The first school founded at Paris by the members of this congregation was in the parish of St. Sulpice about 1688. In 1770 the superior-general established the seat of the order at Rheims, but some years later it was removed to

Melun. In 1789 the order counted 1000 members, and possessed 121 houses. The members of this order refused the oath at the time of the civil constitution of the clergy, and were forced to quit France. They returned after the conclusion of the Concordat of 1801, and re-opened their schools at Lyons, St. Germains, and then at Paris, but did not resume the dress of their order till 1805. The decree of the 17th of March, 1808, which founded the university, gave them a legal existence. In 1819 they established the residence of their novices at Paris. The opposition to the government of the restoration, wishing to cast upon this order part of the unpopularity which attached to the party in power, called the members in derision Frères ignorantins, but they themselves had assumed this title in token of humility long before the revolution.

IGUALADA (ancient *Aquæ Latæ*), a town in Spain, in Catalonia, in the province of Barcelona, in a well-watered valley 36 miles W.N.W. of the town of Barcelona. It consists of an old town, with narrow winding streets and antiquated houses, and a new town, in which the streets are generally spacious and the houses handsome. The principal building is an ancient Gothic church, with some good sculptures. The manufactures, chiefly woollen, have lost their importance since the American colonies became independent. Pop. (1897), 10,419.

IGUANA, a genus of saurian reptiles, the type of the extensive family of the Iguanida (which see), is a native of Brazil, Cayenne, the Bahamas, and neighbouring localities in the New World. It was formerly very common in Jamaica, but is now becoming gradually rarer. It has a lizard-like form, with a long tail, and an average length of about 4 feet, though it sometimes reaches a length of fully 6 feet. Its head is large, and covered with large scales; the mouth is wide, and studded around the edge with teeth, round at the roots, swollen and slightly compressed at the tip, and notched on the edge. The palate is generally furnished with rows of small teeth. The food of the iguana consists almost entirely of fruits, fungi, and other vegetable substances, though it occasionally feeds on eggs, insects, and various animal substances. When domesticated it eats leaves and flowers. Along the whole length of the back to the tip of the tail there is a crest of elevated, compressed, pointed scales, while over the lower part of the head and neck there is a deep, thin, dew-lap or throat-pouch, the border describing a curved line, and dentilated at the part nearest the chin. The toes of the feet, five in number, are furnished with sharp claws, which enable it to climb trees with ease, while a rapid serpentine movement of its tail propels it swiftly through the water, immersion in which for an hour it has been known to endure with perfect immunity. Its usual colour is dark olive-green, but it varies in the same individual, being affected by weather, locality, or temper. Its flesh is considered a delicacy, being tender and delicately-flavoured, resembling the breast of a spring chicken, and is freely used by all classes of persons. The animal, therefore, is keenly hunted, being taken by means of a noose thrown over its neck, or by nets. Dogs are trained to run it down and secure it without killing it. The eggs, of which the female lays from four to six dozen, are also eaten, having an excellent flavour. They are about the size of those of a pigeon, are laid in the sand, and hatched by the heat of the sun. There are peculiar constitutions, and certain forms of disease, on which the flesh and eggs of the iguana act injuriously.

IGUANIDA. A family of Lacertian reptiles belonging to that group which possesses a columella (*Kionocrania*), whose vertebræ are concave anteriorly (*Procœlia*), and which have epidermic plates on the head. The family is properly restricted to arboreal forms, the terrestrial genera belonging to the group *Agamida*. The family characters of *Iguanida* are: body rounded, moderately thick, sometimes laterally compressed and furnished with a ridge, vertical plate, or serrated crest along the middle line of the back from snout to tip of tail, and even on the under surface of the tail, the head in some elevated, helmet-like; throat-pouch or dew-lap occasionally present. Some change colour, chameleon-like. The dentition is either acrodont, the teeth being placed on the summit of the jaw, or pleurodont, when they are borne by an outer lateral plate. The former condition is found in *Histiurus, Chlamydosaurus, Draco*, the latter in *Iguana, Basiliscus, Cyclura*. The dew-lap is a singular structure, very bovine in *Iguana*, but in the Dragons (*Draco*) reduced to a conical sac, not hollow, and not in any way connected with the larynx. The scales vary in character, being, in *Iguana*, polygonal, or rounded on the head, and tuberculous or carinated; small and circular on eye-lids, large quadrangular on lips; rhombic and diagonally keeled on the under surface of the body. To these examples of variation in size and shape must be added the thick, conical, laterally compressed spines which traverse the middle line from the skull to near the tip of the tail. The anterior teeth of Iguana are rounded on the summit, the posterior assuming more and more distinct serrations. The type species, *I. tuberculata*, attains a length of five feet. It is of a greenish tint, yellow predominating on the under surface of the body, blue modifying that of the upper. The sides are marked with yellow zigzags, in the middle of which is a dark brown band. The tail is surrounded by alternate brown and yellowish-green bands. The pleurodont *Iguanida* are all American, and this character of teeth among the *Agamida* likewise coincides with American distribution. The genus *Draco*, whose metropolis is in Asia, is remarkable for the possession of a patagium or parachute-like expansion of the integument of the sides of the body from the shoulder to the flank. The membrane is supported by rib-like processes, and is not a wing, but simply when expanded allows the animal to glide through the air from a higher to a lower level. Some of these forms are smaller than many tropical butterflies, and their colourings are similar to those of nocturnal moths. The *Agamida* have as a rule shorter limbs and tails, flat bodies, and spines scattered over the surface. The outer aspect of the genera ranges from that of the ordinary lizard to one strikingly like that of the toad. The *Agama* has a collaret of spines; the Egyptian *Uromastyx* has, as its name indicates, only caudal circlets of spines; the Australian *Moloch* and the American *Phrynosoma* are set all over with dermal spines, from which a thin epidermal sheath may be removed. The *Agamida* are not of special value, but *Iguana* is highly prized as an article of food. The dropping of the tail so frequent among the *Iguanida* either after an injury or when the member is seized is associated with the presence in each vertebra of an unossified septum equidistant from either end. Through this line of weakness the appendage breaks, and the fracture being an irregular one there is no hemorrhage. The lost portion is reproduced, but does not for a long time attain the dimensions of the rest of the tail.

IGUANODON. This, the largest known quadruped, was a denizen of South England during the later Tertiary times. It belongs to the group of *Ornithoscelida* (*Dinosauria*, Owen), an assemblage of reptiles whose pelvic bones are strikingly like those of birds, especially in the elongation and slenderness of the ischium, and in *Iguanodon* there is midway in

its length the obturator process as in birds. Other details of arrangement of the bones in the hind limb are characteristically ornithic, and unlike those in any living reptile. The integument of Iguanodon does not seem to have possessed the spines or bony plates of allied species. The anterior vertebræ were slightly amphicœlous or biconcave; the posterior flat. The premaxillæ were beak-like and without teeth, and the lower jaw is notched for the reception of the beak, as in the parrot. The teeth were large and broad, implanted in sockets, but not anchylosed to the jaw. They were transversely ridged, at first trenchant, but becoming ground by friction so as to present a surface as varied as that of the ruminant, to which there is this additional resemblance, that the former has a process answering to a third trochanter. The size attained by these reptiles was overestimated by Mantell and Buckland at 70 feet: Owen's calculation is 30 feet, a size still gigantic enough to impress strongly on the imagination the extent of that continent which formed the dry land of the cretaceous ocean and the abundance and large dimensions of its vegetation.

IHRE, JOHAN, a Swedish scholar, born at Lund on March 14, 1707; died on Dec. 1, 1780. Educated at Upsala University, he travelled in Denmark, Germany, and England (1730–33), and on his return to Sweden became librarian at Upsala, and then obtained in 1737 a chair of literature and politics in the university of that city. In 1756 he received the title of councillor, and in 1759 was made a Knight of the Polar Star. Ihre was one of the most learned men, and one of the most sagacious critics of his time. The lectures which he delivered at the University of Upsala attracted large bodies of students, and secured him a place in literature corresponding to that which was held at the same time by Linnæus at that university in science. With the view of obtaining a more perfect knowledge of the Swedish language he studied the Icelandic, Germanic, Anglo-Saxon, and Mœso-Gothic languages, and made investigations on the history, manners, customs, and modes of thought of the Swedes in the Middle Ages. The result of these studies was the preparation of his most important work, called Glossarium Suiogothicum, a Swedish-Latin dictionary (Upsala, 1769), for the publication of which a sum of money was granted by the state. It was Ihre who first threw light upon the Icelandic Edda, in a series of letters addressed to the historian Lagerbring (Stockholm, 1772). His other works are very numerous.

ILDEFONSO, ST., a village, containing La Granja, a royal palace of the King of Spain, in Old Castile, built in a mountainous country, by Philip V., in imitation of Versailles, 6 miles north-east of Segovia, 40 north by west of Madrid. The exterior of the palace is not very magnificent, but the interior contains a great number of valuable paintings, statues, &c. The gardens are very magnificent, being the chief ornament. The elevation of the palace above the sea is 3840 feet, the highest royal residence in Europe. Pop. (1897), 3490.

ILEUM. See INTESTINE.

ILEX. See HOLLY and OAK.

ILFRACOMBE, a seaport and market town in England, in the county of Devon, on the Bristol Channel, 41 miles N.W. Exeter; consists mainly of one street about 1½ mile in length, extending along the sea-shore, with several terraces on the higher grounds, and is very picturesquely situated. Trinity Church, restored in 1878, is of considerable interest, and the town-hall, market-hall, cottage hospital, Victoria Promenade, may also be mentioned. There is an inner harbour protected by rocky heights, and an outer harbour, formed by a fine wood and stone pier, was opened in 1874. There is an active trade in coal cattle, and agricultural produce with Welsh and Irish ports, and regular steam communication with Bristol and Swansea. In winter the port is much used as a harbour of refuge by Bristol Channel traders. There is also a successful herring-fishery here. Ilfracombe is much resorted to as a bathing-place and health resort; for the accommodation and recreation of visitors, hotels, lodging-houses, marine walks, and drives abound. As a port it was of considerable importance at an early period, having contributed six ships and eighty-two mariners to the fleet destined for the Calais expedition in 1346. Pop. (1891), 7692; (1901), 8557.

ILI, a river of Central Asia, partly in Chinese territory, but mostly in territory belonging to Russia. It is formed in Chinese Kulja by the junction of two streams, the Tekes and the Kunges, rising in the Thian-Shan Mountains, and the united stream flows westwards to Iliysk, where its direction changes to north-west, and it falls into Lake Balkash by several mouths after a course of about 800 miles, half of which is navigable for small craft. Its valley is fertile.

ILIAC PASSION, an ailment regarded by some as a distinct disease, though it is in fact the last stage of the severest forms of colic, and is often produced by mechanical obstruction. Acute pain, frequent vomiting, and hiccup are the chief symptoms. It is often fatal. Dilatation of the bowels by the bellows may produce good results; as a last resort gastrotomy may be attended with success. The disease is also called *Ileus*.

ILIAD. See HOMER.

ILISSUS, a rivulet which watered the plain of Attica, and flowed down from the Hymettus, laved Athens, and was lost with the Cephissus in the morasses.

ILITHYIA, among the Greeks, the goddess who assisted women in childbirth. When she was propitious she assisted the birth, but when displeased she retarded it. Homer speaks of two Ilithyiæ to which these different parts were assigned, but afterwards only one was recognized, a daughter of Zeus (Jupiter) and Hera (Juno), and sister of Hebe and Ares. In after-times she was almost identified with Artemis, both being maiden divinities, and the latter also sometimes lending her assistance to women in labour. In the Roman pantheon Lucina (by which sometimes Juno and sometimes Diana is to be understood) took her place as goddess of childbirth.

ILIUM. See TROY.

ILKESTON, a municipal borough of England, in the county of Derby, 8 miles E.N.E. of Derby, on a lofty hill. The church is a fine ancient edifice, partly built in the time of Stephen, with a lofty tower, erected in 1737. There are also a town-hall, a cottage hospital (1894), &c. The principal manufactures carried on here are those of hosiery, lace, and needles. A considerable number of the inhabitants are also employed in mining coal and smelting ironstone. The Erewash and Nutbrook Canals intersect the borough, and the Erewash Valley Railway has a station here. The town is also served by a branch of the Great Northern Railway. Pop. in 1891, 19,744; in 1901, 25,383.

ILKLEY, a town and health resort of England, in the county of York, 31 miles west of the city of York, on the right bank of the Wharfe, much resorted to by visitants to the hydropathic establishments of the neighbourhood (one of them being the well-known Ben Rhydding). A grammar-school was opened in 1893. In the district are Ilkley College and Convalescent Homes. Many Roman coins and other interesting relics have been discovered in the vicinity. Not far from Ilkley is the fine

old ruin of Bolton Abbey, or more properly Bolton Priory, supposed to have been built about the beginning of the twelfth century. Pop. in 1891, 5767; in 1901, 7455.

ILLAMPU. See SORATA.

ILLE-ET-VILAINE, a department in France, bounded on the N. by the English Channel and the department of Manche, E. by Mayenne, S. by Loire-Inférieure, and W. by Morbihan and Côtes-du-Nord. The greatest length from N. to S. is 75 miles; greatest breadth, 56; area, 2596 sq. miles. The coast-line is of very limited extent, and, except towards the east, where it is low and sheltered, is bristling with rocks, and lined with rocky islands. It, however, contains two tolerable harbours, that of St. Malo, and another in the Bay of Cancale. The principal rivers are the Rance and Couesnon, falling into the English Channel; and the Ille, a tributary of the Vilaine which also flows through the department, and falls into the Atlantic. These two basins are connected by the canal of Ille-et-Rance. There are numerous lakes, or rather large stagnant pools, within the department; and extensive marshes occupy a considerable portion of its surface. The marsh of Dol, covering 58 square miles of surface, is now drained, and forms a fertile plain. The soil of the department is generally of inferior quality, and the agriculture, owing partly to the excessive subdivision of the land into small patches, is very imperfect, but there are now manifest signs of improvement. Little more than one-half of the surface is arable, and nearly one-sixth of it is absolutely waste. The cereal crops consist chiefly of wheat, meslin, rye, and oats; other crops are buckwheat, hemp, tobacco, and flax. The apple and pear are diffused over the department, and from their produce some of the best cider and perry of France are made. Among domestic animals, the sheep are generally inferior; the horses and horned cattle, especially cows, are of a better description, and considerable attention is paid to the dairy. Much of the cheese made resembles Gruyère, and finds a ready sale. The minerals include iron, zinc, and lead, all of which are worked to a greater or less extent. The principal manufactures are leather, sail-cloth, sacking, and coarse linens, hats, sewing thread, cordage, and ship-biscuits. The department is divided into six arrondissements—Rennes, containing the capital of the same name; St. Malo, Fougères, Redon, Montfort, Vitré. Pop. in 1886, 621,384; in 1896, 622,039; in 1901, 613,567.

ILLEGITIMACY. See BASTARD, PARENT AND CHILD.

ILLINOIS, a river in the United States, formed by the union of the Kankakee and Des Plaines, in the north-east part of the state of Illinois, to which it gives its name. It flows thence south-west and south, diagonally, through the state, and falls into the Mississippi about 20 miles north-west of its junction with the Missouri, after a course of about 350 miles from the union of the two rivers by which it is formed; principal tributaries, the Fox and Vermilion. It is 1200 feet wide at its mouth, and is navigable to the entrance of the Vermilion, above which it is obstructed by rapids. A canal of about 120 miles in length connects the river with Chicago, on Lake Michigan.

ILLINOIS, one of the North Central United States, bounded on the north by Wisconsin, east by Lake Michigan and Indiana, south-east by Kentucky, from which it is separated by the Ohio, and west by the Mississippi, separating it from Missouri and Iowa; greatest length, 370 miles; greatest breadth, 160 miles; area, 56,650 square miles. The surface is somewhat hilly near the Ohio, and undulating towards the west; and a range of bluffs runs for a considerable distance along the margin of the Mississippi, sometimes rising abruptly from the water's edge, generally a few miles from it; but with these slight exceptions the whole state is one continuous plain, with a gentle inclination towards the south-west. It has a greater proportion of arable land than any other state of the Union. The soil may be divided into alluvium of inexhaustible fertility, some of it having produced Indian corn uninterruptedly, and without manure, for nearly a century; dry prairie ground rising from 30 to 100 feet above the alluvial soil, and almost equally valued, for although less fertile, it is also less subject to inundations; wet prairie land covered with coarse grass, and timber land, some portions of which are amazingly fertile. The only part of the state thickly wooded is the extreme south portion; everywhere else the prairies predominate. The principal rivers are the Illinois, which traverses the state diagonally north-east to south-west, Rock, Kaskaskia, and Wabash. About 200 miles above the mouth of the Illinois is a beautiful sheet of water called Lake Peoria, 20 miles long and 2 broad. Indian corn, oats, and wheat are the chief objects of cultivation, but rye, buckwheat, potatoes, turnips, cotton, hemp, flax, tobacco, castor-bean, &c., are also produced. The cultivation of the vine is making considerable progress. The forest trees are oak, walnut, ash, elm, sugar-maple, locust, hackberry, buckeye, sycamore, and white pine. The common domestic animals are abundant, and immense numbers of swine are reared on the mast of the forests. In the area of its coal-fields Illinois is second only to Pennsylvania, its annual production being over 20,000,000 tons. Lead and zinc are mined in the extreme north-west. Fire-clay, kaolin, copper, limestone, sandstone, and potter's-clay are also worked. The climate is generally healthy: average annual temperature 50° to 53° Fah.; but winter, especially in the north, is remarkably cold. The commerce and manufactures are rapidly developing. Springfield is the seat of government, and Chicago, on Lake Michigan, the principal commercial depot. The legislature consists of 51 senators and 153 representatives, and the state is represented in congress by 22 representatives, besides the usual two senators. It was constituted a separate territory in 1809, and admitted as a state into the Union in 1818. Pop. in 1890 3,826,351; in 1900, 4,821,550.

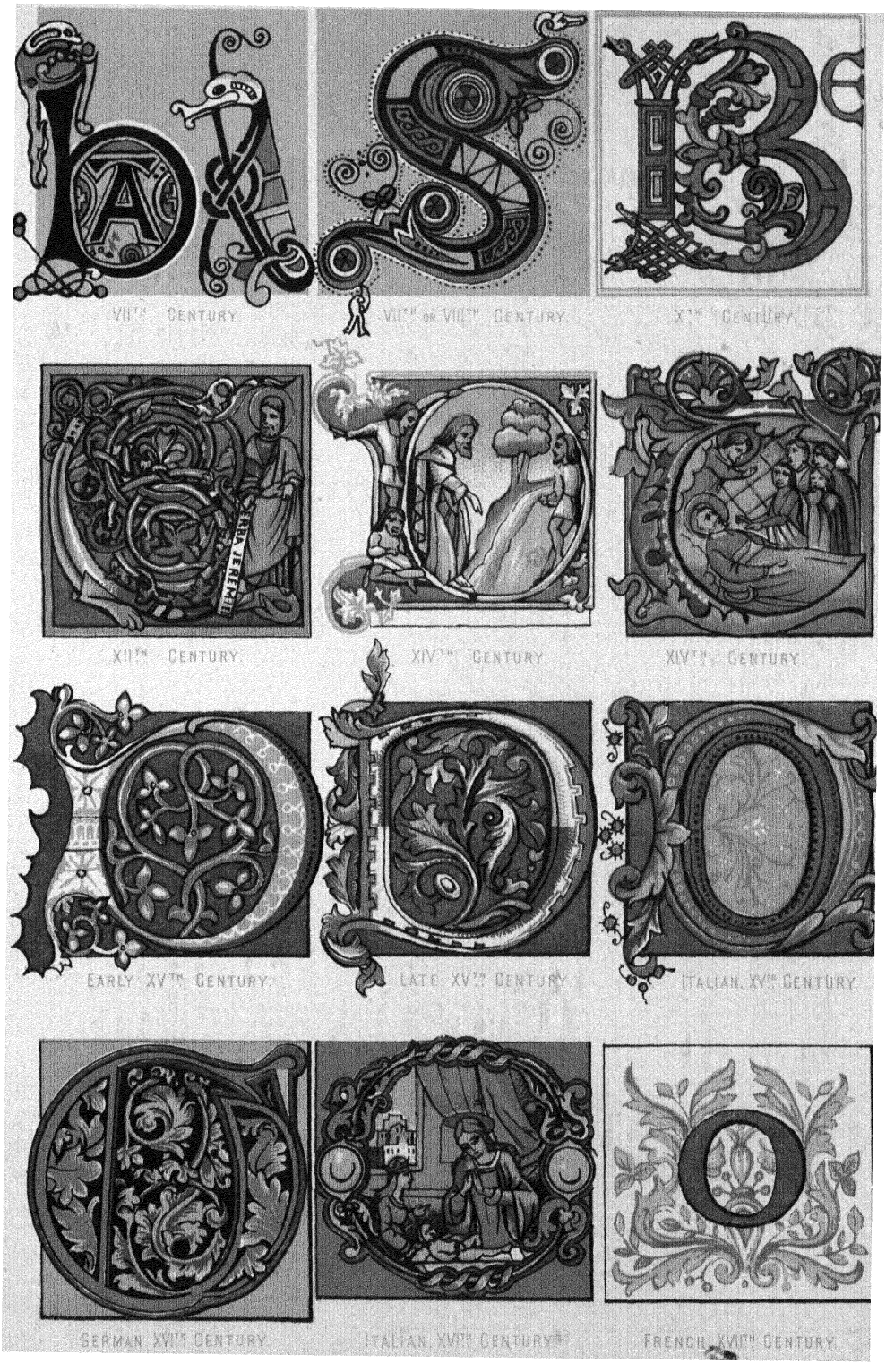
ILLUMINATI (that is, the enlightened), a secret society, founded on the 1st of May, 1776, by Adam Weishaupt, professor of law at Ingolstadt, for mutual assistance in attaining a higher degree of morality and virtue. It contained in its most flourishing condition 2000 members, among whom were individuals of distinguished talents and high rank. The constitution and organization were taken partly from the Jesuits and partly from the masons. In a comparatively short time, however, dissensions were introduced into the body, and the hostility of the government was brought down upon it. In 1784 it was dissolved by an order of the Bavarian government.

ILLUMINATING, the art of adorning manuscripts with small paintings, elaborate capital letters, and other ornaments in colour and in gold and silver paints, an art much practised in Europe during the Middle Ages, but not confined to this quarter of the world, and not even yet extinct in some Asiatic countries. See MANUSCRIPTS.

ILLYRIA (ancient Greek, *Illyris*; Latin, *Illyricum*, *Illyria*). The Illyrians, the ancestors of the modern Albanians, a nation of kindred origin with the ancient Thracians (mingled with Greeks, Phœnicians, Sicilians, and Celts), were spread over the whole coast on the east of the Adriatic, the neigh-

ILLUMINATING.

CAPITALS, CHRONOLOGICALLY ARRANGED



bouring islands, and Western Macedonia as far as Epirus. Philip, king of Macedonia, took from them the part of their country extending from Macedonia to the river Drinius (now Drino), and their country was then divided into Illyris Græca and Barbara (afterwards Romana). The former (modern Albania) was incorporated with Macedonia. It contained Dyrrachium (Durazzo), formerly Epidamnus, and Apollonia, a Greek commercial city of some importance, with an academy. The latter division extended from the river Arsia (now Arsa), in Istria, to the Drinius, and was divided into Japydia, Liburnia, and Dalmatia. Piracy was one of the principal means of subsistence of the Illyrians, whose kings, therefore, were frequently embroiled in quarrels with the Romans, which at last ended in the subjection of the Illyrians, under their queen Teuta, 228 B.C. The savage race sought, indeed, from time to time to shake off their chains; but being beaten by Cæsar, and greatly enfeebled by Augustus, Germanicus, and Tiberius, the country at last became a Roman province, and as such held a high rank, especially under the late emperors, when it supplied valuable recruits to the Roman armies stationed on the Danube and the Save, and on some occasions had an important political influence, as when the Illyrian troops raised Diocletian (a native of the province) and Maximian to the purple. The name, to which in the fourth century was added the epithet of *magnum* (great), included almost all the Roman provinces situated in the East. At the division of the Roman Empire Illyria fell to the empire of the West; but upon the overthrow of the latter in 476 it came to the emperor of the East. In the middle of the sixth century Slavonian colonists from Russia and Poland settled there, and soon succeeded in rendering themselves independent of the weak Byzantine government. Thus arose the small kingdoms of Dalmatia and Croatia, which, however, in 1020 again fell into the hands of the emperors. In 1090 the Venetians and Hungarians also made themselves masters of a small part of Illyria. In 1170 arose the Rascian Kingdom, from which afterwards Bosnia and Servia were formed. Dalmatia at first was taken by Venice, but in 1270 the greater part of it was conquered by the Hungarians, who penetrated to the Black Sea. Both they and the Venetians lost nearly all these conquests to the Turks; for the Venetians retained only a small part of Dalmatia, while Hungary kept possession only of Slavonia and a part of Croatia. The Peace of Campo-Formio, October 17, 1797, brought Venetian Dalmatia, and its islands as far as Cattaro, under the dominion of Austria. Twelve years later the old name of Illyria was revived by a decree of Napoleon promulgated October 14, 1809, declaring that the circle of Villach, Carinthia, what was formerly Austrian Istria, Fiume, and Trieste, the lands known by the name of the Littorale, and all that remained to the French on the right bank of the Save, Dalmatia, and its islands should bear the name of the *Illyrian Provinces*. This state of things lasted fifteen months, during which Illyria received an addition of 660 square miles by the annexation of a part of Italian Tyrol, ceded by Bavaria; when, April 15, 1811, appeared a decree of the French emperor definitively organizing the Illyrian Provinces in their military and financial concerns. The country independently of its great commercial cities and seaports, which were very important to the navy of an empire such as that of France was to be, had great internal resources. After the fall of Napoleon in 1815 the Illyrian Provinces were restored to Austria, and in 1816 were erected into the Kingdom of Illyria. In 1822 the kingdom was diminished by the separation from it of the Hungarian Littorale with Croatia; but in 1825, on the other hand, it received the addition of the whole of Carinthia. The kingdom was thus bounded on the north by Austria Proper and Styria, on the east by Croatia, on the south by Croatia and the Adriatic, and on the west by Venetia and the Tyrol. In 1849 the kingdom was dissolved and divided into the three administrative districts of Carinthia, Carniola, and the coast-lands (including Görz, Gradiska, Istria, and the town and territory of Trieste), so that the name of Illyria has once more disappeared from the geographical nomenclature of Europe.

ILMEN (formerly Moisk), a lake in Russia, in the government of Novgorod, near its western borders. It is nearly in the form of an equilateral triangle, at whose north angle stands the town of Novgorod. Its greatest length is about 33 miles; its breadth 28 miles. It receives numerous streams, and discharges itself by the Volkhov into Lake Ladoga.

ILMINSTER, a market town in England, in the county of Somerset, 17 miles south by east of Bridgewater. It has a fine cruciform church in the Perpendicular Gothic style, with an elegant tower; grammar-school and girls' grammar-school; reading-room, library, &c. Many females are employed in collar and cuff making; and there are flax-spinning and various other industries. Pop. in 1901, 2287.

ILOILO, a seaport on the south coast of Panay, one of the Philippine Islands, the second port of the Philippines. It is improving under the Americans, schools, electric light, &c., being established. Sugar is the chief export. Pop. 22.000.

IMAGE. When the luminous rays from an object are reflected or refracted in mirrors or lenses they enter the eye of an observer as if they had proceeded from a representation of the object. This representation is called the image of the object formed by the mirror or lens. More correctly, the image is the locus of the foci (or circles of least confusion. See FOCUS) of rays from consecutive points of the object. When the light rays actually pass through the points of the image the image is *real* and may be thrown upon a white screen. If no screen is interposed the image can be seen by an eye placed in the pencil of rays which pass through it. When the light rays do not actually pass through the points of the image, but diverge from one another on leaving the mirror or lens, the image is said to be *virtual*, and cannot be thrown upon a screen; it becomes visible to an eye placed in the pencils of rays which *appear* to have passed through it. The images formed in a camera-obscura, in the eye, and by the object-glass of a telescope, are real; the images formed in a common looking-glass are virtual. The phantom bouquet is the erect, real image of an inverted bouquet hidden under a table; it is formed by a concave mirror, and may be made to appear standing in a vase placed on the table. An image is usually of a different size from the object; it may be a distorted representation, it may be erect or inverted. See MIRROR, LENS, FOCUS.

IMAGES, ELECTRIC. When a small electrified body (an electrified point) is brought into the neighbourhood of an uninsulated spherical conductor the conductor becomes electrified. Poisson, employing very advanced mathematical methods, calculated the distribution of electricity on the surface of the sphere and the influence of the sphere on neighbouring bodies. Lord Kelvin later discovered that the influence of the sphere on all external bodies was exactly the same as that which a certain quantity of electricity situated at a certain point inside the sphere would have. This imaginary electrified point was called by him the electric image of the first. He developed this discovery into an easy geometrical method of great power for the solution of electrical problems.

'An electric image is an electrified point or system of points on one side of a surface which would produce on the other side of that surface the same electrical action which the actual electrification of that surface really does produce' (Clerk Maxwell).

The distribution of electricity (1) on a conductor formed of spherical and plane surfaces meeting at angles which are submultiples of two right angles; (2) on two conducting spheres in contact; (3) on an ellipsoid, on a disc, and on a spherical bowl; (4) on two neighbouring spheres (Poisson's problem), are notable problems which have been solved by Thomson's method (see Thomson and Tait's Natural Philosophy, Thomson's Electrostatics, Clerk Maxwell's Electricity and Magnetism).

IMAGE WORSHIP. See ICONOLATRY.

IMAGINARY QUANTITY. When the application of the rules for resolving algebraic equations leads to an operation that cannot be performed, the roots of the equation are said to be *imaginary*. The operation referred to is the extraction of the square root of a negative quantity. Thus in the equation

$$x^2 = -a^2,$$

to find the value of x we should require to take the square root of $-a^2$; and this is impossible. To indicate this impossibility the roots of the equation above are written thus: $x = +\sqrt{-a^2}$, $x = -\sqrt{-a^2}$, or more frequently and more neatly $x = +a\sqrt{-1}$, $x = -a\sqrt{-1}$. The name imaginary quantity is given to the $\sqrt{-1}$, and any algebraic expression containing $\sqrt{-1}$ is called an imaginary expression: thus $a + b\sqrt{-1}$ is an imaginary expression.

These imaginary roots have proved of great importance in algebraic geometry. In fact, the employment of imaginary quantities systematically is the foundation of some of the greatest modern discoveries and improvements in geometry. Even in algebra, although it is impossible to obtain a value for the expression, or to explain the meaning of it, yet it may prove of use in indicating how to alter the statement of a problem so as to obtain a real solution.

IMAGINATION, the faculty of the mind which forms images or representations of things. Besides the power of preserving and recalling such conceptions, the imagination has also the power to combine different conceptions, and thus create new images. It is this latter faculty which is more strictly termed imagination, another term, memory, being applied to that faculty by which we retain and recall more or less faithful copies of what we have previously perceived. In the creation of new images, or more properly in the combining of images which have previously been derived from objects of perception (for this is all the length to which the power of the imagination extends), the imagination operates according to the laws of the association of ideas. Its operations are nevertheless not wholly independent of the will) for by directing the attention to some leading thought the will can determine the limits within which the laws of association are to act. Such free and yet regulated action of the imagination alone can give birth to the productions of the fine arts. In this case it forms images according to ideas. It composes, creates, and is called the *poetical faculty*. From the twofold action of the imagination we may distinguish two spheres within which it moves—the prosaic and the poetical. In the former it presents subjects on which the understanding operates for the common purposes of life. Here it is restricted by the definite object for which we put it in action. In the latter it gives life to the soul by a free yet regulated action, elevates the mind by ideal creations and representations above common realities, and thus ennobles existence. Imagination operates in all classes, all ages, all situations, all climates, in the most exalted hero, the profound thinker, the passionate lover.

IMAM, IMAMODE, IMAN, a class of Mohammedan priests. In Turkey they attend in the *jamis* and mosques, call the people to prayer from the minarets, perform circumcision, &c. They are chosen by the people, and confirmed by the secular authority, under whose jurisdiction they also are in criminal and civil affairs. In ecclesiastical affairs they are independent, and are not subject to the mufti, though he is the supreme priest. They may quit their office and re-enter the lay order. They are distinguished by a wider turban of a different form from the common ones, and by their sleeves. They enjoy some privileges, and cannot be put to death without being stripped of their ecclesiastical dignity. The sultan, as chief of all ecclesiastical affairs, has the title of *imam*. In the sect of the Sunnites the title of imam is given to the most celebrated orthodox teachers. The Shiites apply it to a personage endowed with divine virtues, and possessing both spiritual and temporal powers. They recognize twelve of these, the last of whom they believe, having been driven from this world by the wickedness of men, will one day re-appear and once more cause justice to reign upon the earth.

IMAUS, a name applied by the ancients sometimes to the Hindu Kush and the western part of the Himalayan range, and sometimes in a vague way to a range in central Asia (supposed to be the Altaian Mountains), which they believed to divide the vast region to which they gave the name of Scythia, into two parts, whence they spoke of Scythia intra Imaum, and Scythia extra Imaum.

IMBECILITY. See IDIOT. In Scots law, a distinction is made between those who are absolutely fatuous and exhibit no signs of intelligence, and those who show some sparks of reason. The latter are capable of executing deeds of lesser moment, but the former are totally incompetent to act for themselves, and must have curators appointed to protect their interests. The person who is entitled to act in this capacity is the next male agnate or relation on the father's side, who is above twenty-five years of age, and is himself capable of managing his own affairs. Before the curator is appointed the judge-ordinary of the district within which the imbecile person resides has to hold an inquest to determine, first, the state of the fact as to the person's imbecility, and the time during which he has been imbecile; and second, who is the next male agnate upon whom the office of curator may be conferred. Where protection of an imbecile is required, and no remedy by the ordinary method of appointing a curator can be obtained, the Supreme Court has the power of appointing a judicial factor or *curator bonis*. In some cases the same person may be judged to have sufficient understanding to execute one class of deeds without being considered capable of executing another class. Thus he may be quite competent to make a testament which is revocable, and yet not capable of signing a deed preventing him from making a second testament, which would amount to depriving himself of all power over his own effects. As a general rule the court is ready to support the obligation of any contract that a person of weak mind has entered into, unless it is of such a nature that a person of sound mind would not have agreed to, or unless there is suspicion of fraud. An imbecile person may be summoned as a witness, but the degree of credibility attaching to his evidence naturally depends very much on the amount of intelligence he displays, and on the nature of the circumstances regarding which his evidence is offered.

IMBRO, or IMBROS, an island in European Turkey, in the eyalet of Djessair, west from the entrance to the Dardanelles. It is 18 miles long, east to west, 8 miles broad, and terminates west in Point Auflaka, and east in that of Basse. It is mountainous, rising in its loftiest peak to the height of 1959 feet; well wooded, and intersected with richly-fertile valleys, producing wine, honey, oil, cotton, and lead. It has only two towns or villages—Flio and Castro. Pop. 10,000, mostly Greeks.

IMERETIA, a Russian district, on the south side of the Caucasus, now included in the government of Kutais. It formed part of the Kingdom of Georgia in the fourteenth century, became afterwards independent, and in 1804 was voluntarily ceded to Russia by the last of its sovereigns. It is about 90 miles long from north to south, by 75 miles broad; has a generally mountainous surface intersected by numerous valleys, and owing both to the excellence of its climate and the fertility of its soil has in general a very luxuriant vegetation, producing abundant crops of wheat, barley, maize, tobacco, hemp, and madder. Fruit-trees grow almost everywhere, and the vine is often found entwining itself with the trees of the forest. A good deal of honey, wax, and silk are obtained. Pop. about 81,000.

IMMACULATE CONCEPTION. See CONCEPTION (IMMACULATE).

IMMERMANN, KARL LEBERECHT, a dramatic poet and writer of romance, born at Magdeburg in 1796, studied at the gymnasium there, and proceeded to the University of Halle to study law, but quitted it in 1813 to carry arms in defence of his country. He afterwards returned to Halle, where he completed his studies, and shortly after obtained appointments under government, first as referendary in Magdeburg, then in 1819 as auditor in Münster, and in 1827 as rural judge in Düsseldorf. Here, it is said from disinterested motives, he undertook the management of the theatre, which he hoped to make a model establishment for Germany. He did not prove successful, and was obliged to abandon the attempt after having suffered considerable loss. While employed with the compilation of his Memorabilien (Hamburg, 1840) he was seized with apoplexy, and suddenly cut off in 1840. At the commencement and towards the middle of his literary career he acquired considerable reputation, particularly by his dramatic poems. In his tragedies he made Shakspere his model, and imitated him with considerable success. His romance entitled Epigonen (Düsseldorf, 1836) possesses great merit, but in some parts is too close an imitation of Goethe's Wilhelm Meister. He displayed greater originality, and obtained still greater popularity, by his Münchhausen (four vols. Düsseldorf, 1838–39), abounding in excellent descriptions of village life. An edition of his works in 20 vols., with biography and introduction by Boxberger was published in 1883.

IMMERSION, in astronomy, the disappearance of one heavenly body behind another or in the shadow of another. Immersion occurs at the beginning, and emergence at the end of an occultation or an eclipse.

IMMORTALITY, exemption from death; the state of everlasting life. Immortality has a beginning, and thus differs from eternity, which has neither beginning nor end. Eternity is an attribute of God; immortality of some of his creatures, as, for instance, of the soul. The dogma of the immortality of the soul is very ancient. It is connected with almost all religions, though under an infinite variety of conceptions. By the immortality of the soul we understand the endless continuation of our personality, our consciousness, and will. Philosophers have endeavoured in different ways to prove the immortality of the soul—the anchor of man's hope amid the storms of life—in modern times particularly, from the immateriality of the soul. But this immateriality is not susceptible of rigorous proof, and, if it were, it would only follow that the soul need not perish with the death of the body. It might still pass into a state of unconsciousness, as in a deep sleep and a swoon, a state little better than annihilation; yet the idea that the dissolution of the body involves the annihilation of existence is so cheerless, so saddening, that the wisest and best of men of all ages have rejected it, and all civilized nations have adopted the belief of its continuation after death as one of the main points of their religious faith. There are so many reasons to render it probable, which are as convincing to most men as any strict proof could be, that with most nations the belief in the immortality of the soul is as clear and firm as the belief in a God; in fact the two dogmas are intimately connected in the minds of most men. The hope of immortality must be considered a religious conviction. Reason commands man to strive for continued perfection. This duty man cannot relinquish without abandoning at the same time his whole dignity as a reasonable being and a free agent. He must, therefore, expect that a continuation of his better part, as the necessary condition for his progress in perfection, will not be denied to him. Hence the belief in immortality becomes intimately connected with our belief in the existence and goodness of God. The perfection at which man aspires depends on the continuance of his individuality; and therefore he is hardly more startled by the doctrine of the materialist, who denies all difference between the mind and the body, than by the opinion which maintains that after death the soul of man loses its individuality, and is absorbed in the universal spirit. The noblest feelings are called into exercise by objects which affect man as an individual. Love cannot exist without individual objects of affection; and man trembles at the idea that the purest enjoyments of which he can conceive shall perish by the extinction of his individual nature. The proofs of immortality which the Scriptures afford are familiar to our readers.

The views of man in regard to the nature of his future existence are chiefly influenced by his ideas of the relation of the body to the soul. As soon as man begins to observe the peculiar operation of the soul the idea of its existence after death arises, and is supported by the emotions of hope and fear, by many inexplicable phenomena of nature, and even by illusions. At first this continuation of its existence is conceived of in connection with that of the body, and with a state of being not essentially different from the present, in which the hunter shall renew his chase, and his corporeal senses shall have their accustomed gratifications. This perhaps is the reason of the careful preservation of dead bodies at an early period. Subsequently a new and more finely organized body is conceived of, or the soul is represented as of a more ethereal substance (hence the name of *spirit, air,* or *breath* is commonly used in the more ancient languages to denote the soul); or as a shadow, which, being separated from the body by death, continues its existence by itself. In this case the life after death is also considered as a shadow of the present, as in the Greek mythology. Whilst the life of the soul was conceived of as connected with the earthly body, or with a new and ethereal body, it became necessary to assign a distinct place, different from that in which we live, for its habitation. The invisible world is conceived of by most nations at first as subterranean. In the more advanced stage of the progress of mankind the imagination attributes changes of condition to the future life, and the doc-

trine of the metempsychosis, or the progress of the mind in different stages, is now formed. See TRANSMIGRATION OF THE SOUL.

The belief in apparitions, in conjurations of the dead, and the influence of the dead upon the living, is intimately connected with the belief in immortality. The conception of the state of the departed depended of course upon the state of civilization, and what was considered as perfection here was believed to be enjoyed in the after life, whether this perfection were skill in hunting, or the intellectual enjoyment of knowledge. It was also natural that the after life should be considered as standing in connection with this; and thus morality, as well as the belief in the justice of the Ruler of man's destiny, created the belief of a retribution after death, which has also been considered according to the state of civilization in all possible gradations, from the coarsest bodily pain to the intellectual pain of exclusion from the presence of God; hence naturally arose the idea of places where this retribution was accomplished—hell and heaven. This idea of a state of retribution seems almost necessarily to imply the resurrection of the body. Connected with the belief in the immortality of the soul is the belief in a state where souls are purified after death, as existing among the ancient Egyptians, R. Catholics, &c. (See PURGATORY.) No religion teaches so pure a state of the soul after this life as the Christian, according to the gospel. One of the monstrosities of the French revolution was a decree denying the immortality of the soul, and declaring death to be an eternal sleep.

IMOLA (ancient *Forum Cornelii*), a town in the Kingdom of Italy, in the province of Bologna, on an island in the Santerno, 24 miles west by south of Ravenna. After the destruction of Forum Cornelii by Justinian it was founded under its modern name by the Lombards, and after passing through different hands was annexed to the Papal territory by Julius II. In 1860 it passed with the rest of the province of Romagna to the newly formed Kingdom of Italy. Besides its walls flanked by towers, it possesses an old castle situated on a commanding height, a cathedral and other churches, a college, public library, hospital, and theatre. A fertile plain in its immediate vicinity is covered with vineyards, and makes it the centre of a considerable wine trade. The population is about 12,000.

IMPACT is the impulsive action which takes place on the coming together of two bodies, one or both of which are in motion. If an ivory ball is allowed to fall on a marble table which has a very thin coating of oil, after impact the ball is found to have on its surface a circular patch of oil, which shows by its size that the ball must have been compressed during the short time of impact. When two bodies come into collision they compress each other at the parts in contact until they both have the same velocity; during this time of compression each body acts upon the other with exactly the same impulses, the momentum lost by one being gained by the other; if now the bodies are perfectly inelastic no further mutual action will take place, and they will keep together for the future; if the bodies are elastic they will regain their old shape, and the mutual impulsive forces of restitution will cause separation. The impulsive forces of restitution are found to be less than those of compression; that is (see IMPULSE), the momentum lost or gained by either of the bodies during the second or restitution part of the impact is less than the momentum lost or gained in the first or compression part of the impact in a certain ratio which is called the *elasticity* of the bodies. In a perfectly elastic body this ratio would be equal to 1, in a perfectly inelastic body it is 0.

Examples.—When an ivory ball comes into direct collision with a similar one of equal size at rest the first comes to rest and the second moves in the direction of motion of the first before impact, but with a slightly diminished velocity. When two similar and equal ivory balls come together with equal and opposite velocities each returns on its old path with a velocity slightly lessened. When one perfectly inelastic body overtakes or meets another directly the common velocity after impact is equal to the sum or difference of momenta of the bodies before impact divided by the sum of the masses.

In a collision of two balls not perfectly elastic it may be shown that the total energy of motion (see ENERGY) of the two balls after collision is less than it was before, some of it having been converted into heat.

IMPALEMENT (from *palus*, Latin, a stake), the putting to death by thrusting a stake through the body, the victim being left to perish by lingering torments, which sometimes last for days, and are aggravated by a feverish thirst. This manner of inflicting death was known to the Romans, though not practised by them. It was used by the Turks as a punishment for Christians who said anything against the law of the Prophet, who intrigued with a Mohammedan woman, or who entered a mosque. Soleyman, a young Mussulman, the assassin of General Kleber in Egypt, was impaled in the presence of the French army. Impalement was said to be one of the cruelties perpetrated by the Turks on the Bulgarians in 1876, but this seems not to have been clearly proved.

IMPANATION. See CONSUBSTANTIATION.

IMPANNEL. See JURY.

IMPEACHMENT. An impeachment is an accusation and prosecution for a crime or misdemeanor; but is distinguished from other criminal prosecutions, either by the tribunal before which the proceedings take place, the rank or office of the party accused, or the offence alleged, or by all these circumstances. The term impeachment is usually applied to prosecutions of judicial and executive officers for misdemeanors involving an abuse of their official functions, or immediately connected with those functions. The necessity of some tribunal distinct from the ordinary courts, for the trial of certain offences, or for any high misdemeanor in certain officers, is apparent, since the judges of the highest courts cannot in all cases safely be intrusted with the trial of each other; and if they could be so trusted, the duty of persons who are in the ordinary course of administration associated together in the exercise of their public functions, to try their fellows for offences involving not only reputation but life, would be most ungrateful, and too painful to impose, even if it could be supposed that justice would always be strictly administered; and besides, the ordinary judicial tribunals are not so constituted in all states as effectually to secure them against the influence and power of the officers of the state. The first object then in trials of this description is to bring them before a tribunal sufficient in authority to overawe any individual, however high or powerful. In countries governed by absolute monarchs, or those whose prerogatives overbear all other powers in the state, the practice is either for the sovereign himself to give decisions in those cases which are usually the subjects of impeachment, or to constitute tribunals for this purpose by special commission, which is in effect equivalent to the direct exercise of those judicial functions by the sovereign himself; for if he has any strong bias in the particular case, he will be influenced by it in the appointment of the judges, as much as he would be in the decision were he to act as judge himself.

But in every free government, that is, in every government under which each citizen knows no absolute sovereign but the law itself, and every one, whether ruler or ruled, is constrained to an unqualified submission to its sovereignty, there must be a permanent tribunal established by the fundamental constitution, for the application of the sovereign law to try the judicial and executive officers, in respect to acts done by them in their respective branches of the administration of the government. This is one of the indispensable parts of a well-constituted government, since it guarantees the sovereignty and the faithful administration of the laws. It is therefore a part of the government in which the whole people are as directly interested as in the establishment of the ordinary tribunals. In Great Britain the tribunal before which impeachments are tried is the House of Lords, and the impeachment is made by the House of Commons. The person impeached may be either a peer or a commoner; but while a peer may be impeached for any crime whatever, a commoner cannot be impeached for a capital crime. The method of procedure is this. A member of the House of Commons charges the accused with high crimes and misdemeanours, and moves that he be impeached. If the motion is carried the member is ordered to go to the bar of the House of Lords, and lay the impeachment before that tribunal. A committee of the House of Commons then prepares the articles of impeachment, which, after being discussed and agreed upon, are delivered to the Lords. The accused returns answers to each of the articles, and these answers are communicated by the Lords to the Commons, who may return replications if necessary. A day for the trial is then fixed by the Lords, managers are appointed, and the witnesses summoned. The Commons attend with the managers as a committee of the whole house. The lord high-steward presides at the trial. After the charges have been laid, and the answers of the accused heard, the lord high-steward puts the question whether the accused be guilty or not guilty of the crimes charged in the first article of impeachment to each of the peers in succession, beginning with the junior baron, and each of the peers answers 'guilty' or 'not guilty,' as the case may be, 'upon my honour.' The lord high-steward gives his own opinion after all the other peers. The same question is then put with regard to all the other articles of impeachment successively, and the result is declared by the lord high-steward. The question of guilty or not guilty is decided by a majority of votes.—In the United States the procedure is similar to that of England, the House of Representatives being the accusers and the votes of two-thirds of the senate being necessary for a conviction.

IMPERATOR, among the ancient Romans, originally applied to a military commander, one who held the *imperium*, or military power. Under the republic it became customary for the soldiers of a victorious general to salute him after a great battle with the title of *imperator*, but this custom involved the bestowal of no official designation. In later times no one received this title who had not defeated a hostile force of at least 10,000 men. After the overthrow of the republic imperator became the highest title of the supreme ruler. The successors of Augustus used it, and it expressed the same thing as the hated title of *king*. In still later times it had the signification which we attach to the word *emperor*. It was still given, however, to triumphant generals, and, in this case, had its old signification. The emperors appear to have used it because they were considered as superior to all the generals. In the times of the republic this title was placed after the name; for instance, *Cicero imperator;* as the title of an emperor it stood before the name. Imperator was a surname given by the inhabitants of Præneste to Jupiter, whose statue was carried to Rome and placed in the capitol by Titus Quinctius when he captured Præneste. See EMPEROR.

IMPERIAL CHAMBER. See CHAMBER (IMPERIAL).

IMPEY PHEASANT (*Lophophorus refulgens* or *Impeyanus*), a bird of the pheasant family (Phasianidæ) remarkable for the splendid colours and metallic lustre of the plumage of the male, whence it is called in India (of which it is a native) *monaul*, meaning bird of gold. It is found in the high and cold regions of the Himalaya. It is of the size of a small turkey. Its head is surmounted by a crest, from which circumstance it has obtained its generic name, signifying 'crest-bearing.' It obtained the name of Impey pheasant from the fact that Lady Impey was the first who attempted (unsuccessfully) to introduce the bird alive into Europe.

IMPHAL, or MANIPUR, a town of British India, capital of the state of Manipur, in the Manipur valley, between Upper Burma and Assam. It is the residence of a British political agent, and there are British cantonments; trade is restricted by defective communications. Pop. (1901), 67,093.

IMPRESSMENT OF SEAMEN, the act of compelling persons to serve in the British navy. The power of impressing seamen, though still existing, has fallen into abeyance since the long war ending in 1815. It is recognized in many statutes, such, for instance, as exempted certain persons from impressment, though the power of impressing is not expressly granted in the acts of Parliament. Sir William Blackstone says this practice is only defensible from public necessity, to which all private considerations must give way. Act 5 and 6 William IV. cap. xxiv. provides that no person shall be detained against his will in the naval service longer than five years except in cases of special emergency.

IMPRIMATUR (Latin, 'let it be printed'), the word by which the licenser allows a book to be printed in countries where the censorship of books is exercised in its rigour. An account of this worst species of tyranny has already been given under the head of BOOKS, CENSORSHIP OF (see also INDEX). Milton, in his eloquent speech for unlicensed printing, or Areopagitica, humorously describes this practice of licensing books, exhibiting a specimen of what he calls a quadruple exorcism, approved and licensed under the hands of two or three monks—'Let the chancellor Cini see if this work may be printed;' (signed) V. R., vicar of Florence. Then comes the chancellor—'I have seen this work, and find nothing against the Catholic faith and good morals;' (signed) N. C., chancellor of Florence. Then the vicar reappears—'Considering,' &c., 'this work may be printed;' (signed) V. R.; and, finally, Imprimatur, signed by the chancellor of the holy office in Florence.

IMPROPRIATIONS, in the English Church, benefices in the possession of laymen, those annexed to ecclesiastical corporations being called *appropriations*, though they are sometimes identical. Blackstone gives the following account of them. Benefices are sometimes appropriated, that is, perpetually annexed to some spiritual corporation, either sole or aggregate, which the law esteems as capable of providing for the service of the church as any single clergyman. This contrivance sprang from the policy of the monastic orders, who begged or bought all the advowsons within their reach, and then appropriated the benefices for the use of their own corporation. Such appropriations could not be completed without the king's license and the consent of the bishop,

When it was once made, the appropriators and their successors became the perpetual parsons of the church. Blackstone is of opinion that appropriations may still be made in this way. Those formerly made were originally annexed to bishoprics, prebends, religious houses, and certain military orders; but on the dissolution of the monasteries in the reign of Henry VIII. the appropriations of the several personages belonging to them were given to the king, and were afterwards granted out from time to time by the crown. It was after this time that the term *impropriation* was introduced to denote a benefice in the hands of a layman. The appropriator deputed some person to perform divine service in such parish, who, being merely his deputy or vicegerent, was called *vicar*, and his stipend was at the discretion of the appropriator. The distinction therefore of a parson (or a rector) and vicar is that the former is entitled to all the ecclesiastical dues of his parish, while the vicar is in effect only the curate of the real parson (the appropriator), and receives but a part of the profits.

IMPROVVISATORI, the name given in Italy to poets who compose and declaim extemporaneously a poem on any given subject, or sing it, accompanying their voice with an instrument. This art is said to have been introduced into Italy with the Provençal poetry in the twelfth century, and Petrarch appears to have practised it. In the fifteenth century the most renowned improvvisatori were Serafino d'Aquila and Bernardo Accolti. The most famous improvvisatore of the sixteenth century was Silvio Antoniano, who raised himself by his talents to the rank of cardinal. Among improvvisatori of the eighteenth century were Perfetti, Zucco, the lady improvvisatore Maddalena Morelli Fernandez (called Corilla Olimpica), and Metastasio. Metastasio at a very early period showed an extraordinary talent for this kind of composition, but the exercise of it cost him so much effort that from a regard to his health he was obliged to give it up. Even at the present day Italy abounds in this class of poetical composers. The printed works of the improvvisatori who have been most admired have never passed mediocrity.

IMPULSE, a very great force acting upon a body for a very short time, producing a definite change of motion. The strict definition requires the time to be indefinitely short, so that the force is supposed to be indefinitely great. An impulse, like other forces, obeys the laws of mechanics, but neither the force nor the time of its action can be observed, and therefore the impulse is measured by the whole momentum which it produces in the body on which it acts. Impulsive forces are usually so very great that they are never compared with ordinary forces. To cut iron it is necessary that the edge of a chisel should exert a very great force; this great force is an impulse obtained by striking the end of the steel chisel with a hammer (see IMPACT); when wood is to be cut, the force need not be so considerable, but it ought to act for a longer time; the proper impulse is obtained by striking a sharp wooden-handled chisel with a wooden mallet. The driving of a nail into wood, the dressing of different kinds of stone with chisels, the driving of piles, &c., give to an observer good notions of impulsive action.

IMPUTATION, as a term in Christian theology, is used by some divines to signify, on the one hand, the reckoning of the sins of man to Christ, and, on the other hand, the reckoning of the righteousness of Christ to believers. When sin is spoken of as imputed to Christ it is meant that the condition or state which was actually man's becomes by imputation judicially his, and thus in law Christ became fitted to be a sacrifice and sin-offering for man. Had he not been man's substitute by the imputation of sin he could not have become his substitute in the endurance of the penalty of sin. The two are inseparably connected. In the very same sense in which Christ was made sin men are made the righteousness of God in him. According to this view he was made sin, not actually and personally, but by imputation; and men are made righteousness, not actually and personally, but by imputation. The imputation of the sins of man to Christ was necessary in order to the satisfaction on his part, as man's substitute, of the demands of divine justice; and the imputation of Christ's righteousness to man is necessary to the satisfaction on his part of the demands of the law of God. This doctrine belongs especially to Calvinistic theology.

INA, or INE, king of the West Saxons in the seventh and eighth centuries. He succeeded Ceadwalla about 689, and after having obtained advantages over the people of Kent in 694, and obtained the supremacy of all the country south of the Thames, he turned his arms against the Britons, from whom he wrested Somersetshire, and other parts of the west of England. He then had to fight the Mercians, and the contest terminated by a bloody battle in 715. His death took place in 726, and shortly before this he resigned his crown and went as a pilgrim to Rome, where he passed the rest of his days in devotion. He is celebrated as one of the principal legislators of the Anglo-Saxons. Between 690 and 693 he published a series of laws, which are the oldest remaining to us of the Anglo-Saxon kings, except those of the kings of Kent, and served as the foundation of the code formed by Alfred the Great.

INACHUS, in Greek mythology, a river god, a son of Oceanus and Tethys, the founder of the first royal race of Argos. He is usually represented as the father of Io. When Hera (Juno) and Poseidon (Neptune) contended for the dominion of Argos, Inachus, who was the arbiter of the dispute, adjudged it to Hera, on which account Poscidon dried up the waters of the river in Argolis which was sacred to Inachus and bore his name.

INARCHING, the same as grafting by approach. See GRAFTING.

INCA, or YNCA, an appellation which the natives of Peru gave to their kings and princes of the blood. The Chronicle of Peru thus relates the origin of the incas:—This country had been a long time the theatre of all sorts of wars, horrible crimes, and dissensions, till at length there appeared two persons, Manco Capac and his wife Mamma Ocllo, who gave themselves out as children of the Sun who were sent by Heaven to instruct and civilize the natives. Manco Capac, it is further said, built the city of Cuzco, settled laws and policy, and taught them to adore the sun, and he and his descendants took the name of *inca*, which in the language of Peru signifies *king*, or *great lord*. These incas grew so powerful that they made themselves masters of the whole country from Chile to Quito, establishing in every province their peculiar policy and religious institutions, and held it till the dispute between the brothers Huascar and Atabalipa or Atahualpa, of which the Spaniards under Pizarro availing themselves, obtained possession of Peru, and put an end to the empire of the incas in 1533. Fourteen incas are enumerated in the chronicle, both Huasca and Atabalipa being reckoned in the number.

INCANDESCENCE. See LUMINOSITY.

INCARNATION (from the Latin *in*, in, and *caro*, *carnis*, flesh), a word used to express the descent of the Deity, or his manifestation in the flesh under the human form; thus we speak of the *incarnation* of Christ. (See JESUS CHRIST, CHRISTIANITY.) The

Hindus believe in innumerable incarnations of their deities. See AVATAR.

INCENSE, the name given to aromatic substances or compositions burned in religious rites or other solemn ceremonies on account of the sweet odour they emit. Certain resinous gums or balsams are commonly so employed, the heat being applied and the odour given out through the medium of a censer or thurible. (See CENSER, FRANKINCENSE.) The custom of burning incense is ancient and widely spread. Among the Jews the practice was enjoined as part of the worship of the sanctuary (Ex. xxx. 27), the ingredients of the incense also being laid down, and it was to be burned on a special altar called the *altar of incense*. This altar was made of acacia (shittim) wood, and was overlaid with gold, being hence called the *golden* altar, as distinguished from the altar of burnt-offering, which was made of brass. The incense was burned daily—morning and evening. In ancient Egypt, Assyria, Babylonia, India, Greece, and Rome incense-burning was part of the worship of the gods, and it is still employed as a part of the Buddhist ceremonial. Both the Greek and the Latin churches use incense in worship, but the practice cannot be shown to have existed among Christians till after the first four centuries at least. Among Roman Catholics it is used at every high mass, at consecrations of churches, in processions, funerals, &c. In the English Church it is only the high ritualistic section that make use of it, and recently this practice has given rise to a good deal of controversy and angry feeling. In 1899 the Archbishops of Canterbury and York held an inquiry on this subject and on that of processional lights, and the conclusion at which they arrived was that the use of incense in public worship, and as a part of it, was not permitted by the law of the church, though incense might lawfully be employed to sweeten the air of the building, outside of the ritual altogether. English clergy have therefore been requested to discontinue the use of incense in worship, and in most cases have complied. Incense-burning forms part of the ritual of the Catholic Apostolic (or Irvingite) body. According to Addis and Arnold's Catholic Dictionary, 'the mystical significations of incense are obvious. It symbolizes the zeal with which the faithful should be consumed; the good odour of Christian virtues; the ascent of prayer to God.' According to Walcott (Sacred Archæology), as anciently used in the Church, 'it mystically represented, (1) contrition (Eccles. xlv.); (2) the preaching of the Gospel (2 Cor. ii. 14); (3) the prayers of the faithful (Ps. cxli. 2; Rev. v. 8–24); (4) and the virtue of saints (Song of Songs iii. 6)'. The same writer states that 'Bishop Andrewes, Archbishop Laud, and George Herbert used incense, which was a common article of purchase in the churchwardens' accounts of the period'.

INCEST, sexual intercourse within the prohibited degrees, which by the laws of England and Scotland are founded on the Levitical code, and include degrees both of consanguinity and of affinity. (See Leviticus, chap. xviii.) In England incest is an ecclesiastical offence, and is left to the jurisdiction of the spiritual courts, the offender thus practically escaping punishment. In Scotland it is a capital offence, but ignorance of the relationship, the onus of proving which ignorance rests on the accused, exculpates, and the offence is not constituted by intercourse with bastard relations, however near. In nearly all countries intercourse between near relations, especially in direct descent, has been forbidden, but the prohibited degrees differ in different periods and countries. In some ancient nations, as Egypt, marriages between brothers and sisters were permitted. Marriages between uncle and niece, which are prohibited by the Levitical code, are lawful in some countries, and those with a deceased wife's sister are generally allowed, except in the United Kingdom. (See DECEASED WIFE'S SISTER.) Among modern nations the law differs considerably in its details. In general the code of the Roman Catholic Church is the strictest. It prohibits even degrees which are allowed by the Mosaic code, as first cousins; but such marriages are permitted by special Papal dispensation.

INCHBALD, ELIZABETH, a novelist and dramatic writer of great talent, was the daughter of a farmer named Simpson, and born at Stanningfield, in Suffolk, in the year 1753. She lost her father at the age of eight, and went to London in 1772 with the view of obtaining an engagement for the stage, where she married Joseph Inchbald, then an actor of some celebrity, and accompanied him on several provincial tours, partaking in his engagements. He dying in 1779 she returned to London, and made her debut at Covent Garden, Oct. 3, 1780. She continued on the boards about eight years, and from her great personal attractions, which she retained to a late period of her life, as well as from her natural talents, was a popular performer. After her retirement from the stage in 1789 she depended principally on her literary labours for support, publishing several dramatic pieces, most of which had a temporary success, while some are even yet considered as what are technically termed *stock plays*, among the latter of which may be mentioned, Such Things Are; Every one has his Fault, a comedy; and Lover's Vows. She also wrote two novels, both of which display much original thought and genuine pathos—the one entitled, A Simple Story (1791, four vols. 12mo), the other, Nature and Art (1796, two vols. 12mo). She also edited a collection of dramas, entitled the British Theatre, with biographical and critical remarks (in twenty-five vols. 12mo), during the period from 1806 to 1809; a similar collection of the most popular farces (in seven volumes, 1809); and the Modern Theatre (in ten vols. 1809). Her death took place at Kensington, Aug. 1, 1821, in her sixty-eighth year. This ingenious and able woman passed a life attended with many difficulties and temptations with unsullied reputation. Her Life and Correspondence was published by Boaden in two vols. 8vo (1833). This work displays in a striking light the noble and self-denying character of her nature. Latterly she lived in a comparatively humble way, in order that she might have the more to spend on charity.

INCHCOLM, an island of Scotland, off the coast of Fifeshire, with the ruins of a celebrated monastery founded by Alexander I. in 1123. Pop. (1901), 4.

INCHKEITH, an island of Scotland, in the Firth of Forth, belonging to Fifeshire, 4 miles N.N.E. of Leith, and 3 miles S.E. of Kinghorn Ness. In 1878 the War Office bought the island from the Duke of Buccleuch, and powerful batteries have since been built on it. Pop. (1901), 55.

INCIDENCE, ANGLE OF, the angle which a ray of light falling on a reflecting or refracting surface makes with the perpendicular or normal to the surface. The angle of incidence is always equal to the angle of *reflection*. The *sine* of the angle of incidence is equal to the *sine* of the angle of *refraction* multiplied by a certain number, called the *index of refraction*. See OPTICS.

INCLEDON, BENJAMIN CHARLES, an English vocalist, born at St. Keveran, in Cornwall, about 1763. From his eighth till his fifteenth year he was a chorister in Exeter Cathedral. In 1779 he entered the navy as a common sailor. His vocal abilities having attracted the notice of his officers he was advised to try his fortune on the stage. In October,

1790, he made his debut on the London boards at Covent Garden Theatre with great success, in the character of Dermot, in O'Keefe's musical farce of the Poor Soldier, and rose at once into a degree of popularity which attended him till the infirmities consequent upon advancing years, and an irregular mode of life, compelled him to retire from the active duties of his profession. His voice—a rich tenor—combined uncommon power, sweetness, and ductility, both in the natural and *falsetto*, and his intonation was singularly correct, taking his imperfect education into consideration. His articulation was, however, coarse, not to say vulgar. The better sort of the old English ballad was decidedly his forte: in this style of singing he had no equal. He died at Worcester, February, 1826.

INCLINATION; *of two lines*, is the angle between them;—*of two planes*, is the angle contained by two lines drawn in the planes at right angles to their line of intersection from any point in it;—*of a line and a plane*, is the complement of the angle contained by the line and a perpendicular drawn from a point in it to the plane;—*of the axis of a planet*, is the angle which it makes with a perpendicular to the plane of its orbit;—*of the orbit of a planet*, is the angle which the plane of the orbit makes with the ecliptic. The inclinations of the orbits of comets and asteroids are in general much more considerable, and vary more from one another than those of the planets.

INCLINATION, MAGNETIC, or MAGNETIC DIP. A steel bar may be suspended at its centre of inertia, in such a way that it can move freely in all directions; it will therefore be in equilibrium in all positions. (See CENTRE OF GRAVITY.) Now, when the bar is magnetized this is no longer the case; it has only one position of stable equilibrium, which it will vibrate about and at length assume, if allowed to come to rest after being disturbed. It will come to rest pointing along a line of magnetic force of the earth (see FIELD), that is to say, it will come to rest in a particular vertical plane, called the *magnetic meridian*, and it will make an angle with a horizontal plane. This angle, which our magnetized needle or bar, at rest in the magnetic meridian at any place, makes with a horizontal plane, is called the magnetic inclination or dip at that place.

In the northern hemisphere generally the end of the needle which points north also points downwards; in the southern hemisphere the south end points downwards. At Greenwich the dip is about 67°. The dip at any place is determined by means of a dipping needle. (See DIPPING NEEDLE.) Observations of dip are represented on charts by means of isoclinic lines.

INCLINATION COMPASS, or DIPPING NEEDLE. See DIPPING NEEDLE.

INCLINED PLANE, one of the mechanical powers. When a body lies on an inclined plane, part of its weight is supported; so that if a cord be fastened to it and pulled, a force less than the weight of the body, acting in a direction parallel to the plane, will prevent it from sliding, or will move it up the plane. Thus a heavy waggon is raised on an inclined road by a horse which would be quite unable to exert a pull equal to a quarter of the weight of the waggon. A body lifted by means of an inclined plane is moved through a greater distance than if it had been raised vertically, so that although the force employed may be smaller, it is exerted through a greater space. When the plane is smooth, so that friction may be neglected, the force parallel to the plane necessary to raise the body is equal to the weight of the body, multiplied by the vertical height through which it is lifted, divided by the distance it is moved along the plane. For instance, when a train moves up an incline which rises 3 feet for every 100 feet of rail, the engine exerts a pull equal to $\frac{3}{100}$ of the weight (neglecting friction).

Whether a body is moved along a level or an inclined plane, there is often a considerable amount of friction (see FRICTION) to be overcome; this friction may of itself be sufficient to prevent the motion of a body down an inclined plane, as when a brick rests on a sloping plank, and it has always to be overcome when we cause motion in the other direction. In calculations first determine the pull necessary to move the body on the supposition that the plane is smooth, and then add a force equal to the friction. Thus, suppose it known that the friction in the train of the example given above, when it runs on level roads or gentle inclines, is 22·4 lbs. per ton, or $\frac{22\cdot4}{2240}$ of the weight, then the engine must exert a pull equal to the weight multiplied by $\frac{3}{100} + \frac{22\cdot4}{2240}$, or a pull equal to $\frac{1}{25}$ of the weight.

INCLINOMETER, or DIPPING NEEDLE. See DIPPING NEEDLE.

IN CŒNA DOMINI (*Bulla in Cœna Domini*), the most remarkable of all the Papal bulls, as it most strikingly shows the lofty claims of the popes, and their pretensions as absolute rulers of the church, and the authority which they claimed over temporal princes. The first known copy of this bull, though perhaps not the first in reality, is said to be preserved in the Vatican, dated under the reign of Gregory XI., 1371-78. It is founded upon older Papal decrees, which declared all heretics and favourers of heretics without distinction, and those who imposed taxes upon the clergy for the purpose of supplying the wants of the state, solemnly excommunicated. After the fourteenth century it was extended and modified by several popes. Pope Pius V. ordered that it should be read aloud in all the churches on Maundy Thursday, because many Catholic princes tolerated Protestants in their countries, and required contributions from the clergy. Philip II. and the republic of Venice forbade the publication, for the exhausted state of their treasuries would not allow them to spare the clergy, and even the Emperor Rodolph II. and the Archbishop of Mainz would not acknowledge a bull so prejudicial to the rights of sovereigns. Its authority was never admitted in France; but in Naples in particular, from 1568, it excited great disturbances, for it was promulgated by the bishops and monks without the permission of the king, and according to the ordinance of the pope the right of government to impose new taxes was denied. Notwithstanding this opposition the bull received its latest form from Pope Urban VIII. in 1627. This pope, in behalf of God, and by virtue of the power committed to the apostles Peter and Paul and himself, excommunicated and anathematized all Hussites, Wickliffites, Lutherans, Zwinglians, Calvinists, Huguenots, Anabaptists, Unitarians; all who had fallen off from the Christian faith, all heretics, as well as all those who trusted, received, favoured, or defended them; all who read heretical books without permission from the Papal see; all who possessed and printed them, or defended them in any way whatever, whether public or private, or on any pretence whatever; and finally, all schismatics who obstinately avoided communion with the Catholic Church. All who appealed from the decision of the pope to a council were threatened with the anathema; and if a university, college, or chapter, with the interdict. Pirates who disturbed the Papal sea from Argentaro to Terracina, and all those who robbed wrecked vessels of the goods of Christians, incurred this anathema. Moreover, those princes were anathematized who imposed new taxes, or increased those

already laid, except in those cases in which they were allowed by law or by the special permission of the Papal see (added by Pius V. in 1567); also all forgers of Papal letters; all who provided Saracens, Turks, or heretics with horses, arms, money, implements of war, wood, hemp, cordage, or anything which could be of service to them in making war on Christians and Catholics; all who should prevent the carrying of provisions to the Papal court; all who robbed, injured, or murdered travellers to the Papal court; all who abused cardinals, Papal ambassadors, or bishops; all who appealed from the commands of the pope or his ambassadors to temporal courts of justice, or avoided the judicial decision of the pope in spiritual concerns, or compelled the clergy to appear before temporal judges, or made laws against the freedom of the church, or interrupted the bishops in the exercise of their judicial power; all who seized upon the revenue which the pope derived from churches and convents, or imposed taxes upon the clergy without the consent of the pope, even though the offender were an emperor or king; all officers who interfered with the criminal jurisdiction of the clergy; and finally, all who should attack or conquer the Papal territory, of which Sicily, Sardinia, and Corsica formed a part. None but the pope can remove this anathema, the priest being able to absolve only in the hour of death, when the person excommunicated has satisfied the offended church. Paul III. in 1536 added excommunication against those who should infringe this rule. The bull was ordered to be publicly posted up at Rome, and once a year, or oftener, every bishop was to read it to the assembled people. This was done at Rome until 1770 every Maundy Thursday in the principal churches.

INCOMBUSTIBLE CLOTH. The danger from fire to which ladies are exposed from the inflammable material of which their dresses are frequently made, and which was greatly aggravated during the period crinoline was in fashion, caused chemists, especially at this time, to turn their attention to the discovery of some means for rendering the common light fabrics of female attire inflammable. This is commonly accomplished by steeping the fabric in some saline solution. Borax, phosphate of soda or ammonia, alum or sal-ammoniac, will render the fabric to which they are applied non-inflammable, that is, it will burn slowly without flame; but these salts are not suitable for fine fabrics, and that which has been found to answer the purpose most effectually is tungstate of soda. A solution containing 20 per cent. of this salt renders a fabric perfectly non-inflammable, and does not interfere with the ironing of the cloth, which other salts frequently do. Three per cent. of phosphate of soda is recommended to be added to the tungstate.

INCOME TAX, so called because leviable directly from income of every description, whether derived from land, capital, or industry, was first imposed in Great Britain in January, 1799, during the ministry of Mr. Pitt, after the failure of an attempt to raise a revenue adequate to the exigencies of the period by trebling the amount of the assessed taxes. In Mr. Pitt's act incomes under £60 were exempted; from £60 to £200 the amount rose by a series of gradations till it reached 10 per cent., at which rate it was charged on all higher incomes. This tax, which averaged £5,500,000 sterling annually, was repealed in 1802, but was again imposed in the following year, though with a change of name to property tax, and a difference of rate. As before, all incomes under £60 were exempted, but the graduated scale terminated at £150, and the maximum rate was only 5 per cent. After an addition in 1805 the rate rose in 1806 to 10 per cent. The only exemption was in favour of industrial incomes under £50. Above that amount there was a graduated scale terminating at £150. All incomes from land or capital, however small, and all industrial incomes from £150 upwards, were charged at the uniform rate of 10 per cent. The gross assessment for this tax, which was repealed in 1816, was in the last year of its existence £16,548,986, and the net assessment £15,298,982. The income tax, as renewed by Sir Robert Peel in 1842, exempted all incomes under £150, and charged all above at the uniform rate of 7*d.* in the pound sterling. The actual income, so far as it could be ascertained by the machinery of the act, was charged on all persons except farmers, who were charged, not upon their actual, but a conjectural income, estimated to amount in England to a half and in Scotland to a third of their rent. Ireland was wholly exempted. The duration of the tax was limited to three years, but when these expired the public revenue could not dispense with it, and it still continues. Ireland was included in 1853. After various alterations, due to varying exigencies, the tax in 1902 was made 15*d.* in the pound, in 1903, 11*d.*, having been at one time as low as 2*d.* in the pound. Incomes under £160 are totally exempted; those under £400 have the first £160 exempt, under £500 the first £150, under £600 the first £120, under £700 the first £70. The tax as actually levied is a property and income tax. The taxable subjects or income are classified in five schedules, A to E; but the rate in all of them is uniform. Each penny of income tax produces over £2,000,000 of revenue.

INCOMMENSURABLE. Two magnitudes are incommensurable when they cannot both be measured by the same quantity, that is, when they do not contain it one or more times exactly. The diagonal and side of a square are an example.

INCORPOREAL HEREDITAMENTS. See HEREDITAMENTS.

INCUBATION (pathology). This name is given by analogy to the period preceding the open attack of the disease, when it is gathering head in the system of the patient but is as yet indicated by general symptoms, such as loss of appetite or sleep, &c., so slight or indefinite as often to defy the diagnosis of the physician. In epidemic and contagious diseases the period of incubation is more defined, and its symptoms and duration can be calculated within certain limits.

INCUBATION is the mode in which the highest class of oviparous animals, birds, commonly bring forth their young, that of sitting on the eggs till they are hatched by the natural heat of the body; the term is also applied to artificial processes by which young birds are hatched from eggs without the care of the parent birds. Incubation is analogous to the gestation of mammalia, and to the various contrivances by which the eggs of insects, reptiles, fishes, and other ovipara are developed. In order to successful incubation the egg must have been fecundated by the male. This can only be distinguished after incubation has commenced, when the process of organization begins in the germ. In general it is the female which undergoes the labour of incubation. Among some species, chiefly of monogamous birds, the male relieves the female while she seeks her nourishment; in others the male feeds her. Among some sea-birds which have common nests the birds lay and hatch together, one bird sitting on all the eggs. Among polygamous species, in which the whole charge of hatching devolves on the female, she employs various contrivances to protect the eggs and carry on the process during her absence. In some cases she covers them over with down plucked from her body, principally from the abdomen, some-

times with dried leaves; in others the nest is built with a southern exposure, that the heat of the sun may be used as an auxiliary to her care. Some birds, like the cuckoo, abandon their eggs to be hatched by others. In intertropical regions the ostrich leaves her eggs in the sand to be hatched by the heat of the sun, but she sits on them at night. In a state of nature birds generally commence to sit in spring. During incubation the female experiences a febrile excitation, which, according to Buffon, is a state of great pleasure, and which causes a determination of heat to the ventral surface of the body. The heat increases towards the close of the period of incubation. In hatching chickens artificially the extreme heat which it has been found desirable to use is 104° Fah., and according to some practical authorities the range of heat for the different periods ought not to exceed 88° to 95°. The process of incubation for a chicken is thus described by Haller. At the end of twelve hours a commencement of organization may be observed in the gelatinous patch called the germ, which, whatever may be the position of the egg, always occupies the upper part of the yolk. At the end of the first day the head and the beginning of the spine may be distinguished, at the end of the second the vertebræ and the heart, the neck and breast begin to be developed on the third, the eyes and the liver on the fourth, the stomach and veins appear on the fifth, the lungs or skin on the sixth, the intestines and the beak begin to take form on the seventh, the gall vessel and the brain on the eighth, the wings and thighs on the ninth, on the tenth day all the members are complete, and during the succeeding days they develop and take their proper form. The time of incubation varies with different species, but is always the same with the same species, thus all the eggs that are sat upon at one time come to maturity at once, leaving the mother free to attend to their nourishment and education. In the humming-birds it is 12 to 14 days; in the swallow and lark, 15; crow, 20; common hen, 21; pheasant, partridge, &c., 22; peacock and turkey, 30; swan, 40–45; cassowary, 62.

Artificial incubation was practised by the ancient Egyptians, and has also been long in use in China. Pliny mentions that the heat of the human body is sufficient to hatch eggs. The Egyptian stoves called *mammals* were rectangular constructions of brick, generally backed by a mound of sand to prevent the loss of heat. Réaumur proposed as an economical means of hatching eggs to make use of the heat developed by the fermentation of the dung-heap or emitted from a baker's oven. In 1816 Bonnemain contrived a stove heated with hot water, and on which the eggs were placed in drawers on humid sponges, which were changed daily to supply the loss from evaporation. This apparatus is still sometimes used. Various other contrivances were successively adopted until in 1848 Messrs. Adrien and Tricoche founded a large establishment at Vaugirard for both hatching and rearing chickens. Their incubating apparatus, which is a modification of Bonnemain's, can hatch 1500 chickens at once. In Great Britain various attempts have been made to introduce artificial incubation, and latterly incubators of more than one type have been employed with success.

INCUBUS (Latin, *incubus*, one who lies upon), a spirit to whom was ascribed the oppression known by the vulgar name of *nightmare*, in Greek *ephialtes* (from *epi*, and *hallomai*, I leap upon). These dæmons play an important part in the superstitions of the middle ages, having been perhaps not unfrequently employed, like the older gods of Greece, to cloak the advances of earthly lovers. The nuns and other single ladies of the middle ages were not always safe from their violence or their persuasions, as numberless tales and grave histories abundantly prove. See NIGHTMARE.

INCUMBENT (English law), a clergyman in possession of an ecclesiastical benefice.

INCUMBERED ESTATES ACT (IRELAND). An act was passed in 1848 to facilitate the sale of incumbered estates in Ireland, and in the following year a court was established for this purpose. This act enables an owner of land, or of a lease or leases for not less than sixty years unexpired, to apply within three years from the passing of the act to the commissioners to direct a sale of such property. The incumbrancer may also apply for a sale of the property, which is to be granted on his application only if the annual charge of the incumbrance exceed half the net income of the property. The sale is to be made under the commissioners, and the assignment or conveyance to be signed by two of them. It is to respect existing tenancies, leases or sub-leases, &c. The incumbrancer, if he becomes the purchaser, may retain the amount of his incumbrance. When application is made for the sale of an undivided share of a property, the commissioners may divide the property. The act, which contains fifty-five clauses, has numerous other provisions. By an act passed in 1858 the powers of the Incumbered Estates Court were transferred to the Landed Estates Court, and extended to unincumbered property. The gross amount of sales effected under the act from October 1849 to August 1859 was £25,190,839.

INCUNABULA (from the Latin, signifying cradle) is a term applied by bibliographers to editions of books printed during the early period of the art, and is generally limited to works which appeared previous to 1500. The incunabula are divided into xylographic and typographic, the former those printed from engraved blocks, the latter from movable types. The Biblia Pauperum (Bible of the Poor), a book of the former kind, is said to date from before 1440; the Mazarin Bible, in type, dates about 1450 to 1455. Among the most highly esteemed of the incunabula are those which are first editions (*editiones principes*) of the ancient classics. Panzer's Annales Typographici; Maittaire's Annales Typographici, the former of which goes down to 1536, the latter still later; Santander's Dictionnaire bibliographique choisie du 15me siècle; and Brunet's La France littéraire au 15me siècle, are among the leading authorities on incunabula. See BIBLIOGRAPHY.

INDEMNITY, a term frequently employed in politics and jurisprudence, and is used in various significations, but is usually applied to an act of the legislature passed for the purpose of relieving individuals from the penalties to which they may have rendered themselves liable by some violation of the law whether by act or omission. Thus, in England, while the Test and Corporation Acts were in force, persons who had assumed any office without qualifying according to the provisions of those acts were annually relieved by an act of indemnity; and in like manner, on particular emergencies, when ministers have ventured on their own responsibility to take some particular step which was not strictly legal, but to which Parliament, had it been sitting at the time, would most probably have assented, the illegality is afterwards cured by an act of indemnity. The term indemnity is also often applied to compensations which one state pays to the government or subjects of another state for losses sustained through its proceedings. An act of indemnity was formerly passed every year for the relief of those who had neglected to take the necessary oaths of office, but the act 31 and 32 Vict. abolished many superfluous oaths, and contains a general saving clause. By 22

and 23 Vict. cap. xxxv. s. 31, every deed, will, or instrument creating a trust is to be held implicitly to contain a clause for the indemnity of trustees.

INDENTURE, a deed entered into between two or more parties, and so called because duplicates of every deed *inter partes* were once written on one skin, which was cut in half, irregularly or with a jagged or indented edge; so that when the duplicates were produced in court they were seen to belong to one another by fitting into one another. By 8 and 9 Vict. cap. cvi. s. 5 it is provided that a deed purporting to be an indenture shall have the effect of an indenture, though not actually indented. (Wharton's Law Lexicon.) See APPRENTICE.

INDEPENDENTS. See CONGREGATIONALISTS.

INDEX, in bibliography, an alphabetical table prefixed or more commonly placed at the end of a work, containing a list of the principal words, names, or subjects treated of in the body of the work. A good index is of great importance in every work of permanent utility. The plan of the index of course differs with the nature of the work. Authors frequently intrust this necessary piece of drudgery to others, when it is often imperfectly and not seldom inaccurately done. The making of an index involves a good deal of mechanical labour, but to make a first-class index not only requires a thorough acquaintance with the contents of the work, but a considerable power of method and analysis, and for a new work it can seldom be done so well as by the author himself.

By the Roman Catholic Church, *Index* is used absolutely to designate the catalogue or list of books prohibited by ecclesiastical authority, on account of the heretical opinions supposed to be contained in them, or maintained by the authors or editors of them. The catalogue or list of books absolutely prohibited is simply called the Index or Index Librorum Prohibitorum; but when the list or catalogue is of books allowed to be read after correction or alteration, agreeably to the orders of the Papal authorities, it is termed Index Expurgatorius. The origin of ecclesiastical prohibitions dates from a very early period in the history of the church. Thus at the Council of Carthage in 400 a condemnation was pronounced upon pagan books. The emperors also prohibited the reading of certain books. Constantine, for instance, prohibited the reading of the works of Arius. The popes, too, used to order obnoxious books to be burned. These prohibitions issued from various ecclesiastical authorities; thus in 1408 a synod at London prohibited the reading of the books of Wickliffe. The books of whole sects were sometimes prohibited in a mass. The invention of printing in the middle of the fifteenth century caused a rapid multiplication of books, and induced the ecclesiastical authorities to prevent, if possible, the circulation of any which might prove injurious to the interest of the Roman Church. Hence originated *imprimaturs* or official permission to print works; and the promulgation and diffusion of the doctrines of the Reformation in the following century increased the determination of the powerful adherents of Popery to suppress and to destroy all the books tinctured with Lutheranism, or maintaining any of the peculiar opinions held by the reformed churches. The various universities, which were all originally ecclesiastical foundations, were naturally regarded as authoritative judges in doctrinal controversies. They were frequently appealed to by princes desirous of pacifying such controversies, and by the controversialists themselves. By an easy transition they early took on themselves to publish on their own authority, or by the request of civil or ecclesiastical rulers, lists of prohibited books.

The first index seems to have been published at Venice. It appeared in 1543 under the title of Index Generalis Scriptorum Interdictorum. In 1544 the Faculty of Theology in Paris published a catalogue of books censured by them within a certain period, and in 1551 a list of books censured since 1544. In 1546, in pursuance of an edict of the Emperor Charles V., the University of Louvain published an index or catalogue of books regarded as dangerous, of which a revised edition was published in 1550. Similar lists of interdicted books appeared nearly at the same time in other universities. Philip II. of Spain having caused a catalogue of all books prohibited by the Inquisition to be printed (Venice, 1558), Pope Paul IV. followed the example, and ordered an Index Librorum Prohibitorum to be published by the Congregatio Sancti Officii, in which not only all heretical books were noted down, but also all which tended to lower the Catholic hierarchy, many even written by Catholic clergymen. The first part contains the names of the authors whose works are altogether prohibited, the second single prohibited works, the third anonymous works. A particular part contains the names of forty-two booksellers whose publications are altogether prohibited. In this index books were prohibited for the first time, not only to the general public, but to Catholic theologians and savants. After this the councils published a number of such indexes, and these were followed by some for single countries—for instance, by the Sorbonne for France. The indexes assumed their most systematic form at the Council of Trent, which, at its eighteenth session, referred the consideration of works to be prohibited to a select committee; and in the twenty-fifth session what had been done by that committee was referred to the pope, that it might be completed and published with his authority. The work was accordingly published in 1564. Besides the catalogue of prohibited books, it contains general rules relative to such books, drawn up by certain persons deputed for that purpose by the Council of Trent, and sanctioned by Pope Pius IV. These rules, which are ten in number, are prefixed to the different indexes which have been published since that period.

The right of censuring books belonged to the Inquisition till 1586, when the Congregation of the Index was formed, with authority to judge of new works, to indicate those of which the reading is entirely prohibited, and those which are permitted after correction, and also to grant to learned and pious men the right of reading prohibited works. The authority of the index of the congregation has never been very great beyond the Papal States. In all Catholic countries it has had a certain amount of respect shown it by Catholics, and especially ecclesiastics as emanating from a central authority of the church; but the various Catholic countries have for the most part followed their own authorities. In Spain the Inquisition has maintained its right to issue its own index. The last index of the Spanish Inquisition is dated 1790, and was reprinted with a supplement in 1805. In France the decrees of the Council of Trent in regard to matters of discipline were never received, and one of the Gallican liberties asserted since 1682, and admitted by the concordat of 1801, consists in the non-recognition by the French Church of the authority of the Roman congregations. Notwithstanding the concession of the concordat the ultramontane party in the French Church has since striven to secure its submission to the authority of the Congregation of the Index; but the books prohibited are so numerous and of so high a class, that it is said that there is hardly a Catholic not wholly illiterate who can boast of obeying its mandates. The Inquisition continued to interfere with the cen-

suring of books until the middle of the eighteenth century, when Pope Benedict XIV. reformed the Congregation. He blamed it for attending more to the prohibition of books containing doctrines free within the church, according to the rival schools of theologians to which the members belonged, than of books contrary to morals and religion. This censure has been little attended to, and the Congregation has continued to illustrate by its decisions the force of the *odium theologicum*. It has also been blamed for selling the liberty to read prohibited books too freely. The Parliament of Paris, by a decree of 4th April, 1732, prohibited this practice to the nuncio resident in France. The last edition of the Index was published in 1892, and there is a yearly supplement.

INDEX, in algebra, is the number placed over a quantity on the right hand, to show how often the quantity is multiplied by itself. When the index is fractional, its numerator indicates a power and its denominator a root. When the index is negative, it indicates a reciprocal. Thus:—

a^4 represents $a \times a \times a \times a$, or the fourth power of a.

$a^{\frac{2}{3}}$ represents $\sqrt[3]{a^2}$, or the cube root of a^2.

a^{-2} represents $\frac{1}{a^2}$, or the reciprocal of a^2.

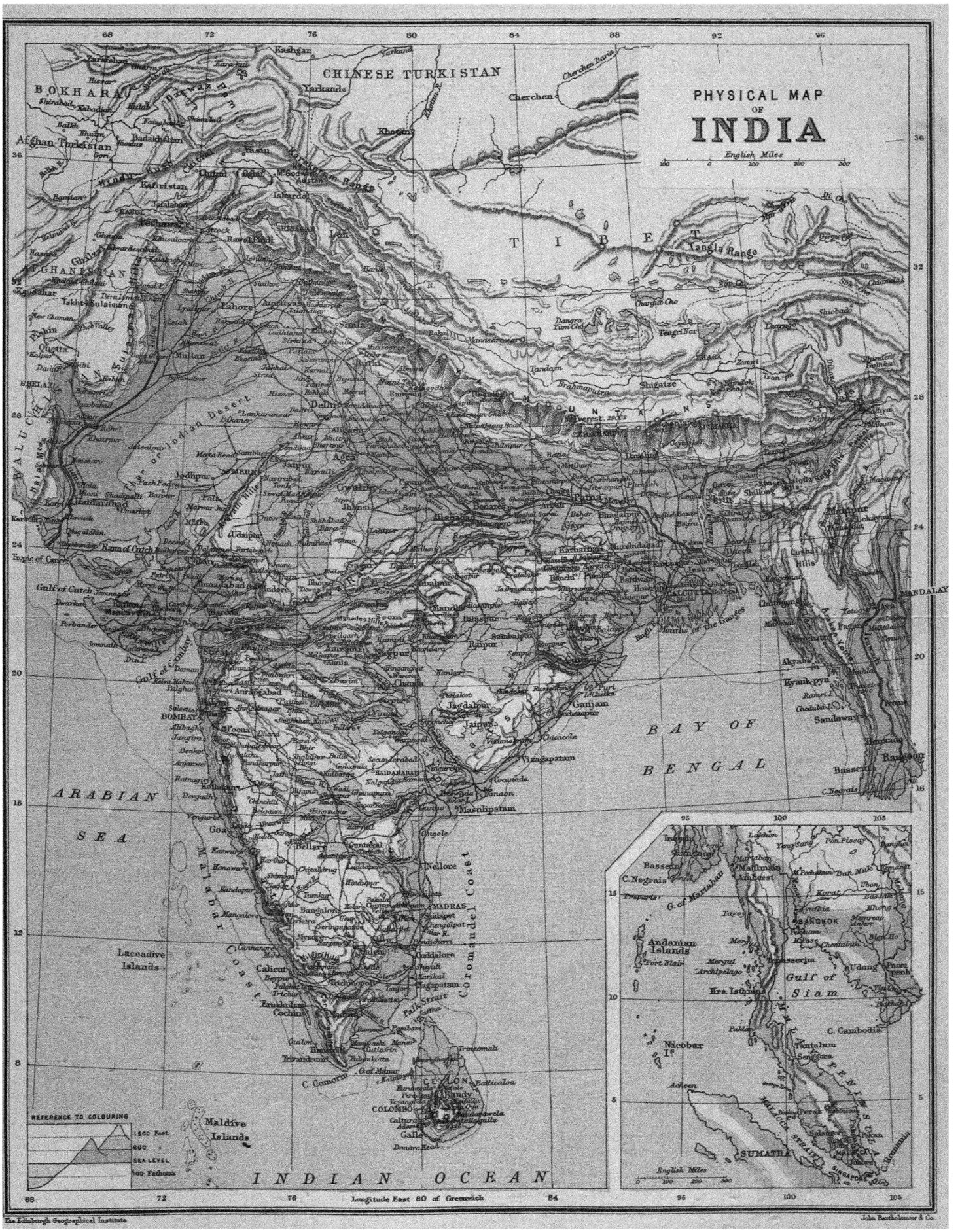
INDEX OF REFRACTION. When a ray of light passes obliquely from one medium, such as air, into another medium, such as glass, it is refracted or caused to change its direction at the separating surface. The *sine* of the angle of incidence (see INCIDENCE) bears a certain ratio to the sine of the angle of refraction; this ratio is always the same, whatever be the obliquity of the ray, and it is called the index of refraction for these media. The index of refraction, when light passes into a medium from a vacuum, may be determined in many ways (see Light, in Watt's Dictionary of Chemistry); it is called the *index of refraction of the medium*. The index of refraction is always greater for violet than for red light (see SPECTRUM and other articles). The indices given in the following table are for light of the mean refrangibility:—

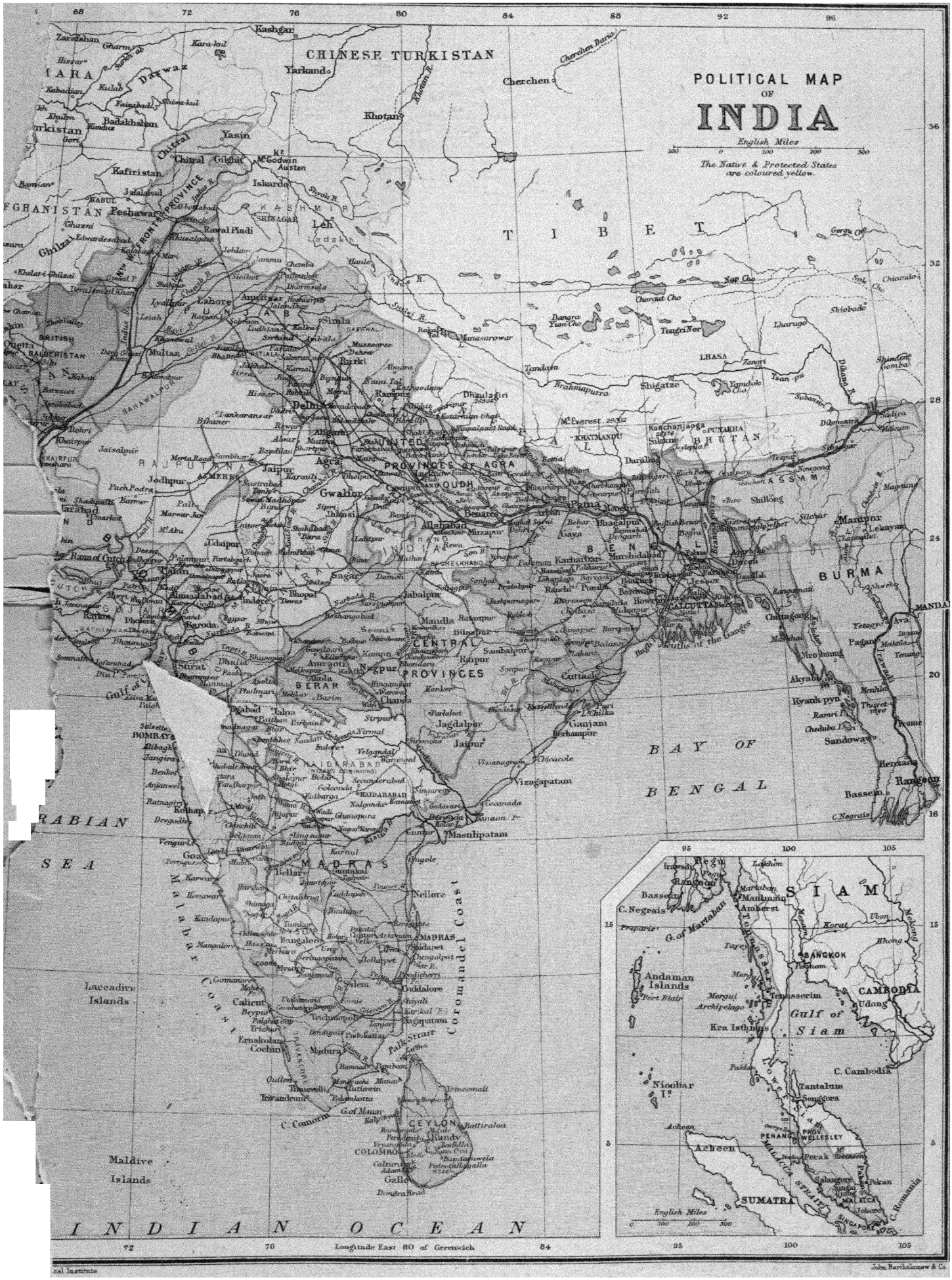
Diamond,	2·44 to 2·755	Aqueous humour of eye,	1·337
Flint-glass,	1·576 to 1·642	Vitreous humour,	1·339
Crown-glass,	1·531 to 1·563	Crystalline lens—	
Rock-salt,	1·545	Outer coat,	1·337
Canada-balsam,	1·540	Under coat,	1·379
Bisulphide of carbon,	1·678	Central portion,	1·400
Pure water,	1·336	Air,	1·000294

INDIA, a name used both in ancient and modern times with great latitude of signification. It has always been applied more or less comprehensively to the central peninsula of Southern Asia, but even the eastern peninsula is sometimes included in the term, and is known by the names of Further India, India-beyond-the-Ganges, and Indo-China. British conquests having extended to and beyond the utmost limits of the central peninsula, India, in its widest sense, may now be taken to include all the territories in this region that are directly or indirectly under British rule, or at least under British control, and are supervised under the government of which the Viceroy of India is head. India, as thus defined, excludes the island of Ceylon, but includes a considerable portion (namely, Burma) of the eastern peninsula and some adjacent islands. Small portions of territory still owned by France and Portugal are also comprised in it. The mainland of India Proper is bounded north by the Himálaya Mountains; east by mountain ranges which divide it from Burma; south-east by the Bay of Bengal; south by the Gulf of Manaar, which separates it from Ceylon; west by the mountain chains inclosing the valley of the Indus, which separate it from Afghanistan and Baluchistan, and by the Indian Ocean. Its length north to south is nearly 2000 miles; its greatest breadth east to west about 1800 miles. It extends between lat. 8° 5′ and 35° 15′ N., and lon. 65° 45′ and 97° E.

Physical Features.—The natural boundaries of the peninsula of India, which forms a triangle washed on two sides by the sea, and having its base in the great mountain chain which separates it from Tibet on the north, are completed by its three great rivers, the Indus, the Ganges, and the Brahmaputra. These all rise in the Tibetan Mountains beyond the Himálayas, and the first flowing west, the two latter east, descend in a southern direction towards the sea; the Indus discharging itself into the Indian Ocean; the Ganges and the Brahmaputra, after watering in their separate course a large part of Northern India, uniting to pour their waters together by numerous mouths into the Bay of Bengal. The mountains inclosing the basins of these rivers form the east and west boundaries of the northern part of the peninsula. The Himálayas, the loftiest mountain range in the world, with heights of upwards of 5 miles above the level of the sea, descend by successive slopes to the elevated plain of Northern India. (See INDUS, GANGES, BRAHMAPUTRA, HIMÁLAYA.) The entire peninsula has been distinguished by natural divisions into three parts. The Vindhya Mountains, a range of about 3000 feet in height, which extends irregularly across the peninsula from Gujerat to the basin of the Ganges, forms an anciently-recognized division into two parts under the names of Hindustan and the Deccan (Southern Land). The name Hindustan, given in this restricted sense to the northern part of the peninsula, is frequently applied to the whole. The names Hindu and Hindustan, as well as India, are probably derived from that of the river Indus, India having been first known as the country beyond the Indus. The ancient division of the Deccan is again subdivided into two, the name Deccan being restricted to the northern part, the southern from the river Krishna or Kistnah, which flows from west to east almost across the whole peninsula, being called Southern India or India south of the Krishna. The portion of Hindustan Proper watered by the Ganges and its tributaries is by far the most fertile and populous of the whole of India. At no great distance from the opposite extremities of the Vindhya Mountains two great ranges proceed southward along the line of the coast. The Western Ghâts, which attain a height of 5000 to 6000 feet, though at some parts much lower, proceed along the west coast to Cape Comorin, the southernmost point of India. They do not generally recede more than 40 miles from the sea, and rarely more than 70. On the sea-side their descent is generally precipitous, forming a regular sea-wall. On the land side they descend gradually, and sometimes almost imperceptibly, to the elevated plains of the interior. The Eastern Ghâts recede further from the east coast, are less elevated and precipitous. Before reaching as far in their southern course as Madras, they trend inwards, and unite with the transverse range of the Nilgiri Hills, which connects them with the Western Ghâts. This mountain-formed triangle incloses an elevated table-land with a gradual slope eastward from the Western Ghâts, and which is continued beyond the Eastern Ghâts to the sea. The elevation of the plain of Southern India also increases towards the south. In the Deccan it is about 3000 feet above the level of the sea. In the neighbourhood of the Nilgiri Hills, which rise 3000 feet above it, it reaches 7000 feet.

The chief rivers of India besides those named are the Jamna, Ramganga, Gumti, Gogra, Gandak, Kusi, &c., tributaries of the Ganges; the five rivers of the Panjab, Satlej, Bias, Ravi, Chenab, and Jhilam, tri-


PHYSICAL MAP
OF
INDIA
English Miles
100 0 100 200 300
CHINESE TURKISTAN
BOKHARA
Afghan-Turkistan
Hindu-Kush
Kafiristan
AFGHANISTAN
BALUCHISTAN
Thibet
T I B E T
Tangla Range
Himalaya Mountains
Mt Everest 29,002
Mt Godwin Austen
Indian Desert
Aravalli Hills
Vindhya Hills
Satpura Hills
Western Ghats
Eastern Ghats
Nilgiri Hills
Khasia Hills
Garo Hills
Naga Hills
Lushai Hills
Arakan Yoma
Shan Plateau
Irrawaddy R.
Salween R.
Mekong R.
Menam R.
Indus R.
Ganges R.
Brahmaputra
Godavari R.
Kistna R.
Cauvery R.
Narbada R.
Mahanadi R.
Tapti R.
Jumna R.
Sutlej R.
Gulf of Cutch
Gulf of Cambay
Gulf of Manar
Palk Strait
Coromandel Coast
Malabar Coast
ARABIAN SEA
BAY OF BENGAL
INDIAN OCEAN
Laccadive Islands
Maldive Islands
CEYLON
Andaman Islands
Nicobar Is
Gulf of Siam
SUMATRA
MALACCA STRAITS
REFERENCE TO COLOURING
1500 Feet.
600 "
SEA LEVEL
100 Fathoms
Longitude East 80 of Greenwich
The Edinburgh Geographical Institute
John Bartholomew & Co.


POLITICAL MAP
OF
INDIA
English Miles
100 0 100 200 300
The Native & Protected States are coloured yellow.
CHINESE TURKISTAN
TIBET
KASHMIR
PUNJAB
RAJPUTANA
UNITED PROVINCES OF AGRA & OUDH
CENTRAL PROVINCES
BERAR
HYDRABAD (NIZAM'S DOMINIONS)
MADRAS
BOMBAY
BENGAL
ASSAM
BURMA
SIAM
CEYLON
BHUTAN
NEPAL
AFGHANISTAN
BALUCHISTAN
BAY OF BENGAL
ARABIAN SEA
INDIAN OCEAN
Coromandel Coast
Malabar Coast
Laccadive Islands
Maldive Islands
Andaman Islands
Nicobar Is.
Gulf of Siam
SUMATRA
Longitude East 80 of Greenwich
English Miles
0 200 300

butaries of the Indus; the Narbada, inclosed on its northern bank by the Vindhya Mountains, and the Tapti, which flow west into the Gulf of Cambay; the Mahánadi, the Godávari, the Kistna, North and South Penner, Vellar, Kaveri, &c., all flowing eastward into the Bay of Bengal. The uniform direction of the great rivers south of the Tapti is explained by the inclination of the land already described. The coasts of India have very few indentations, and consequently very few good natural harbours. The western coast is known by the name of the Malabar, the eastern by that of the Coromandel coast. There are no lakes of any extent in India, Chilka and Kolair near the east coast being the largest.

Climate.—Of 28° of north latitude over which India extends 15½° are within the tropical, and 12½° within the temperate zone. Owing to modifying circumstances, the climates contained within this range are not only extremely various, but distributed with great irregularity. In Hindustan the basin of the Ganges is surcharged with humidity, that of the Indus is for the most part dry and parched. In Southern India the Coromandel coast is much dryer than the western side of the peninsula. The isothermal line indicating the greatest annual heat on the surface of the globe crosses the southern part of India obliquely from the Malabar to the Coromandel coast nearly in the same latitude in which the Nilgiri Hills enjoy the climate of the finest part of the temperate zone. One of the chief modifying circumstances, of course, is altitude; another is the distribution of moisture, the great regulators of which are the monsoons. The north-east monsoon blows from October to March, the south-west from April to September. The latter surcharged with vapour from the Indian Ocean condenses in torrents on the heights of the western Ghâts, and forms the rivers which flow to the east. Before it reaches the Coromandel coast, it becomes a dry wind which scorches up vegetation. In Hindustan, on the contrary, this wind passes over the low plains in the lower valley of the Indus, is arrested by the Himálayas, and fills the tributaries of the Ganges. The north-east moonson runs a similar course in the opposite direction, but deriving less moisture from the Bay of Bengal, which is of less extent than the Indian Ocean, it has less influence on the climate, and its season is in general the dry one. The chief features of the climate of India are heat and moisture. The great plain of Southern India being exposed to greater heat than that of Hindustan, and not being watered by the snow-fed streams of the Himálayas, is naturally much less fertile. The seasons in India are divided into rainy, cool, and hot. The periods of these different seasons vary according to latitude and modifying circumstances. On the Malabar coast the rain begins earliest to the south. At Calcutta rain falls from June to October; the cool season begins about November, the hot season in February, the heat increasing gradually till May. In Calcutta, where the mean annual temperature is about 79°, the range is from 50° to 85° Fahr. In Bombay the mean annual temperature is about 82°, the range about 10°; in Madras mean about 84°, range 7° to 8°. The annual rainfall in India is very much greater than that of England; but it is distributed with great irregularity. The basin of the Indus, including all Sind and the half of the Panjab, is an arid region with an annual rainfall under 15 inches. The high plateau in the interior of South India has an annual rainfall generally under 30 inches. On the whole Malabar coast the rainfall is over 75 inches; at Kananor it reaches 128 inches. On the Coromandel coast it is very much lower, being 45 inches at Vizagapatam, 50 inches at Madras, while further south it falls below 30 inches. Between the arid region of the Indus and the Ganges runs a dry zone of 100 to 200 miles wide, including Lahore, Delhi, and Agra, with a rainfall between 15 and 30 inches. The valleys of the Tapti, the Narbada, the lower part of the Jamna, the Ganges, and the Brahmaputra, are generally over 30. Along the slopes of the Himálay s from Cashmere east to the boundaries of India, and south-east to the mouths of the Mahánadi runs a belt of country with a rainfall over 60 inches, within which is included the lower course of the Ganges. Within this is another belt, including a lower slope of the Himálayas, and the lower course of the Brahmaputra before its junction with the Ganges, in which the rainfall rises above 75 inches.

Botany and Zoology.—We cannot attempt here anything like an enumeration of the vegetable products of India. Where moisture is plentiful, as in the valley of the Ganges, vegetation is superabundant. The delta of the Ganges, in particular, called the Sunderbunds, is covered with dense jungle full of the largest wild animals, and the excessive vegetation renders most of the mouths unnavigable. There are many other similar tracts of extensive forest and jungle. On the Coromandel coast, on the other hand, the heat, which reaches 100° or 120° Fahrenheit, destroys vegetation, and the delta of the Indus from the south-east of the Panjab to the Ran, or great salt marsh of Kach (Cutch), forms a great sandy desert, continuous across the river with the desert of Baluchistan, and with a wide band stretching across the whole continent of Asia to Central Africa. In the various altitudes of the Himálayas forms of vegetable and animal life belonging to all the various climates from tropical to polar are to be found. These as well as the Western Ghâts are magnificently wooded. Among the staple natural products of India are rice, maize, wheat, barley, cotton, flax, hemp, jute, rhea, indigo, tea, coffee, sugar-cane, opium, tobacco, ginger, pepper, cardamoms, palms bearing nuts which are extensively consumed, anise, dye-woods, &c. European fruits abound, and among indigenous fruits may be mentioned the mango, plantain, pomegranate, citron, date, almond, grape, pine-apple, and tamarind. Many of the forest trees of India are hardly known in Europe even by name, though this can scarcely be said of the teak tree, so valuable for its timber, or of the deodar, banyan, and one or two others. Palms, including the date, coco-nut, palmyra, betel-nut, and other species, are common features of the vegetation, as is also that gigantic grass, the bamboo. On forests, forest conservancy, and kindred matters, see below under the title *Forests*; and for the cultivated natural products, see under *Agriculture*. The elephant, the rhinoceros, the camel, the tiger, a few lions in the north-west, the leopard, bears, hyæna, jackal, wolf, and numerous smaller carnivora, the boar, antelopes, deer, wild ox, ass, sheep, and goat, monkeys in great variety, and the greater number of European quadrupeds are found. There are several large species of ox, such as the gaur or 'bison' and the arnee or wild buffalo. Crocodiles, snakes (including the dreaded cobra), and reptiles in all varieties are very numerous; of birds, the eagle, vulture, falcons, peacock, parrots, kingfishers, mina-bird, partridge, quail, heron, stork, are characteristic species, and other varieties, both indigenous and common to other regions, are numerous. Fish are plentiful and in great variety both on the coasts and in the rivers.

Geology and Minerals.—The geology of India, as far as it is known, considering its extent, is not complicated. All the great mountain ranges are chiefly composed of granite and of granitic rocks, which form also the base of the plateau of the Deccan. Both in

the peninsula and in the Himálayas gneiss predominates associated with mica-schist, hornblende schist, chlorite slate, and primitive limestone. Syenite prevails in the south-east of the peninsula. In the southern portion of the Western Ghâts the granitic rocks are overlaid by an iron clay, which is continuous to the end of the peninsula, and reappears in the island of Ceylon. In the upper portion of the Western Ghâts and adjoining ramifications of the Vindhya range, basaltic trap in various forms overlies the granite to an extent unparalleled elsewhere in the world. It entirely covers a large portion of the table-land of the Deccan. In this district trap and granite frequently pierce the surface in isolated masses, forming flat-topped hills nearly perpendicular, and which can only be ascended by steps, or winding, dangerous paths. These have been converted into strongholds from a remote antiquity. They are frequently crowned with forts, and form a peculiar feature of the landscape. On the lower sides of the Himálayas regular strata of the secondary and tertiary periods are largely developed. Many of the sandstones and shales of the secondary period belong to the coal-measures. The Indian tertiary formations attain their greatest breadth towards Sind and the Panjab, where fossil remains, including many of singular forms and gigantic dimensions, are abundant. The principal coal-fields in India are found in the region bounded north by the Ganges, south by the Godávari, and stretching east and west from the neighbourhood of Calcutta to the middle of the valley of the Narbada. Indian coal is distinguished by its excessive lamination. The fixed carbon averages 52 per cent, about 15 per cent less than English coal, and the ash is from 16 to 30 per cent. The annual production of coal in India was 1,946,000 tons in 1889, and 4,933,000 tons in 1899. Of the latter quantity Bengal, with over 200 mines, produced 3,883,000 tons, Haidarabad 401,000 tons, Assam 226,000 tons, Rewah State in Central India 164,000 tons, the Central Provinces 157,000 tons, Panjab 82,000 tons. The total output in 1902 was 6,779,877 tons. The most important mines are those of the East Indian Railway Company near Giridhi (Bengal) and the Singareni mine in Haidarabad. Of the coal used on the railways 95 per cent is Indian coal. Iron ore is abundant in many parts of India, but the amount produced (60,700 tons in 1899) is still small. The only large ironwork in India is at Barrakur in Bengal, but iron is manufactured locally on a small scale in other parts of Bengal and in the Central Provinces. The chief obstacle to the successful development of the iron industry of India is the difficulty of finding the ore, fuel, and flux sufficiently near to one another to make it profitable, but it is believed that ironworks near Calcutta, using Madras ore and Bengal coal, would succeed. Gold is worked to some extent, more especially in Mysore, the total production in 1899 being 448,071 ozs. Copper, lead, antimony, and other metals are fairly abundant. Burma yields a large amount of petroleum annually, and smaller quantities are obtained from Assam and the Panjab. The total output for 1901 was 50,075,117 gallons, but much is still imported. There are valuable ruby mines in Upper Burma, and a few diamonds are still obtained in Central India. Salt is an important manufacture and source of revenue: its production is treated under the head of *Finance*.

Inhabitants and Languages.—India is inhabited by numerous peoples belonging to several distinct groups or families, speaking numerous dialects founded on two or three distinct stocks, and much blended by the intercourse of the different peoples with each other. Previous to the Mohammedan ascendency the dominant race were the Hindus, whose language is spread in various dialects over a great part of India, but who were not the aboriginal inhabitants nor even the first invaders. From the north-west of India, through Kashmir and down the valley of the Indus, and from Tibet through the passes of the Himálayas, the inhabitants of Northern Asia have from a very early period migrated southward to the milder and more fertile plains of India. Two great successions of these invasions are recognized as having taken place before the period of authentic history. The first immigrants, of dubious ethnological connections, but commonly known as the Tamil races, appear to have overspread the entire peninsula. Following them the Sanskrit-speaking peoples, called the Hindus, of Aryan speech, dispossessed the Tamil races, and superseded their language in the whole of India north of the Narbada. The Hindus subsequently descended into the peninsula and penetrated as far as Cape Comorin; but though their influence on the languages of Southern India was considerable in the way of introducing new terms, the grammar and construction of the Tamil languages maintained their place in the districts south of the Narbada. Two great groups of languages were thus spread over India, which were further modified by the Mohammedan invasion. The native tribes were not exterminated by these invasions, but are still to be found under various names, as Bhils, Catties, Coolies, Gonds, &c., inhabiting the fastnesses of the mountain-ranges in Bengal, the Vindhya and Satpura Mountains, the Ghâts, &c. The hill tribes and other aborigines in all India are estimated at 70,000,000.

All the Hindu languages are cognate dialects founded upon the Sanskrit, a language of the Aryan or Indo-European family, which has been extinct as a spoken language for more than 2000 years, and bears a similar relation to the spoken languages of India with that of Latin to the modern European tongues. (See SANSKRIT LANGUAGE AND LITERATURE.) In the time of Alexander the Great, Sanskrit had already been superseded by a vulgar tongue, the Prakrit, founded on it. In ancient Hindu dramas persons of rank are represented as speaking Sanskrit, common people Prakrit. Pâli, a dialect of Prakrit, became the sacred language of the Buddhists, their scriptures being compiled in it. It was spread by them into Ceylon and India-beyond-the-Ganges. It is still used for works, chiefly religious, for which a wider circulation is desired. Hindi, the prevailing literary language of the non-Mohammedan population, is a modernized form of an older dialect, Hindui, which flourished during the middle ages, having grown out of the Prakrit dialects about the tenth century. Both Hindui and Hindi are rich in poetical chronicles. Hindustani or Urdu, a kind of Hindi mixed with Persian and Arabic, is the language of the Mohammedan conquerors, and grew up after the conquest of Delhi at the close of the twelfth century. It is also rich in literature, particularly in translations from the Persian, Arabic, and Sanskrit. It is the language which has been favoured by the British government for purposes of administration and diplomacy. The Dakhni, a mixture of similar elements, grew up from the same cause in the Deccan. Among the numerous other descendants of the Sanskrit the most important are the Bengâli, the Orissa, Uriya, or Utkala, the Marâthi, the Gujerâti, the Sindhi, and the Panjabi. The languages of Southern India form a distinct group called the Dravidian, differing in structure from those of the north. The most important of them are Tamil, or Malabarese, spoken or

the Coromandel and Malabar coasts, Telugu or Telinga, in the middle of the Deccan, Kanarese in the Carnatic and neighbourhood of Mysore, Malayâlam on the Malabar coast from Mount Dilli to Cape Comorin. From all these Burmese stands apart.

Religions.—The religions of India like the races are numerous. The most important is the Hindu or Brahmanical, which is very ancient. It has passed through many transitions, and has latterly generated numerous sects. The earliest period of the Hindu religion is called the Vedic, from the Vedas or sacred books in which its records are preserved. These exhibit several marked phases of transition. The earliest date of the Vedic literature cannot be satisfactorily determined, either from philological or internal evidence. Its latest writings are not more recent than the second century B.C. Each Veda consists of two parts, the Sanhitâ, a collection of mantras or hymns, and the Brâhmana, which contains the doctrinal and ceremonial development of the religion. The latter are always of later date than the former. The oldest Veda, called the Rig-Veda, is considered to be probably the oldest literary document in existence. Although the habits of the Hindus at the time of its production must have been comparatively simple, they appear to have made some progress in civilization, and to have had some knowledge of art. The worship represented in the greater number of the hymns of the Rig-Veda is that of natural objects: Indra, the cloudless firmament; the Maruts, the winds; Ushas, the dawn; Vishnu, Surya, Agni, and other deities, to whom various attributes of the sun were attributed. These deities do not appear at first to have had any distinct ethical qualities attributed to them. The most distinguishing attribute at all events is power. They were invoked for assistance in the common affairs of life, and were reminded by the suppliants of their former glorious deeds. Indra and Vishnu are spoken of in one hymn as the granters of desires. There are, however, the rudiments of an ethical code in relation to the worshippers. He who neglected the worship of the gods, or who robbed or injured their worshipper, was a sinner, and the devout worshipper complained of him to his gods; but the worshipper of the gods himself could commit no evil, and might rob or kill his enemy with impunity. Notwithstanding a morality so convenient and so consonant with human nature, the wrongs complained of are said on the whole not to indicate an unfavourable moral condition. In the earlier hymns the offerings to the gods are few and simple. The juice of the Soma or moon-plant, an intoxicating beverage, is most frequently mentioned, and clarified butter poured on fire forms another common offering. In another class of hymns mystical speculation succeeds poetical imagery, beings that inspire awe become more common, sacrifices more complicated, and objects of worship more numerous. Among the last the objects of sacrifice themselves are introduced, in particular Soma, the moon-plant, which is invoked as the bestower of all worldly goods. Animal sacrifices also become common, and mystical perfections and associations with the deity are attributed to them. In a third class a philosophical creed appears struggling into existence. The problems of primæval being and of creation are proposed in ambiguous and enigmatical terms. The developments of the philosophical and of the popular creeds already tend apart, and the influence of the former is exerted in putting symbolical interpretations on the latter. In the Brâhmanas this tendency of the later hymns is more systematically developed. Epithets are expanded into historical legends, and a complex ritual is founded on them; the class of priests, which appears to have existed even in the time of the earlier Vedas, attains its full organization and importance, and caste is gradually developed. An advance is at the same time made in what may be called systematic theology, the abstract rules of right and wrong are developed, and the ethical qualities of the gods are dwelt on for imitation and praise. In the earlier Vedas no attempt is made to classify the gods and assign them particular ranks; this now becomes a special object of attention, and is done with a manifest regard to unity, a special priority being given to one. A further advance in this direction is made in the Upanishads, a species of commentary on the Vedas, in which a systematic attempt is made to solve the problems of creation, of the nature of the supreme being, and of his relations with the human soul. Some of the Upanishads are legendary in form, others doctrinal or exegetical. The deities of the Vedic creed are treated in them as symbolical, the human soul is defined to be of the same nature with the supreme being, and its destiny is determined to consist in reunion with him. The means prescribed for the accomplishment of this destiny are in accordance with the newly elaborated theology rather than with the ancient forms of external worship. It is by the comprehension of itself and of the supreme being that the human soul is to become united with the divine. Brahma, the supreme soul, is the only reality, the world is regarded as an emanation from him, and as only on this account worthy of consideration. The necessity for the purification of the soul, in order to its reunion with the divine nature, gave rise to the doctrine of metempsychosis. These commentaries, though not in form philosophical, being professedly founded on the Vedas, contain the germs of the great systems of Hindu philosophy which were afterwards developed. A necessary consequence of the development of such doctrines was a further separation between the educated and the vulgar creeds.

A new era in the history of Hinduism begins about the time of the Christian era with the composition of the two great epics, the Râmâyana and the Mahâbhârata, the latter of which was the product of successive ages. The vulgar creed had by this time experienced the influence of the theological and metaphysical speculations we have adverted to, and had assumed a mystical unity. Brahmâ, Vishnu, and Siva, the three emanations of the great soul Brahma, representing respectively the creative, preserving, and destroying principles, had become the leading objects of worship. Brahmâ, though considered the most exalted of the three, soon sunk out of notice, and the worshippers became divided between Vishnu and Siva. An element of contention was introduced between the worshippers of these deities, and the progress of this struggle is marked in the epics alluded to. The Râmâyana treats Vishnu as the superior deity, the Mahâbhârata displays the progress of the rivalry between him and Siva. From the epic period the inferior gods are considered as mortals, rendered immortal by external agency, first by Soma offered by their worshippers, and subsequently by a beverage, Amrita, obtained through the instruction of Vishnu. During this period was also developed, particularly in the poem Bhagavadgita, what is called the Yoga doctrine, namely, that the union of the individual soul with the supreme being may be aided by penances, postures, protracted fasting, modes of breathing, &c. The three great systems of Hindu philosophy, called the Sânkhya, the Nyâya, and the Vedânta, also grew up in this period. The doctrine of metempsychosis assumed the fantastic forms indicative of degeneracy.

The third or Purânic period of Hinduism corresponds with the period of the middle ages in Europe. The Purânas are discussions upon religion and philo-

sophy, in the form of dialogues conducted by sages. They are designed for popular instruction, and mark a rapid and extensive corruption of the Hindu religion. The epic legends are amplified and distorted. The struggle between Vishnu and Siva becomes more marked and antagonistic. The worship of the latter and of his wife Durgâ, which is offensive and revolting, widely prevails over the comparatively innocent worship of Vishnu. The Tantras, another class of religious dialogues, were composed expressly for the worshippers of Durgâ, and she and her husband are the interlocutors in them. The Vedânta philosophy, which had become the basis of the educated creed, still exercised a favourable influence on the popular worship. The creed of the Purânas is still that of the masses in India, and among the educated classes the principles of the Vedânta philosophy, which acknowledges the unity and perfections of the deity, are more popular than those of the more sceptical Sânkhya. The worshippers of Vishnu are called Vaishnavas; those of Siva, Saivas; the worshippers of Durgâ, Sâktas. Of the Purânas some are Vaishnava, others Saiva.

Buddhism arose in India in the sixth century B.C. It prevailed there extensively, and being animated by a propagandist spirit it spread itself through the adjoining regions of Asia. Whether from internal dissensions, which are known to have prevailed in it, or from persecution, as is generally supposed, or both combined, it became extinct in India before the twelfth century; but it still flourishes in China, Japan, and in the south-eastern regions of Asia, as well as in Nepal and Ceylon. (See BUDDHA.) The Jainas or Jains, whose religion is a mixture of the Buddhist and the Brahmanical creeds, are still numerous in Hindustan, and particularly in Gujerat. There are two sects of this creed, called Digambaras and Swetâmbaras. Sikhism is another heretical form of Brahmanism prevalent in the Panjab. There are numerous other minor sects of Hinduism and worshippers of particular gods in the Hindu mythology. The Brahmo-Somaj is a modern Hindu theistic sect, which has made no great progress as yet. There are Hindu Fakirs, or devotees, who give themselves up to penance, filth, and self-torture. The Parsees or fire-worshippers are descendants of the Persian followers of that religion (see GUEBERS), who took refuge from Mohammedan persecution on the western coast of India. Their principal emigration was to Surat, and is supposed to have taken place about the end of the eighth century. They were well received in Gujerat. They are now to be found mostly in the mercantile towns of India, and are most numerous in Bombay. The Mohammedans of India are chiefly descendants of its Asiatic conquerors from Afghanistan, Persia, Baluchistan, and Arabia. They are said to be more liberal-minded than the Mohammedans of Western Asia. There is among them a sect of Fakirs like those of the Hindus. There are also numerous Jews in India. On Christianity in India see below under *Christian Missions*. Hinduism recognizes four castes—the Brahmans, or sacerdotal class; the Kshatriyas, or military class; the Vaisyas, or mercantile and agricultural class; and the Sûdras, or servile class. These castes are hereditary (see CASTE). Closely connected with the Hindu religion is the collection of laws commonly known as the Institutes of Manu. (See MANU.) In the Indian census table of religions more than nine million people are returned as heathens or aboriginals, that is, devotees of some form of animism. Practically, for the purposes of the Indian census, all are classed as animistic who are not locally acknowledged to be Hindu, Mohammedan, Christian, Buddhist, Jew, Parsee, &c., but every stratum of Indian society is in reality more or less saturated with animistic conceptions.

Agriculture.—The total area accounted for in the agricultural returns of India is 545 million acres, of which 64½ million are under forest, 136½ million not available for cultivation, and 147½ million culturable waste and current fallows. The net crop-yielding area is thus 196½ million acres, or, taking account of land cropped several times in a year, 223½ million acres. The three chief food-grains of India are rice, millet, and wheat. Rice is the staple food of about a third of the population, and is grown on 75 million acres, but it is nevertheless essentially a local crop, which can be cultivated with profit only under exceptional circumstances. Of the total rice area 40 million acres belong to Bengal, where it is the staple crop, and about 7 million each to Madras and Burma. Over 90 per cent of the cultivated area of Lower Burma is under rice, and it is grown on nearly three-quarters of the area of Assam, about one-third of that of the Central Provinces, a quarter of that of Oudh, while it is of importance also in the North-west Provinces and Sind. It is grown to a less extent in the Panjab and Bombay. Rice is also cultivated by hill tribes in all parts of India. In Bengal there are two chief rice harvests in the year, the *âus* or early crop, chiefly for local consumption, and the *âman* or winter crop, chiefly for export; but in Lower Burma, whence most of the exported Indian rice comes, there is but one harvest, corresponding to the Bengal winter crop. The total area under wheat is 24 million acres, mainly in the Panjab (7½ million), where it is the leading crop, the United Provinces of Agra and Oudh, the Central Provinces, Bombay, Central India, and Bengal. 'Taking India as a whole, it may be broadly affirmed that the staple food-grain is neither rice nor wheat, but millet.' The area under the various kinds of millet and maize is 43 million acres, chiefly in Bombay (13½ million), where these are the chief food crops, Madras, where also, though to a less extent, millets are the chief food-grains, the Panjab, the United Provinces, Berar, in which millets are by far the most important food crops, Central Provinces, Sind, Bengal, and Upper Burma. The chief varieties of millet grown in India are *joár*, or *jawári*, or *cholam*, great millet (*Sorghum vulgare*); *bájra*, or *kambu*, spiked millet (*Pennisetum typhoideum*); and *ragi*, or *nâchani* (*Eleusine corocana*), grown chiefly in Southern India. About 8 million acres are sown with barley, chiefly in the upper Ganges valley, the Himalayan valleys, and the Panjab. Gram crops or pulses, especially chick-pea, green-gram, horse-gram, lentil, and pigeon-pea, occupy about 10 million acres, especially in the United Provinces, the Panjab, and Bengal. The large native demand for oil has been reinforced in recent times by a rapidly-increasing foreign demand, and in consequence the cultivation of oil-seeds has greatly developed. They are grown in many parts as a second crop on ground from which rice or some other food crop has already been taken. The chief varieties cultivated are linseed, rape-seed, sesamum (*til* or gingelly), and castor-oil, and the total area occupied by them is 22 million acres, chiefly in Bengal, Bombay, and Sind, Madras, Central Provinces, and Panjab. The area under ground-nuts in Bombay and Madras is about 170,000 acres. The cultivation of vegetables for household use is general, and near some of the towns it is carried on more extensively. Potatoes thrive best in the more elevated tracts. Among cultivated fruits are the mango, guava, orange, melon, citron, lime, fig, plantain, pine-apple, pomegranate, tamarind, shaddock, jack, papaw, and custard-apple. The area under sugar-cane is about 2,800,000 acres

in Bengal (especially in Orissa), the United Provinces, the Panjab, Madras, and Bombay. Jaggery sugar is made from the bastard date-palm, which is grown for this purpose in the neighbourhood of Calcutta and in north-eastern Madras. The tea crop is one of great and increasing importance, and occupies about half a million acres, of which 330,000 are in Assam, the rest being in Bengal, Panjab, the United Provinces, Madras, Burma, and native states. With the exception of a few hundred acres in Burma, Assam, &c., the whole of the coffee-growing area, amounting to about 280,000 acres, is in Southern India, in Mysore, Kurg, Madras, Travancore, and Cochin. The chief cinchona plantations are the government ones at Darjiling and in the Nilgiris. The tree was introduced by the Indian government.

Cotton is one of the most valuable vegetable productions of India. The total area under the cotton-plant is 14,000,000 acres, distributed as follows: Bombay and Sind (3,900,000), Berar (2,500,000), Haidarabad (1,700,000), Madras (1,400,000), the United Provinces (1,250,000), Panjab (1,200,000), Central Provinces (1,000,000), and smaller areas in Central India, Rajputana, Burma, and Bengal. Next in importance to cotton among Indian fibres comes jute, which is cultivated in eastern Bengal along the valleys of the Ganges and the Brahmaputra, occupying fully 2 million acres. The cultivation of the mulberry, for the rearing of the silk-worm, is chiefly carried on in eastern and northern Bengal, with Murshidabad as a centre. The indigo industry is one of the oldest in India, but it is at present in a languishing condition. The area under the plant is about 964,000 acres, chiefly in Bengal (360,000 acres), the United Provinces, Madras, and Panjab. The opium poppy is cultivated in certain parts of western Bengal and the United Provinces, and also in the Panjab, and in the native states of Rajputana and Central India, occupying in all about 600,000 acres. (See below under *Finance*.) Tobacco is grown in every district for local consumption. Among the numerous minor cultivated vegetable products of India are turmeric, chillies, ginger, coriander, aniseed, black cummin, fenugreek, pepper, cardamoms, betel-pepper, areca or betel-nut palm, cocoa-nut palm, palmyra palm, and date-palm. Experimental cultivation of rhea, rubber, sisal-hemp, and other valuable economic plants has been carried out on the experimental farms maintained by government in various parts of the country.

Horned cattle are used in agricultural operations throughout all India, except Sind and the Panjab, where camels generally take their place. The total number of cattle in India is over 100 millions, of sheep and goats 40 millions, of horses, ponies, mules, and donkeys, 2½ millions, and of camels about a quarter of a million. There are large numbers of buffaloes in all parts of the country. A public veterinary department has been organized to attend to the improvement of the breeds of horses, ponies, mules, and cattle, the prevention of disease among domestic animals, and the provision of veterinary instruction. Its operations are mainly confined to Northern India, where the conditions are most favourable for the breeding of horses for military purposes.

Forests.—The three most valuable timber trees of India are the teak (*Tectona grandis*), the sál or saul (*Shorea robusta*), and the deodar (*Cedrus Deodara*). The teak grows most luxuriantly along the Bombay coast, in Travancore and Cochin, and in Burma, but it is also abundant throughout much of Central India and elsewhere. The sál is the chief forest tree of the Himálayan slopes, from the Satlej eastward to Assam, and it grows also in the forests of Central India and the Eastern Ghâts. The home of the deodar is the North-western Himálayas. Among the most valuable trees of the densely-forested Western Ghâts from Kanara to Travancore and Mysore are teak, blackwood, bamboos, sandal-wood, a kind of ebony, and *Calophyllum inophyllum*, whose wood is prized for the spars of ships. In the United Provinces and neighbouring districts the leading species are sál and several varieties of pines, and in the extensive jungles of the Ganges delta the most useful wood is that of the sundari (*Heretiera littoralis*). The forests of Assam yield sál, *Pinus Kasya*, caoutchouc (*Ficus elastica*), and other useful species, and plantations of teak, tun or toon (*Cedrela toona*), and sissoo (*Dalbergia sissoo*) have been laid out. Besides teak the Burmese forests contain iron-wood and the cutch-tree (catechu). Before the formation of the Indian Forest Department the forests were recklessly destroyed by timber-cutters, nomadic cultivators, and others, but large forest areas in all the provinces have now been marked off as reserved forests under the immediate care of the forest officers, and other forest areas have been brought under partial conservancy. Timber-cutting and grazing have been either prohibited or restricted; and plantations of the more useful trees have been formed in many parts of the country. In every province a few of the most valuable timber trees are declared to be reserved trees, and can only be felled under special license. Forest revenue is raised by royalties on, or by the sale of, timber or other produce, and by the issue at specified fees of permits to graze cattle, or to extract for sale timber, fire-wood, charcoal, bamboos, canes, and other minor forest produce. The reserved forests now cover an area of more than 80,000 square miles, and the protected or partially conserved forests occupy other 30,000 square miles. Some of the native states, such as Mysore, Travancore, Baroda, and Kashmir, have followed the example of the British government.

Canals and Irrigation.—In some parts of India, such as Sind, cultivation is impossible without irrigation, whilst in others, such as much of Lower Bengal, irrigation may be regarded as quite unnecessary; but in the greater part of all the provinces the rainfall is either insufficient for the proper cultivation of the soil, or so uncertain as to expose the agriculturists to the constant risk of scarcity and even of actual famine. The necessity of irrigation has long been recognized in India, and many of the irrigation works now administered by the Public Works Department are simply old native works restored, and in some cases extended or improved. The total irrigated area of India is about 37 million acres. Tank irrigation is very common in some districts, especially in Southern India, and the tanks are mostly of native origin. Many old tanks, however, have been repaired or improved by the British government, and new ones have been constructed in Madras (where there are now 60,000 tanks), the Bombay Deccan, and Ajmir-Merwara. In parts of Baluchistan, where the rainfall is scanty and capricious, water for irrigation purposes is drawn from underground springs by means of tunnels driven into the hill-sides. The most common method of irrigation in India, however, is that by wells, which prevails over large areas in all the provinces. Canal irrigation was practised to some extent by the native rulers, but all the important canals have been constructed since the British occupation. Irrigation canals are of two kinds, inundation and perennial. The latter are furnished with permanent headworks and weirs, and are capable of irrigating

large areas throughout the year, independently of the local rainfall; whilst the former, which are peculiar to Sind and the Panjab, are simply earthen channels supplied with water by the annual rise in May of the Indus and its affluents. Many of the perennial canals are, either in whole or in part, used for navigation, and there are, besides, a few canals used for navigation alone. Up to 1899–1900 the total capital outlay on the canals for which full accounts are kept had been £27,541,021; the gross receipts for that year were £2,617,576; the net receipts, £1,677,303; and the area irrigated by them, 13,430,841 acres. The total length of irrigation canals in operation was 42,352 miles, of which 12,497 miles were main canals and the rest distributaries. The total mileage of navigable canals in Bengal, Panjab, the United Provinces, and Madras is fully 4000 miles, of which about 1600 miles are for navigation only.

The total area irrigated by canals in Bengal exceeds 720,000 acres, and the length of irrigation canals is 3381 miles, of which 747 miles are main canals. Of these canals 495 miles are open to navigation, and there are 1339 miles of canals used for navigation only, thus giving a total length of 1834 miles of navigable canals. The area in the United Provinces of Agra and Oudh irrigated by canals exceeds 2,800,000 acres (over 1½ million acres being irrigated by the Upper and Lower Ganges Canals), and the total length of irrigation canals is 12,534 miles, 1554 miles being main canals. Of these canals 537 miles are open to navigation. Over 5 million acres in the Panjab are irrigated by canals, the total length of these being 12,069 miles, of which 3478 are main canals, 432 miles of the latter being utilized for navigation also. Three million acres are irrigated by canals in Madras, and rather more by tanks and in other ways. The total length of irrigation canals in the province is 10,522 miles, of which 3474 are main canals. The total length of canals used for navigation is 1252 miles, of which 262 miles are for navigation only. In Bombay proper the canals are generally small, and they are usually associated with storage reservoirs. Taking Bombay and Sind together, the total irrigated area is 1,700,000 acres; the length of irrigation canals is 3801 miles, of which 3240 miles are main canals. There are no large irrigation works in Lower Burma, but a considerable amount has been expended on river embankment and drainage works, and on making navigable channels. The chief work in Upper Burma is the Mandalay Canal.

Divisions and Population.—India as a whole is partly under direct British rule and partly under native rule subject to control by British political agents. The total area of British India is 1,766,797 square miles, of which 1,087,404 square miles are under direct British rule. The total population of British India according to the census returns of 1901 is 294,360,356, of which 231,898,807 are under immediate British authority. Ajmir-Merwara, Berar, Kurg, and the North-West Frontier Province are under the immediate control of the Governor-general; Madras and Bombay (with Sind, Aden, and Perim), the two presidencies, are each ruled by a governor; Bengal, the United Provinces of Agra and Oudh, Panjab, and Burma are each under a lieutenant-governor; and there are chief commissioners over Assam and the Central Provinces. The North-West Frontier Province was formed in 1901 out of part of the Panjab, and certain other areas adjacent which were not previously included in India, and the United Provinces of Agra and Oudh were known till 1902 as the North-west Provinces and Oudh. The following table gives the areas of the British provinces and their populations in 1891 and 1901:—

Province.	Area. sq miles.	Population 1891.	Population 1901.
Under Governor-General—			
Ajmir-Merwara	2,711	542,358	476,912
Berar	17,710	2,897,491	2,754,016
Kurg	1,582	173,055	180,607
North-West Frontier Province	16,466	——	2,125,480
Under Governors—			
Bombay (with Sind, Aden, Perim)	123,064	18,901,123	18,559,561
Madras	141,726	35,630,440	38,209,436
Under Lieutenant-Governors—			
Bengal	151,185	71,346,987	74,744,866
United Provinces	107,164	46,905,085	47,691,782
Panjab	97,209	20,866,847	20,330,339
Burma	236,738	7,608,552	10,489,924
Under Chief Commissioners—			
Assam	56,243	5,476,833	6,126,343
Central Provinces	86,614	10,784,294	9,876,646
Other Parts—			
Baluchistan	45,804	27,270	308,246
Andamans, &c.	3,188	15,609	24,649
Total	1,087,404	221,175,944	231,898,807

Burma, Baluchistan, and the Andamans, &c., were incompletely enumerated in 1891. The population of the Panjab in 1891 is that on its former area.

Six of the eight large provinces have a number of native states attached to them. Those attached to Bengal have an area of 38,652 square miles, and a population in 1901 of 3,748,544—the individual states being Orissa, Chota Nagpur, Kuch Behar, and Hill Tipperah; to the United Provinces, area 5079 square miles, pop. 802,097—the states being Rampur and Garhwal; to the Panjab, area 36,532 square miles, pop. 4,424,398—the chief states being Patiala, Bahawalpur, Kapurthala, Jind, and Nabha; to Madras, area 9969 square miles, pop. 4,188,086—the chief states being Travancore and Cochin; to Bombay, area 65,761 square miles, pop. 6,908,648—the chief states being the Kathiawar group, Kolhapur, Rewa Kantha, Palanpur, Mahi Kantha, Cutch, and Khairpur (Sind); to Central Provinces, 29,435 square miles, pop. 1,996,383—chief states, Patna, Kalchandi, Bastar, Bamra, and Raigarh.

The other native states and agencies are: the Rajputana Agency, including among others the states Jaipur, Jodhpur, Udaipur, Bikanir, Alwar, Bhartpur, and Jaisalmir, with a total area of 127,541 square miles and a pop. (1901) of 9,723,301; Central India Agency, including among others the states Gwalior, Rewa, Indore, and Bhopal, with a total area of 78,772 square miles and a pop. of 8,628,781; Baroda, area 8099 square miles, pop. 1,952,692; Haidarabad, area 82,698 square miles, pop. 11,141,142; Mysor, area 29,444 square miles, pop. 5,539,399; and Kashmir, area 80,900 square miles, pop. 2,905,578. The total area of native states and agencies was 679,393 square miles, and their total population in 1891, 66,047,487; in 1901, 62,461,549.

The first census of all India was taken in 1871–72, but it was not till that of 1891 was taken that a really reliable and comprehensive statistical account of the peoples of India was available. In 1871–72 the total population of India was returned at 240,931,521, in 1881 at 253,793,514, in 1891 at 287,223,431, in 1901 at 294,360,356.

Of the total population in 1901, 207,146,422 professed the Hindu religion, the greater number of these being in Bengal, the United Provinces, Madras, Bombay, Haidarabad, and Rajputana. There were 62,458,061 Mohammedans, chiefly in Bengal and the Panjab (where they preponderate); 8,711,360 aboriginals, chiefly in Bengal, Central

India, and Central Provinces; 9,476,750 Buddhists, almost all in Burma; 2,923,241 Christians, of whom two-thirds are in Madras and the Madras states; 2,195,268 Sikhs, almost all in the Panjab and the Panjab states; 1,334,148 Jains, chiefly in Rajputana and in Bombay and the Bombay states; 94,190 Parsees, mostly in Bombay; and 18,228 Jews, mostly in Bombay. The total number of Europeans was only 169,677.

France still possesses in India Pondicherry, Karikal, and Yanaon, on the east coast of Madras; Mahé, on the west coast of Madras; and Chandarnagar on the Hugli, north of Calcutta. To Portugal belong Goa, Damão, and the small island of Diu, on the coast of Bombay. These French and Portuguese possessions have a total area of 1754 square miles and a population of 852,752.

Finance.—The gross revenue of India in 1899–1900 was £68,637,164, and the gross expenditure charged against revenue £65,862,541. In addition, there is a capital outlay on railways and irrigation not charged against revenue, amounting in 1899–1900 to over £4,000,000. The total public debt of India on Mar. 31, 1900, was £199,127,535, of which £74,983,134 represented the debt in India, and the rest the debt in England. The largest item in the revenue is that derived from land, which amounted in the year under review to £17,875,230. (See *Land Revenue and Land Settlement* below.) The revenue from forests was £1,235,425, and the total amount of tribute received from native states was £586,603. The revenue from opium amounted to £4,401,982, but the net revenue is less than that amount by about £1,700,000. The opium revenue is raised partly by a monopoly in Bengal, and partly by the levy of a duty on all opium exported from native states. The cultivation of the opium poppy is prohibited throughout British territory, except in certain parts of Bengal and the United Provinces of Agra and Oudh, but on a few thousand acres in the Panjab it is grown for local consumption. The opium grower in the monopoly districts receives advances from government to enable him to prepare the land for the crop, and he is required to deliver the whole of his produce to government agents at the fixed price of 6 rupees per seer. The manufacture for the foreign market is carried on only in the government factories at Patna and Ghazipur, and the chests of manufactured opium are sold by auction at monthly sales in Calcutta. Outside of British territory opium (known as Malwa opium) is cultivated in the native states of Rajputana and Central India, and some of these states have agreed to control the manufacture and sale of opium in much the same way as the Indian government does in British territory. They levy heavy duties on opium exported from their territories for the China market, and the Indian treasury imposes on all such opium a duty now fixed at £33⅓ per chest. The revenue from taxation is £20,200,000, the chief item in it being the salt revenue, £5,850,463. The salt revenue is raised by a duty on all salt imported into, or manufactured in India, the duty being now 2½ rupees per maund, except in Burma, where it is 1 rupee per maund. The native sources of salt supply are the coast, especially the Rann of Cutch (Baragra salt) and Maurypur (Sind), the salt lakes and pits (especially Sambhar Lake) of Rajputana, and the salt mines (especially the Mayo mine) of the Panjab. Bengal and most of Burma import their salt by sea, much of it coming from England. Several native chiefs have entrusted the management of their salt sources to the British authorities in return for certain payments. The excise accounts for £3,859,942 of the revenue from taxation. The only excisable articles are intoxicating liquors (including toddy, palm-wines, and rice-beer), and certain drugs (opium, ganja, bhang, charas), and the aim of the government in taxing these has been as much to reduce consumption as to raise revenue. The government treats the right to manufacture and the right to sell spirits as state monopolies, which are granted to individuals on special terms. Throughout the whole of Bombay and the Panjab, the most populous tracts of Madras, the United Provinces, and Burma, and in some parts of Bengal and the Central Provinces, the central distillery system in some form prevails, and a still-head duty is levied on all spirits manufactured at the recognized distilleries. Except in Madras and some other parts, these central distilleries are government establishments at which private persons distil spirits. In other districts the spirit revenue is raised by farming out the spirit monopoly to the highest bidder, or by licensing the establishment of private stills, the latter method being called the out-still system. The Indian government is replacing the farming and out-still systems as far as possible by the central distillery system. The customs revenue amounted in 1899–1900 to £3,070,628. Import duties were abolished in India in 1882, but in 1894 they were reimposed, and now all goods, with the exception of railway material and industrial machinery, food grains, coal, jute, wool, and other raw materials, gold and unset precious stones, and some other commodities, are subject to import duty. The amount of the duty is generally 5 per cent, but petroleum is charged at the rate of 1 anna per gallon, and iron and steel are subject to a duty of only 1 per cent. Since 1896 all cotton yarns imported into or manufactured in India have been duty-free, whilst all woven cotton goods imported from abroad, or manufactured at power-mills in India, pay an *ad valorem* duty of 3½ per cent. There is an export duty on rice and rice-flour of 3 annas per maund of unhusked rice. A countervailing duty on bounty-fed sugar came into force in March, 1899. The revenue from stamps was £3,265,477. The provincial rates, amounting to £2,498,785, are levied mostly on the land to meet local charges for roads, schools, &c., and are generally collected with the land revenue. The income-tax, which yielded £1,300,295 in 1899–1900, is levied at the rate of four or five pie per rupee, certain incomes being exempted. Other important heads of revenue are: post-office, telegraphs, and mint, £2,336,178; civil departments, £1,175,300; railways, £16,587,845; irrigation, £2,617,576; buildings and roads, £441,800. The chief elements in the expenditure are: railways, £16,511,086; army, £14,850,000; civil salaries, &c., £9,597,544; charges of collection, £4,448,839; buildings and roads, civil and military, £4,134,652; miscellaneous civil charges (furlough and superannuation allowances, pensions paid in England, &c.), £3,513,138; irrigation, £2,241,765; famine relief and insurance, £2,098,848; post-office, telegraphs, and mint, £1,685,587; interest on public debt, &c., £1,342,283; refundings, compensations, drawbacks, &c., £1,259,000.

Land Revenue and Land Settlement.—In India the state, or the monarch, has always enjoyed a share in the rent or profits from the land. Before the advent of the Mohammedans and the establishment of the Mogul Empire the almost universal unit for the purposes of revenue collection was the village community. In a village community land was held, not by private owners, but by cultivators occupying it under the village corporation, and the land revenue was collected from the head-man as representing the community. With the Mohammedan

conquest new methods of revenue collection were introduced. The state claimed one-third of the gross produce of the soil as its share, and entrusted its collection to persons who each agreed to pay a definite amount from the district assigned to him. These revenue farmers, known as *zamindars*, were often local magnates under the old Hindu system. Under British rule the aim has been to substitute private property in the soil, wherever practicable, for the older communal systems, and in consequence the zamindars, who were in no sense proprietors, have become so in several parts of British India, whilst in others the cultivating *rayats* (or *ryots*) have been raised to the status of peasant proprietors. The village community, however, in some form still exists both in British and in native territory.

'The term 'settlement' is applied in Indian revenue affairs to the process of assessing the land revenue demand. Occasionally, in newly-acquired or specially backward tracts, the land revenue is assessed for a short term of years on a general review of the circumstances and capabilities of the land and people concerned; such a process is called a summary settlement. But a regular settlement is a more complicated affair, and consists of many stages. In the first place, every separate estate or holding is demarcated by permanent marks on the ground; and disputes between neighbouring right holders are investigated and decided. Every estate or holding is then surveyed and mapped, all boundary-marks, wells, and buildings being shown on the field or cadastral maps. After the field maps are prepared, the next process is to classify or record each field according to its productive value, as evidenced by its soil, the amount of its produce, or by the rent it pays. A record is at the same time drawn up of all rents paid, and of all rights, whether landlord rights, or tenant rights, or rights of user, over all the ground, buildings, wells, and trees shown in the map. Then the assessing officer (or settlement officer, as he is often called) compiles the information obtained for all the lands in a circle of villages; and on a review of all these data, of the past fiscal history of the tract, of the range of prices, of the accessibility of markets, and of other general considerations, he proposes rent rates or revenue rates for the several classes of lands in the circle. The rent rates or revenue rates proposed by the settlement officer, and the grounds on which they were based, are then investigated by a superior officer, and are not adopted until they have been accepted or modified by the latter.

'In provinces where the zamindari tenure prevails, that is, where single proprietors or proprietary brotherhoods possess large estates of several hundreds or thousands of acres, the state revenue is assessed at an aliquot part (usually about one-half) of the ascertained or assumed rental. The revenue, though it is fixed with reference to acreage rates on the land actually cultivated, is assessed on, and is payable by, each estate as a whole; the assessment remains unchanged for the thirty years, or other period of the settlement; the proprietor can bring as much as he likes of his waste and fallow land under the plough; and it is only on re-assessment at the end of the term of the settlement that the state obtains any increase of revenue on account of the extensions of cultivation during the settlement period. In provinces where the rayatwari tenure prevails, that is, where each petty proprietor holds directly from the state, generally cultivates his own land, and has no landlord between himself and the government, the revenue is separately assessed at an acreage rate on each petty holding, and land revenue becomes payable at once, or after a short term of grace in the case of uncleared lands, on all extensions of cultivation. The rayatwari proprietor is at liberty to throw up his holding, or any portion of it, at the beginning of any year, after reasonable notice; the zamindar, or large proprietor, engages to pay the revenue assessed upon him for the term of the settlement' (*Statement exhibiting the Moral and Material Progress and Condition of India during the year 1899–1900*, pp. 71–72, abridged).

The land revenue assessment was fixed permanently more than a hundred years ago on the greater part of Bengal, about a third of Madras, and certain southern tracts of the United Provinces, paying in all about £2,850,000 a year. In the temporarily settled tracts, comprising the rest of India, it is fixed periodically for terms of 12 to 30 years. In the nine chief provinces (Bengal, Bombay and Sind, Madras, the United Provinces, the Central Provinces, the Panjab, Burma, Assam, Berar) the total number of rayatwari holders is about 273,000, of whom none belong to Bengal, the Panjab, and the United Provinces. The total number of zamindars and village communities is about 318,500, of which only Sind and Berar have none. The total number of holdings is thus about 591,500. In the greater part of Bengal land is held by zamindars under a permanent settlement, but the tenants are protected by recent legislation. The rayatwari system is the prevalent one in Madras, and in Bombay a similar system has been established. In the latter province the cultivators are now protected by law against the extortions of the money-lenders. The village community is still common in the United Provinces and the Panjab. In Oudh much of the land is held by talukdars, who have been granted certain privileges which have been denied to the zamindars.

Money, Weights, and Measures.—By an act passed in 1835 a uniform monetary system was established throughout India, with the Madras silver rupee of 180 grains, $\frac{1}{2}\frac{1}{2}$ths fine, as the monetary unit. The rupee was subdivided into 16 annas, and each anna into 12 pies (or four pice). Silver was made the universal standard of value, and the silver rupee and half-rupee were declared to be legal tender to any amount. The other smaller coins were made legal tender up to the value of one rupee. 100,000 rupees are called a lakh or lac, and 100 lakhs a crore. The coins under this system are: Silver—Rupee, half-rupee, quarter-rupee; Bronze or Copper—Three pies (or a pice), six pies, one pie. There are also gold coins called mohurs, but they are not a legal tender, and there is no fixed ratio between them and the silver coins. Small payments in the bazaars are made in cowries, of which from 2500 to 5000 are equivalent to one rupee. The rupee was formerly valued at two shillings, but it has fluctuated greatly, mainly downwards. In Jan. 1895 it was nearly as low as one shilling; at present it is about sixteen pence. In view of the steady depreciation of silver, and the consequent financial embarrassments and burdens to which the government of India was subjected in its dealings with gold-standard countries, an act was passed by the Governor-general's Legislative Council in 1893 under which the Indian mints were closed to the free coinage of silver. On Sept. 15, 1899, a further act was passed, by which gold coins issued from the Royal Mint in England, or any branch of the Royal Mint, were made legal tender at the rate of fifteen rupees to the sovereign. Arrangements are being made for the coinage of gold in India. By an act of 1861 and some subsequent acts, promissory notes for amounts varying from 5 to 10,000 rupees have been emitted under the authority of a public issue department. Currency

circles have been established from time to time, and these notes are legal tender only within the circle of issue. They are payable at the place of issue and also at the capital city of the presidency in which the place of issue is situated.

By the Measures of Length Act of 1889 the British imperial yard of 3 feet or 36 inches was made the standard of length for the whole of British India. The most important of the old native measures of length was the *guz* of Bengal, which was practically equal to a yard. An act was passed in 1871 to prepare the way for the adoption of a uniform system of weights and measures of capacity throughout British India. The unit and standard of weight established by the act is the *ser*, which is equal to a kilogram or 2¼ lbs. The unit of capacity was declared to be a measure containing one ser of water, at its maximum density, weighed in a vacuum, and is thus equal to a litre or 1¾ pint. Among native weights the most important are the tola (Bengal) of 180 grains, and the imperial or Indian maund of 40 seers, equal to 82⅔ lbs.

Manufactures.—The domestic industries of India, such as weaving and spinning, pottery, brass-work, iron-work, and art work of many kinds, continue to be practised after ancient methods all over the continent of India. But Indian fabrics and products, made on a small scale by workers at their homes, have for years past been giving way before the cheaper, less artistic, and often less durable cotton yarn and fabrics, and the iron or steel products of British factories. Meanwhile an important manufacturing industry has been growing up, and steam-power factories are at work, among which those for spinning and weaving cotton, for spinning and weaving jute, for making paper, for husking and cleaning rice, for sawing timber, and for brewing beer, are the most important. Steam power is also largely employed in factories, on tea gardens, and indigo estates. In 1900 the number of cotton-mills in British India and native states was 186, containing 38,420 looms and 4,728,000 spindles, and giving employment to 163,000 persons. Of these mills 136 were in Bombay Presidency (80 in Bombay City), the rest being in Madras, Bengal, the Central Provinces, the United Provinces, Burma, the Panjab, and Berar, besides some of the native states. The number of jute-mills was 33 in 1899–1900, containing 14,021 looms and 293,218 spindles, and employing over 100,000 persons. All the jute-mills are in Bengal, except one in Cawnpore, which is the chief manufacturing locality in the United Provinces. Four woollen mills produce blankets, serges, and cloths worn by the army and the police. The largest brewery is at Murree, in the Panjab Himálayas. Among other industrial works of importance are silk-mills, soap-factories, tanneries, iron and brass foundries, sugar-factories, coffee-works, cotton-presses and ginning-factories, jute-presses, rope-factories, oil-mills, cutch and lac factories, flour-mills, ice-factories, pottery and tile factories, bone-crushing works, tobacco and cigar factories, silk filatures, glass-factories, dye-works, indigo-factories (over 5000), printing-presses, and dairy farms. The total number of persons employed in all these manufacturing industries is about 700,000. The present Indian Factory Act came into force at the beginning of 1892. The daily wages of a man employed in a factory vary, according to locality, from 2 to 4 annas (2*d.* to 4*d.*).

Trade and Commerce.—From a very early period down till comparatively recent times Western traders visited India in order to obtain the gold and silver, jewels, spices, and other costly products for which India was then celebrated, but the present foreign trade of India has developed under British rule and rests on an entirely different basis. In the year 1700 the total value of the exports from India was under £1,000,000, in 1834 the value had risen to £10,000,000, and now goods and treasure to the value of about £80,000,000 are exported every year. In 1899–1900 the total value of private imports by sea (excluding treasure) was £47,141,240, of government imports of stores, £3,061,745; total of all imports other than treasure, £50,202,985. The total value of private exports of Indian merchandise was £70,475,902, of foreign merchandise re-exported £2,195,105, of government exports of stores £71,423; total of all exports other than treasure, £72,742,430. Treasure was imported to the value of £13,982,457, and exported to the value of £5,304,259. Thus, including treasure, the total exports by sea amounted to £78,046,689, and the total imports to £64,185,442, the total sea-borne trade being £142,232,131. The exports by land in the same year were valued at £3,760,185, and the imports by land at £4,705,805. Thus, the total trade of India by land and sea amounted in 1899–1900 to £150,698,121. The chief articles of import were: cotton woven goods, £18,001,000; metals and hardware, £4,181,000; oils, chiefly petroleum, £2,284,000; sugar, £2,251,000; railway material, £1,851,000; machinery and mill-work, £1,695,000; cotton yarns, £1,633,000; chemicals, medicines, dyes, £1,288,000; woollen goods, £1,172,000; silk, raw and manufactured, £1,137,000; provisions, £1,125,000; liquors, £1,065,000; and apparel, £976,000. The chief exports were: jute, raw and woven, £9,557,000; husked rice, £8,671,000; hides and skins, £6,976,000; oil-seeds, £6,745,000; raw cotton, £6,618,000; tea, £6,061,000; opium, £5,469,000; cotton yarns, £4,601,000; wheat, £2,606,000; indigo, £1,795,000; coffee, £990,000; raw wool, £904,000; and cotton woven goods, £841,000. The proportion of trade directly with European countries is about 63½ per cent, omitting the trade with Egypt, much of which really goes to Europe. The trade with the United Kingdom is over 70 per cent of the trade with Europe and nearly 45 per cent of the total trade. Next to the United Kingdom, the chief countries trading with India are China, Germany, United States, Straits Settlements, France, Japan, Belgium, Ceylon, Austria-Hungary, Italy, and Russia. The chief imports from India into the United Kingdom are tea, jute and jute manufactures, wheat, oil-seeds, rice, leather, wool, indigo, coffee, teak-wood, cotton, and lac; and the chief articles of British produce exported to India are cotton manufactures, iron, machinery, cotton yarns, woollens, and copper. The share of the five chief seaports of India in the total foreign trade (excluding treasure and government stores) in 1899–1900 was as follows: Calcutta, £52,826,000; Bombay, £37,646,000; Rangoon, £8,118,000; Karáchi, £7,034,000; Madras, £6,436,000. India has many other seaports of minor importance. The value of merchandise and treasure carried in coasting vessels during 1899–1900 was £27,094,000. The trade across the land frontiers is steadily increasing, the chief item among imports being food grains, and among exports cotton goods. Much greater than her trade with foreign countries is the internal trade of India, but no returns of its amount are available. It is mostly in the hands of natives, and to a large extent in those of particular groups or castes. It is still carried on, as it has long been, at village markets, town bazaars, religious fairs, and similar gatherings, but the development of railway and canal communication and the transformation in

the system of agriculture have greatly altered its character in many ways.

Railways and Roads.—The first Indian railway, from Bombay to Thana, was opened in 1853. The main trunk lines constructed from that time till about 1875 were built and managed by private companies on whose capital the Indian government guaranteed a fixed rate of interest, generally five per cent. The government, in return for this assistance, exercised a general control over the companies, and reserved the right of buying the undertakings at specified dates on stated terms. In 1870 Lord Mayo initiated the policy of railway construction by direct state agency, but in more recent times several lines have been constructed by 'assisted companies'. Several of these latter lines have been taken over by government. There are also native state railways constructed from capital raised in native states, but generally worked by a staff employed by the government of India or by the trunk railway companies to whose lines they serve as feeders. The total mileage of railways in India on Dec. 31, 1900, was 24,593, distributed as follows: state lines worked by the state, 5884; state lines worked by companies, 11,654; total state lines, 17,538. Lines owned by native states and worked by state railway agency or by the states themselves, 1314; native state lines worked by companies, 1560; total native state lines, 2874. Total of lines owned by government and native states, 20,412. Lines worked by guaranteed companies, 2663; lines worked by assisted companies, 1518; total private lines, 4181. The total capital outlay on these railways till the end of 1900 was slightly over £200,000,000; the total number of passengers carried in 1900 was 117,613,218; and the total weight of goods carried slightly over 43,000,000 tons. The chief roads are well metalled with a kind of limestone called *kankar*, but in Lower Bengal and similar districts, where there is no available stone, roughly-made bricks are used for road-metal. Many of the roads are planted with avenues of trees. The total length of roads in India maintained by public authorities is over 152,000 miles, of which over 36,000 miles are metalled. The number of post-offices in India in 1899–1900 was 10,823, and the length of postal lines 91,534 miles. The total number of letters and post-cards carried was 448,868,998; of packets of every kind, 509,006,476. Adding the district post lines and the political and military lines administered by the Imperial post-office, the total length of the lines over which mails were carried was 127,934 miles. The Indian telegraph system now consists (1900) of 52,909 miles of line, 170,766 miles of wire, and 283 miles of cable. The number of telegraph offices is about 5000, and the annual number of messages over 6,000,000. There are telephone companies at important towns such as Bombay, Calcutta, Karáchi, Madras, Maulmain, Rangoon, and Ahmadabad. India is now in direct telegraphic communication with the Straits Settlements and the Australian colonies, with Europe *via* Suez, *via* Teheran, and *via* Turkey, with the East Coast of Africa, and with China *via* Bhamo.

Education, Literature, and the Press.—A system of education for India was inaugurated in 1854 in conformity with the instructions of the home government, and the despatch of Sir Charles Wood (afterwards Lord Halifax) of 19th July, 1854, is the basis on which the educational system still rests. The fundamental principle of the despatch was that the native languages should be made the medium of communicating European knowledge. Examining universities with affiliated colleges were to be founded, and English and vernacular elementary schools were to be established. The despatch enumerated five government colleges in Bengal; the Sanskrit College and Mohammedan Madrasa at Calcutta; also five colleges in the United Provinces; the Elphinstone Institution, Puna College, and Grant Medical College in Bombay; the High School at Madras, and several missionary schools, as proper to be at once affiliated to the universities. In 1857 the three universities of Calcutta, Madras, and Bombay were formally incorporated by law as examining bodies based on the model of the University of London as then constituted. A somewhat different university, with teaching powers, was established in 1882 at Lahore in the Panjab, and in 1887 a fifth university was founded at Allahabad for the North-west Provinces. The Education Commission of 1882–83 extended the system of Wood's despatch by placing education on a more popular basis and giving greater recognition to indigenous schools, and the first proposals for extending education to Indian women were made by this commission. Educational institutions in India are officially divided into two classes: (1) Public Schools, 'in which the course of study conforms to the standards prescribed by the Department of Public Instruction or by the University, and which either undergo inspection by the Department, or else regularly present pupils at the public examinations held by the Department or by the University'. These institutions may be under either public or private management, and among them are many schools receiving grants-in-aid. (2) Private Schools, comprising all which do not fulfil the above conditions. The three main grades of institutions through which the system of education operates are: (1) Primary schools, 'which aim at the teaching of reading, writing, and such elementary knowledge as will enable a peasant to look after his own interests'; (2) Secondary Schools, either English or Vernacular; and (3) Colleges, 'the students in which, having passed the matriculation examination of a university, are reading for the further examinations required for a degree'. There are also many other colleges teaching special branches of knowledge, such as medicine, law, and engineering, and special colleges for sons of native chiefs and noblemen. In Burma primary education is still very largely in the hands of Buddhist monks. Outside of a few exceptional districts female education is exceedingly backward in India, but slow progress is being made. There are schools of art in Madras, Calcutta, and Bombay, and many of the chief towns have good museums. Many normal schools have been established for the training of teachers.

The total number of colleges in India in 1899 was 169, of which only 5 were for females. The number of pupils in these colleges was 21,006. Secondary schools numbered 5396, with 569,271 pupils, 43,403 of the latter being females. The number of primary schools was 100,858, with 2,824,257 male and 313,289 female pupils, or 3,137,546 in all. The total number of training and other special schools was 720, with 28,158 pupils, 2371 of them being females. Besides all these, there were 42,805 private institutions, with 558,914 male and 42,926 female scholars, in all, 601,840. The total number of educational institutions of all kinds was thus 149,948, of which 7454 were for females, and the total number of persons under instruction, 4,357,821, of whom 402,153 were females. Of these institutions 22,804 are under public management, 61,494 are state-aided, and 65,650 are unaided private schools. It has been estimated that 22·2 per cent of the boys of school-going age attend school, but for girls the percentage is only 2·3. In nearly all branches of education in

India the missionaries have been the pioneers, and their work is still important.

The chief vernacular languages in which books are published are: Urdu (Bengal, United Provinces, Panjab, Bombay), Bengali (Bengal), Hindi (Bengal, United Provinces, Panjab, Bombay, and Central Provinces), Panjabi (Panjab), Marathi (Bombay and Central Provinces), Gujarathi (Bombay), Tamil and Telugu (Madras), and Burmese (Burma), and the bilingual works are mostly either in English and another language, or in a classical and a vernacular language. Many works are also published in English alone, or in one of the three classical languages, Arabic, Sanskrit, and Persian. The greater number of these publications belong to the departments of poetry, religion, philosophy, and philology, but Urdu and Hindi fiction has developed greatly in recent years. Till about 1850 newspapers were prevailingly religious, but since then the native press has become more and more a medium for the discussion of social and political questions.

Christianity and Christian Missions in India.—The introduction of Christianity into India is variously ascribed by tradition to St. Thomas the Apostle, Thomas the Manichæan of the third century, and Thomas, an Armenian merchant of the eighth century. The first of these three legends is more than doubtful, but it seems fairly probable that there was a Christian community on the Malabar coast towards the end of the second century, and therefore before the advent of the other two Thomases. Pantænus of Alexandria, a convert from Stoicism, is said to have visited India as a missionary about 190 A.D. The earliest Christian church in India of which we have any definite knowledge was Nestorian, but the Portuguese inquisition established at Goa in 1560 gradually forced these St. Thomas Christians, as they were called, to acknowledge the supremacy of Rome. In 1663 the arrival of the Dutch removed the pressure of the proselytizing Portuguese, so that many of the St. Thomas Christians renounced their allegiance to Rome. In 1665 these received from the Patriarch of Antioch a Jacobite bishop known as Mar Gregory, and to this day they have remained faithful to his Jacobite tenets. Thus, the ancient Nestorian church of south-west India is represented now by two bodies, namely: (1) Catholics of the Syrian Rite, owning the supremacy of the Pope, but retaining the Syrian language and ritual in their services; and (2) the Jacobite Catholics, rejecting the errors of Arius, Nestorius, and the Popes, and following the Nicene Creed. The spread of the Roman Catholic faith in India was mainly the work of Jesuits from the sixteenth century onwards, the first of these being the celebrated St. Francis Xavier, who reached India in 1542. The Jesuits were suppressed in the eighteenth century, but since the re-establishment of the order in 1814 they have made great progress. The Roman Catholics of India are at present organized in seven archbishoprics (Goa, Agra, Bombay, Calcutta, Madras, Pondicherry, and Verapoly), and sixteen bishoprics (Daman, Cochin, Mailapur, Allahabad, Lahore, Poona, Dacca, Krishnagar, Haidarabad, Nagpur, Vizagapatam, Coimbatore, Mangalore, Mysore, Trichinopoly, and Quilon), and there are also several vicars and prefectures apostolic. The earliest Protestant missionaries in India were the Lutherans Ziegenbalg and Plutschau, who arrived in the country in 1705 and began work at the Danish settlement of Tranquebar. The Lutheran missions were supported from the first by the Society for Promoting Christian Knowledge, and from 1719 till 1844 they were entirely maintained by that body. The celebrated Christian Friedrich Schwarz worked under the auspices of this society from 1750 till his death in 1798. Kiernander, a Dane, was the pioneer of Protestant missionary enterprise in Bengal. He was allowed by the East India Company to settle at Calcutta in 1758, but soon afterwards the Company changed its policy, and began to prevent missionaries from landing in the country controlled by it. When William Carey, the great Baptist missionary, arrived in 1793, he had to settle on Danish territory at Serampore, fifteen miles from Calcutta, and it was not till twenty years later that the Company's opposition to missions was withdrawn. Carey was followed at Serampore by Marshman and Ward, whose names will always be associated with his and with the wonderful literary activity begun by him. Other celebrated Indian Protestant missionaries are Henry Martyn and Bishop Heber of the Anglican Church, and Dr. Alexander Duff, at first of the Church of Scotland, afterwards of the Free Church of Scotland. The head of the Anglican Church in India is the Bishop of Calcutta, and under him are the seven bishops of Madras, Bombay, Lahore, Rangoon, Lucknow, Chutia Nagpur, and Travancore. Many American missionaries also work in India.

According to the census of 1901 the Christians of India numbered in all 2,923,241, divided amongst the denominations as follows: Roman Catholics, 1,202,169, mostly in Madras; Church of England, 360,818, one-half in Madras; Syrian, 571,327, practically all in Madras; Baptist, 221,040, mainly in Madras and Burma; Lutheran, 155,455, mostly in Madras and Bengal; Protestant, 92,644, mostly in Madras and Bengal; Presbyterian, 53,931, mostly in Madras and the Panjab; Methodist, 76,907, practically all in United Provinces, a few in Bengal; Congregationalist, 37,874; others, 151,076, mainly in Madras, Bengal, and Bombay.

Military.—The army in India is under a commander-in-chief, who is under the control of the Indian government, and has directly under him four lieutenant-generals commanding respectively the forces in Bengal, the Panjab, Madras, and Bombay. The Indian army numbers usually from 215,000 to 220,000 in all, the native soldiers being twice as many as the Europeans. The native troops are officered by Englishmen. Wherever European troops are stationed there is always a larger native force, and in many of the smaller and less important posts there is a native force only. Much money has been spent in recent years on defensive works and military establishments, strategic roads, &c. India has also a certain number of vessels for coast defence.

Administration.—The government of the Indian empire is regulated by the act for the better government of India passed in 1858, by which all the territories formerly possessed by the East India Company are transferred to the crown, and all the powers of the said Company exercised in name of the sovereign, all taxes being received and disposed of for the purposes of the government of India alone. His majesty's secretary of state for India is invested with the powers formerly exercised by the Company or the board of control, and he must countersign all orders and warrants under his majesty's signmanual. He is assisted by a council of from ten to fifteen members, the greater number of whom must be persons who have resided ten years in India, and have not left it more than ten years previous to their appointment. The secretary for India fills up vacancies in the council. The members receive a salary of £1200 a year payable out of the revenues of India, and they hold their office for ten years. All orders sent to India must be signed by the secretary, and all despatches from the Indian govern-

ment must be addressed to him. The executive authority in India is vested in the governor-general or viceroy appointed by the crown, and acting under the direction of the secretary of state for India. He has a salary of 250,000 rupees, or about £16,700. The governor-general in council has power to make laws for all persons, whether British or native, within the dominions subject to the British crown, and for all British subjects residing in allied native states. His council consists of five ordinary members and one extraordinary member, namely, the commander-in-chief. The ordinary members preside over the departments of home affairs, foreign affairs, finances, revenue and agriculture, military administration, legislation, and public works, and together with a certain number (not less than ten nor more than sixteen, by the act of 1892) of 'additional members for making laws and regulations', appointed by the viceroy, form a legislative council. The meetings of the legislative council are open to the public, and the governor of the province in which a meeting is held is a member for the time being. The members may discuss the annual financial statement, and ask questions about it, but they are not allowed to propose resolutions or to divide the council. The whole of India is now divided into a number of separate provinces, each with a separate administration of its own, but all subordinate to the supreme government at Calcutta the capital. These are not all on exactly the same footing nor ruled by officials having the same title. Two of them, Bombay and Madras, are each under the rule of a governor, appointed by the crown, and assisted by a separate executive council. Bengal, the United Provinces, the Panjab, and Burma are each under a lieutenant-governor, appointed by the governor-general with the approval of the crown, and the lieutenant-governor of the United Provinces is also chief commissioner of Oudh. The head of the government in Assam and the Central Provinces is a chief commissioner, appointed by the governor-general in council. The governors and lieutenant-governors are each assisted by a legislative council similar to that of the governor-general. Ajmir-Merwara, Berar, Kurg, and the N.-W. Frontier Province are under the immediate control of the governor-general. All the provinces, except Madras, are divided into divisions, each under an official called a commissioner, and all, including Madras, are divided into sections distinctively designated districts, the district forming the unit of administration. At the head of each district is an officer called a collector-magistrate or deputy commissioner, the former name implying the twofold nature of his duties, since he is not only a fiscal officer charged with the collection of the revenue from the land and other sources, but is also a revenue and criminal judge, both of first instance and of appeal. Police, jails, education, municipalities, roads, sanitation, &c., all come under his supervision; and he is expected to be familiar with the social life of the natives in all its phases. The districts are sub-divided into lesser tracts, known in Bengal as sub-divisions, in Madras and Bombay as *taluks*, in Northern India generally as *tahsils*. The unit of police administration is the *thana* or police circle. An important portion of the administrative staff consists of persons who have received appointments in the Indian civil service, after being successful in competitive examinations held in England: these form what is called the *covenanted* civil service. A certain section of the civil service, known as 'the statutory civil service', consists of natives specially selected. The native states are generally governed by hereditary princes, who exercise sovereign power within their own dominions. They are more or less controlled, however, by British influence, a British resident, agent, or commissioner being stationed at their courts. They have no power to make war or peace, to send ambassadors to each other or to non-Indian states; they can only keep up a certain specified military force, and they may be dethroned for misgovernment.

The law administered by the courts of India is chiefly based on the enactments of the Indian legislative councils, the statutes of the British parliament relating to India, the Hindu and Mohammedan laws of inheritance and their domestic law in cases affecting Hindus and Mohammedans, and the customary law affecting particular castes and races. Bengal, Bombay, Madras, and the United Provinces have each a High Court supreme in civil and criminal cases (but with an ultimate appeal to the Privy Council in England), and somewhat similar tribunals exist in the other provinces. There are numerous courts of different grades throughout the country, and many of the judges are natives of India. Various enactments have been passed for the establishment of local government, and there are now upwards of 760 cities and towns with municipal government in the different provinces under these acts, and local taxation for police and local improvements has been enforced.

History.—Little is known of the political history of India previous to the expedition of Alexander to the Indus, B.C. 326. The twentieth satrapy of the Persians comprehended, as Herodotus states, part of the north-west of India. Alexander did not penetrate beyond the tributaries of the Indus, and between his invasion and the Mohammedan conquest there is no authentic political history of India. At the time of the Mohammedan invasion a Hindu monarchy was the dominant power in India. The conquest of Persia (632–651) brought the successors of Mohammed to the Indus, and they subsequently acquired a temporary hold of some parts of India, as Sind, which they conquered in 710 and lost in 750. The foundation of a more durable Mohammedan empire in India was laid some centuries later. The Kingdom of Ghazna, in Afghanistan, founded, according to Ferishta, by Alptegin, an ex-governor of Khorassan, in 962, was declared independent by Mahmud in 999. This monarch, of whom as many as twelve expeditions into India are recorded, penetrated in one direction beyond the Jamna; in another he occupied Gujerat and captured Somnauth. He annexed the territory of Lahore to his kingdom, and nominally extended his dominion to the Ganges on the west, and to Gujerat on the south. His last expedition was to Gujerat in 1024. About the middle of the twelfth century the Kingdom of Ghazna was divided, and Lahore became the capital of the Indian portion. The Ghaznavide Kingdom of India was overthrown in 1186 by Mohammed Ghori. On his assassination in 1206 Kutb-u-din, his governor in India, established the Afghan or Pathan dynasty at Delhi, and conquered Behar and Bengal. His successor Altamsh conquered Sind (1225), and completed the sujugation of Hindustan. About this time Genghis Khan overthrew the western empire of Ghazna, and founded a great Mongolian empire, which began to extend eastward, and came into collision with the monarchs of Delhi while these were still pushing their conquests to the south and east of India. The Delhi kingdom was, moreover, exposed to frequent commotions, both from the revolts of its own rajahs and from the predatory excursions of the hill tribes. A revolt of the rajahs was suppressed in 1250, and in 1265, after an extensive slaughter of the predatory tribes, a line of forts was constructed to check their incursions. But

though frequently defeated the Mongols continued their incursions into all parts of India. In 1240 they reached Lahore, in 1244 they invaded Bengal; Gujerat, the Deccan, and the Carnatic were assailed in turn; the Panjab was subject to frequent invasions; in 1298 they were defeated at Delhi. A new dynasty, the Khilgi dynasty, arose under the usurper Jelal-u-din in 1288, which was succeeded by a fresh dynasty in 1321, the house of Toghlak. The invasions of the Mongols still continued with greater or less success. During the reign of the last Toghlak king the celebrated Tamerlane invaded India at the head of a great host, took and sacked Delhi in 1398, leaving behind him his deputy Khizr Khan, who now assumed the government. A period of anarchy ensued, which terminated in the conquest of India by the Mogul emperors. Ibrahim, the last of the dynasty of Lodi, the third in order from that of Toghlak, was defeated in 1526 by Baber, who established the Mogul dynasty in Hindustan. His grandson Akbar succeeded his father at the age of fourteen (1556), and during a long reign of about fifty years, terminating in 1605, subdued nearly the whole of India, which, by introducing religious toleration, he succeeded in consolidating into an empire. At the death of Akbar his empire was divided into fifteen subahs or vice-royalties, which indicate its extent, namely, Allahabad, Agra, Oudh, Ajmir, Gujerat, Behar, Bengal, Delhi, Cabul, Lahore, Multan, Malwa, Berar, Khandesh, Ahmadnagar. His son Selim succeeded him under the title of Jehanghir. The Portuguese, as will be seen in another section, had already established their territorial dominion in India. In 1615 an English ambassador appeared for the first time at the court of the Mogul emperor in Hindustan. He died in 1623, and was succeeded by his son Shah Jehan, who had disturbed his father's reign by rebellions, and during his own reign the country was filled with civil wars. He quarrelled with the Portuguese, and expelled them from their settlement at Hugli. During his reign the Mahrattas or Marathas, under their chief Sivaji, began to be an important power in the Deccan. He was deposed in 1658 by his youngest son Aurengzebe, who also murdered his brothers. His reign was passed amid continual contests, both for extending his dominion, and subduing the revolts of the numerous peoples under his sway, both within the limits of India and beyond the Indus. He made war successfully with the Afghans, the Rajputana tribes, and the rising power of the Mahrattas. The Sikhs, a Hindu sect which had been persecuted by the Mohammedans, formed a religious and military commonwealth in the Panjab in 1675. Aurengzebe died at Ahmadnagar, in the Deccan, in 1707. On his death the Mogul empire began to decline. The succession was disputed by his four sons. Bahadur Shah, who succeeded, died in 1712, and was succeeded by his son Jehundar Shah, who, in the following year, was put to death by Farokshir, a great-grandson of Aurengzebe, who usurped the crown. He was deposed and put to death in 1718 by Hosen Ali. Mohammed Shah, grandson of Bahadur, was raised to the throne in 1718. His reign was disturbed by the insubordinate spirit of his viceroys, and through the defection of one of them the Mahrattas succeeded in subduing the Deccan. In revenge for an insult Nadir Shah of Persia invaded Hindustan in 1738, took possession of Delhi, and gave it up to be sacked and plundered by his soldiers. The country west of the Indus was ceded to Nadir Shah in 1739. Mohammed died in 1748, and was succeeded by his son Nadir Shah. The empire was now tending to dissolution. The new emperor called in the Mahrattas in 1751 to aid him against the Rohillas, who, in 1749, had defeated the last imperial army ever called into existence. The various states were seized by the former viceroys or by independent chiefs. The Mahrattas, now the most powerful people of India, possessed, besides the Deccan, part of Malwa, and the greater part of Gujerat, Berar, and Orissa. The whole empire was at this time in extreme agitation and disorder, every government fearing the attacks and intrigues of its neighbours. Ahmed Shah was deposed in 1754 by Ghazi-u-din, a former vizier of the empire, who set up Alamgir II. In 1757 Delhi was captured by the Afghans, against whom Ghazi-u-din called in the Mahrattas. In 1759 the vizier assassinated the emperor. His successor, Shah Alum, without the shadow of power, escaped from Delhi, and finally took refuge with the British. The rival powers of the Afghans and the Mahrattas, which had been brought into collision by the feebleness of the empire, now engaged in a fierce struggle for the mastery over its ruins. This terminated at the decisive battle of Paniput, fought 6th January, 1761, in the complete overthrow of the Mahrattas. The victor, Ahmed Shah, recognized the grandson of Alamgir as emperor by the title of Shah Alum II.; but the empire was now only a shadow, and the native states, which had divided its power, were destined soon to give way to the superior organization of the European adventurers, whom the mere pursuit of gain, or the love of adventure itself, had brought to their shores. Henceforth the history of India follows the course of these European colonies, until it is merged in the Indian empire of Great Britain.

PORTUGUESE INDIA.—The doubling of the Cape of Good Hope opened up the way by sea to India, and led the Portuguese to the possession of a kingdom in Asia. A few years after Vasco da Gama had landed on the coast of India they were already the most favoured merchants upon the whole coast, and in spite of the active jealousy of the Mohammedans, who had hitherto monopolized the lucrative commerce of India, they formed settlements, and made commercial treaties with some Indian princes, in which the latter acknowledged the King of Portugal for their lord. Francis of Almeida, the first Portuguese viceroy in India (1505–1509), besides his conquests on the east coast of Africa, established factories and fortresses on the coasts of Malabar, Cochin, and Malacca, brought the greater part of these territories virtually under the Portuguese dominion, and took possession of Ceylon and the Maldives. His successor, Alfonso de Albuquerque, who held the chief command between 1509 and 1515, had preceded him in the Indies, and contributed yet more largely to the Portuguese power there. He took Goa, which he made the capital of the Portuguese possessions in the east, and Ormuz in the Persian Gulf; and extended and established the Portuguese dominion on the Malabar and Malacca coasts. The Moluccas and other islands of the Indian seas were at the same time brought under the Portuguese dominion, and by his wise and skilful government Albuquerque caused their name to be respected throughout India. Soon after his death the Portuguese ruled from the Arabian to the Persian Gulf; nearly all the ports and islands on the coasts of Persia and India fell into their power; they possessed the whole coast of Malabar to Cape Comorin, and had settlements on the coast of Coromandel and the Bay of Bengal; Ceylon was tributary to them; they had factories in China; and the ports of Japan, to which a tempest had shown them the way, were open to their merchant ships. Their power had attained this extent in 1542, and for sixty years they carried on their lucrative commerce without any considerable

rivals. They determined the price of merchandise in all the European and Asiatic markets. The central point of the Portuguese dominion after the time of Albuquerque was Goa, where the royal Portuguese governor, under the title of *viceroy* or *governor*, had his seat. By bold and often revolting acts of power they secured their dominion in Asia. Even on the coasts, where they merely trafficked without governing, and where the people were subject to the native princes, they ruled indirectly by the terror of their name. Portugal owed this power to a few able men, whose adventurous spirit led them to this distant scene of action. The inclination to knightly adventures, which, after the overthrow of the Moors, had no object of enterprise at home, found here a field for action. But the successors of the men who established the commercial greatness of their nation were not endowed with the same talents. Avarice and love of plunder soon became the only motives of enterprise; the honour of the Portuguese name was sullied; a revolting abuse of power excited the resistance of the natives, who had been before armed against each other by the artful policy of the strangers, but now became united by the sight of their common danger. After Emanuel (1495–1521) weak princes succeeded to the throne of Portugal; under Sebastian, the disciple of the Jesuits, when the kingdom was fast approaching to its ruin, the Portuguese dominion in Asia was also lost. The union of Portugal with Spain, under Philip II., in 1580, decided the fall of their commercial power in India. The Spanish kings neglected the Asiatic settlements. Robbery, pillage, and insubordination prevailed there. Some commanders in India made themselves independent, others joined the Indian princes, and others became pirates. The Portuguese were treated as Spaniards by the Dutch and English.

Dutch India.—The Portuguese, satisfied with bringing the commerce of India to Lisbon, had allowed the Dutch to become the carriers between that port and the markets of Europe. But Philip II. closed the harbour of the Portuguese capital to the Dutch ships on account of the revolt of the United Provinces, and thus obliged that enterprising people to go to the sources of this commerce. They were engaged in fruitless attempts to find a passage to India by the northern seas, where they might avoid their enemies, when Cornelius Houtmann, a Dutchman who had made several voyages to India in Portuguese ships, offered his services to his countrymen. In 1595 he was sent with four ships to India to explore the coasts and gain information concerning the inhabitants and the commercial relations in that region; and he returned with favourable accounts, for in this very first voyage treaties of commerce were made with the princes of the island of Java. The company of merchants who had begun the undertaking sent out Admiral Van Steck with orders to enter into treaties with the native princes and to establish factories on the island, which was at a distance from the centre of the Portuguese commerce, but was near enough to the Spice Islands to favour a contraband trade, and was very well situated for trade with China and Japan. The hatred of the natives against the Portuguese, who had at times landed here, assisted in the accomplishment of this enterprise. Several societies were now formed in Holland to prosecute the commerce with India; but the markets both of India and of Europe were soon overstocked. To avoid this inconvenience, and to be able to oppose a firmer resistance to the jealous Portuguese than they could do separately, the small commercial societies united in 1602, and formed the Dutch East India Company, which had power to make peace or war with the princes of Asia, to build forts, to maintain garrisons, and to choose a governor. Now that they had formed settlements at Java and upon other points, and had made commercial treaties with several princes of Bengal, began the long struggle between the rivals. The Portuguese had the advantage of a better knowledge of the Indian seas, but the Dutch could rely on more powerful support from Europe, for Philip II. and his successors often left their Asiatic settlements unprotected. Time and experience gave the advantage of knowledge to the Dutch, and their stronger and better-served navy enabled them to take one place after another from the Portuguese. In 1607 the latter were stripped by their victorious rivals of the Moluccas; in 1641 of Malacca; in 1658 of Ceylon; in 1660 of Celebes, where the Portuguese had settled after the loss of the Moluccas, to retain by smuggling some part of the spice trade; and after 1663 the most important places on the coast of Malabar, where they had longest maintained themselves, fell into the power of the Dutch. The Dutch made Batavia the capital of their eastern dominions. Their power in India began to decline from the time of their wars with Louis XIV. For a sketch of the French, Danish, and other European possessions in India, see Colony.

British India.—The English began to form commercial settlements in India about the same time as the Dutch. (See Colony and East India Company.) A settlement was formed at Surat in 1613, which became the chief station of the Company on the west coast in 1615, and in 1657 the seat of a presidency. A grant of a small territory around Madras was received from the Rajah of Bijnagar in 1639, on which was erected the fort of St. George. Madras became a presidency in 1654, and till the rise of Calcutta commanded the Company's possessions in Bengal. Calcutta, the third presidency, and ultimately the seat of government in India, was settled in 1690, and became a presidency in 1707. The English had to defend themselves against the Mahrattas in Surat in 1664, and early came into collision with the Portuguese and Dutch in the Indian seas. It was, however, the struggle with the French, who followed them, and who had acquired considerable territorial possessions in India, and the alliances of both parties with the native princes, coinciding with the decay of the Mogul empire, which brought about that long succession of almost unbroken successes by which this great empire was established. In the war of the Austrian Succession (1741–48) England was brought by its German connections into collision with France, and the struggle between these powers was transferred in 1746 from Europe to India. The claims of rival candidates for the governments of the Deccan and the Carnatic brought the two parties into collision at various points, and after a succession of manœuvres Dupleix, the French commander, succeeded in compelling the English to take refuge in Trichinopoly. Here Clive, who had already distinguished himself in an unsuccessful attack upon Pondicherry, proposed to carry the war into the enemy's country. In 1751 he besieged and took Arcot, Tinnevelly, Conjeveram, and Arani. On his return to Fort St. David he was despatched by Major Lawrence on another expedition, which he again conducted successfully. Lawrence at the same time gained other successes against the French and their allies. These successes led to the Treaty of Pondicherry in December, 1754, in which the French and English agreed to divide their territorial possessions on a footing of equality, and abstain from interference in native affairs. This treaty

procured for the English the cession from the French of the Four Circars; nevertheless, they treated it as a dead letter, and immediately began to reduce Madura and Tinnevelly. The French, after vainly remonstrating, followed their example in disregarding the treaty. About this time important events took place in Bengal. Suraj-ud-Dowla, nabob of Bengal, in 1756 besieged Calcutta with a large army, when it was evacuated so suddenly by the English that a considerable part of the garrison was left behind. These had no alternative but to surrender (June 20, 1756). To secure the prisoners taken in the capitulation, 146 of them were thrust, apparently more from mere recklessness than intentional cruelty, into the common prison of the garrison, a room 18 feet square, with two small windows barred with iron, since famous as the Black Hole of Calcutta. After a night of unparalleled suffering only twenty-three were found alive in the morning. Clive, who was sent from Madras with an armament to Bengal, recovered Calcutta on 2nd January, 1757. War had again broken out between France and England, and the English commander was now placed in a delicate position, but the French refused the alliance of Suraj-ud-Dowla, and maintained their neutrality. Suraj again invested Calcutta, but Clive, though he failed in a night attack, inspired him with so much respect for his means of resistance that he restored the English factories and made peace. Regardless of the benefit he had received from the neutrality of the French, Clive, in spite of the opposition of the nabob, determined to attack their settlement at Chandernagor, which he succeeded in taking. The nabob supported the French till he was attacked by the Afghans, when he became desirous of peace with the English. Clive, however, had determined to dethrone him and replace him by Mir Jaffier, his aunt's husband. In the battle of Plassey, 23rd June, 1757, the nabob was overthrown by the prowess of the English commander and the treachery of his relative, and afterwards assassinated by the son of his rival. Mir Jaffier bound himself to pay for his elevation a sum of over £2,500,000 sterling. This plunder was partitioned among the Company and the Company's servants, with the exception of a small share assigned to the native allies.

While the English in the Carnatic were engaged as collectors for Mohammed Ali in reducing the districts of Madura and Tinnevelly, the French seized the opportunity to recommence hostilities. An attack upon Trichinopoly failed (May, 1757), but Bussy reduced Vizagapatam, and established the French superiority throughout the Deccan. Count Lally, who had arrived with a formidable armament in April, 1757, besieged and took Fort St. David, 1st June, 1758. He afterwards besieged Tanjor and Arcot, the latter of which he took. The want of funds, which crippled his operations, compelled him to engage with inadequate forces in the siege of Madras, which, after lasting two months, entirely failed in February, 1759. The English took Conjeveram, to which the French retired, by assault. In the following campaign the French, after some successes, were totally defeated by Colonel Coote near Wandewash on 22nd January, 1760. Their power was now completely broken, their fortresses one after another fell into the hands of the English, and the English fleet, which had the command of the seas, co-operated in the reduction of those on the coast. Pondicherry, their last stronghold, surrendered on 15th January, 1765. The English had now established themselves, as a formidable if not altogether a ruling power, both in West and South India; but in both they committed the mistake of greatly overestimating the resources of the country, and their rapacity and extortion, though they ultimately led to the extension of their power, were the cause of serious and protracted troubles. Mir Jaffier had found the exchequer of Bengal wholly inadequate to the demands made on him, and the extortions to which he was driven to satisfy them produced rebellions, which were suppressed by the aid of the English. He was, however, unable to meet the claims of his allies, and when Vansittart succeeded Clive as president of the council in February, 1760, they determined to replace him by his son-in-law, Mir Cossim, who agreed to pay the balance due by Mir Jaffier, and give them the revenues of Burdwan, Midnapore, and Chittagong, and five lacs of rupees to defray the expenses of the war in the Carnatic. Mir Jaffier, being without the means of resistance, was compelled to submit to the dictation of his former friends, and, resigning his government, took refuge in Calcutta. The new ruler displayed an amount of vigour and patriotism hardly to have been expected under the circumstances, and the minority of the council which had disapproved of the deposition of Mir Jaffier having become the majority, his proceedings were regarded with jealousy and dislike, and he also found himself in opposition to the English. When he had succeeded, by the assistance of his allies, in establishing his authority, he took care to maintain it by good government and economy; but in this he found the English the chief obstacles to his plans. Under the native governments of India one of the chief imposts was a tax on the transit of goods, levied by toll. The East India Company had, by a firman of the emperor, early secured their exemption from all transit duties on goods imported by them from Europe, or intended for export thither. Their goods were protected in transit by a certificate. The Company's servants had long abused this privilege by claiming it for goods not intended for export, but for an internal trade carried on by themselves. The subahdars or governors of provinces had successfully resisted this abuse until the elevation of Mir Jaffier, when the English became the masters and did as they pleased. They carried on an internal trade in every village, and when the collectors attempted to do their duty they were seized and imprisoned, or corporally punished. Had the government only been defrauded there might have been some compensation in the exemption which this trade would have afforded the poorer inhabitants of Bengal from duties which must have pressed heavily upon them; but the English used their monopoly only for their own advantage, and frequently defrauded the natives both in buying and selling. Mir Cossim appealed in vain to the council against these extortions, in which they were themselves deeply interested. They refused to pay a transit duty much lower than that exacted from native traders, and only offered to pay of their own free-will 2½ per cent on salt. Finding himself powerless to enforce the duties against the aliens, Mir Cossim resolved to relieve his own subjects of them by abolishing all internal duties. But this project was equally distasteful to the Company's servants, to whose unlawful gains it would have put an end. They denounced it as a violation of the Company's rights, and resolved to depose Mir Cossim and restore Mir Jaffier. Notwithstanding his skilful and vigorous preparations for a war he had anticipated, Mir Cossim was worsted in successive engagements, particularly at Gheriah, 2nd August, 1763, and forced to flee. In revenge he massacred his English prisoners. Sujah Dowlah, the nabob of Oudh, who received him, was defeated and deprived of his dominions, with the exception of Corah and Allahabad, which were given to the Mogul Emperor, who for-

mally invested the Company in the dewanee or collectorship of revenues and virtual sovereignty of Bengal, Bahar, and Orissa, by a firman dated 12th August, 1765. Mir Jaffier died in 1765, and the English, in choosing his son to succeed him, took upon themselves the charge of defending the country, allowing the nabob only a few domestic troops. They also obliged him to choose a deputy with the advice of the governor and council, to conduct the civil administration. The directors of the Company, who had viewed many of the recent proceedings of their servants with disapprobation, had appointed Clive to the supreme government of Bengal, with the assistance of a secret committee of four, who were to be independent of the remainder of the council, and it was by him the last arrangements had been effected. They had also made strong remonstrances against the tyranny of their servants, and sent peremptory instructions for the prohibition of their inland trade in salt, betel-nut, and tobacco, which robbed the poor of the country without advantage to the Company. The practice of receiving presents from native rulers was also prohibited. The proprietors of the Company, however, took a different view from the directors. They opposed the prohibition of the private trade, as depriving the servants of the Company of the opportunity of returning with a fortune to their native country, and the directors were compelled to instruct the council to form, after consulting the nabob, a proper and equitable plan for carrying on the inland trade. In the meantime the prohibition of the directors had taken no effect. Lord Clive himself, who assumed the government in May, 1765, entered into a partnership for a monopoly of salt, and a monopoly was subsequently organized to include salt, betel-nut, and tobacco, for the joint benefit of the Company and their superior officers. This association, which was formed and carried on in violation of the peremptory orders of the directors, was abolished by them in 1768. At this time the Company's agents exercised an arbitrary authority which was controlled neither by the council, whose jurisdiction was limited to the presidency, nor by the native princes, who dared not interfere with them. During the administration of Verelst, who succeeded Clive in 1767, the Company's affairs were in extreme embarrassment. The expectations raised at home by their political successes had produced the most exaggerated expectations, and raised the stock of the Company to 263 per cent. While the directors were raising their dividend till Parliament had to interfere, the council in Calcutta were compelled to draw heavily on them for the expenses of government, and they in turn had to borrow largely to avoid bankruptcy. Parliament took advantage of the discontent and clamour raised in these circumstances against the Company's servants, and in 1773 remodelled the constitution of the Company, and appointed Warren Hastings Governor-general of India, with a salary of £25,000, and a council of four members, each of whom had £10,000. See EAST INDIA COMPANY.

The French had in the meantime (1768) been reinstated in their forts in South India. The English had received from the Mogul Emperor a grant of the Northern Circars, uniting their possessions in the Carnatic with the province of Orissa, and had come to terms with Nizam Ali, subahdar of the Deccan, who opposed their occupation of them, by agreeing to pay him a rent for the territory, and assist him with their forces. This agreement brought them in 1776 into collision with Hyder Ali, the powerful sovereign of Mysore. Nizam Ali afterwards joined Hyder against the English, and both invaded the Carnatic, and, in spite of several defeats, laid waste the country to the gates of Madras. Finally, Nizam Ali deserted Hyder, and the latter concluded a treaty with the English, April, 1769, by which their conquests were mutually to be restored. Warren Hastings, who had already as second councillor begun to govern India in 1772, entered in 1773 into a treaty with the Nabob of Oudh for the use of English auxiliaries, first against the Mahrattas and afterwards for the conquest of the Rohillas. In accordance with the policy of the Company Hastings assumed the direct administration of the provinces of Bengal, Bahar, and Orissa, and on pretence of the emperor's accepting the assistance of the Mahrattas, refused to continue the payment for them of the English tribute of twenty-six lacs of rupees. For further details of his administration, see HASTINGS (WARREN).

The Bombay government had for some time been desirous of possessing the islands of Salsette and Bassein. The dissensions of the Mahratta state, which was governed by a sort of mayors of the palace, at length afforded the opportunity. Ragoba, the guardian of the Peshwa, being forced to take refuge in Surat, they were negotiating with him for the surrender of these places, when, hearing that the Portuguese in Goa intended to reoccupy them, they at once took possession of them, and afterwards entered into an alliance with the Rajah of Gujerat to restore Ragoba. All these proceedings were condemned by the governor-general in council, and they were peremptorily ordered to withdraw their troops from their allies. The Mahrattas finally agreed to surrender Salsette, 3d June, 1776. The extortions of the English in the Carnatic had brought Mohammed Ali, who was entirely in their power, to the end of his resources, and they were compelled to look elsewhere for supplies. The Rajah of Tanjore, an excellent ruler, was the victim they selected. His capital was captured and his territory seized. This act was disapproved of by the court of proprietors, and Lord Pigot was sent out (1775) to restore the rajah, and to enforce economy and reform on the servants of the Company at Madras, where corrupt practices had been carried further than elsewhere. In 1778 war again broke out between France and England. The English captured Pondicherry and Mahé, the last port of the French on the Malabar coast. This place was considered by Hyder Ali as one of his dependencies. In revenge for its capture he seized the passes of the Eastern Ghâts, invaded the Carnatic with an army of 120,000 men and laid waste the country. Sir Eyre Coote was sent into the Carnatic to conduct the war against him. Hyder Ali died in 1782, but the war was continued with his son Tippoo Saib, till 11th March, 1784, when it was concluded by a treaty of mutual restitution. In 1784 Pitt's India Bill (see EAST INDIA COMPANY) was passed. In 1786 Lord Cornwallis was appointed governor-general, and by an act of Parliament passed that year the holder of that office was entitled to act contrary to the advice of his council. Cornwallis made various administrative reforms for the relief of the people from former exactions. Tippoo Saib diverted his attention from these peaceful measures. He had endeavoured to form an alliance with the French, and failing this, attacked the Rajah of Travancor, now an ally of the British. Having made an alliance with the Mahrattas and the Nizam, Cornwallis invaded Mysor, besieged Tippoo in his capital, compelled him on 9th March, 1792, to conclude a treaty, by which he ceded half his territory and undertook to pay the expenses of the war. On the death of Mohammed Ali in 1795, Lord Hobart, governor of Madras, determined to assume the government of the Carnatic, but the plan was opposed by the supreme government and was not carried out. In

May, 1798, Lord Mornington arrived in India as governor-general, and immediately learned that Tippoo Saib was making arrangements to renew his enterprises against the British, for which purpose he was soliciting the alliance of France and of Cabul. Early in 1799 Lord Mornington invaded Mysor. On the 4th of May he stormed Seringapatam. Tippoo was killed in defending his capital, and Mysore was divided among the British, the Mahrattas, and the Nizam. Seringapatam, the capital of Tippoo, his possessions on the Malabar coast, the passage of the Ghâts, and the territory between their possessions on the east and west coasts fell to the English, who assigned the fortress of Vellore as a residence to the family of Tippoo, who with his principal servants were liberally pensioned. Some time before this (1775) Oudh had agreed to receive and subsidize auxiliary troops for the defence of their territory. The subsidy was fixed in 1787 at £500,000 including the expenses of the British residency, in 1798 it was raised to £760,000, and the fortress of Allahabad was ceded to the British, who undertook to defend Oudh against all enemies. Subsequently in 1801 the subsidy was commuted for the cession of Southern Doab, Allahabad, and other territories. During the war with Tippoo, Lord Mornington, whose policy was to induce the native powers to accept of British protection and mediation in their disputes, endeavoured to induce his allies the Mahrattas and Nizam Ali to come under similar arrangements. The Nizam in 1798 agreed to dismiss his French troops and receive British auxiliaries. The Peshwa, the nominal head of the Mahratta Confederacy, forced by the contentions of the chiefs Holkar and Scindia, accepted the policy of the governor-general. Under the Treaty of Bassein, signed 31st December, 1802, Sir Arthur Wellesley restored the Peshwa, driven from his capital by Holkar. Scindia and the Rajah of Berar now entered into an alliance against the British. After a campaign in 1803 distinguished by the successes of Generals Wellesley and Lake, the former defeating the allies at Assaye, 23d September, the latter at Laswaree, 1st November, Scindia was compelled to make peace. He ceded to the British Baroach, Ahmadnagar, and the forts in the Doab (29th December); the Rajah of Berar ceded Cuttack (17th December). Scindia, thus weakened, accepted the British alliance, and received an auxiliary force to defend him against Holkar, 27th February, 1804. A war with Holkar immediately followed, which the skill of that chief in predatory warfare enabled him to sustain with some dexterity, and in 1805 he was joined by Scindia, but the British arms finally prevailed and he was forced to flee. The Marquis of Cornwallis succeeded Wellesley on 30th July, 1805. He disapproved of the ensnaring alliances into which the former statesmen had drawn the native powers, and although he died before being able to carry out his views (5th October, 1805), Sir George Barlow, who succeeded him, adopted his policy. New treaties were made with Scindia, 23d November, and Holkar, 24th December, restoring their territories and their independence. The new policy was even carried so far as to abandon the petty princes who had trusted to the British alliance. Lord Minto succeeded to the governor-generalship in 1807. During his administration the chief enterprises of the English were directed against the insular possessions of the French and Dutch in the Indian seas. The Moluccas, Java, and other islands were taken; many of which were restored at the peace. Some disturbances took place during this period at Travancor, and among the British troops at Madras and elsewhere, which threatened at one time serious consequences. Travancor and Cochin were placed under British management. The Earl of Moira (Marquis of Hastings) succeeded to the governor-generalship in 1813. In 1814 a war broke out with Nepal, which was at first attended with some serious repulses, but was brought to a successful close by Sir D. Ochterlony in 1815, and resulted in the cession of Kamaon. The pacification of 1805 with the Mahrattas had been attended with some inconveniences which now demanded the attention of the governor-general. Bodies of troops engaged in the previous contests had formed themselves into predatory bands, who assumed the name of Pindharis, which were encouraged by Holkar and Scindia, and made frequent incursions into British territory, returning with large booty. A line of forts was established along the Narbada in 1816, and many of the depredators cut off on their return. These circumstances determined the governor-general to resume the policy of alliances. A new treaty, more rigorous than that of Bassein, was forced upon the Peshwa, who accepted it under protest, and soon after took up arms. His capital was speedily seized, he himself deposed, and the Mahratta Confederacy dissolved. His ally the Rajah of Nágpur, Scindia, who submitted, and Holkar, who was defeated, were compelled to accept alliances virtually placing them under British protection. The Pindharis were subdued, conciliated, and taken into British pay, for the defence of the protected territories. This pacification was completed in 1818, and greatly improved the revenues of the districts affected by it. The Marquis of Hastings was succeeded as governor-general in 1823 by Lord Amherst, who soon found himself involved in hostilities with the Burmese, whose territorial claims were incompatible with those of the British. The first Burmese war was concluded in 1826 by a treaty ceding to the British the Aracan and Tenasserim provinces together with a large pecuniary indemnity. During the governor-generalship of Lord William Bentinck (1828–35) various administrative reforms were effected, but no great political events took place. Lord Auckland assumed the governor-generalship in 1836. The Afghan war broke out in 1838, in consequence of long and complicated intrigues arising from the advance of Russia in the East, and the mutual jealousy of that power and Great Britain. War was declared on 1st October, the object of the British was to dethrone Dost Mohammed and restore Shah Sujah, a former ruler. It was at first attended by great disasters, particularly the famous massacre of the Khoord Cabul Pass. It was terminated in 1842, under the governor-generalship of Lord Ellenborough, by the evacuation of Afghanistan by the British, after they had relieved their captives and vindicated the superiority of their arms by the capture of Cabul. Sind was annexed to British India after a war conducted by Sir Charles Napier in 1843. After a brief war, arising out of a disputed succession, the dominions of Scindia lay at the mercy of the British, and were disposed of by a treaty dictated by the governor-general at Gwalior in January, 1844. While he was thus engaged Lord Ellenborough was recalled and superseded by Sir Henry Hardinge (May, 1844), who was soon engaged in one of the most formidable wars the British had yet had to encounter in India. The Sikhs, a politico-religious sect already mentioned, had, under their leader Runjeet Singh, conquered the Panjab about the beginning of the century. Runjeet Singh, who had always maintained friendly relations with the British, died in 1839, and his son and grandson died soon after; the latter, it is believed, being killed by order of Shere Sing, a reputed son of Runjeet and claimant of his throne, to which he succeeded. Shere Sing was soon after assassinated together with his

son. The government now fell into a chaotic state, and the army, being without a head, began to commit disorders and threaten encroachments on the British territory. The Indo-British government was strongly desirous of peace, and took no steps to check the threatened aggression until, about 11th December, 1845, the Sikh army crossed the Satlej in great force. Sir Henry Hardinge now issued a proclamation declaring the possessions of the Maharajah Dhuleep Singh on the left bank of the Satlej confiscated. In the short war which followed, the Sikhs were defeated by Sir Hugh Gough and Sir Henry Hardinge at Moodkee, 18th December, Ferozeshah, 21st–22nd December, Aliwal, 28th January, and Sobraon, 10th February, 1846. Peace was made at Lahore, by the surrender of the Sikh territories on the left of the Satlej, and between the Satlej and the Bias (Jalindar Doab), and the payment of an indemnity of £1,500,000. Part of the ceded territory was given by a separate treaty to Gholab Sing. During the governor-generalship of the Marquis Dalhousie, 1848–56, a new war broke out with the Sikhs, and after their final defeat by General Gough at Gujerat, 21st February, 1849, the Panjab was annexed to the British dominions. This was immediately followed by the second Burmese war, ending in the annexation of Pegu, 20th June, 1853. Sattara, Jhansi, Nágpur, and Oudh were, on the failure of the native succession, also annexed to the British possessions, 1852–56. During Lord Dalhousie's administration the extensive scheme of Indian railways and telegraphs was planned and inaugurated, the Ganges Canal opened, and the Panjab Canal begun. His last important act as governor-general was the annexation of Oudh, 7th February, 1856. The administration of Viscount Canning was distinguished by a short war with Persia, by the great Sepoy rebellion, and by the assumption of the direct sovereignty of India, and of the powers of government hitherto vested in the East India Company by the crown, 2nd August, 1858. (See INDIAN MUTINY and EAST INDIA COMPANY.) A legislative council for India was formed, which was opened in 1862, and by an act passed in 1865 the limits of the presidencies were amended, and the powers of the governor-general enlarged. After the mutiny had been suppressed Lord Canning pursued with energy those schemes for the development of the resources of the country, adverted to elsewhere, which had already been inaugurated by his predecessors, and which have chiefly occupied the attention of his successors. He returned to England early in 1862, and was succeeded by the Earl of Elgin, who died at Dhurumsalla, November 20, 1863, while similarly engaged. Sir John (afterwards Lord) Lawrence was governor-general from 1863 to 1868, when he was succeeded by the Earl of Mayo, who earned a high character for the ability of his administration. He was assassinated by a Mohammedan fanatic at Port Blair, in the Andaman Islands, 8th February, 1872.

India has suffered severely from famine on many occasions, and not seldom the scourge of famine has been accompanied by that of plague. The chief famines which have occurred under British rule are the following: that of 1769–70 in the lower Ganges Valley, in which one-third of the population of Bengal perished; that of 1780–83 in the Karnatik; the Madras famine of 1790–92; that in the North-West Provinces in 1838; that of 1860–61 in the same district, when the first serious attempts at relief were made; the terrible Orissa famine of 1865–66, in which one-fourth of the population perished; the great famine of Southern India in 1876–78; that of 1896–97; and that of 1899–1900, in Bombay, Berar, Central Provinces, Central India, Rajputana, South-East Panjab, and other parts, at one period of which about 6½ million persons were in receipt of relief. The problem of famine is not really a problem of scarcity at all, taking India as a whole, but it is partly a financial problem, partly one of irrigation, and partly one of inland communication. For the plague in India see PLAGUE.

The other chief events since 1870 are the following: the proclamation of Queen Victoria as Empress of India at Delhi and elsewhere, 1876; the Afghan War of 1878–80; the rendition of Mysore to its native dynasty, 1881; the annexation of Upper Burma after a short war, 1886; the passing of the Indian Councils Act of 1892; closing of the Mints, 1893; Chitral campaign, 1895; the war against the Afridis and other frontier tribes, 1897; the creation of a gold standard, 1899; and the expedition against Tibet, 1904. The governors-general since Lord Mayo's assassination have been: Lord Northbrook (1872–76); Lord Lytton (1876–80); Marquis of Ripon (1880–84); Marquis of Dufferin and Ava (1884–88); Marquis of Lansdowne (1888–94); Earl of Elgin (1894–99); and Viscount Curzon of Kedleston, whose rule began in 1899.

INDIANA, one of the north-central United States, bounded north by Michigan lake and state; east by Ohio; east and south by the Ohio River, separating it from Kentucky; and west by Illinois; area, 36,350 square miles. It belongs wholly to the basin of the Ohio, excepting a narrow strip on the shores of Lake Michigan, backed by lofty bare sand-hills, and is almost one continued plain, with an inclination south-west. A range, however, of low hills, occasionally 300 feet above the level of the Ohio, lies parallel to that river, from the mouth of the great Miami to the Blue River, sometimes approaching close to it and sometimes receding 2 or 3 miles from it. These hills are followed by an extensive heavily-wooded plain. The state is well watered by several streams, of which the Wabash, flowing circuitously north-east to south-west, dividing the state into two unequal parts, a north and a south, and in the latter part of its course forming the frontier line towards Illinois, is the most important. In the north the soil is composed of drift materials, but in the south limestones, shales, and sandstones form its basis. The bottoms along many of the streams are extremely fertile. There are broad prairies in the west and north-west of the state, and in some parts of the north there are stretches of barren sand. The chief crops are maize, especially in the centre of the state; wheat, chiefly in the north and south-west; oats, best in the north; potatoes, also best in the north; rye, barley, buckwheat, and tobacco. Indiana is one of the chief maize-growing states, and in respect of its production of wheat it is ahead of all others, except Minnesota, California, and Illinois. The western part of the state is rich in bituminous coal, its annual production being nearly four million tons. The east central part of the state produces large quantities of petroleum, and in respect of its production of natural gas it takes high rank among the states of the union. Other mineral productions are limestone, sandstone, fire and other bricks, porcelain and other clays, glass sand and clay iron ore. The manufactures of Indiana are extensive, and include iron, glass, encaustic tiles, woollens, carriages, railroad cars, and many other commodities besides those referred to in connection with its mineral wealth. Its live stock industry is of great importance. The railway system of the state is a very complete one, and centres in Indianapolis, the capital. There is also some river and lake traffic.

There is a well-organized system of education managed by a state department, and among the chief educational institutions are the state university at Bloomington, the normal school at Terre Haute, and the college of agriculture and the mechanic arts at Lafayette. The benevolent and charitable institutions comprise several lunatic asylums, a school for feeble-minded youth at Fort Wayne, schools for the deaf and the blind at Indianapolis, reform schools for boys and girls, &c. The strongest religious denomination numerically is the Methodist Episcopal, and after it come, in order, the Roman Catholics, the Disciples of Christ, the Baptists, &c. For administrative purposes the state is divided into ninety-two counties. The chief towns are, in order of population, Indianapolis, the capital (pop. in 1900, 169,164), Evansville (pop. in 1900, 59,007), Fort Wayne, Terre Haute, South Bend, New Albany, Richmond, and Lafayette. Indiana was formerly one of the French possessions in America, but it was ceded to England in 1763. In 1783 it was formally transferred to the United States government, and in 1800, after Ohio had been separated from it on the east, the territory of Indiana, including also the present Michigan and Illinois, was created. The separation of the two last-named districts in 1805 and 1809 left Indiana Territory with its present boundaries, and in 1816 it was admitted into the union as a state. The present constitution dates from 1851. Pop. (1860), 1,350,428: (1890), 2,192,404; (1900), 2,516,463.

INDIAN CORN. See MAIZE.

INDIAN MUTINY. The British occupation of India had been largely aided by native troops, which, from 1748, it was the custom to enrol under British officers in the service of the East India Company. (See SEPOY.) At the close of Lord Dalhousie's sway, when the whole of India seemed to have been either reduced directly under British rule, or if retaining its native princes to have placed itself under British protection, a mine was sprung beneath the feet of the Anglo-Indian government by an extensive revolt of this trusted force, and it seemed for a moment as if the fall of British power in India would be more sudden than its rise. The Sepoy mutiny was a contingency for which the government ought not to have been altogether unprepared. Previous symptoms of disaffection had not been wanting. Mutiny had on several occasions broken out in the native army, in a way to indicate how easily through causes which Europeans, from their defective sympathy with native thought and feeling, could not anticipate, these troops might be alienated; but, on the other hand, the general fidelity of the Sepoys merited confidence, and this feeling prevailed over any grounds of suspicion which might have been formed from isolated occurrences. On the outbreak of the first Birmese war the troops destined to be employed in it had shown great disaffection, and had deserted in great numbers. The mutiny in one regiment was put down by force, and some of the mutineers hanged. The first cause of this disaffection seemed to be the aversion of the troops to a sea voyage, by which they would have forfeited their caste; but when this objection was yielded to a new difficulty arose. The Sepoys, to protect their caste, had to carry about with them their own culinary apparatus, which, consisting of articles of brass, was of considerable weight. Government did not in general charge itself with the expense of procuring carriage for this private baggage, and on a long journey it became a serious matter, and the Sepoys complained with reason of their inability to procure the means of transport. But though this complaint also was met the disaffection was not subdued without force. In 1850, again, a wide-spread disaffection arose among the troops under Sir Charles Napier in the Panjab, in consequence of the refusal of a demand for increase of pay, and that able officer was of opinion that only the decisive measures he took prevented a general revolt at that time. At the time when Lord Canning acceded to office it was pretty generally known that the praises which had been liberally bestowed on the native troops, and the constant consideration which had been shown for their prejudices, had not been without their effect in giving the Sepoys a strong conviction of their own importance; but no immediate danger was apprehended, and it was not deemed safe to make any sudden change in their treatment. The Sepoys in Bengal were mostly either Mohammedans, or Hindus of the Brahmanical or military castes. A number of circumstances concurred to prepare for an outbreak at the time it occurred. The recent annexations had alarmed the native chiefs, while the fanatical Hindus had been deeply offended by reforms, including the successive abolition of various rites of their worship. Two European regiments had been drafted off for the Crimean war, and had not been replaced. Others had been sent to Birmah, and in the beginning of 1857 fresh regiments were despatched to Persia, so that only eighteen regiments were left in all Northern India, of which nine were in the Panjab. In Oudh, where, from its recent annexation, disaffection was rife, there was only one British regiment, and Delhi and Allahabad, the two chief arsenals, were guarded by native troops. To add to these favourable circumstances a Hindu devotee had prophesied the termination of British rule at 100 years after the battle of Plassey. A slight incident sufficed to give point and direction to a spirit of disaffection which so many circumstances tended to favour. It happened that at this time the Enfield rifle was first introduced into the Bengal army. This rifle was loaded with a greased cartridge, the end of which required to be bitten off at the time of loading. By a natural inadvertence the authorities had neglected to consider how this seemingly trifling requirement might affect the easily excited sensitiveness of the Hindus in regard to caste, while by a strange fatality which hardly any prudence could have foreseen, this insignificant circumstance removed the last security against a united movement of disloyalty among the native troops, by establishing a bond of sympathy between the Mohammedans and Hindus. A report got abroad that the cartridges were to be soaked in cow and pork fat. The prejudices of Hindus and Mohammedans were thus equally struck at, and as this rumour, however raised, rapidly spread, the excited imagination of the Sepoys conceived a conspiracy on the part of the government to convert them forcibly to Christianity, by compelling them to violate the laws of their own religion. When this grievance was explained it was at once removed, the manufacture of greased cartridges at Dumdum was put an end to, and the men were instructed to grease them themselves with materials procured at the bazaars; but suspicion once aroused was not thus to be allayed, and easily found a new object to attach itself to. The paper of the new cartridges was found to be glazed, and it was again alleged that grease was used in its manufacture. This second ground of complaint has frequently been treated as insincere, but nothing could be more unsound than such an inference. To allay suspicion, especially of a religious nature, is much more difficult than to excite it, and there is hardly any interval in excited minds between the wildest conjectures and the most rooted conviction. Very soon, however, the spirit of disaffection became too deep-rooted for any measures of conciliation. Conferences among the disaffected gave rise to am-

bitious schemes, and the original grievances became little more than a pretext in the hands of unscrupulous leaders, whose excesses debarred them even from the plea of patriotism, by which the attempt, however treacherous on the part of soldiers in British pay to extirpate the British power in India, might have been justified. General Hearsey having received advice of a contemplated revolt of four regiments situated at Barrackpur, harangued the men on the 9th of February, and seemingly allayed their discontent. On the 26th the first overt act of mutiny took place at Berhampur. The men of the 19th refused to receive their cartridges, although those offered them were not the new cartridges, but the same as they had always used. They were intimidated into compliance at the moment; but during the night they broke into the huts containing their arms, which they seized in defiance. Other native troops were called out against them; but as these could not be trusted, the dangerous but probably necessary expedient was resorted to of coming to terms with the mutineers. The authorities now became alarmed, and the 84th British Regiment was summoned from Burma. Another dangerous outbreak took place among the 34th at Barrackpur, on 29th March, and two days afterwards the 19th arrived there from Berhampur. It had been determined by the governor-general that this regiment should be disbanded on its arrival at Barrackpur, a punishment which the authorities still believed would be sufficient to intimidate other disaffected corps. The 34th, in fact, had only waited the arrival of this regiment to concert a movement with them. The 84th Regiment and some other British troops had already arrived at Barrackpur, and the disbandment of the 19th was effected immediately on its arrival. They were dismissed on liberal terms, and their seeming contrition deceived even General Hearsey, an officer who was keenly alive to the dangerous position of affairs. The government now imagined the matter at an end, and proposed sending the 84th back to Rangun. It was, however, evident that disaffection, which had only wanted an occasion, was spreading rapidly not only among the Sepoys, but among the Hindus generally. Incendiary fires and other symptoms of conspiracy speedily occasioned new alarms. Another outbreak took place on 2d May near Lacknow, when the 7th Oudh irregular cavalry were, by some oversight of the government's instructions, ordered to bite their cartridges. This regiment entered into correspondence with the 48th native infantry, and gave open signs of aggravated mutiny; but Sir Henry Lawrence succeeded by a show of force in disarming it. A more formidable outbreak occurred about the same time at Meerut, 85 miles N.N.E. of Delhi. Eighty-five troopers of the 3d native cavalry for refusing to use their cartridges, although tearing with the hand was substituted for biting, were tried by a native court-martial, and sentenced to ten years' imprisonment. The jail to which they were sent already contained 1200 prisoners, and was under a feeble native guard. The native troops had planned an outbreak during evening service on Sunday, while the British regiments were at church. It broke out prematurely, and but for the incapacity of Colonel Hewitt, an officer incompetent from age, might have been frustrated. As it was he drew up his troops to cover the barracks, and permitted the mutineers, with the assistance of the native inhabitants, to massacre indiscriminately the Europeans in Meerut, and escape to Delhi. The 28th, 54th, and 74th native infantry, with a battery of artillery, occupied cantonments 2 miles north of Delhi, the city itself still nominally belonging to the King of Delhi. The advance-guard of the mutineers reached Delhi on 11th May, and at once entered the city, where they were assisted by the king's servants in massacring the Europeans. The troops cantoned outside the city in the meantime joined the main body of the mutineers, and assisted in massacring their European officers. A momentary stand was made in the Flagstaff Tower; but the last remains of the Sepoys proving unfaithful, the few Europeans collected there had to disperse and flee for their lives. About fifty Europeans had taken refuge in the palace, and placed themselves under the protection of the king, who, whether from choice or necessity, had now placed himself on the throne of the Moguls. These after some days were coolly murdered in an open court in presence of a general concourse of spectators, conspicuous among whom was Mirza Mogul, the king's eldest son, who had assumed the title of commander-in-chief. The magazine at Delhi had already been blown up by its defenders; but unfortunately the explosion was only partial, and most of its contents fell into the hands of the mutineers. European troops were now summoned from all quarters. Several regiments were detached from an expedition which was proceeding under Lord Elgin to China, and the Persian war having been happily concluded, the troops engaged there were immediately recalled. When intelligence of these events reached the Panjab the mutinous spirit which prevailed among the large body of Hindustani troops there was promptly subdued by disarmament. The Sikhs, though the Panjab had been so recently annexed, continued faithful. But the revolt had spread rapidly elsewhere, and British authority was almost extinct throughout the Bengal Presidency. Everywhere the mutiny was attended with savage excesses—women were outraged, and Europeans, without distinction of age or sex, barbarously murdered. Sir Hugh Wheeler, at Cawnpur, was betrayed by Nana Sahib, maharajah of Bithur, who, after offering him his aid, took the mutineers into his pay, and raising the Mahratta standard, besieged him in Cawnpur. The siege, or rather bombardment, lasted from 7th to 24th June, when a capitulation was agreed to, on a sworn promise of Nana Sahib to allow the garrison to retire to Allahabad. On the 27th the embarkation was proceeding when the boats were attacked by the Nana's troops, and the men indiscriminately massacred. The women and children were for the meantime made prisoners. Sir Henry Lawrence was besieged in Lacknow, where he died on 4th July, from a wound received in a sortie.

General Anson, the commander-in-chief, on learning the result of the mutiny at Meerut, hastened from the Simla Hills with all the troops he could muster to Delhi; but he was cut off by cholera on the way, at Karnál, 27th May. Sir Harry Bernard, who succeeded him, effected a junction with the British troops from Meerut under Brigadier Wilson, who had already had a successful encounter with the enemy on 7th June. On the 8th they carried the heights above Delhi. On the 9th they received a reinforcement from the Panjab. On the 12th they repelled an attack on their camp; but the force was still too small to attempt the capture of Delhi. The enemy in the meantime was continually receiving reinforcements, and new and more formidable attacks on the British position were made on the 19th and 23d June, the latter the anniversary of Plassey. Before the last attack Sir John Lawrence had been able to send further reinforcements from the Panjab. By the end of June the British force before Delhi amounted to 6000, and though still too weak to operate against the place, was no longer in danger of being forced. Sir John Lawrence, who had rendered this effectual aid, had, by the assistance of the Sikh

chiefs and by means of a movable column, put down all disaffection in the Panjab. After protracted operations and repeated reinforcements on both sides Delhi was taken by assault, 14th to 20th September. Sir Henry Havelock, who had been engaged in the Persian campaign, had arrived in Calcutta on 25th, and immediately set out for Allahabad, to commence operations for the relief of Lacknow and Cawnpur. (See HAVELOCK, SIR HENRY.) While his force was victoriously advancing on Cawnpur Nana Sahib, on the 15th July, barbarously massacred his prisoners, consisting of 210 women and children. Havelock was succeeded in the command at Lacknow by Sir James Outram, who held it till relieved by Sir Colin Campbell (17th November), who arrived at Calcutta on 14th August, and was followed by reinforcements from England. It had been at first apprehended that the mutiny might extend to the Bombay and Madras presidencies, and from this cause and the occupation of the troops in Bengal the mutineers had been left unchecked in Central India. At length columns organized in these presidencies entered Central India, and were united under Sir Hugh Rose. By the operations of these commanders the mutiny was finally suppressed. (See CLYDE, LORD.) Among the distinguished officers who perished in it besides those named, were Generals Nicholson, Neill, and Havelock. The war was substantially closed by June, 1858, although the complete pacification of Oudh was not effected till the end of the year. The exasperated feelings caused by the savage conduct of the mutineers were perhaps too freely indulged in their punishment. Many were blown from the mouths of guns, a punishment several times before inflicted by the British in India, others expiated their crimes on the scaffold; but, finally, a royal proclamation offered an amnesty to all who had not committed crimes, declared that none should be favoured or molested on account of religion, and declared the intention of her majesty in assuming the government of India to respect the rights, dignity, and honour of native princes as her own, and to promote the social advancement of India by internal peace and good government.

INDIAN OCEAN, that great body of water which has Asia on the north, the Sunda Isles and Australia on the east, Africa on the west, and the Antarctic Ocean on the south. The Cape of Good Hope, and the southern extremity of Tasmania may be considered its extreme limits from east to west. Its length from north to south somewhat exceeds 6500 miles, its breadth varies from 6000 to 4000 miles. Its principal gulfs are the Red Sea, the Arabian Sea, and the Bay of Bengal. Its islands are Ceylon, Madagascar, the Laccadives, Maldives, Socotra, Andamans, Nicobar, Mauritius, Bourbon, Kerguelen's Land, &c. Numerous rocks and coral reefs render the navigation dangerous. The Ganges, Brahmaputra, Irawaddi, Indus, Euphrates, empty the accumulated waters of Southern Asia into the Indian Ocean. The south-east trade-wind, which prevails between the 10th and 28th parallels of S. latitude, blows with much force and pretty constantly from April to October, after which date its northern limits are considerably contracted; south of these are the constant north-west winds, which prevail almost in the same latitude, in the Atlantic and Pacific. The monsoons are found principally in the north part of this ocean, over a tract extending from the continent of Asia to about lat. 8° S., and from the Mozambique Channel on the west to the shores of Australia and the sea of China on the east. They blow uniformly in the same direction for six months, changing about the equinoxes. North of the equator the north-east monsoon prevails from October to April, the south-west from April to October; while south of that limit the north-west monsoon blows while the north-east is blowing on the north side, and the south-east prevails during the time of the south-west monsoon north of the equator. In the hot season, likewise, when the south-east trade-wind recedes south, the north-west monsoon occupies the space between the equator and the 12th south parallel. The hurricanes of this ocean usually range between lat. 9° and 35° S., extending from Madagascar to the Island of Timor. They usually come from the north-east near Java, and travel south-west and south, returning again east. The season for them south of the equator is from December to April; at other times they are almost unknown.

INDIANAPOLIS, a city of the United States, the capital and chief city of Indiana, on the White River, in a wide plain, 194 miles south-east of Chicago. It is an important railway centre, and the surrounding country is fertile and rich in mineral wealth. The city is encircled by a railway which connects all the great trunk lines, and so facilitates the traffic. The streets are broad, and laid out on the rectangular plan, except for four fine diagonal avenues which radiate from a central park. The chief buildings and institutions are: the state capitol (1888), which cost £400,000; the county court-house; the Propylæum, a women's literary institute; the United States building; the United States arsenal; the union station; the Board of Trade building; the public library (1893); the Masonic Temple; the Soldiers' and Sailors' Monument, 285 feet high; the Blind Asylum; the Deaf and Dumb Asylum; the Central Hospital for the Insane; schools and colleges; and many churches. The manufactures comprise iron and iron goods, furniture, terra cotta, carriages and wagons, &c., and there are extensive stock-yards and flour-mills. Pop. (1890), 105,436; (1900), 169,164.

INDIANS, AMERICAN, the collective name for the tribes inhabiting America at the time of the discovery by Columbus, and their descendants. The name of Indians was first given to these races from the mistaken notion of the early voyagers that the newly-discovered continent formed part of India. The Esquimaux, the most northerly of these tribes, extend across the continent along the Polar Sea. Next below them, to the west of Hudson's Bay, is the large family of Athabascans. Canada and the United States, east of the Mississippi, were formerly inhabited by the Algonquin-Lenape and the Iroquois; south of these were the Floridan tribes, the Creeks, the Cherokees, &c.; west of the Mississippi were the Pawnees, Sioux, &c.; on the Pacific coast the Californian and Oregon tribes, relatively lower in civilization than the Atlantic nations, and split up into smaller communities; in New Mexico, a more advanced family, stationary and agricultural, called Moquis, or Pueblo Indians. Mexico was occupied by a number of families, of which the Nahuatls or Aztecs were the most powerful and civilized. The Othomis were also a numerous people in Mexico. In Central America the predominating family was the Tzendal or Maya, including the Quichés, Zuttugils, Kachiquels, &c., who occupied the entire region of Chiapas, Tabasco, Yucatan, Guatemala, and parts of the adjacent states, and who built the most remarkable monuments of aboriginal architecture with which we are acquainted. Portions of the Aztec tribes were also found in Central America, besides another large group of tribes, in a lower stage of development. In South America the leading and more advanced families were the Muyiscas of Colombia, and those which made up the Peruvian Empire, among which the Inca race (Quichuas or

Kechuas) and the Aymaras were the chief. The Araucanians, to the south of these, in Chili, were a brave people, bearing considerable resemblance to the Algonquins and Iroquois of North America. The remaining portions of South America, including the great alluvial tracts of the Atlantic slope, were occupied by various tribes, such as the Tupuyas, Tupis, and the Caribs, the last of whom were spread over a wide area, and occupied also most of the West Indian Islands.

By most ethnologists the American Indians are considered an aboriginal and single stock; by some a mixture of Mongolian, Polynesian, and Caucasian types, and by others as derived from the grafting of old world races on a true American race. As to their physical characteristics, race divisions, probable origin, &c., see the article ETHNOLOGY. We will here give a few particulars regarding their civilization as it existed before it was affected by that of Europe.

When America was discovered by the Spaniards some of the American nations or peoples had attained a considerable degree of civilization. Thus, in Mexico, Central America, Peru, &c., there were large towns, architecture was practised with considerable skill, agriculture was carried on with success, maize, cotton, cacao, tobacco, and other crops being grown, and irrigation and artificial manures being employed. The Mayas of Central America were among the most advanced, especially in the art of writing, as also in paper-making and the making of cotton cloths—but the latter were made over a wide area—as well as fabrics of various other materials. The native articles of dress varied greatly, and naturally the materials worn in the colder regions of the north and south were very different from those worn within the tropics, where some tribes wholly dispensed with clothes. Personal ornaments of the most multifarious kind were very common, being made not only of gold, silver, and copper, but also of the feathers of birds, and of the claws, teeth, hoofs, and skins of animals. Painting the face and other parts of the person was exceedingly common, being employed among the women and girls as well as the men. Tattooing was practised also among certain tribes. Stone implements were in use over the whole continent, and implements and articles of metal were also becoming common, at least among the more advanced communities, such as existed in Mexico, Central America, and those ruled by the Incas in South America, where spades and hoes of bronze were in use. Axes, chisels, knives, needles, arrows, and spear-heads were among articles made of metal, as well as ornaments. In some localities the potter's art had reached a high degree of perfection, and not only articles of ordinary utility were made, such as various vessels, dishes, &c., but also such objects as pipes, whistles, rattles, beads, masks, small figures, &c. The glazing of pottery was unknown, but various methods of surface decoration were practised, including modelling in relief and painting in colours. In some regions the chief food was supplied by hunting, along with vegetable productions found growing wild; but agriculture in some fórm was carried on over a wide area, and where this was the case corn and other cultivated products supplied a large part of the food of the people. Maize was cooked in a number of ways, and the making of maple-sugar was an industry learned by the Europeans from the American Indians. Fish as well as game was largely eaten. Dwellings were constructed of the most varied types and materials—from the rude shelter of leaves and branches erected by the wandering tribes, the wigwam of the North American Red men, the snow-house of the Esquimaux, to the substantial buildings of sun-dried brick and stone erected by the Peruvians, Mexicans, and others. Among the most advanced communities large cities existed, and an active commerce was carried on, which extended even to the West Indian Islands. There were few domestic animals: the dog was probably common everywhere; various animals and birds were tamed as pets; but the only beasts of burden appear to have been the llama and alpaca, which were employed almost solely in Peru and Chili. Of the social, religious, or political institutions we cannot here speak; and, indeed, regarding some of these topics little is really known with certainty. Games and sports were exceedingly common, and some of these have been taken up by the white inhabitants of America, such, for instance, as the now well-known *la crosse*. See also AMERICA, MEXICO, PERU, &c.

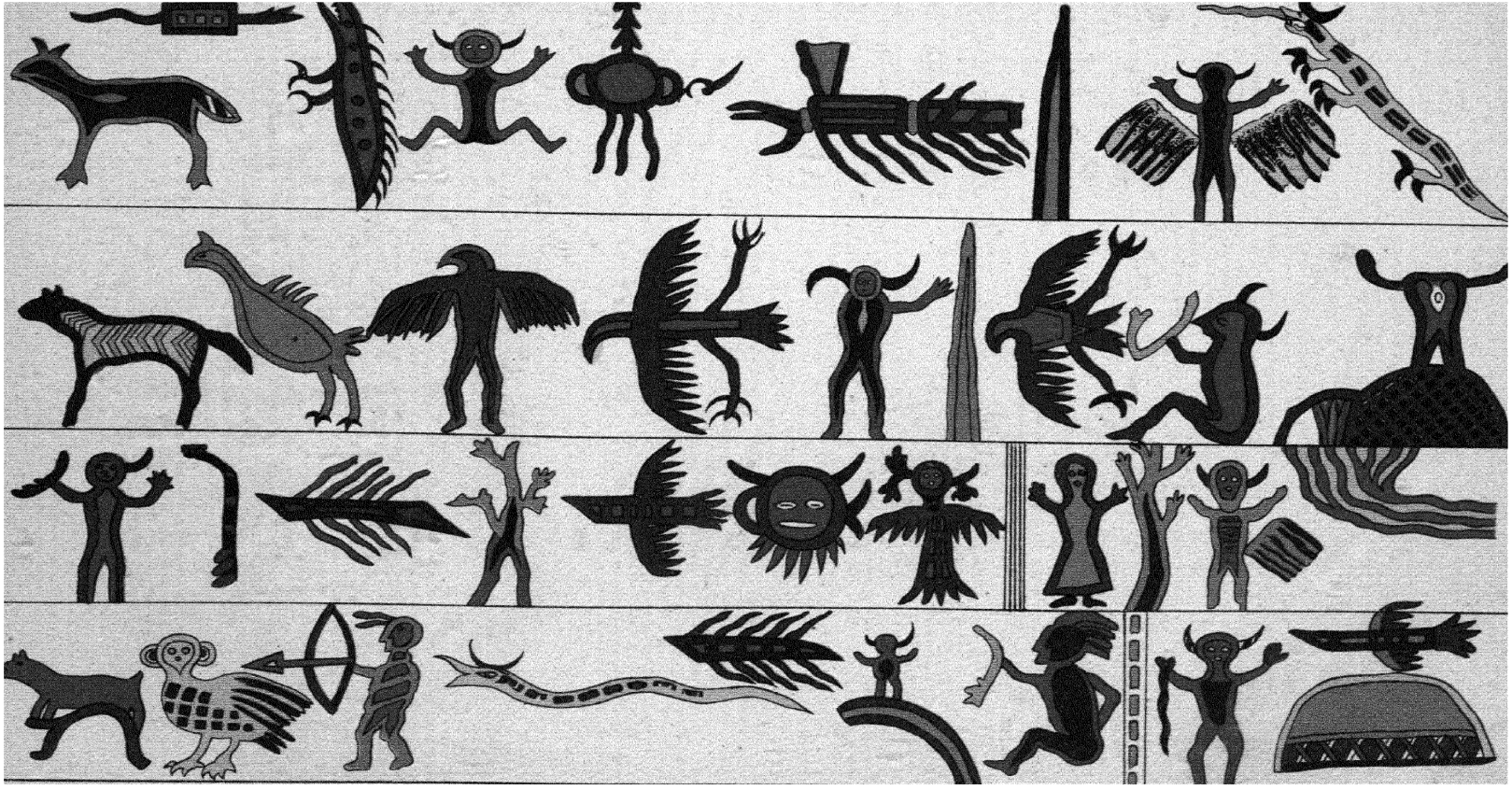
INDIAN TERRITORY, a territory of the United States of America, bounded north by Oklahoma and Kansas, east by Missouri and Arkansas, south by Texas, and west by Oklahoma. Its area is 31,400 sq. miles. The surface is generally flat, and there are no hills higher than 2500 feet above sea-level. The territory is traversed in a south-easterly direction by the Arkansas River, which here receives the waters of the Canadian River and other streams. The Red River forms the southern boundary of the territory and receives much of its drainage through the Washita and other tributaries. The chief formation is carboniferous, and valuable semi-bituminous coal-fields are worked to some extent. Gold and silver are also known to occur. There is much fertile land in the territory, and among the chief crops raised are maize, oats, wheat, potatoes, sweet-potatoes, and cotton. There are extensive woodlands in the south and east. The climate is warm and generally rather dry. The territory is divided into allotments or reservations for the five Indian tribes for whose use it was originally set apart. The Cherokees dwell in the north, the Creeks and Seminoles in the western central part, the Choctaws in the south-east, and the Chickasaws in the south-west. Several railways now pass through the territory. The principal industries of the Indian population are agriculture, stock-raising, wool-growing, and the making of blankets and shawls. The mining is in the hands of whites who have become members of the Indian nation by marriage with Indian women. The leading churches are the Methodist and the Baptist South, and education is largely in their hands. There is an Indian University (Baptist), a Baptist Academy, and several other higher educational institutions. Muscogee is the chief commercial town and seat of the United States court. The territory came to the United States as part of Louisiana in 1803, and in 1834 was set apart as a permanent home for Indians. In 1890 the western half of the original territory was erected into a separate territory known as Oklahoma. In recent years there has been an agitation for the erection of the territory into a state. The population in 1890 was 186,490, of whom 50,647 were Indians proper (about one-half Cherokees), the rest being white (107,987) and coloured. The population in 1900 was 391,960.

INDIA-RUBBER. See CAOUTCHOUC.

INDICATOR, an instrument designed by Watt to determine how the pressure of steam in the cylinder of a steam-engine varied during the stroke. See STEAM-ENGINE.

INDICTION, in chronology, a period or cycle of fifteen years, the origin of which is involved in obscurity. Unlike other cycles, the indiction has no reference to any astronomical phenomena, but is supposed to relate to some judicial acts, probably the

INDIAN PICTURE-WRITING.



Picture-writing (Medicine-man's chant) of the Chippewa or Ojibbewa Indians of North America.

Printed from the Originals by the Bibliographisches Institut, Leipzig.

publication of tariffs of the taxes which took place at stated intervals under the Greek emperors. Three sorts of indiction are mentioned:—(1) the Cæsarean, which fell on the 8th of the calends of October, or 24th of September; (2) the indiction of Constantinople (beginning A.D. 312), on the 1st of September; and (3) the pontifical or Roman, which begins on the calends of January. We find ancient charters in England also dated by indictions.

INDICTMENT. An indictment, according to the English law, is a written accusation of one or more persons for a crime or misdemeanour, preferred to and presented upon oath by a grand jury to a court. It consists of three principal parts, the caption, which is merely the style of the court where it is preferred; the statement, which describes the time, place, and circumstances of the crime; and the conclusion or accusation, which is in the name of the grand jury. In Scotland the indictment, or form of process, runs in the name of the lord-advocate, and is addressed to the prisoner directly by name. The grand jury determine whether there is a reasonable cause to put the accused on trial. If the indictment is found he is publicly delivered into court; if it is not found, he is discharged. While in England a prisoner is not entitled before trial to have a copy of the indictment, and a list of the witnesses against him, in Scotland he is entitled to copies of these fifteen days before the trial.

INDIES, WEST. See WEST INDIES.

INDIGESTION. See DYSPEPSIA.

INDIGO. The leaves of several species of plants yield this colouring matter, which forms an important commercial product in the East and West Indies, Mexico, Brazil, Egypt, &c. The only European plant which certainly yields indigo is the common woad (*Isatis tinctoria*); many others yield blue colouring matters, which, however, appear to differ from true indigo. But it is chiefly from tropical plants belonging to the various species of the genus *Indigofera* that indigo is obtained. The species of *Indigofera* are leguminous plants, herbaceous or shrubby, with pinnate leaves, and small blue, purple, or white pea-shaped flowers disposed in axillary racemes. They are very numerous in the equatorial regions of the globe. The species most commonly cultivated are the *I. anil*, a native of Tropical America, but now cultivated even in the East Indies; the *I. tinctoria*, also cultivated in both Indies; and the *I. cærulea*. The *I. tinctoria* is the species most abundantly cultivated. The principal varieties of indigo recognized in commerce are named Bengal, Oude, Manilla, Caraccas, Spanish Floras, Spanish Sobres, and Spanish Cortes. Besides the *Indigofera*, plants belonging to the orders Cruciferæ, Apocynæ, Polygoneæ, &c., yield this substance. The milk of cows is said, under certain conditions, to contain indigo; it may also, according to Schunck, be obtained from the urine of men and animals by the action of strong acids.

The history of indigo is one of the most interesting of all chemical stories, stretching back as it does to the time of our remote ancestors, and illustrating not only the gradual advance of chemical knowledge, but also the slow progress of those ideas of free-trade which now govern the commercial world. Cæsar tells us that the ancient Britons stained their bodies with woad, so as to give themselves a more formidable appearance in battle; and from Pliny we learn that their women, before engaging in certain mystic religious rites, also covered their nude bodies with this same material. A pigment, called by Pliny and Dioscorides *indicum*, is generally supposed to have been essentially the same substance as our modern indigo. The characteristics of this indicum, as detailed by Pliny, were that its colour was black, becoming a fine mixture of purple and blue when dissolved; that on heating it gave a beautiful purple vapour, and emitted a smell like that of the sea. The same author also states that an article in imitation of indicum was manufactured by dyeing pigeon's dung or chalk with woad. Egyptian mummies have been found wrapped in blue cloths, the colouring matter of which has exhibited all the characteristics of indigo. During the middle ages indigo, very similar to that now manufactured, appears to have been known; the mode of its extraction from the plant was described by Marco Polo. In various parts of Germany and France woad was also largely manufactured from the leaves of the *Isatis tinctoria*. The Jewish dyers seem to have been the first persons to introduce the true indigo dye into Europe, Italy being the country which claims the honour of the earliest use of this substance. It was not, however, until after the discovery of the passage to India by the Cape of Good Hope that indigo was largely imported into Europe. Gradually the use of the new dye superseded that of the old woad; but as the process employed in the dye-works was crude, the goods coloured by indigo were found to fade sooner than those coloured by woad, and it was also said that the sulphuric acid used in the process rotted the goods. At the same time the persons who cultivated woad, and who had derived great profits therefrom, began to lose their trade; hence arose a violent opposition to the new indigo dye, an opposition which culminated in many European countries, in Britain among the rest, in royal edicts forbidding under heavy penalties the use of the dreaded innovation. These edicts, however, could not hinder the dyers from employing a substance so admirably suited to their wants as indigo, so that they were gradually relaxed until, about the middle of the eighteenth century, they were for the most part repealed.

The greater part of the indigo used at the present day comes from India, especially from the provinces of Bengal, Oude, and Madras. The district of India where the finest indigo-yielding plants are grown is situated between 88° and 90° E. lon. and 22½° and 24° N. lat. A light mouldy soil is most suited for the cultivation of the *Indigofera tinctoria, anil, disperma*, and *pseudo-tinctoria*, which are the plants grown in India for the sake of the indigo they furnish. The ground is ploughed towards the end of the year, and the seed sowed in the early spring of the following year. The first cutting of the plants takes place about midsummer, and the second about two months later. Two processes are employed for the preparation of the dye from the leaves and stems of the plants:—

1. *From the Fresh Leaves.*—The leaves and stems as they come from the fields are placed in a large stone-built cistern or reservoir about 20 feet square and 3 feet deep; water is then pumped into the cistern until it reaches within 3 or 4 inches of the brim. Fermentation soon sets in, the mass in the cistern is violently agitated, bubbles of gas making their escape through the liquid, while a copper-coloured scum gathers on the surface. After twelve or fifteen hours the fermentation slackens, and the liquid becomes quiet; it is then drawn off into a lower cistern, where it is beaten up with oars or shovels. While one set of men are employed in beating the liquor in the lower cistern, another set remove the exhausted plants from the upper, spread them to dry in the sun, and fill the tank with fresh plants. The plants generally lose about 12 to 14 per cent. of their weight by the fermentation process. The process of beating is continued until the colour of the liquid changes from green to pale yellow, the indigo at the same time gathering together into grains, and subsiding

to the bottom of the tank. The object of this beating is to disengage the carbon dioxide which the liquor contains, to expose the newly-formed indigo to the action of atmospheric oxygen, and at the same time to cause it to gather together into little lumps, in which state it subsides more easily than when it is finely divided throughout the liquid. The precipitated indigo is collected, boiled in a copper vessel for three or four hours, and then filtered through linen filters. In this way the indigo is freed from a yellow extractive matter which accompanies it, and its colour is at the same time rendered more intense. The mass on the filters is now squeezed in a press, and then cut into pieces measuring about 3 inches each way; these pieces are then dried upon shelves of wicker-work in an airy shed. 1000 parts of the solution of the leaves yields from 0·5 to 0·7 parts of indigo.

2. *From the Dried Leaves.*—The plants are dried in the sunshine, the leaves separated from the stems, and the former stored in a dry place. After about four weeks the colour of the leaves has changed from green to pale bluish-gray; they now contain the maximum amount of indigo which can be obtained from them by maceration in water. This maceration takes place in the large steeping-vat previously described. After two hours or so the green liquid is run off into the lower or beating-vat; the rest of the treatment is the same as in the case of the preparation of indigo from the fresh leaves. In China a species of Indigofera is cultivated, and the indigo obtained from it by a process resembling that used in India, the chief modification consisting in allowing the leaves and stems to remain for five days or so in the steeping-tank, and then removing the plants, adding lime and beating the liquid in the same tank.

Indigo occurs in the market in pieces which are sometimes cubical, sometimes of an irregular form; these pieces are easily broken, the fracture being dull and earthy. The colour of indigo varies from light blue to blackish blue; when rubbed with the nail, a copper-coloured streak is formed on the surface of the mass. The pieces of indigo are generally homogeneous, but they sometimes contain cavities which arise from the drying process having been conducted too rapidly; grains of sand sometimes occur throughout the mass. Indigo may be obtained in shining needles with a coppery lustre by condensing its vapour on a cold surface. The finest kind of indigo comes from Bengal; it consists of cubical pieces, which are light, brittle, of a clean fracture, soft to the touch, of a fine bright colour, porous, and adhere to the tongue.

Indigo, before it can be employed in dyeing, must be obtained in solution, but indigo blue is insoluble in water. Recourse is therefore had to chemical reagents, which transform the indigo into a soluble substance, in which form it can penetrate the pores of the cloth, where, by the influence of atmospheric oxygen, it is again re-formed into indigo blue. This is the *rationale* of the indigo dyeing process; the details of the chemical changes we will speak of when describing the chemical nature and relations of indigo. The most ordinary means whereby this solution of indigo is effected is the *copperas vat*. The indigo, after being broken into pieces and moistened with water, is ground to a soft paste, which is then thrown into a vat along with ferrous sulphate, slaked lime, and water. The ferrous sulphate reacts with the lime to form calcium sulphate and ferrous oxide, the latter being immediately oxidized at the expense of part of the oxygen of the indigo, which in its turn is reduced to a substance called indigo white. This last-named substance dissolves in the excess of lime. The goods (cotton, linen, or silk) are dipped into the vat after the liquid in it is clear. On removing the fabric the indigo white which has penetrated its pores is re-oxidized by atmospheric oxygen to indigo blue, and by repeating this treatment the goods may be obtained dyed of any desired depth of blue. Lastly, the goods are passed through dilute acid to remove any adhering lime or ferric oxide. The action of the *woad vat*, which is chiefly employed in the dyeing of woollen goods, is in general similar to that of the copperas vat, differing, however, in that the reduction of the indigo to soluble indigo white is brought about by a process of fermentation which is set agoing by the nitrogenous ingredients of the woad, bran and madder, which, along with indigo, lime, and water, constitute the vat. Another method of indigo dyeing consists in forming indigo sulphate, or *extract of indigo*, by dissolving indigo in strong sulphuric acid, and precipitating with common salt. The ensuing precipitate is washed with a solution of salt, and is now easily soluble in water, forming a deep-blue solution. (See also CALICO-PRINTING, DYEING.)

Having briefly described the preparation of indigo and the methods of using it for dyeing, let us consider the chemical nature and relationships of this substance. That indigo blue (*indigotin*) does not exist ready formed in the plant from which it is obtained seems to be now abundantly proved. At one time it was supposed that the plant contained indigo white, and that this was converted into indigo blue by oxidation when the juice was exposed to the air. Schunck has, however, shown that indigo white requires the presence of a free alkali to hold it in solution; but the juices of plants are always acid, and, moreover, contain free oxygen, hence it is impossible that indigo white can exist under such circumstances. Schunck has also shown that a substance called *indican* exists in, and can be obtained from, woad and other indigo-yielding plants; he has proved that this substance is decomposed by dilute acids—slowly in the cold, quickly when heated—one of the products of this decomposition being indigo blue. The same naturalist has shown that acids—such as tartaric or oxalic acid—which exist in plants bring about this decomposition.

Hence we are led to believe that the indigo plant contains this substance indican, which, during the process of fermentation, is changed by the influence of the acid sap of the plant into indigo blue. The relationship between indican and indigo blue is more clearly seen by considering their respective formulæ—

Indican. Indigo blue.

$$C_{52}H_{62}N_2O_{34} + 4H_2O = C_{16}H_{10}N_2O_2 + 6C_6H_{10}O_6.$$

The substance represented by the formula $C_6H_{10}O_6$ (called indiglucin) is produced along with indigo blue. It is, however, not yet ascertained with perfect certainty that the decomposition represented by the above equation actually takes place in the plant during the manufacture of indigo. According to some chemists the indigo-forming substance in the plant is a body called indol, to which the formula C_8H_7N is assigned. This substance exists in the urine in certain conditions of that liquid. But it has been found by Iaffé that if indol be subcutaneously injected, indican shortly afterwards appears in the urine; hence it seems that indol is the first step towards the formation of indigo blue, and we may perhaps conclude that this substance indol is the nucleus of all the members of the indigo series.

Thus indigo blue yields, upon oxidation by nitric acid, a substance called isatin, the relationship between which and indigo is shown by the following equation:—

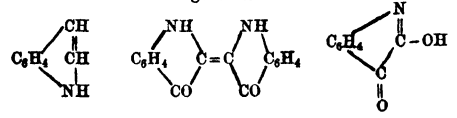
Indigo blue. Isatin.

$$C_{16}H_{10}N_2O_2 + O_2 = 2C_8H_5NO_2.$$

Some of the relationships probably existing between indol, indigo blue, and isatin might be brought pro-

eminently before us by considering the following structural formulæ:—

Indol. Indigo blue. Isatin.



By syntheses of indol and isatin we can prove that they contain eight carbon atoms in the molecule, and similarly we can readily demonstrate that indigo blue contains sixteen carbon atoms instead of eight.

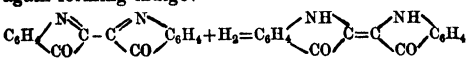
Upon ortho-nitrobenzaldehyde being acted upon by acetyl chloride we get ortho-nitrocinnamic acid:—

$$C_6H_4.NO_2.CHO+CH_3COCl=HCl+C_6H_4.NO_2.CH:CH.COOH.$$

Bromine reacting with this gives us the dibromide, which when treated with alcoholic potash yields ortho-nitrophenylpropiolic acid ($NO_2.C_6H_4.C:C.COOH$). This acid boiled up with water undergoes decomposition, yielding ortho-nitrophenylacetylene and carbon dioxide. We next treat this body with potassium ferricyanide in alkaline solution, when it condenses with the production of dinitro-diphenyldiacetylene:—

$$2\,C_6H_4\begin{cases}NO_2\\C\equiv CH\end{cases}=H_2+NO_2.C_6H_4.C:C.C:C.C_6H_4.NO_2$$

After extraction with chloroform strong sulphuric acid is added. This reacts to produce the metameric di-isatogue, which on reduction takes up hydrogen, again forming indigo:—



Commercial indigo contains about 50 to 60 per cent. of pure indigo blue, the remainder consisting of substances called indigo gluten, indigo yellow, indigo red, &c. The process of the *vat*, as already described, separates the true indigo blue from these other substances. Pure indigo blue may also be obtained in a crystalline condition by mixing commercial indigo with an equal weight of grape sugar, adding warm alcohol and 1½ part by weight of the strongest soda-lye, again adding a large quantity of alcohol, and allowing the mixture to stand for some time. The following, among other substances dissolve indigo blue:—nitro-benzene, castor-oil, aniline, phenol, oil of turpentine, amylic alcohol, white bees'-wax, and boiling paraffin. Some of the tests for the purity of commercial indigo have been already pointed out. For details of more exact chemical methods recourse must be had to a text-book of practical chemistry. Latterly indigo has been produced artificially, but with what commercial result remains to be seen.

INDIUM, a metal discovered in 1863 by means of spectroscopic analysis. (See SPECTROSCOPE.) The zinc-blende of Freiburg was found by Reich and Richter, after a process of purification, to yield a substance the spectrum of which was different from all known spectra. They hence inferred the existence of a new element. This element has been isolated, but only in small quantities. It is of a silver white colour, soft, and marks paper like lead; its specific gravity is 7·421 at 16°·8. The metal indium is related to cadmium and zinc, both of which occur associated with it in nature. The spectrum of indium exhibits two characteristic lines, one violet α and another blue line β; besides these two fainter blue lines are visible if the burner in which the metal is volatilized be fed with hydrogen instead of coal gas.

INDIVIDUALITY. The definition of an individual has long been a subject of discussion in botany and zoology, and no satisfactory solution of the difficulty has been, or perhaps can be, given. The test of self-consciousness is limited in its range, though very definite in its results within that range. It has been proposed to use the purely physiological test, that is, the capacity of maintaining that balance between external influences and internal adjustments which constitutes life. But this test also fails when we have to deal with cases of Alternate Generation, or of Metamorphosis, nor does it cover all instances even of plants and animals. Thus the Hydrozoa form colonies, compound organisms, each member of which fulfils the above condition of life; but the whole mass forms a unity, its parts, the members of the colony, being in vital connection with each other. Is the colony an individual? The test, moreover, assumes that the individual is, so to speak, axial; but individuals sometimes arise, as in Bignonia and Sundew, from the leaves, which are appendages, and by no means axial. Where budding takes place abundantly, as in the Hydra, each bud becomes an individual capable of nutrition and reproduction; but among the Hydrozoa, buds arise which do not fulfil these conditions. They are umbrella-like swimming discs, in which the reproductive elements are matured: are they individuals? Among some internal parasites (the King's Yellow Worm, or Fluke, *Distoma*) a tadpole-like form is met as one stage in the metamorphosis. And this larva repeats itself by internal budding, so that the representatives of this stage are greatly multiplied, and the mature forms correspondingly multiplied: are these larvæ to be regarded as individuals? Among plant-lice the insect which issues from the egg gives rise by internal budding to similar forms, each of which in turn repeats itself, so that in a few generations the egg is represented by millions of seemingly complete forms, which, however, do not prolong the species beyond the close of summer; then sexually complete forms arise, and eggs are deposited. The millions of buds, are they individuals? It has been proposed to regard as an individual all that intervenes between egg and egg. This would include the whole of these virgin aphides. Nor does it simplify the case even as regards man; for it would be necessary to regard male and female as together completing the individuality included in the series between egg and egg. Now, whatever hypothesis may be framed regarding the condition of the earliest animals, the distinctness of the sexes goes along with higher development. Accepting the position that no perfect definition of individual can be given, the substitution of zoöid for individual is the only available resource. By that term is meant a living thing which is capable for a longer or shorter time of maintaining its existence and of discharging some function which determines or is followed by its death. The lower we descend in the organic series the more are we called on to use this term; till at least, if the Bathybius of Huxley is proved to fulfil his description of it, a single sheet of protoplasmic matter covers large part of existing sea bottoms. This extensive diffusion of organic matter represents, to some evolutionists, the primitive substance out of which, by successive differentiations, individuals have been developed. If these steps are gradual and successive, sharp definitions cannot be looked for; and as the directions of evolution are various, the anatomical and physiological tests above mentioned may come each to have its place as well as that of self-consciousness.

INDO-EUROPEAN (or ARYAN) LANGUAGES, the noblest and most highly developed of the great divisions into which the numerous languages of the world have been divided, a division including languages now or formerly spoken by various peoples both in Asia and in Europe. The title *Indo-European*, as applied to all these languages, is not strictly accurate: (1), because members of the family other than In-

dian, as Persian, Afghan, Armenian, &c., exist in Asia; and (2) because all European tribes do not speak tongues of this class, the Finns, Magyars, Turks, &c., speaking Turanian languages. The older name *Indo-Germanic* was still more restricted, and therefore still more inapplicable. The term now often used to designate this class of tongues is Aryan. This term, applied by Bopp and Schleicher to the tongues of the two Asiatic peoples who can be certainly proved to have called themselves by that name, has been extended by Max Müller to the whole group, and his pre-eminence in the region of philology, as well as its convenience, has gained for it a very wide acceptance. The appellation *Aryan*, connected, according to Max Müller, with the Latin *aro*, to plough, and signifying a cultivator of the soil, the people chose to designate themselves by, in order to distinguish themselves from the *Turanians* or nomadic races, whose original name *Tura* signifies the swiftness of the horseman. Peile, however, and others question this etymology, preferring the root *ar*, to fit, whence they deduce the derivative term Aryan with the successive meanings of fitting, worthy, noble. The Aryan languages must all be descended from one ancient language, the parent speech spoken originally by a simple people. The earliest home of this people is by some placed in Central Asia, near the sources of the Oxus and Jaxartes; but many now rather believe that it was in Europe. 'The parent stock (from whom all the Aryan tribes have sprung) was', says Max Müller, 'a small clan settled probably on the highest elevation of Central Asia, speaking a language not yet Sanskrit, or Greek, or German, but containing the dialectic germs of all. . . . There was a time when the ancestors of the Celts, the Germans, the Slavonians, the Greeks and Italians, the Persians and Hindus, were living together beneath the same roof, separate from the ancestors of the Semitic and Turanian races.' See ETHNOLOGY.

The Indo-European or Aryan tribe of tongues comprises seven great or chief branches. Two of these branches form the Asiatic group, namely: (*a*) *Indic*, comprising Hindustani proper, with Pali, the sacred language of the Buddhists; Prakrit, the language of the vulgar in Sanskrit dramas; and Sanskrit, the sacred language of the Brahmans, which, in the form of the Old Indian of the Rig-Veda, is the mother of all the Indic group; (*b*) *Iranian* or *Eranian*, comprising Zend or Avestan, or Old Bactrian, in which the Zend-Avesta of Zoroaster, or Zarathustra, is written; Pehlevi or Pahlavi, or Old Persian; modern Persian, with Kurdish, Ossetic (a dialect of the Caucasus), and Afghan or Pushto.—The European group comprises five main branches, namely: (*a*) *Greek*, comprising ancient Greek and modern Greek or Romaic; (*b*) *Latin*, comprising Latin proper, with many of the ancient dialects of Italy, modern Italian, French, Spanish, Portuguese, Provençal, Rhæto-Romanic (South Switzerland and head of Adriatic), Wallachian, &c.; (*c*) *Slavonic*, divided into two branches—*Eastern*, comprising Russian, Polish, Bohemian, Servian, Bulgarian, and Old Bulgarian, otherwise called Old or Church Slavic, and still employed as the sacred language of the Greek Church; and *Western*, comprising Lithuanian, Lettish, and Old Prussian; (*d*) *Germanic* or *Teutonic*, divided into three groups—(1) *Low German*, comprising Mœso-Gothic, Anglo-Saxon or Early English, Frisian, Old Saxon (as in the poem called the *Heliand*), Dutch, and, closely allied to it, Flemish; (2) *High German*, divided into three periods, Old High German, Middle High German, and Modern German; (3) *Scandinavian*, comprising Old Norse or Icelandic, Norse, Danish, and Swedish; (*e*) *Celtic*, divided into two groups—(1) *Gadhelic*, comprising Irish, Gaelic, and Manx; (2) *Cymric*, comprising Welsh, Breton or Armoric, and Cornish (now extinct.) Armenian and Albanian, respectively belonging to Asia and Europe, are also regarded as independent branches.

The original home of the Indo-Europeans, as already stated, is now often placed in Europe, some believing it to have been in Central Europe, others in Northern Europe generally, others in Scandinavia more particularly, while some of the most recent authorities favour a region in the south-east of Europe intersected by the lower course of the Volga. A great many schemes and theories have been put forward as to the spread of the Indo-European peoples and languages from their early home, and the steps by which their present distribution was brought about. Schleicher had a theory that the farther towards the east an Indo-Germanic people lives, so much the more of what is ancient has their language retained; the more towards the west they have gone, the more of what is new in form and grammar is to be found. According to this and other tests he judged that the race called by him Slavo-Teutonic, and comprising the ancestors of the Teutons, Lithuanians, and Slaves, were the first to begin the north-westward migrations; then followed the Græco-Italo-Celtic branch. Many have supposed that the Celts were the first to enter Europe, and that they were long the sole Aryan occupants of Western Europe, expelling or subduing the less civilized races they found roving over it on their entrance. Their advent is supposed by some archæologists to be marked by the appearance of metal (generally bronze) implements, weapons, and ornaments in their sepulchral mounds, cairns, cists, &c., in place of the rude stone implements of their predecessors. After the Celts came, it is thought, the ancestors of the Greeks and Italians, later the Teutons, and last of all the Slaves. Another great stream of migrating Aryans flowed towards the south, into the Panjab and the valley of the Ganges, displacing a darker race and becoming the ancestors of the present Hindus. It is to this branch, and to the Persians, &c., that the term *Aryans* is more particularly applicable. It is the name by which they designate themselves in their ancient Vedas, as well as in the Zend-Avesta, and it appears not only in many place-names in Northern India, ancient Bactria, and Persia, *Aryavarta*, the abode of Aryans, being their name for India, and *Airya*, Greek *Ariana*, Modern Persian *Airan*, their name for Persia; but also in many personal names, as *Ariaramnes*, *Ariobarzanes*, *Ariomanes*, and *Ariomardos*. According to Max Müller the schism which separated the Zoroastrians or Parsees from the Brahmans, and which was a protest on the part of the Iranians against the nature-worship of the Hindu section (as Buddhism at a much later period was a protest against caste, penances, and sacrifices), took place after the great southern migration into Northern India. Some authorities maintain that the Dravidians of S. India are also an Aryan people.

Of the early language of the primitive Aryans or Indo-Europeans we have no remnants. Even though we had, they could only exhibit to us the tongue at certain particular stages of its development. We are not to assume that the primitive tongue was, so to speak, a constant quantity. Language is in a continuous state of flux. Even where a printed literature exists with all its crystallizing tendency, we find it incapable of fixing a tongue. Growth and decay are constantly at work on it. Much more would such change-producing elements be at work on a tongue on which printing or writing had as yet conferred no degree of permanence. A suffi-

cient number of cognate words, however, exist in the various languages of the race to enable us to form some estimate of the condition of the primitive stock at the date of the first exodus. It is thus established that not only had the early race a sense of religion and the immediate family relations, as father, mother, wife; but that the more complex relations of father-in-law, mother-in-law, and sister-in-law were also recognized. To the knowledge of family relationship they superadded that of state organization: they had rulers and cities; they knew the use of metals, the arts of agriculture, grinding corn, weaving, sewing cloth into garments, &c. Cattle constituted their chief riches, although grain-tillage was also practised, and they had given names to the numerals on the decimal system as far as a hundred. The word for a *thousand* varies in the various languages. It is, however, the same in both the Aryan dialects proper (Sanskrit *sahasra*, Zend *hazanra*), also in the Gothic and Slavonic tongues (Gothic *thusundi*, Slavonic *tiisiasta*, Lithuanian *tukstantis*), as also in Latin and Celtic (Latin *mille*, Gaelic and Irish *mile*). This shows that the need for a distinct word had not been felt before the dispersion, while it aids in determining the degree of relationship existing between the various tribes of the race. The following extract from Max Müller is so interesting that we venture again to quote from him. 'It should be observed that most of the terms connected with the chase and warfare differ in each of the Aryan dialects, while words connected with more peaceful occupations belong generally to the common heir-loom of the Aryan language. The proper appreciation of this fact in its general bearing . . . will show that all the Aryan nations had led a long life of peace before they separated, and that their language acquired individuality and nationality as each colony started in search of new homes—new generations forming new terms connected with the warlike and adventurous life of their onward migrations. Hence it is that not only Greek and Latin, but all Aryan languages have their peaceful words in common; and hence it is that they all differ so strangely in their warlike expressions. Thus the domestic animals are generally known by the same name in England and in India, while the wild beasts have different names even in Greek and Latin.'

We have seen that no records of the language of the primitive Aryan stock exist. The oldest representative of the Indo-European family of tongues is the Old Indian, the language of the Rig-Veda (the Veda of hymns of praise), the oldest of the Vedas, or sacred songs of the Hindus, the earliest portions of which Dr. Haug would place between 2000 and 2400 B.C. This language on coming to have a grammar and a literature acquired the name of Sanskrit. These Vedas grew out of the simple admiring wonder with which early man, so soon as he was capable of regarding anything beyond his mere physical wants, looked on the phenomena of outward nature, and constitute the earliest of man's attempts, so far as is known, to solve the infinite problem of the origin of all things. Being expressed in highly metaphorical language, and making use especially of the figure of personification, what was at first merely descriptive of outward nature personified came to be received as the history of an individual, and satisfied man's yearning after a deity. Thus the dawn (Sanskrit *Ushas*, *Ushâsâ*, Latin *Aurora*), the daughter of *Dyaus* (Greek *Zeus*), the Sky, becomes from *Devi*, the bright, *Devi*, the Goddess (Latin *Diva*); and we can hardly determine whether in each passage the poet in describing it is speaking of a bright apparition or of a bright goddess, of a natural vision or of a visible deity:—

'She shines on us like a young wife, rousing every living being to go to his work. The fire had to be kindled by men; she brought light by striking down the darkness.

'She rose up, spreading far and wide, and moving towards every one. She grew in brightness, wearing her brilliant garment. The mother of the morning clouds, the leader of the rays, she shone gold-coloured, lovely to behold. . . .

'Shine for us with thy best rays, thou bright Dawn, thou who brightenest our life, thou the love of all, who givest us food, who givest us wealth in cattle, horses, and chariots.

'Thou daughter of the Sky, thou high-born Dawn, whom the Vasishthas magnify with songs, give us riches high and wide.'

This figurative mode of speaking is by some considered to have given rise to the Hindu, Greek, and Roman mythologies (see MYTHOLOGY). In reality, however, the earliest form of Aryan religion as exhibited in the Rig-Veda is monotheistic; the deities may bear a hundred names, but they are all resolvable into different titles of three deities (*Fire*, *Air*, the *Sky*), and ultimately of one God, the *Mahán Atmá* or Great Soul, antecedent to all their recognized deities, and the great ineffable existence behind them, whose majesty they only serve to conceal, the muttered repetition of whose mystic name, *Om*, still forms a most essential part of the Brahmanical worship. This system, originally so simple, gradually developed into Brahmanism, with all its cumbrous and complicated polytheistic mythology.

In the Zend-Avesta, the sacred songs of the Zoroastrians, we perceive a growing sense of the greatness of moral law, of truth, of righteousness, and of duty; but even in them we do not find any full appreciation of contact between the spirit of man and the God whom he celebrates and adores. It is only in the Hebrew Psalms, the product of the Semitic soul, that these convictions and feelings culminate, and in which, above all, we find an abiding sense of a personal God, with whom man can hold communion, before whom he can bend in reverence, or prostrate himself in penitence and contrition, and towards whom his heart can go forth in gratitude for acts of loving-kindness and free favour.

Almost all the really valuable literature in the world is embodied in one or other of the Indo-European tongues. There are, however, some notable exceptions, chief amongst which are the Old Testament, the Koran, both Semitic productions, the writings of Confucius, &c. Poetry may be said to be common to all peoples.

INDOR, a maharajahship or native state, Hindustan, protected by the British, and consisting mainly of a territory partly comprised in the table-land of Malwa, and partly in the valley of the Narbada; surrounded, south and west, by the territories of the Bombay Presidency; and north and east by those of Scindia, and the petty rajahships of Dhar and Dewass. In addition, it includes the detached town and district of Mehidpur, and some other small districts inclosed by Scindia's Dominions; the whole forming the remnant of the sovereignty of the Mahratta dynasty of Holkar, and attached politically to what is now the Central India Agency. Estimated area, 8400 square miles. The Vindhya Mountains, here rising to only 500 or 600 feet above the adjacent table-land, traverse the north part of the main territory, and the Sátpura ranges bound it on the south: between them are the districts watered by the Narbada, which flows through them east to west. Much of the country is well wooded, and over some fertile plains are scattered mud villages, generally inclosed by ruined walls. Opium is one of

the principal products. After Indor, the capital, the chief towns are Mhau and Mehidpur, the places of British garrisons; Mheysur and Mandlesir, ports on the Narbada; and the ruined city of Mandu. The curious caves and sculptures of Baug are on the west frontier. Amongst the inhabitants of this part of India are numerous Bheels. The dominion of Holkar was at one period much more extended than at present. (See HOLKAR.) Pop. (1901), 850,690.

INDOR, a town of Hindustan, capital of the above state, in a fine undulating plain, lat. 22° 42′ N.; lon. 75° 50′ E. It is now a large town, having been nearly rebuilt since 1820, on very unequal ground, and has crooked streets, some of tolerable width, and paved with granite. The houses are mostly of two stories, built of mud or ill-burned bricks, and covered with thick tiles fastened upon bamboo rafters. It has some mosques, new pagodas of a mitral form, constructed of basalt; and a new granite palace; but its best edifice is the British residency, one of the handsomest in Hindustan. Indor acquired considerable notoriety in connection with the revolt of 1857. Pop. (1901), 86,686.

INDORSEMENT, or ENDORSEMENT. See BILLS.

INDRA, a Hindu deity worshipped in the Vedic period, but popular also in the Epic and Purânic periods. He is sometimes represented with four arms and hands, with two of which he holds a lance, the third wields a thunderbolt, and the fourth is empty; at other times as a white man sitting on an elephant, having a thunderbolt in his right hand, and a bow in his left. When painted, he is covered with eyes. As the god of the hundred sacrifices he is jealous of every mortal who attempts to equal him in this respect, for the sacrificer would rise to a rank as high as his own. Hence he is ever ready to disturb sacrificial acts by sending one of the celestial nymphs to draw away the minds of the devotees from their religious observances, and induce them to return to a life of sensual gratification. In the most ancient of the Rig-Veda hymns the character of Indra is that of a mighty ruler of the bright firmament, who conquers *Vritra*, the symbol of the cloud obstructing the clearness of the sky, and withholding the fertilizing rain from the earth. He is at once beneficent as giving rain and shade, and awful and powerful as in the storm. In the earliest ages he rose to the sovereignty among the gods; but in the Purânic period his star gradually declines, and he is no longer the principal divinity, but only the chief of the inferior deities. The gradual expansion of his mythical character arose from his being regarded as the protector of the pious and virtuous; and his ultimate degradation to a subordinate position in the Hindu pantheon was the result of his being conceived as essentially a warlike god, not only powerful, but self-willed. He is represented as being constantly engaged in war with the giants and demons, by whom he is for a time deposed. A curse from the sage Durvâsa causes his power and that of his subject deities to decline, and he suffers defeat from Krishna in a fight for the Pârijâta tree, which had been planted by Indra in his own garden. The eyes with which he is represented as being covered were originally a thousand marks of disgrace pronounced on him as a curse by the sage Gautâma. The bow which he bends for the destruction of his foes is the rainbow. The attributes chiefly ascribed to him are those of physical superiority, and of dominion over the external world, while spiritual elevation and moral grandeur are not prominently characteristic of him. He is the guardian who presides over the east; he sends the refreshing rain, and wields the thunderbolt, at the crash of which heaven and earth quake with terror. The Rig-Veda abounds in allusions to the elemental conflicts of which Indra is the author. A more pleasing aspect of this deity is that of lord of *Swarga*, the beautiful paradise where the inferior gods and pious men who during their life on earth have faithfully discharged their religious duties, dwell in full and uninterrupted felicity, and enjoy those delights of the senses which in anticipation exercise so powerful an influence on the eastern imagination. Indra is delighted and invigorated with the juice of the Soma plant offered to him by the pious.

INDRE, a department, France, bounded north by department Loir-et-Cher; east Cher; south Creuse and Haute-Vienne; and west Vienne and Indre-et-Loire; area, 2622 square miles. It is generally flat, though a few low hills in the south-west relieve the general monotonous appearance, and furnish some picturesque scenery. The rocks generally consist of granite and schist. The whole department belongs to the basin of the Loire, which receives its waters by the Indre, a river of 140 miles of total length, which gives the department its name—the Creuse, and the Cher. A branch of the Canal du Centre follows the course of the last-named river, and traverses part of the department. The climate is in general mild and healthy. Nearly two-thirds of the whole surface is arable, and one-eighth in permanent meadows and pastures. About one-twelfth is under wood, and one-ninth waste. Large crops of wheat and barley are produced, and the corn raised leaves a considerable surplus for exportation. The other important crops are hemp and flax. A considerable quantity of land is occupied by vineyards. Among domestic animals sheep appear to be the favourite stock. Poultry, particularly turkeys and geese, are numerous, but there is not much game. The minerals include iron, which is worked to some extent, lithographic stones, and several varieties of marble. The principal manufactures are fine woollen cloth; iron, which is smelted in several blast-furnaces, and extensively manufactured, particularly into scythes; linen, hosiery, &c. The trade is in corn, wine, wool, woollens, wood, iron, cattle, and sheep. The department is divided into four arrondissements—Châteauroux, the capital; Le Blanc, Issoudun, and La Châtre—subdivided into 23 cantons, and 245 communes. Pop. (1896), 286,693; (1901), 286,961.

INDRE-ET-LOIRE, a department, France, bounded on the north by the departments of Sarthe and Loire-et-Cher, east by Loire-et-Cher and Indre, south by Vienne, and west by Maine-et-Loire. It is of a compact and somewhat circular form; greatest length, north to south, 65 miles; greatest breadth, 60 miles; area, 2362 square miles. The surface is finely diversified by hills and slopes, valleys and plains. The whole department belongs to the basin of the Loire, and, as its name implies, is traversed both by it and its tributary Indre. Two other still more important tributaries, the Vienne and the Creuse, water it in the south. In addition to these the only important river is the Cher. They are all navigable within the department, and furnish it with almost unlimited means of water communication. The arable land occupies rather more than one-half, and permanent meadows and pastures rather more than one-fifth of the whole surface. About one-eighth is under wood, one-eighteenth in vineyards, and one-tenth waste. The climate is regarded as one of the finest in France, being in general remarkably mild, and alike free from the extremes of heat and cold. Agriculture in recent times has made considerable progress, and now furnishes a surplus for exportation. Hemp and flax are extensively cultivated, and in particular spots liquorice, anise, coriander, and similar plants are grown on a large scale. Fruit, particularly melons and prunes, is very abundant. Walnuts and almonds are also

gathered in vast quantities, and crushed for oil. The only metal of any importance is iron, which is worked to some extent; and there are many valuable millstone quarries. Clay, both for ordinary purposes and the finer kinds of pottery, is abundant. The manufactures are not of much importance, but include woollen and silk goods, iron, and gunpowder. The principal exports are agricultural produce. The department is divided into three arrondissements—Tours, the capital; Chinon, and Loches—subdivided into twenty-four cantons and 282 communes. Pop. (1896), 335,311; (1901), 334,073.

INDUCED CURRENT, the current of electricity which is produced in a conductor when the magnetic field (see FIELD) in which it is placed is altered in any way; that is, 1st, when the strength of the current in a neighbouring conductor is altered; or 2nd, when a neighbouring conductor in which a current flows is altered in position; or 3rd, when a neighbouring magnet is moved; or 4th, when the magnetization of a neighbouring magnet is altered.

In fig. 12, Pl. II., at ELECTRICITY, A is a coil of wire; by the battery V and a key of peculiar construction currents of electricity may be passed in different directions and with different strengths through A. B and the galvanometer G form what is called the secondary circuit, it has no connection with any battery; G is so placed as not to be perceptibly affected by currents in A, or by the magnets used in the experiments.

(1.) It is found that at the instant when a current is sent in a certain direction round the coil A, G indicates that a current is passing in the opposite direction in the coil B. This is an induced current; if the current in A continues to flow without alteration of its strength, the current in B ceases; if at any time the current in A gets stronger, an induced current flows in B in the opposite direction; if at any time the current in A gets weaker, an induced current flows in B in the same direction as the current in A; if the primary current in A ceases to flow an induced current flows in B in the same direction as the current flowed in A. In fact, induced currents are produced only when a *change* occurs in the primary current, and when the change is made in a shorter time the induced current is more instantaneous. The induced currents are much stronger when a bar of soft iron D or a bundle of iron wires is placed inside A.

(2.) Let the current in A be maintained of a constant strength. When A is removed from B an induced current flows in B in the same direction as the primary current in A; when A is brought near to B an induced current flows in B in the opposite direction to that of the primary current; when A and B are motionless there is no induced current in B. In fact, induced currents are never produced except when a change occurs in the relative positions of A and B.

(3.) Let A be taken away and a bar magnet be substituted for it inside B; exactly as in the last case, it is found that induced currents are never produced except when a change occurs in the relative positions of the magnet and B.

When the magnet is rapidly withdrawn from B there is an instantaneous induced current; when the magnet is approached to B there is an instantaneous induced current in the opposite direction.

(4.) Let a bar of soft iron, or a bundle of iron wires, be placed inside B. If a magnet is suddenly brought near so as to induce magnetization (see INDUCTION, MAGNETIC) in the soft iron, an instantaneous induced current flows in B; if the magnetization of the soft iron is destroyed, an instantaneous current flows in B in the opposite direction; as in former experiments, induced currents are never produced except when changes occur in the magnetization of the soft iron.

Induced currents generally last only a very short time; they exhibit themselves in jerking the galvanometer needle from its position of rest; the greatest deviation of the needle is nearly proportional to the quantity of electricity flowing as an induced current. The *quantity* of induced electricity produced by a change in the magnetic field is the same whether the change is made slowly or quickly; but the *electromotive force* of the current depends on the suddenness of the change.

Readers who have studied the article FIELD will be able to understand Faraday's quantitative statement of the laws of induced currents, which may be put in the following form: When a current is due either to relative motions of the conductor and the magnetic field in which it is placed, or to a change in the character of the field, the electromotive force produced in every loop of the conductor is equal to the change in the number of lines of force inclosed by the loop divided by the time in which the change is made.

The induced current will behave like any other electric current in attracting or repelling or otherwise affecting neighbouring magnets and conductors in which currents are flowing (see ELECTRO-MAGNETISM). Lenz, a Russian philosopher, stated Faraday's laws of the direction of the induced currents in a general form;—the direction of the induced current in a conductor is such that it resists the motion of the primary current, or the change of strength of the primary current, or the motion of the magnet, or the change of magnetization which produced it. Thus a vibrating conductor through which a current is passing, or a vibrating magnet (as in Arago's experiment for example), is rapidly brought to rest when in the neighbourhood of conducting bodies, for it induces currents, and these resist its motion. We see that in the vibrating conductor here mentioned the primary current is alternately increased and lessened at every swing, through the inductive reaction of the induced currents. So also when a current increases or diminishes in strength the reactive induction of the induced currents produced in neighbouring conductors *delays* the increase or diminution (see also INDUCTIVE EMBARRASSMENT). When the circuit through which a current is passed consists of a great number of coils of wire placed close together, the inductive action of the current in each coil on all the other coils is very great. When contact is broken in such a circuit a momentary induced current in the same direction, but of much greater electromotive force, is produced. This 'extra current,' as it is called, is that which produces such striking effects in the induction-coil.

Helmholtz and Kelvin, working separately, deduced Faraday's laws of induction currents from the experimental results of Oersted and Ampère, employing the principle of conservation of energy.

The induction currents produced by the earth's magnetism in a rapidly rotating ring were employed by the British Association committee to determine the measurement of resistances in absolute units.

INDUCTION, in logic, is that process of scientific method by which we rise from the particular to the general, and is the counter-process to deduction. In induction individuals are not only raised into genera ls, but these into still higher generalities. The term, strictly understood, implies the proving of general propositions. In following this method we proceed from the known to the unknown, and obtain a conclusion much wider than the premises. Thus a person who has had any experience easily arrives by induction at the conclusion that fire burns wood, and when any piece of wood whatever is presented to him

he will have no hesitation in saying that fire will burn it. As it is impossible that all particulars can be observed, there is always a certain risk of error, and the inductive method must be worked with extreme caution; but science properly so called would be impossible if we did not presuppose a faculty of arriving from experience at the knowledge of truths not contained in that experience. Hence the ground of induction is the established fact that nature is uniform.

INDUCTION, in English ecclesiastical law, means the investing of a clerk presented to a benefice with the temporalities thereof. The person inducting takes the clerk by the hand, and lays it on the ring, key, or latch of the church-door or wall of the church; or he delivers a clod, turf, or twig of the glebe, and thus gives corporal possession of the church. The doors are then opened, the clerk put into the church, and the bell tolled to make the induction known. The incumbent must assent to the Thirty-nine Articles and the Book of Common Prayer, and take the oath of allegiance. In Scotland the minister is inducted by the presbytery.

INDUCTION, ELECTROMAGNETIC, the action by which a current of electricity is produced in a conductor when the magnetic field in which it is placed is altered in any way. The phenomena of electromagnetic induction were first observed by Faraday. See INDUCED CURRENT.

INDUCTION, ELECTROMAGNETIC (MACHINES FOUNDED ON). See ELECTROMAGNETISM, INDUCTION COIL, MAGNETO-ELECTRIC MACHINES.

INDUCTION, ELECTROSTATIC. This name is given to the action by which the distribution of a charge of electricity on a conductor is altered by the approach of an electrified body. When a body charged with one kind of electricity is approached towards an insulated conductor which originally had no charge, a charge similar to that of the influencing body is produced on the remote side, and an equal charge of the opposite kind on the near side of the insulated conductor. If instead of an insulated conductor we employ a conductor connected with the earth, similar electricity to that of the influencing body will be repelled into the earth, or, what amounts to the same thing, electricity opposite in kind to that of the influencing body is attracted from the earth into the conductor. When the influencing body is removed, the conductor resumes its original condition unless a change has previously been made in the connections. If, in the second case, we disconnect the conductor from the earth before removing the influencing body, the conductor will be unable to discharge itself, and will remain charged with the electricity which was drawn into it from the earth. If, in the first case, the insulated conductor consists of two parts, which can be separated by means of insulating handles, the part next the influencing body will retain a charge opposite, and the remote part a charge similar to that of the influencing body, if the separation be made before the influencing body is removed. When the connections remain unchanged, so that things return to their original condition, the removal of the influencing body requires exactly as much work to be done *against* electrical forces as was done *by* electrical forces during its approach. When the connections are changed, so that, as in the two cases above considered, a permanent charge is given, the work required for the separation is more than the work done in the approach. The electrophorus (see article), Nicholson's doubler, Varley's electrostatic induction machine, Thomson's replenisher, and Holtz's electrical machine, are various adaptations of this principle, enabling the operator, by the help of a charge given in the first instance, to go on producing fresh supplies of electricity without the aid of friction.

It is to the mutual induction between the two coatings, one charged positively and the other negatively, that the Leyden jar is indebted for its large electrical capacity.

Faraday showed that in all cases of electrostatic induction the quantities of inducing and induced electricity are equal and opposite. If we let down a charged body into the interior of a hollow conductor, it produces a charge equal and opposite to its own on the inner surface, and if the conductor is an insulated one a charge equal and similar to that of the charged body is produced on the outer surface.

INDUCTION, MAGNETIC, the action by which iron and other substances become magnetic when in a magnetic field (see FIELD), that is, when in the neighbourhood of magnets or currents of electricity. When a piece of soft iron is in contact with a magnet, or in its neighbourhood, iron-filings scattered on it will be attracted at the ends, which have become magnetic poles. When the influencing magnet is taken away the soft iron loses nearly all its magnetism, and the iron-filings are no longer attracted. An iron bar placed in the magnetic meridian, and inclined downwards towards the nearest pole of the earth, and the longitudinal iron beams of a ship sailing north or south, become strongly magnetic under the influence of the earth. (See MAGNETISM, TERRESTRIAL.) A bar of soft iron placed in a coil of wire through which a current of electricity is flowing possesses magnetic properties. When the current ceases to flow, or when the coil of wire is removed, the bar loses its magnetism. When the north pole of a magnet influences a piece of iron, the nearest end of the piece of iron becomes a south pole. In every case a small bar of iron placed in a magnetic field will tend to place itself along a line of force (see FIELD), as a small magnet would do, and its magnetism is like that of such a small magnet. The magnetism induced in a piece of hard iron or steel when it is placed in a magnetic field is not so marked as in the case of soft iron; but hard iron and steel have a property which has been called *coercive force*, and which, while it retards magnetization, causes these substances to retain their magnetism when removed from the field. If hard iron or steel placed in the magnetic field, or just removed from the magnetic field, is subjected to hammering, it gains or loses its magnetism more readily. Joule found that in an iron bar, when it is magnetized under different conditions of stress, there are molecular changes produced which effect a lengthening or shortening of the bar.

Iron which has been carefully annealed possesses little coercive force, and is in great demand for armatures in telegraph instruments, where, during rapid signalling, it is magnetized and demagnetized many times every second. All actual magnets, whether made of hard steel or of loadstone, are affected by being brought into the presence of other magnets and of electric currents. Magnetism may be induced in nickel, cobalt, and other substances in exactly the same way as in iron, but to a less degree. These are called *magnetic* substances, and small bars of them in a magnetic field will tend to place themselves parallel to lines of force. (See FIELD.) When a *diamagnetic* substance, such as bismuth, is placed in a magnetic field, the direction of magnetization is opposite, end for end, to that of a piece of iron, and a bar of bismuth hung between the poles of a powerful magnet tends to place itself at right angles to the line joining the poles.

For small values of the force in a field the induced magnetization of iron is proportional to the force, but as the force increases the magnetization increases more slowly, and there is a limiting value which the

magnetization cannot exceed, however great the magnetic force may be. See ELECTRO-MAGNETISM, MAGNETISM.

INDUCTION COIL, an instrument invented by Ruhmkorff, in which rapid breaking and making of the current of electricity in a primary short coil of wire gives rise to a succession of induced currents (see INDUCED CURRENT) of very great electromotive force in a long secondary coil. Fig. 12, Pl. II., at ELECTRICITY, represents the instrument. The *primary coil* is of thick copper wire a number of yards long, it is wrapped round a bundle of soft iron wires called *the core*, and it terminates at *c* and *z*, where it may be connected with a voltaic battery. Directly above the protruding end of the core is a soft iron *hammer* fastened to *d* by means of a spring which also keeps it pressed against the point of a screw on *f*. Now *f* and *d* are in the primary circuit, so that a current from the battery after entering the instrument at *c* passes from *f* along the hammer to *d* before entering the primary coil; but as soon as a current passes into the primary coil the core becomes magnetic and attracts the hammer, so that contact is broken between it and *f;* when contact is broken the current ceases to flow, the core loses its magnetism, the spring restores contact between the hammer and *f*, and the current flows again. Thus the hammer *makes* and *breaks* the primary current a great number of times per second. The secondary coil is a very long, well-insulated copper wire; it is wrapped round the primary coil and terminates in *m* and *n*, so that the secondary circuit is completed when *m* and *n* are joined. As is explained in the article on INDUCED CURRENTS, every time the current is made in the primary coil an induced current passes through the secondary coil, and an induced current in the opposite direction passes through the secondary every time the current in the primary is broken. Thus, there is a rapid succession of currents of great electromotive force in opposite directions so long as the battery is attached at *c* and *z*. These currents consist of equal quantities of electricity; they pass through the communication between *m* and *n*, and may be made to exhibit very striking effects, luminous, chemical, and physiological.

The electromotive force of an induced current is increased by more rapidly breaking or making the primary current; but the breaking of it is effected with much more suddenness than the making, because of the existence of an *extra current* (see INDUCED CURRENT), and hence of the two opposite induced currents in the secondary coil one is of much greater electromotive force than the other. Thus, when wires from *m* and *n* are joined, currents pass in opposite directions, but when the ends of these wires are separated by a space, only one of the induced currents has great enough electromotive force to pass from one wire to the other in the form of a spark. This difference of electromotive force in the two currents was increased by M. Fizeau, who included a condenser (to increase its extra current) in the primary coil.

Fig. 13 on same plate is a common induction coil, the arrangement of whose details is clearly shown; the binding-screws of the extremities of the secondary coil are insulated on glass pillars. The *commutator* seen on the left enables us to send the battery current into the primary coil in either direction, or to to cut it off altogether. The *condenser* is inclosed by the wooden base of the instrument; it consists of two very large surfaces of tin-foil separated from each other by oiled silk; one surface is attached to each extremity of the primary coil. The vibrating hammer, for making and breaking, is seen on the right; as sparks pass between the hammer and anvil it has been thought necessary to use a platinum point for the anvil, and to cover the face of the hammer with platinum amalgam; in large instruments the making and breaking arrangement is not usually that which we have described; in some instuments, when very long sparks are wanted, the primary current is made slowly and broken suddenly by means of clockwork.

As the secondary circuit is very long, and of very fine wire, it offers considerable resistance to the passage of the currents; therefore, it is necessary to have the different coils well insulated from one another with silk and shellac, and care is taken that parts of the wire near the two ends are widely separated in the winding, else a spark may pass laterally from one part of the circuit to another. There are frequently a number of compartments separated from each other by discs of vulcanite, and a certain length of the wire is coiled in each compartment. In Mr. Pepper's induction coil, which is one of the largest yet constructed, the primary wire is 3770 yards long, and has a total resistance of 2·2 B.A. units; the secondary wire is 150 miles long, and has a resistance of 33,560 B.A. units.

Leyden-jars, with thick glass, may be charged from the extremities of the secondary coil when brilliant sparks are wanted; a jar may be charged several times in a second. The current from the induction coil gives a feeble electric light; the sparks may be employed in spectroscopic experiments; care must be taken in handling the instrument, as the spark is able to perforate thick glass plates, and to kill small animals even when only three Grove's cells are employed. When the spark is passed through tubes of different shapes, containing rarefied gases (Geissler's tubes), a number of beautiful luminous effects are produced; the stratified coloured light which fills the tube is affected when powerful magnets are brought near.

INDUCTIVE CAPACITY, SPECIFIC. See CAPACITY (SPECIFIC INDUCTIVE).

INDUCTIVE EMBARRASSMENT, a term applied to certain phenomena of submarine telegraphy. When contact is made at one end of a submarine cable some time elapses before the current of electricity attains its full strength at the other end. During this time the cable, which is a condenser of electricity, is being charged. (See LEYDEN-JAR.) For about one-fifth of a second after contact is made in Ireland, the current arriving by the Atlantic Cable in America is unable to affect the most delicate galvanometer; at the end of one second the current is of about half its maximum strength, which it attains somewhat after the end of three seconds. During the whole of this time the current of maximum strength has been flowing into the Irish end of the cable. If now contact is broken in Ireland, no perceptible change is observed in America for one-fifth of a second; in one second the strength of the current is halved; in three seconds it has almost disappeared. If contact does not last for three seconds the received current never attains the maximum strength; it increases for a time equal to the period of contact, and then decreases. In fact if, a number of signals have been made in Ireland, the effect of a new signal, that is, a short contact, or a short break of contact, is simply to create for a short time a small increase or decrease in the strength of the received current. Now the effect of this signal on the receiving instrument will evidently depend on the state in which it finds the instrument, and therefore it will depend on the effect of perhaps twenty previous signals. Thus if the receiving instrument is a Thomson's reflecting galvanometer, as the spot of light wanders over the scale the clerk observes every little *change* in its motion, and by practice he is able

to recognize the same sort of signal in very different motions of the light. In Mr. Varley's mode of signalling only the changes of current are noted. It has been applied in Sir William Thomson's (Lord Kelvin's) siphon recorder, which writes a message in ink on a strip of paper.

In the French Atlantic Cable many of the short signals (dots) produce an increase or diminution of current of only $\frac{1}{1000}$ of the maximum current when fifteen to seventeen words per minute are being sent. Thomson's galvanometers are the only instruments capable of indicating these small changes. When the effect of one signal dies away before another is allowed to come, two minutes is the average time taken by each word.

The time which elapses before the received current attains its full strength in all parts of a telegraph wire is proportional to the capacity of the wire for electricity, and to the resistance of the wire. The capacity of a land line is comparatively very small, and it may be calculated that there is no perceptible inductive embarrassment in an ordinary line of 350 miles when eighty words are being sent per minute.

INDULGENCE, in the Roman Catholic system, is the remission of the temporal penalty of sin, which the church may grant to a repentant sinner. It must be understood that the indulgence is never to be considered a sacramental remission of the sin itself. The principle of indulgences rests on that of good works. Many saints and pious men have done more good works and suffered more than was required for the remission of their sins: these are known as works of supererogation, and the sum of this surplus constitutes a treasure for the church, of which the pope has the keys, and is authorized to distribute as much or little as he pleases in exchange for pious gifts. The historical origin of indulgences is traced to the public penances and the canonical punishments which the old Christian church imposed on offenders, especially on those who were guilty of any grievous crime, such as apostasy, murder, and adultery. When ecclesiastic discipline became milder it was allowed to commute these punishments into fines for the benefit of the church. The first recorded instance of the use of the name indulgence was by Alexander II. in the eleventh century, but the institution itself was in full development during the Crusades. At first the only source of indulgences was in Rome, and they could be obtained only by going there. When the popes were in want of money, and the number of pilgrims who resorted to Rome began to decrease, indulgences were put into the hands of the foreign archbishops and bishops, and finally agents were sent about, who made them an object of the meanest traffic. During the period of jubilee the people were taught to believe that the efficacy of indulgences was doubled, and the richest harvests were always reaped at this time. Leo X. commenced his reign in 1513, and as the building of St. Peter's Church had exhausted his finances, he published a plenary indulgence in Germany without waiting for the jubilee of 1525, in conjunction with the Elector of Mentz, who found an excellent agent for the sale in Tetzel. This flagrant abuse inflamed the zeal of Luther, and the Protestant theologians have always found indulgences one of the most vulnerable points of the Roman Catholic system. For though the grant is made only to 'the faithful who are truly penitent and have confessed,' yet as it is limited to a certain period and to certain conditions, these acquire an importance that militates against the efficacious exercise of penitence, faith, and piety. Indulgences are of two kinds: *plenary*, when considered an equivalent substitute for all penance; and *partial* when only a portion of penitential works is relaxed.

The Catholic view is that the penances of the ancient church were never so strictly binding as to preclude the presbyters from relaxing them in some degree in particular instances where their object seemed more easily attained in some other way. But this never was done except in single cases, and after the circumstances of the petitioners had been closely examined; nor was the whole punishment ever remitted, but merely a part of it, according as the case of the individual required, and his repentance justified it. The Council of Nice in their 12th canon require for such a dispensation proof of true repentance. In the eleventh century indulgence was granted to those who undertook some difficult enterprise for the benefit of the church, as the bearing arms in her cause, of which the Crusades are the most famous example. In the Council of Clermont (1095–96) it was decreed (canon xii.) that every one who, actuated solely by devout zeal, and not by love of glory or by avarice, went on the expedition to Jerusalem for the deliverance of the holy sepulchre should receive a plenary indulgence which should be 'an equivalent substitute for all penance.' In later times this indulgence was extended to those who were not able to go themselves, and sent a champion in their stead. By degrees the exemption was extended still farther, and soon plenary and partial indulgences were granted to those who gave alms for effecting some good work (for example, the restoration of a church, &c.), or performed some prescribed labour of piety (the visiting of a church, for instance) at the time of jubilee, which was established by Boniface VIII. in 1300. This gave the death-blow to the public penance of the church. Considerable abuses, however, stole into the system of indulgences, and the scandal became very great. Under pretext of alms for the benefit of good works, indulgences were made the means of indirectly taxing the whole of Christendom. The popes, bishops, and civil rulers usually divided the proceeds, though the latter sometimes appropriated them entirely. Under such circumstances, when holy institutions were abused for vile gain, it was natural that wrong notions respecting indulgences and their power should spring up among the people, and be spread by the preachers employed to distribute them. As the indulgences proclaimed by Leo X. gave the first spring to the Reformation, it was the object of the fathers assembled at Trent to make a public disavowal of the erroneous doctrines which had been preached by individuals respecting indulgences, that they might not appear to be sanctioned by the church. The council first required (in sess. 24, cap. viii. De Reformatione) the restoration of public penance, but the bishop was permitted to substitute a private for the public penance if he thought it more suitable. Respecting absolution itself the church has established no dogma, because such dogmas are expressed only in the *canones*, of which there exist none on this subject. She has given only a decree which literally says: Since the power of conferring indulgences has been given to the church by Christ, and she has exercised it from the earliest times, the holy council teaches and ordains that this usage, so beneficial to Christians, and confirmed by the authority of many holy councils, is to be retained in the church; and she inflicts the anathema upon such as either declare indulgences unnecessary, or dispute the power of the church to grant them. It is her wish, however, that in the grant of indulgences according to the custom long existing in the church, proper limits should be observed, lest the discipline of the church become injuriously relaxed. But as the church desires that the abuses which have crept in, and have given occasion to heretical preachers to heap reproach upon this

venerable usage, should be corrected, she ordains by the present decree that the shameful bartering of indulgences for money, which has been so fruitful a source of abuse, shall be entirely abolished. The selling of indulgences has accordingly ceased. But in regard to absolution and penance, say the Catholic writers, the spirit of the church is the same as in ancient times. The church still commissions her servants to impose penances upon sinners in proportion to their guilt, and why should she not be authorized to remit part of the sentence if the penitent is found worthy of favour? Whether such remission be deserved by the penitent is to be judged by those ministers of the church who are in immediate intercourse with him.

INDUS (Sanskrit, *Sindhu*), the chief stream of the north-west of Hindustan, and one of the great rivers of the globe. It has a length of about 1950 miles, drains an area of about 360,000 square miles, and rises in Tibet on the north of the Himálaya Mountains, nearly 100 miles north-west from the sources of the upper Brahmaputra, on the north side of the mountain mass of Kailása, 18,000 feet above sea-level. In the upper part of its course it takes a north-westerly direction along the foot of the Himálayas, enters the Kashmir territories, passes through Ladakh or Middle Tibet, below the capital of which, Leh, it receives the Zanskar, farther on the Dras, after which it enters Baltistan or Little Tibet. Here it receives, on the right, the Shayok, from a glacier of the Karakorum, the largest tributary that joins it in the Himálayan regions, and now takes the name of Indus or Sind. About 100 miles below this it takes a sudden bend towards the south-west, and after a course of about 180 miles more in this direction it leaves the loftier regions. At the British fortress of Atak or Attock in the Panjab—where it is crossed by a great railway bridge carrying the line to Peshawar—it is joined by the Kabul from Afghanistan, and here, 950 feet above the level of the sea, it is nearly 800 feet wide and from 30 to 60 feet deep according to the season. For the rest of its course (about 930 miles) it continues, generally speaking, its south-westerly direction till it enters the Indian Ocean. At Kalabagh, 110 miles below Attock, it has a breadth of over 1400 feet. Arriving in the low-lying country its waters become charged with mud, and in the rainy season, and by the melting of the snow in the mountains, it overflows its banks. Near Mittankot it receives on the east the Panjnad, or united stream of the Five Rivers of the Panjab. Below the confluence it has a width of over 1900 yards when the water is low. In Sind it gives off several extensive arms or canals, which are of great value for irrigation; and below Haidarabad it divides into a number of shifting mouths or estuaries, the most navigable of which is at present the Hajamro mouth. It is navigable at all seasons. The delta has a coast-line of about 130 miles, and the point or head of it at Tatta is 70 miles from the sea. The tide rises to this distance. The Indus loses much water from passing through dry and desert regions, and much is also drawn off for irrigation; accordingly it brings down much less water to the sea than the Ganges. Vessels drawing more than 7 feet water cannot generally enter any of its mouths; but steamers of light draught ascend from the railway terminus at Haidarabad to Multan. Since the opening of the railway from Kurrachee to Multan, however, navigation, whether by steamer or by native boat, has greatly fallen off. A great quantity of alluvium is brought down by the river.

INDUSTRIAL SCHOOLS are sometimes classed with ragged schools in which mechanical arts are taught, and sometimes they denote merely common elementary schools in which an attempt is made to instruct the boys in some industrial art, and the girls in sewing, knitting, darning, washing, and cooking. So far as the boys are concerned, these attempts have generally been failures, but the efforts to teach girls sewing and knitting in primary schools have been attended with much success. This may be explained by the reluctance exhibited by parents to have the time that should in their estimation be mainly occupied in the acquisition of the elements of education as commonly understood, taken up with manual occupations. Hence it is only when children are entirely removed from parental control that the industrial element in education has had a fair chance and encouraging results. In Great Britain, ragged schools are recognized by the legislature as industrial schools, and the laws relating to them were consolidated and amended by act 29 and 30 Vict. cap. cxviii. By it any child under the age of fourteen years found begging or receiving alms, and not having any home or proper guardianship; or found destitute as being an orphan, or having a surviving parent undergoing penal servitude or imprisonment, or frequenting the company of reputed thieves, may be sent to a certified industrial school. Children under twelve charged with offences punishable with imprisonment, but who have not been previously convicted of felony, may also be dealt with in a similar way under the act. The treasury may contribute to the expense of maintaining such schools on the representation of the home-secretary; and by the Education Acts (England 1870, Scotland 1872) School Boards may establish and maintain industrial schools. The Reformatory and Industrial Schools Act of 1891 empowered the managers of such institutions to enable well-behaved persons under their charge to begin useful careers at home or abroad.

INDUSTRIAL AND PROVIDENT SOCIETIES carry on some trade for the mutual benefit of the members. The formation of these societies was legalized in Great Britain by act 15 and 16 Vict. cap. xxxi. The law relating to them has been frequently amended, as in 1854, 1862, 1867, 1871, and latterly in 1893, when the Industrial and Provident Societies Act (56 and 57 Vict. cap. xxxix.) was passed to amend and consolidate all preceding acts. The societies which may be registered under this act are societies for carrying on any trade or business, whether wholesale or retail, including dealings of any description with land (but with regard to banking, only under certain conditions), of which societies no member (other than a society registered under this act) shall have or claim an interest in the funds over £200. No society can be registered which has a membership of less than seven persons, and the application for registration must be signed by seven members and the secretary, and be sent with two copies of the rules to the registrar of Friendly Societies. The word 'limited' must be the last word in the name of every registered society. Every society must have a registered office; must publish its name outside that office and every place where it carries on business; must submit its accounts to an annual public audit; must send annual returns to the registrar; must supply copies of annual returns gratis to the members and persons interested in the funds; and must keep a copy of the last balance-sheet and auditors' report hung up in a conspicuous place in the registered office. The registration of a society gives the following privileges: the society is rendered a body corporate in its registered name, by which it can sue and be sued with perpetual succession, and a common seal with limited liability; the rules bind all the members; moneys due from the members are a debt recoverable from them.

Every member may nominate any person except an officer or servant of the society (and one of these if he is a near relation of the nominator) to whom his property in the society shall be transferred at his decease, provided that the amount credited to him does not exceed £100, and may from time to time revoke or vary such nomination by a writing under his hand, and every such society must keep a book wherein the names of all persons thus nominated are entered. Persons above sixteen and under twenty-one years of age may become members (but not responsible officers) if the rules do not forbid. Promissory notes or bills of exchange accepted or endorsed in the society's name by an authorized person are to be deemed to have been made, accepted, or endorsed on behalf of the society. A register of the members' names must be properly kept. Societies carrying on business in more than one part of the United Kingdom must be registered in that part in which their registered office is situated, but copies of their rules must be sent to the registrar of each of the other parts to be recorded; and until such rules are so recorded the society is not to be entitled to any of the privileges of this act in the part in which such rules have not been recorded, and also, until amendments of such rules are recorded they are not to take effect in such part. The chief registrar (or assistant-registrar in Scotland and Ireland), on application of one-tenth of the members, or of 100 members in a society of more than 1000 members, may, with the consent of the treasury, in every case appoint one or more inspectors to examine into the affairs of the society and report thereon, said inspectors having the power to examine on oath its officers, agents, servants, and members in relation to its business, with the right of administering such oath; the chief registrar (or assistant-registrar) may call a meeting of the society, and direct what matters shall be discussed and determined on at such meeting; but such application must be supported by evidence of good reason and absence of malice, and the registrar may require applicants to give security for costs of the inspection or meeting, the costs to be defrayed by the applicants, or the society, or its members or officers, as the registrar decides. Societies registered under this act are commonly called CO-OPERATIVE SOCIETIES (which see).

INEQUALITY, any perturbation in the motion of a celestial body due to the varying attractions of any other body as their relative positions change. The observed inequalities of the planet Uranus led to the mathematical determination of the position in the heavens of the planet Neptune by Professor Adams before it was discovered by the telescope. Inequalities requiring a long period of time to render them sensible are called *secular* inequalities.

INERTIA, the passiveness of matter, or its indifference to rest or motion. Newton's first law treats of this property—a body at rest will remain at rest, and a body in motion will continue to move in a straight line and with a uniform velocity unless some force acts upon it. When a stone is thrown along a flat surface of ice, it moves farther than when thrown along a level road, because friction, which is a force tending to destroy the stone's motion, is less on the ice. When stepping from a moving carriage the body retains its forward motion, and when the feet touch the ground they alone are reduced to rest. When a horse which has been moving rapidly in a straight line suddenly stops or shies, the rider's inertia tends to keep him moving in the old direction; when a horse suddenly gets into motion, the rider's inertia tends to keep him in his former position. In all these cases accidents have to be guarded against.

INES DE CASTRO. See CASTRO.

INFALLIBILITY, exemption from the possibility of error. God is infallible; Christ was infallible, and, according to the belief of the Greek and Roman Catholic, and of most Protestant churches, the apostles were also infallible after the descent of the Holy Ghost. Here, however, the Protestants and Catholics divide. The latter, founding their creed on tradition as well as on the Bible, maintain that the tradition, that is, the general doctrine and belief handed down from age to age, and taught by the great body of the pastors, is above the possibility of error; consequently, also, the councils are infallible, because the councils 'do not make truths or dogmas, but merely express the belief of the church on certain points in question:' the truth pronounced, therefore, always existed, but had not been previously declared by the church. From several passages in the Bible the R. Catholic infers that the above-mentioned tradition and the councils are under the continual guidance and influence of the Holy Ghost: hence the formula so often repeated by the Council of Trent, 'the holy council lawfully assembled under the guidance of the Holy Ghost.' Infallibility, as claimed by the Church of Rome, is of two kinds, *active* and *passive;* the former signifying the function of the church of permanently teaching the truths of God, and of authoritatively settling doctrinal disputes; and the latter that property inherent in the church in virtue of which she can never receive or embrace erroneous doctrine. It is clear, that, if councils are infallible, it is of the utmost importance for the R. Catholic to know what are lawful councils. This is a point which, as may be easily conceived, has created great discussions in the R. Catholic Church, because the popes claimed the sole right to convoke councils. (See COUNCIL.) So far all Roman Catholics agree respecting infallibility, namely, that Christ, the apostles, the body of the pastors, the traditions of the church, and the councils, are infallible; but they disagree respecting the infallibility of the pope, though the Papal infallibility was settled as an article of faith in the so-called œcumenical council of 1870 at Rome. At that council the dogma of infallibility was finally formulated in the following terms:—'We teach and define that it is a dogma divinely revealed; that the Roman pontiff, when he speaks *ex cathedrâ*, that is, when in discharge of the office of pastor and doctor of all Christians, by virtue of his supreme apostolic authority, he defines a doctrine regarding faith or morals to be held by the universal church, by the divine assistance promised to him in blessed Peter, is possessed of that infallibility with which the Divine Redeemer willed that his church should be endowed for defining doctrines regarding faith or morals, and that, therefore, such definitions of the Roman pontiff are irreformable of themselves, and not from the consent of the church.' The theologians who maintain this dogma are called *Infallibilists.* But a certain number of Catholics still refuse to accept the doctrine of Papal infallibility, and maintain that from the suspension of its sittings, in consequence of the occupation of Rome by the troops of the King of Italy, the council is not dissolved; and that, till a council is an accomplished fact, as a whole, its decrees have not yet attained their binding power. In Germany a considerable body who refuse to accept the infallibility of the pope as one of the dogmas of the church, have formed themselves into a separate church, calling themselves Old Catholics, and there are not a few in Switzerland who belong to the same community. In Austria and France there are not many Old Catholics. (See OLD CATHOLICS.)

INFAMOUS BEHAVIOUR, and its penalty, DISCHARGE WITH INFAMY, are terms of the military and naval codes applied to conduct not only subver-

sive of discipline, but so inherently disgraceful as to exclude the perpetrator from reputable society. Certain actions by universal consent have always been considered infamous, as the desertion of colours on the field of battle, refusing or failing to aid comrades in danger, marked cruelty or inhumanity, shameless looseness of life, and all crimes signally inconsistent with the military character. When a court-martial has not attached the penalty of death to such crimes the sentence is generally dismissal from the service with infamy—a punishment of greater severity than death to any man not entirely destitute of moral sensibility, as it stigmatizes him for life as a disgrace to his country, and unworthy to belong to an honourable service.

INFANT, in law. By the English and American law persons come to majority at the age of twenty-one years, until which time they are called in law *infants*, and are under guardianship. Infants cannot, in general, bind themselves by contracts, as they are supposed not to have sufficient discretion and ability for this purpose. But this is their privilege, and their contracts are accordingly held in general not to be void, but only voidable at their election; and they may elect to avoid their contracts during their minority, except such as they may have entered into for necessaries suited to their condition in life, but they cannot confirm them so as to be bound by them until their majority. Infants may possess property, but it must be under the management and control of a guardian. They have not the right of citizens as to voting, and discharging other political functions. But in regard to crimes and punishments, and trespasses and private wrongs, their conduct is regulated by the same laws as that of the other members of the community, in case of their being of sufficient age and discretion to understand their duties and obligations. And for this purpose no general limit can be assigned, as some children are much more intelligent than others of the same age; and it will again depend, in some degree, upon the nature of the offence committed, or the wrong done, whether a child of any given age can be considered legally guilty of it, since some offences and wrongs can be more easily understood to be such than others. The law, in general, has a tender regard to youth, and does not permit them to be convicted and punished for offences and trespasses unless it appears clearly that they have sufficient knowledge and discretion to distinguish them to be such.

There are exceptions to the incapacities of minors as to contracting, and these exceptions are made for their benefit. Thus an infant not sufficiently furnished with necessary clothes, food, or instruction, by his parent or guardian, and not being under the immediate superintendence of the parent or guardian, may make a valid contract, in respect to those subjects, and such contract may be enforced against him. Infants require the consent of parents or guardians to marry, but every infant (if a male of twenty, or if a female of seventeen years) upon or in contemplation of marriage may, with the sanction of the Court of Chancery, make a settlement as valid as if the party were of age. The jurisdiction in respect to infants is generally vested in either probate or orphans' courts. These courts appoint guardians to take charge of the property of infants, and, in case of the decease of the father, to take charge of their persons; but during the life of the father he has the guardianship and control of the persons of his children until they are twenty-one years of age. Under the Guardianship of Infants Act, 1886, the court may, however, give the custody to the mother in certain cases, and in the event of the father's death she is guardian either alone or jointly with those appointed by the father. But at the age of twelve in the case of a female, or fourteen in the case of a male, the child, on decease of the father, may choose his own guardian, who, being approved by the proper judge, is appointed accordingly. The term infant is not used technically in Scotch law. In Scotland the law distinguishes the periods of life as three: pupillarity, from birth to the age of fourteen in males and twelve in females; puberty, from pupillarity to twenty-one, during which time the parties are called minors; henceforth the person is said to be of lawful age; both sexes reaching majority at the same age. In Scotland a minor may marry as freely as if he were a major.

INFANTE, or INFANT (a word derived from the Latin *infans*, signifying child), the title given, particularly in Spain and Portugal, to the princes of the royal house, the eldest being also called *el principe*. The eldest son of the King of Spain was styled *Prince of Asturias*. The princesses at these courts are called *infanta*, the eldest also *la princesa*. The personal domain of an infante or infanta is called the *infantado*. It was erected into a dukedom in 1475.

INFANTICIDE, the murder of a child born alive, is a crime of so frequent occurrence that an inquest is said to be held daily on the bodies of children destroyed through the design or neglect of the mothers. The main cause of the crime is shame, induced by a dread of the social disgrace attaching to mothers of illegitimate children; though in many instances infanticide has been the result of violence produced by puerperal insanity. The morbid disposition to kill the newly born has also been observed in certain of the lower animals. The sanctity of human life, from its beginning to its close, is a maxim of modern civilization, and the law treats as a murderer whoever wilfully terminates it at any stage. Checks on the tendency to infanticide have been multiplied, and the cognate offences are dealt stringently with by the law. According to the law of England every woman who employs means to procure criminal abortion is guilty of felony, and liable to penal servitude for life, or not less than three years; and severe penalties are inflicted on those who aid women to procure miscarriage. The concealment of birth is a misdemeanour, and may be punished with imprisonment for two years. This crime is more frequently the subject of prosecution than the greater one of infanticide, which is more difficult of proof, as there is often a secret sympathy with the mother. Failing to supply food or clothing may destroy the life of an infant as effectually as violent treatment, and therefore amounts to murder or homicide. Unlawfully abandoning or exposing a child is a misdemeanour punishable with three years' penal servitude. In a trial for infanticide it must be proved that the child was in life, the test of which is that it was fully born. Should the death of the child result from striking a pregnant woman, the crime does not amount to murder or manslaughter. The Infant Life Protection Act of 1897 enacted several important regulations regarding hired nurses, and intrusted the duty of enforcing them to the parish councils. Under this act a person receiving for hire more than one infant under five years, to be nursed and maintained apart from the parents for more than forty-eight hours, must within that time notify the parish council. The removal of the infant to another custodier must also be notified. The council is to fix the number of infants under five years that may be received in premises notified under the act, and the inspector of poor is to inspect such premises periodically, and see that the infants are being properly maintained. The council must also be notified within forty-eight hours by a person receiving an infant under two years for not more than £20 paid down, and with-

out any agreement for further payment. The council may cause an infant to be removed to a poorhouse or place of safety, if its health is being endangered by improper conditions and treatment, and any person so deprived of a child may not again receive infants for hire without the council's written sanction. Notice of an infant's death must be given by the custodier to the procurator-fiscal within twenty-four hours. Offenders incur, on summary conviction, a penalty of five pounds or six months imprisonment. In the United States, when a child's death is occasioned by an illegal act, such act is considered either murder or manslaughter according to the circumstances.

Infanticide was prevalent in Greece and Rome. In modern times many barbarous peoples are guilty of wholesale child-murder. Among some of the Pacific Islanders and aboriginal Australians there is a great destruction of infant life. The Hindus used to destroy female children without compunction. In China infanticide is said to be very common.

INFANTRY, primarily from the Latin *infans*, whence Spanish and Italian *infante*, a boy or servant. In the Middle Ages, while the knights rode on horseback their servants went on foot; hence *infanteria* became the name of foot-soldiers in general. Except among semi-barbarous nations, and during the prevalence of the institutions of chivalry, infantry has always been considered the most important military arm, and this has been peculiarly the case since the formation of standing armies, and since war has become a science. Infantry can be used everywhere, and therefore constitutes the moral power of armies. The victories of the Greeks over the Persians may be attributed to their excellently-disciplined foot forces. The strength of the Roman armies lay in their infantry. The tendency of the Middle Ages to attach undue importance to cavalry was effectually checked by the invention of gunpowder, which revolutionized the whole art of war. From the Conquest to the time of Henry VIII. the English infantry was generally defective both in discipline and equipment; but the improvements then introduced into this arm in France and Germany directed attention to its defects, and a better system of discipline has ever since been steadily increasing its effectiveness. The importance of *mounted infantry* in certain circumstances is now generally recognized. Infantry is divided into battalions, these into companies, and companies often into smaller divisions. Several battalions form a regiment.

In the British army the infantry comprises regiments of the Guards and those of the line. The Guards regiments are four in number, namely, Grenadier Guards, Coldstream Guards, Scots Guards, and Irish Guards, of which the first three include three battalions each. The infantry of the line consists of sixty-seven territorial regiments, and two, the King's Royal Rifles and the Rifle Brigade, recruited from the whole kingdom. Of the territorial regiments the Royal Warwickshire, Royal Fusiliers, and Lancashire Fusiliers have each four battalions, whilst the other sixty-four have only two battalions each. One battalion of each line regiment, or two in the case of the three larger regiments above named, is located abroad, whilst the rest is in garrison within the United Kingdom. The home battalions relieve the foreign ones every sixteen years. Every territorial regiment has from one to four battalions of militia attached to it, besides the volunteer regiments of its district. Each of the two non-territorial regiments of the line comprises four battalions, and has four battalions of militia attached to it. In war the battalion is the unit, and regiments are not recognized. Four battalions, together with staff and brigade troops (Army Service Corps, Royal Army Medical Corps, &c.), constitute an infantry-brigade, under the command of a major-general. An infantry-division, under the command of a lieutenant-general, consists of two brigades, with staff, cavalry, artillery, &c.; and an army corps comprises three divisions, besides staff, cavalry, artillery, and other corps troops. The infantry in the French, German, and other Continental armies is organized in practically the same way as in Britain. The United States army comprises twenty-five regiments of infantry, two of them negro regiments, and each regiment consists of three battalions.

INFANT SCHOOLS are institutions of comparatively modern origin. Their object is to amuse, interest, and instruct children from their third to their sixth year, under kindly and judicious supervision, which has generally been that of mistresses. Jean Frédéric Oberlin, Protestant pastor of Waldbach, in Alsace, noted for his philanthropy, is regarded as their founder. In 1812 Robert Owen established one at New Lanark, in Scotland, the first attempt of the kind in Great Britain. A second was set on foot in Westminster in 1819, of which Samuel Wilderspin (1792–1866), whose zealous efforts to extend the system of infant teaching are so well known, was one of the first teachers. Wilderspin opened one in 1820 at Spitalfields. The system has been fostered and propagated by the Home and Colonial Infant School Society. In England these infant seminaries have been more popular and proportionally more numerous than in Scotland, where, however, infant departments are now found in almost all board schools. From Germany we have derived what is known as the *Kindergarten* system (founded by Froebel in 1839), which has attained great importance both in Great Britain and in the United States. In dealing with infants of tender years a frequent mistake of teachers is to attempt too much. Physical and moral, more than intellectual development, should be aimed at; for serious and continued effort to furnish with knowledge will rather have a tendency to dull and deaden than to foster the intellect, and will inspire the child with an aversion to learning that it may be difficult to remove. The moral faculties, however, are capable of being strengthened and enlightened from the earliest age, and hence the necessity that the teacher of infants should be a person of a sound and healthy morality, instinctively kind, and of wide sympathies. The infant school should be rather a playground, under judicious encouragement and surveillance, than an institution for the acquisition of knowledge, unless of the most elementary kind. And in the attempts to impart these elements every available help should be laid hold of, as pictures, models, and the simultaneous singing of simple rhymes charged with a moral or embodying a narrative.

INFECTION. See CONTAGION.

INFERIOR PLANET, a planet whose orbit lies within that of the earth. Mercury and Venus are the inferior planets.

INFINITESIMAL, a quantity so small as to be incomparable with any finite quantity. Of two infinitesimals one may be infinitely small compared with the other. If a is any finite quantity, then the millionth part of a or $\frac{a}{10^6}$ is very small; and $\frac{a}{10^n}$, when n becomes indefinitely large, is an infinitesmal. Again, $\frac{a}{10^n} \div 10^n$ or $\frac{a}{10^{2n}}$, when n becomes indefinitely large, is indefinitely smaller than $\frac{a}{10^n}$; and so on. See CALCULUS.

INFINITIVE, the indefinite mood, in which the verb is represented without a subject. As the verb expresses an action, or a state, it generally belongs to a subject whose action or state is expressed; but if we wish to express the mere idea of this action or state we use the infinitive, which, therefore, in many languages is employed without further change as a substantive—for instance, in Greek and German—only preceded by the neuter article; but as the verb expresses an action or state under certain conditions of time, the infinitive can also express the action or state in the present, past, or future, though these conditions are not expressed in all languages by peculiar forms; nay, some languages have not even a peculiar form for the infinitive, and must express it by some grammatical contrivance, as is the case in English, where it is denoted by *to* prefixed to the general uninflected form of the verb, as *to love* = Latin *amare; to have loved* = Latin *amavisse*. The infinitive may be regarded as the point of transition from a verb to a substantive, and is often used as the subject of a proposition. Like a noun, also, it is often used as an object, as I love *to ride*. The investigations of comparative philology have shown that the infinitive was not originally a verbal form at all, but some case of a substantive, different cases having been selected by different languages, and having in course of time lost their distinctive meaning and function, and become quite incorporated with the verbal forms proper. The infinitive in Sanskrit is an accusative; in Latin it appears to be a dative.

INFLAMMATION, a vague term for a morbid process, of which the most obvious phenomena are pain, swelling of the affected part, perceptible increase of heat to the patient, and even to the observer, in comparison with that of the surrounding parts, and redness beyond the natural degree. The increase of redness is principally caused by increased vascularity; the pain seems referable to distension and pressure upon nervous fibrillæ; the heat is produced partly by the increased quantity of blood in the part and partly by increased chemical changes going on in the affected part; and the swelling is caused by distension from the increased quantity of blood sent to the part, but principally by the overloaded vessels relieving themselves by effusion into the surrounding tissues. The febrile state of the system which supervenes is to be referred to that law of the animal economy by which the distress of a part disturbs the harmony of the whole. Inflammation is the result of injury. This does not mean merely mechanical injury, but anything which acts upon the tissues so as to depress their vitality. Besides mechanical violence, heat and cold, sudden changes of temperature, and other physical causes, and the action of chemical agents, will produce such a condition. As it is evident that in some persons the tissues will be able to resist depressing causes more vigorously than in others, the general state of the body, and its degree of vigour at the time, will come prominently into play in determining whether a particular cause is sufficient to excite the inflammatory state. The commonly described terminations of inflammation are *resolution*, *suppuration*, *ulceration*, and *mortification* or *sloughing*. *Resolution* is that recovery from the disorder which is effected without the intervention of any disorganizing process, and when the vessels return to their normal condition on the exciting cause of the disorder being withdrawn. If inflammation cannot be resolved it must go on to *suppuration*, when the skin is either divided by the knife or breaks of itself, and there is an escape of a yellow cream-like fluid, which has been designated pus, after which the symptoms rapidly abate. The tendency to suppuration is marked by the pain becoming full and throbbing, while the pulse becomes more full without being less frequent. *Ulceration* takes place when some of the tissue in which the inflammation has occurred is destroyed by the pressure of the inflammatory products or by other causes, and is removed in the discharge which subsequently escapes from the part. The discharge in such circumstances is not to be confounded with the discharge which takes place in simple suppuration. In simple suppuration the pus is formed of inflammatory products, and not of broken-down elements of the tissues. That is to say, suppuration may occur without loss of substance of the part in which it takes place; but the discharge in ulceration contains, besides pus, actual broken-down elements of the tissue, and implies material loss of substance in the inflamed tissue. Some of the tissue is dead, and is removed in the discharge in a form not recognizable as tissue. If some of the tissue dies in mass and is removed in pieces, recognizable as such, then the term *mortification* or *gangrene* is used, and the pieces of tissue which separate are called *sloughs*. (Regarding inflammation of the intestines, see ENTERITIS; of the eye, see IRITIS.)

INFLEXION (Latin, *inflexio*, a bending) is that process in grammar which modifies declinable words when placed in relation to other words in a sentence. These changes occur frequently at the end of words, and in such cases were probably at first separate vocables. Pronominal and predicative roots are combined to form one word in the Semitic and Aryan tongues, which are therefore called inflexional, a process impossible in monosyllabic languages like the Chinese, or in languages of the agglutinate order like those of the Turanian family. In grammar, cases, numbers, persons, tenses, &c., are known as inflexions, and in many instances the original affixes can be readily recognized. The Semitic and Aryan families of languages, which admit of phonetic corruption both in the root and in the terminations, are called organic or amalgamating languages, and our illustrative examples will be taken from members of the latter family. The pronominal termination varies according to the person or number. Thus the Sanskrit *mi*, *si*, *ti*, the endings of the three persons singular of the present of the verb, are corruptions of the personal pronouns *ma*, *sva*, *ta*, and the persons of the plural indicate the plural number by the form of the pronominal affixes. The plural of masculine and feminine Greek and Latin nouns of the third declension is probably a contraction of the duplication of *sa*, the pronoun of the third person, the doubling of the pronominal element being symbolical of plurality, a symbol not without analogy in present use, as in the doubling of a letter in such a contraction as LL.D., with the same intent. The termination *m* of the accusative case, marking direction towards, is connected with the pronoun *ama*, yon; the *i* of the dative is locative, marking that the action has reached a definite goal and remains there; while the terminations of the ablative and genitive cases indicate the starting from a certain point, and are corruptions of *ta* and *sa*, that. The verbs *i*, to go, *as* and *fu*, to be, supply the inflections of certain tenses of the verb, there being also a pronominal termination varying according to the person. *I-bat*, for *i-fuat*, means he was in the act of going; *ama-bo* means I may be, that is, I will be loving, and *tup-so*, I may be, that is, I will be striking. In English the common auxiliary verbs am, do, have, shall, will, may, can, asserting respectively existence, action, possession, obligation, volition, liberty, power, assume the function of inflexions, and are themselves inflected to denote past time. In French the same inflexional law exists, the connection between the auxiliary and

the root being closer than in English. *Aimer-ai*, I have to love, that is, I shall love, is compounded of the infinitive *aimer*, to love, and *ai*, I have, the first person present indicative of *avoir*. The same is the case in Italian and Spanish.

INFLEXION, POINT OF, a point at which a curve changes from concavity to convexity. The tangent at a point of inflection meets the curve in three consecutive points, indefinitely near to one another. If we consider the inclinations of tangents at different points of the curve to any fixed line, we may define a point of inflection as the point at which this inclination $\left(\text{and therefore } \frac{dy}{dx}\right)$ is a maximum or a minimum.

$\frac{d^2y}{dx^2}$ changes its sign in passing through a point of inflexion, its value at the point being 0 or ∞.

INFLORESCENCE, in botany, the mode of arrangement of the flowers of a flowering plant; also applied to a flower-cluster. There are two types of inflorescence, namely, *indeterminate* or *racemose* or *centripetal*, when the main axis is not terminated by a flower; and *determinate* or *cymose* or *centrifugal*, when the main axis, as well as the branches, are terminated by a flower. To the first type belong the raceme, corymb, umbel, spike, head, catkin, &c.; to the second the cyme, glomerule, &c. A panicle is a general name for a much-branched open inflorescence. See BOTANY.

INFLUENZA (Italian, influence), a term used in medicine to denote an epidemic catarrh which has at various times spread more rapidly and extensively than any other disorder. It has sometimes apparently traversed the whole of the eastern continent, and in some instances has been transferred to America. The French call it *la grippe*. In the winter of 1889–90 and following spring such an influenza attracted universal attention. It originated somewhere in the East, traversed the greater part of Russia, visited Vienna and Berlin, created almost a panic in Paris, and ultimately arrived in the United Kingdom, where its effects in some localities were severe. It also crossed the Atlantic, and was as prevalent in the United States and Canada as in Europe. No sex, age, or state of health was exempted. Few persons died of it directly, but it caused the death of many who were afflicted at the same time with other diseases. In many public offices and other large establishments business was seriously interrupted owing to the number of the employees off duty from its effects. Less severe epidemics have occurred in several subsequent winters. The attack of influenza is very sudden, and is indicated by chills along the spine, flushes of heat, high fever, pains in back and limbs, and perhaps sickness. The lining membrane of the nostrils, eyelids, mouth, and throat becomes dry, red, and swollen. There are sneezing, intense pain in the forehead and eye-balls, inflammation of the throat and tonsils, soreness of throat, harsh croupy cough, and a sense of tightness in the chest. The skin is dry, the tongue white, the bowels confined, and the appetite is lost. Excessive weakness is a marked symptom. In a short time the dryness of the nostrils yields, and a watery discharge ensues; there is also spit. The skin also becomes more moist, and sweatings occur. Later, the throat and nose discharge is mattery, and difficulty of breathing and cough are marked. Blebs often form on the lips. In from three to five days the attack passes off, usually with free sweating, leaving the patient very weak and afflicted with a troublesome cough. The disease may, however, last longer, owing to inflammation attacking the tubes of the lungs and passing downwards. Bronchitis, pneumonia, and other diseases may thus complicate the attack, and these may result in death. Confinement to bed, bathing of the feet and legs in a mustard bath, the administering of hot drinks and of a mixture, the relieving of the bowels by seidlitz powders, and other similar modes of treatment should be resorted to. Poulticing and the use of stimulants may be necessary.

IN FORMA PAUPERIS. See FORMA PAUPERIS.

INFORMATION, in English law, a term used in several senses. In criminal law, an information, filed by the attorney-general, is a substitute for an ordinary indictment, and is resorted to only in such cases of misdemeanour as tend to disturb the peace or the government, for example libels on judges, magistrates, or public officers, bribery at elections, &c. An information in chancery is a suit on behalf of the crown as to any misapplication of a public charity, or on behalf of an idiot or lunatic. An information in the Exchequer is to receive money due to the crown, or to receive damages for an intrusion upon crown property. The term also denotes a written statement made on oath before a justice of the peace previous to the issuing of a summons or complaint against a person.

INFORMER, a person who sues for a penalty against those who have infringed any law or penal statute. To encourage the apprehending of certain felons, guilty of offences not so much criminal as bordering on criminality, many English statutes, from 1692 downwards, granted rewards to such as should prosecute to conviction. The penalty in whole or in part inflicted in the case of a successful conviction, and immunity from certain troublesome parish offices, were the inducements held out to informers. In many cases this practice has been resorted to in modern statutes. The early legislation on this point gave rise to the most flagrant abuses, and police officers made a trade of seducing ignorant persons to crimes, especially the issuing of counterfeit money, to gain the reward by prosecuting them. In 1818 an act of Parliament (58 Geo. III. cap. lxx.) abolished these rewards in respect to counterfeit money, but the abuse respecting bank-notes long continued. In criminal prosecutions in Scotland the lord-advocate proceeds on information; but he can be compelled to give up his informer, and if the information be malicious the informer is liable in damages and expenses.

INFUSORIA. See PROTOZOA.

INGEMANN, BERNHARD SEVERIN, a distinguished Danish poet and novelist, was born at Torkildstrup, in the island of Falster, on the 28th of May, 1789. His first publication was a volume of lyric poems, which at once achieved a wide popularity. De Sorte Riddere, modelled on the Faery Queen, appeared in 1814. He next applied himself to dramatic poetry, and Blanca (1815) was a favourite on the stage, but the ill success of his Hyrden af Tolosa so far disgusted him with the theatre that the plays he afterwards composed were not intended for representation. In 1818–19 he travelled in Germany, France, and Italy, and in the latter year he completed at Rome Tassos Befrielse, a dramatic poem turning on the circumstances of Tasso's death. On his return to Denmark he produced a series of historical romances, dealing with the social life and habits of his countrymen during the Middle Ages, in which he took Sir Walter Scott for his model. As a prelude to his historical novels he published in 1824 his admirable epic of Valdemar den Store og Hans Mänd, which proved how deeply his mind was imbued with the history of his country, and how well fitted he was to subordinate incident to historical truth. The

most popular of his romances have been translated into English. Among his most successful poetical efforts may be ranked Dronning Margrete (1836) and Holger Danske (1837). These are also based on national history and tradition. After his return from his travels Ingemann displayed a strong religious bias, which found expression in his collection of anthems and psalms, Hoejmessepsalmer (1825), and in other poems, such as Guldœblet (1856), an allegorical poem in twelve cantos. In 1822 he was appointed to the chair of Æsthetics and Danish Literature in the Royal Academy of Soroë, in the vicinity of Copenhagen, and died in 1862.

INGLIS, HENRY DAVID, a popular writer of travels, the only son of an advocate in Edinburgh, and descended from an ancient family, was born at Edinburgh in 1795. His maternal grandmother was daughter of the celebrated Colonel James Gardiner who fell at the battle of Prestonpans. Through her Mr. Inglis was allied to the noble house of Buchan and the Erskines. The writings of Mr. Inglis are twofold—travels and fiction. His first work was his Tales of Ardennes (1825), but his Spain in 1830 is unquestionably his best work, and his Ireland in 1834 attracted very considerable notice. His Channel Islands abounds in elegant descriptions of natural scenery; while his Tyrol, his Switzerland and the Pyrenees, and his Norway, are all books of much merit, and have altogether contributed to establish for him a just and well-earned reputation. Of his fictitious works his New Gil Blas has been ranked by his biographers as his best. Some of his works appeared under the pseudonym of Derwent Conway. Mr. Inglis died in London on the 20th of March, 1835, aged forty, of a pulmonary affection induced by the great fatigues he had undergone in his extensive travels.

INGOLSTADT, a town of Upper Bavaria, on the left bank of the Danube, here crossed by a bridge, 35 miles S.W. Ratisbon. Its fortifications, which were demolished by the French in 1800, have been rebuilt, and are stronger than ever, so that it now ranks as an important fortress. The two forts on the left bank of the river are noted for their elegance and strength. It has a court of law and several important civil and military offices; seven churches, one of them with several interesting monuments; a Franciscan monastery, a nunnery, a Latin and several other schools; an arsenal, old castle, town-house, and hospital; manufactures of woollen and linen cloth, ammunition, guns and gunpowder, and several mills. Ingolstadt had a university of some celebrity, founded in 1472, but in 1800 it was removed to Munich. One of its most distinguished members was Dr. Eck, who acted as the Roman Catholic champion in the celebrated debate which took place here, and in which the cause of the Reformation was maintained by Luther in person. Pop. (1900), 22,207.

INGOT, in the arts, is a small bar of metal made of a certain form and size by casting it in moulds. The term is chiefly applied to the small masses or bars of gold and silver intended either for coining or exportation to foreign countries. The word is of doubtful origin.

INGRES, JEAN AUGUSTE DOMINIQUE, an eminent French painter, born at Montauban, 29th August, 1780. His father designed him for a musician, but his bias for painting was so decided that he was allowed, after some preparatory instruction, to study under the famous David, under whom his progress was signally rapid. About 1804 he went to Rome, where he resided for fifteen years, and after a further residence of four years in Florence he succeeded Denon in the School of Fine Arts in Paris. His fame was by this time fully established, and the promise of his youth more than realized. In 1833 he succeeded Horace Vernet as director of the French Academy at Rome, his services to which were invaluable, though they did not escape adverse criticism. Honours were conferred on him in quick succession, for in 1825 he was elected a member of the Institute, in 1834 he was nominated Chevalier, and in 1845 Commander of the Legion of Honour. In 1855 he received the grand medal of honour at the International Exhibition, and in 1862 he was made a senator and member of the council of public instruction. He died at Paris on the 14th of January, 1867. Few artists have been more persistently depreciated or more extravagantly praised than Ingres. He gradually emancipated himself from David's manner, and his style became freer and less formally academic, though it still retained a somewhat antiquated preciseness. Among his best pictures are Œdipus and the Sphinx (1806); Raphael and the Fornarina (1813); Francesca da Rimini (1818); Roger Rescuing Angelica (1819); Henri IV. and the Spanish Ambassador (1820); Apotheosis of Homer (1827); Stratonice (1839); Joan of Arc Holding the Oriflamme (1854); La Source (1856); besides portraits.

INGRIA (German, *Ingermannland*), a former province of Sweden, on the Bay of Finland. It belonged as early as the thirteenth century to Russia, was inhabited by the Ingrians or Ishorians, and received its name from the river Inger, the former name for Ishora, when the Swedes took possession of it in 1617. In 1700 the Russians reconquered it. It forms at present a part of the government of St. Petersburg, in which the capital, St. Petersburg, is situated.

INGROSSING, in law. See ENGROSSING.

INGULPHUS, Abbot of Croyland, and long considered the author of the history of that abbey, is supposed to have been born in London about 1030. If the account of his life in his history may be believed, he received his early education at Westminster, and afterwards went to Oxford, where he applied to the study of Aristotle, and, as he says, 'clothed himself down to the heel in the first and second rhetoric of Tully.' He became a favourite of Edgitha, the wife of Edward the Confessor, and in the year 1051, William, duke of Normandy, who was a visitor of the court of the Confessor, made Ingulphus, then at the age of twenty-one, his secretary. He accompanied the duke to Normandy, afterwards went on a pilgrimage to the Holy Land, and upon his return entered into the order of the Benedictines at the Abbey of Fontenelle, in Normandy, of which he became prior. In 1075 he was invited to England by William, and created abbot of the rich monastery of Croyland. He died in 1109. His history of the monastery of Croyland (Historia Monasterii Croylandensis) is interspersed with many particulars of the English kings. It was published by Sir Henry Savile in 1596, and reprinted at Oxford by Gale in 1684. Ingulph's Chronicle of the Abbey of Croyland, with the continuation by Peter of Blois, and other writers, has been translated, with notes and an index, by H. T. Riley, B.A., for Bohn's Antiquarian Library. The history of Croyland comprises from 664 to 1091. The authenticity of the book has been called in question, and many believe it to be a fabrication of the thirteenth or fourteenth century. This opinion is now generally accepted as correct. See CROWLAND

INHERITANCE. See DESCENT.

INJECTIONS belong partly to surgery and partly to anatomy. In surgery fluids, different, according to the different effects desired to be produced, are thrown by means of a small syringe into the natural cavities of the body, or those occasioned by disease, partly to remove unhealthy matter, and partly to bring the remedy immediately to the seat of the

disorder, and thus effect a cure. In diseases of the nose and the cavities connected with it, in those which have their seat in the neck, in disorders of the ears, the bladder and urethra, the uterus and vagina, and for the radical cure of hydrocele, injections are often used, and with important advantages. Pure warm water is injected with the highest success for the removal of pus, blood, or even foreign bodies. Sometimes astringent medicines, to restrain excessive evacuations, sometimes stimulating ones, to excite inflammation, as in hydrocele, or even to increase and improve evacuations, sometimes soothing medicaments, to mitigate pain, &c., are added to the water. In diseases of the throat, which hinder the patient from swallowing, and thus tend to produce death by starvation, nourishing fluids are injected into the bowel. The blood of animals, or of men, has been sometimes injected into the veins, which is called *transfusion*. In the same way medicines are introduced speedily to the blood by being injected into the cellular tissue beneath the skin, from which they are quickly absorbed. This, known as *hypodermic injection*, is a method of administering medicine very much resorted to now, a much smaller quantity of the drug being required, and its effects being much more rapidly and surely produced. For example, morphia is injected to relieve pain or procure sleep, ergotinin to arrest bleeding, apomorphia to excite vomiting, and so on. The instrument usually employed for injection is a syringe, but many varieties of size, form, material, &c., are made to suit the nature and situation of the injection. Anatomists inject into the vessels of bodies various coloured fluids, which are liquid when hot and coagulate when cold, to make the smaller ones visible. Thus, the arteries, veins, and lymphatic vessels are injected. Anatomy has carried this art so far as to make very minute vessels visible to the naked eye.

INJUNCTION, in English law, a prohibitory writ, issuing from any of the divisions of the High Court of Justice restraining a person from doing some act which appears to be against equity, and the commission of which is not punishable by criminal law. It is either *provisional*, until the coming in of the defendant's answer, or *perpetual*, that is, perpetually restraining the defendant from the commission of an act contrary to equity. An injunction may be obtained to stay waste, as where a tenant is proceeding to cut down timber which he has no right to cut; to prevent the continuance of nuisances, obstructions, and the like, the infringement of patents, copyright, the breach of contracts, the alienation of real property, while a suit is pending, &c. Disobedience to an injunction constitutes contempt of court, and is punishable accordingly. In certain cases Courts of Common Law were empowered to grant injunctions by the Common Law Procedure Act of 1854. In Scotch law the corresponding term is *interdict*.

INK. This liquor or pigment used for writing or printing varies much in the details of its composition; all ordinary writing inks, however, owe their properties to the presence of gallate or tannate of iron held in suspension by means of gum. Gall-nuts (which see) contain gallotanic acid, which gives a black precipitate with persalts of iron; they also contain pectose (see JELLY), which converts gallotanic acid, when exposed to the air, into gallic acid. This latter acid colours ferric salts a much deeper black than the former acid. The essential points in the preparation of a good writing ink are therefore the presence of an iron salt, the infusion of gall-nuts and gum, and the allowing the mixture to remain for some time exposed to the air. All other substances which are added to ordinary ink as colouring matters in the place of gall-nuts only impair its quality. The following is one method for preparing black writing ink:—12 lbs. of bruised nut-galls are boiled for 3 hours in a cylindrical copper with 9 gallons of water, the water lost by evaporation being replaced from time to time; after all solid matter has settled to the bottom the clear liquid is drawn off and mixed with a mucilage prepared by dissolving 5 lbs. of gum senegal in a little hot water and filtering; a solution of 5 lbs. of ferrous sulphate (green vitriol) in water is then added, and the whole liquid allowed to stand until it begins to get black, when it is drawn off into bottles. It is preferable to bottle the ink before the iron is entirely converted into ferric gallate, so that, when used for writing, the particles of the ink may penetrate into the paper, and the iron salts there undergo a further oxidation and combination with the gallic acid. Another means of retarding the oxidation of the iron salts is to add a small quantity of an acid (generally sulphuric), which is perhaps neutralized by the bases present in the paper, thus allowing complete oxidation of the iron, and consequently complete blackening of the ink, to take place only after characters have been traced with it upon paper. As ink is liable to become mouldy it is customary to add a small quantity of such substances as essential oils, carbolic acid, crushed cloves, or sometimes corrosive sublimate, in order to prevent this result.

The following table taken from Watts' Dictionary of Chemistry shows the composition of several inks:—

	a.	*b.*	*c.*	*d.*	*e.*	*f.*	*g.*	*h.*	*i.*	*k.*	*l*	*m.*
Galls	225.	187.	133.	125.	66.	62.	31.	50.	174.	50.	60.	42.
Green Vitriol	75.	73.	55.	24.	22.	31.	19.	32.	87.	16.	20.	21.
Gum	25.	73.	55.	24.	19.	31.	8.	9.	43.	47.	20.	16.
Logwood	..	..	..	..	..	..	..	..	..	100.	20.	21.
Vinegar	..	..	..	..	..	..	..	125.	135.	..	..	..
Sugar	..	..	..	..	..	..	..	..	..	23.	1000.	16.

These ingredients are calculated for 1000 parts of water. Of these inks *a*, *b*, and *c* are too strong for ordinary use; *d*, *e*, and *f* are very good; *g* is rather too pale; the other inks are not genuine writing inks, however suited some of them may be for special uses. The addition of sugar causes the ink to adhere when dry, so that a copy of the writing may be taken off by pressing a moistened sheet of unsized paper upon the written paper.

The so-called alizarin-inks differ from ordinary inks only in containing a little free acid, the action of which in retarding the oxidation of the iron salts has already been explained. These inks also usually contain a small quantity of indigo dissolved in sulphuric acid, which prevents too pale an appearance in writing. Such inks become very black by exposure to ammoniacal fumes. An ink may be prepared by mixing logwood extract with potassium chromate; this ink is not liable to turn mouldy, but it soon becomes viscid and gelatinous. Ink is sometimes prepared in cakes or powder, which when dissolved in water may be used as ordinary ink; the thickening ingredients added are usually madder and indigo dissolved in sulphuric acid. It is sometimes customary to colour writing inks; the following methods of preparing coloured inks produce very good results:—

Red Inks. 1 part of good carmine is dissolved in 120 parts of caustic ammonia, and 1½ part of gum-arabic is added. A cheaper ink may be prepared by drenching 12 parts of pulverized cochineal along with 4 parts of ammonium carbonate with 32 parts of hot water, then digesting and pouring off the clear liquid. Red ink may also be prepared by boiling Brazil wood in water, adding alum or cream of tartar, and thickening with gum or sugar.

Blue Inks. The best blue ink is prepared by dissolving 30 parts of pure Prussian blue in 4 parts of oxalic acid dissolved in 1000 parts of water.

Yellow and Green Inks. The former ink may be made with decoction of saffron, the latter with indigo-carmine mixed with picric acid.

Hitherto we have been considering inks containing a certain amount of solid matter in suspension, which is deposited on the paper when the liquid portion of the ink has evaporated, but in all these cases the solid matter thus deposited may be removed either by washing with water or some other substance, such as chlorine, oxalic acid, &c. It is sometimes a desideratum to obtain an ink which shall not be thus destroyed. Such an ink may be prepared by mixing Indian ink (which is essentially very finely divided charcoal) with ordinary writing ink. Traill's indelible ink is prepared by dissolving wheat gluten in vinegar of specific gravity 1·033, after steeping it for 24 to 36 hours in water and rubbing up the liquid with Indian ink or lampblack. This ink withstands the action of water, chlorine, or dilute acids. Another indelible ink may be prepared by mixing a decoction of galls with ammonium vanadate. Chlorine destroys the black colour of this ink but does not efface the writing, acids turn it blue. Closely allied to indelible ink is that variety of ink used for marking linen; this usually consists of a solution of silver nitrate thickened with gum and sometimes coloured by means of sap green. The linen to be marked is sometimes prepared by covering it with a solution of sodium carbonate, sometimes with pyrogallic acid dissolved in dilute alcohol; in the former case silver oxide, in the latter metallic silver, is precipitated on the linen after heating it. The writing by these inks may be effaced by a solution of potassium cyanide. Aniline black is also used as a marking ink.

We have now to say a little about a kind of ink which consists essentially of carbonaceous matter mixed with oil. The difference between printers' and ordinary ink may be illustrated by placing slips of paper having characters traced on them with both of these inks in an atmosphere of chlorine. This gas (see CHLORINE) has a strong affinity for hydrogen, it therefore decomposes the ordinary ink, takes away the hydrogen, and thus bleaches it, while it has no effect upon the printers' ink, which consists mainly of carbonaceous matter. Printers' ink may be prepared as follows:—Linseed-oil, after being clarified from fatty matters, is boiled over the open fire, with the addition of a certain amount of yellow soap, which prevents smearing and gives a clearness to the impression of the ink. The required drying agents are also added while the oil is being heated, borate of manganese being frequently used for the purpose. When the oil has assumed somewhat of the character of a varnish, a quantity of lampblack, amounting to about 16 per cent of the weight of the oil, is added and stirred up with the oil. The lampblack is best prepared by the careful combustion of naphtha. If it be wished to obtain coloured printing inks, this may be done by adding the necessary pigments to the oil while it is being heated. Vermilion is used to give a red colour, ultramarine for blues, and lead chromate for yellows.

For copperplate printing and lithographing a thicker ink is used, which is mixed with a denser black than that used for ordinary printing ink. The following are the necessary qualifications of a good printing ink according to Mr. Underwood:—

1. It must distribute freely and work sharp and clean.
2. It must not adhere too tenaciously to the types.
3. It must dry immediately on the paper, but not dry at all on the rollers.
4. It must be proof against the effects of time and chemical reagents.

Sympathetic Inks were formerly used in secret correspondence, but they have now ceased to be thus employed as none of them will withstand the action of a strong heat. The characters written by these inks do not become visible until they are treated with some other solution or exposed to the action of heat. If a solution of gall-nuts be used the writing only appears when washed with a dilute ferrous-sulphate solution. If the letters be formed by means of a dilute solution of potassium ferrocyanide (yellow prussiate of potash), the writing is made visible by wetting the paper with ferrous-sulphate solution. A solution of cobalt chloride affords an ink which is colourless or very nearly so when cold, but becomes green (owing to the dehydration of the cobalt salt) when heated.

INKERMANN, a village of Russia, in the government of Taurida, near the eastern end of the harbour of Sebastopol. It occupies a strong position at the foot of a lofty hill, containing numerous caves, supposed to have been hewn out by monks for residence during the Middle Ages. At a short distance is a church similarly hewn out of the rock. Inkermann is famous for the signal victory of the allied British and French forces, 14,000 in number, over a much larger force of Russians on November 5, 1854. The battle took place on the heights on the opposite side of the river Tchernaya.

INLAND REVENUE is the name applied to that department of the British government which manages the branches of excise, taxes, and stamps. This department does not manage the customs duties. Its chief office is in Somerset House, London, and the board consists of a chairman (salary £2000), a deputy chairman (salary £1500), and two commissioners (each £1200), besides two joint secretaries (each £1200). The principal facts relative to the produce of the inland revenue for the year ending March 31, 1903, have been tabulated in the official statement as follows:—Excise, £32,100,000; estate, legacy, and succession duties, £17,966,000; stamps, £8,200,000; land tax, £725,000; house duty, £1,825,000; property and income tax, £38,800,000; total, £104,931,000. The total for 1899–1900 was £75,830,000. The South African war and the consequent increase in the income tax rate account for the larger sum shown for the year 1902–03. The items under excise are partly duties and partly licenses. Under stamps are comprised—stamps on deeds and other instruments, bills of exchange, probates of wills, receipt and other penny stamps, &c.

INLAYING is the art of ornamenting flat surfaces of one substance by inserting into cavities cut in them pieces of some other substance. Various kinds of metal or wood, or pearl, ivory, &c., are employed in this process, which is now applied chiefly to the production of ornamental articles of furniture. When wood of one colour is inlaid with others of different colours, as in ornamental devices in flooring, it is generally called *marquetry*, the various pieces of wood being usually disposed in regular geometrical figures. The art of inlaying iron or steel with other

metals, as gold or silver, is called *damascening*. *Buhl* and *reisner* work, once highly prized, have lost much of their celebrity. The former took its name from Buhl, an Italian resident in Paris in the reign of Louis XIV., and the latter was designated after Reisner, a German who not long after settled in the same city. Buhl for the most part inlaid brass on tortoise-shell, Reisner a dark wood on a tulip-wood ground. The usual instrument for cutting out veneers for inlaying is a fine saw, mounted in a bow or arched handle, and worked in short quick movements. Three or four veneers are sometimes cut simultaneously in this way. Inlaying with stone, in which the Florentines have long excelled, is called *pietra dura*, and differs from mosaic in having the holes not cut through the ground, which is commonly of black marble, but only to a regulated depth. Perhaps the best work of this kind is now produced at St. Petersburg, the art having received encouragement from the Russian government. An Indian variety of inlaying is known as *koftgari* or *kuftgari*. It is a kind of damascening, a pattern being formed on a surface of steel and a gold wire hammered into the lines of the pattern or design. Another species of Indian inlaying is that known as *bidery* ware or *bidri* (from Bidar in the Nizam's Dominions). In this small pieces of silver are hammered into spaces previously cut in the ground, which usually consists of one part of copper to four of pewter, and is thus both hard and easily cut. Admirable examples of stone inlaying are in the Taj Mahal at Agra.

INN, a river of Europe which issues from a lake at the foot of the Rhaetian Alps, flows north-east through the deep and narrow valley of the Engadine, in the Swiss canton of the Grisons, enters the Tyrol at Martinsbruck, passes Innsbruck, Hall, and Kufstein, and shortly after enters Bavaria. Escaped from the narrow passes within which it had hitherto been confined, it now flows through a wider valley, proceeding circuitously N.N.E. past Wasserburg to Mühldorf. Here it turns east till it receives the Salza, where it begins to form the boundary between Austria and Bavaria, and joins the right bank of the Danube at Passau, after a course of over 300 miles. At its mouth its bed is 755 feet wide, while that of the Danube is only 492. It begins to be navigable at Hall, but its channel is much encumbered, and the difficulties of navigating it are increased by the sudden and extensive floods to which it is subject. It is well supplied with fish.

INN AND INNKEEPERS. Inns are houses where travellers are furnished, for the profit of the provider, with everything they have occasion for whilst on their journey, and may be set up without license by any person, provided he refrains from selling excisable liquors, which of course require a license. Hotels, public-houses, taverns, victualling-houses, and coffee-houses are all inns when the keepers of them make it their business to furnish travellers with food and lodging; otherwise they are not. Innkeepers are bound to take in all travellers and wayfaring persons, and to entertain them if they have accommodation for them (and they are only bound to give such accommodation as they have) at reasonable charges, provided they behave themselves properly. As a protection they have a lien on the goods of their lodgers (with the exception of the clothing which they are actually wearing), so that they may retain them as security for the price of their lodging and entertainment. The common law compels them to take uncommon care of the goods, money, and baggage of their guests, and they are responsible for the acts of their domestics and servants, as well as of their other guests. Thus they are obliged to reimburse a guest (that is any person who receives entertainment or refreshment as one of the public) for the loss or damage of goods and property received into their premises, whether directly intrusted to their care or not. In England (as well as in the United States) this liability has been somewhat modified by recent statutes. In England the innkeeper's liability is restricted to the amount of £30, unless as regards a horse or carriage; or unless where goods have been stolen, lost, or injured through the act or neglect of the innkeeper or his servant, or where such goods have been deposited with him for safe custody. The innkeeper is exempted from liability if loss has arisen from an unavoidable accident, 'the act of God,' or of public enemies. To determine when such an accident has taken place is sometimes a question of considerable difficulty. Some exclude fire from this category, and loss by robbery is a controverted point. If the robbery of a traveller's goods has been caused by his servant or companion, or by gross negligence on his own part, the innkeeper is exempt from liability. If the guest takes upon himself the charge of his own goods the innkeeper is excused. If, after taking reasonable precautions, a traveller is robbed, he has a claim on the landlord, whose liability is not removed by any notice in his rooms that he will not be answerable for losses. An innkeeper neglecting to give a parcel containing money to a carrier, as he ought to have done, has been held liable for its contents; but liability does not attach to him for money contained in a parcel addressed to his care if the person be not a guest in his house. The lien he has over a horse in his stable for provender and stabling operates against even the true owner of the horse, though the person who brought it to the inn may have stolen it. If the horse is allowed to go away the lien is lost without revival. As above mentioned, innkeepers are bound to open their houses to receive travellers, but mere neighbours and friends occasionally visiting the house are not regarded as travellers in the legal sense. The innkeeper can order a traveller to leave his house if he will not accept reasonable accommodation; neither is a guest entitled to select what room he pleases. The main difference between inns in Scotland and England is that in the former country inns must be shut up during the whole of Sunday, except for the accommodation of *bonâ fide* travellers. In the United States the law is substantially the same as in England, though there are some differences in different states. A recent British act, 41 Vict. cap. xxxviii. (1878) empowers an innkeeper to sell by public auction (advertised at least one month beforehand) all goods, horses, &c., he has kept in virtue of his lien after six weeks.

INNATE IDEAS, certain primary notions or impressions, supposed by many philosophers to be given to the mind of man when it first receives its being, and to be brought into the world with it. Their existence has afforded ground for much dispute among philosophers. The term innate, as applied to ideas, was first used by Descartes, who distinguished ideas into three classes of *innate*, *adventitious*, and *factitious*. As his definitions of terms failed in precision, the doctrine of Descartes was keenly assailed by Hobbes and Locke, who, however, attributed to the French philosopher opinions which he did not hold. As afterwards more strictly stated by himself, his views may be stated thus:—An innate idea is not one that presents itself always to our thought, for there could be no such idea; but we have within ourselves the faculty of producing it. He has nowhere given an enumeration of the ideas that he considers innate, though he attaches particular importance to that of infinity, which he makes the foundation of his proofs for the existence of God in his reply to the

attacks of Hobbes and Gassendi. Leibnitz replied to the strictures of Locke. What the followers of Descartes designate *innate ideas*, those of Cousin term *universal, necessary*, and *absolute*. Some of the greatest names in European philosophy are associated with the discussion of this theory, or of cognate theories, as Clarke, Newton, Malebranche, Kant, &c.

INNER HOUSE. See SESSION (COURT OF).

INNERLEITHEN, a burgh of Scotland, county of Peebles, 6 miles E.S.E. Peebles, stands on level ground on both sides of the Leithen, and near the Tweed. It consists chiefly of three principal streets, straight and well kept. The houses are well built of stone. It is amply supplied with water, has a parish church, &c., and several considerable woollen factories. It is much resorted to for its saline springs, which have obtained some celebrity. It is the 'St. Ronan's Well' of Sir Walter Scott's novel of that name. Pop. (1901), 2181.

INNER TEMPLE. See INNS OF COURT.

INNOCENT, the name of thirteen popes, the chief of whom are mentioned in the following articles:—

INNOCENT I., a native of Albano, succeeded Anastasius I. as Bishop of Rome in 402. He was in great favour with the Emperor Honorius, and induced him to take severe measures against the Donatists. He supported St. Chrysostom, and renounced the communion with the eastern churches on account of their treatment of that eminent man. In 409 he was sent to obtain terms of peace from Alaric, but without success, in consequence of the opposition of the pretorian prefect Jovius. Rome was taken and pillaged in 410, while Innocent was still in Ravenna. He condemned the Pelagians as heretics in a letter to the African churches, but excited their opposition by his arrogant tone. He died in 417. He is one of the most distinguished among the saints; his day is July 28. His decrees (in the Collection of Dionysius Exiguus) and letters (most complete in Schönemann's Pontificum Romanorum Epistolæ Genuinæ) prove his zeal for the establishment of the Roman supremacy; but part of them are considered by many critics spurious. Zosimus was his successor.

INNOCENT II., a Roman of noble birth, elected pope in 1130 by a part of the cardinals, whilst the others elected Peter of Leon, who took the name of Anacletus. Innocent fled to France, where, by the mediation of Peter of Clairvaux, he was acknowledged by the Council of Étampes, by Louis VI., and soon after by Henry II. of England; also by the Emperor Lothaire, who conducted him in 1133 to Rome, where he occupied the Lateran, whilst Anacletus occupied the Castle of Crescentius, the Church of St. Peter, and a large part of the city. Innocent was soon obliged to retire to Pisa, and though the emperor reinstated him in 1137 Anacletus maintained himself until his death in 1138. Having prevailed against another anti-pope, he held the second Œcumenical Council in the Lateran, which condemned Arnold of Brescia and his heresy, declared all the decrees of Anacletus null, and excommunicated Roger of Sicily, who had supported the latter. But Roger waged war against the pope, made him prisoner, and obliged Innocent to acknowledge him as king, absolve him from excommunication, and invest him and his heirs with Apulia, Calabria, and Capua. Towards the end of his pontificate he had to struggle with constant disturbances in Rome and Tivoli. He died in 1143. Celestine II. succeeded him. His letters are to be found in Baluze, Martène, and others.

INNOCENT III., Lothario, Count of Segni, born at Anagni in 1161, studied in Rome, Padua, and Bologna. On the death of Celestine III. (1198) Cardinal John of Salerno proposed Lothaire as pontiff, and he was unanimously elected at the age of thirty-seven. The death of the Emperor Henry VI. in 1197 had thrown the imperial affairs in Italy into the greatest confusion. Innocent, in the vigour of manhood, endowed by nature with all the talents of a ruler, possessed of an erudition uncommon at that time, and favoured by circumstances, was better qualified than any of his predecessors to elevate the Papal power, which he considered as the source of all secular power. By his clemency and prudence he gained over the inhabitants of Rome, obliged the imperial prefect to take the oath of allegiance to him, and directed his attention to every quarter where he believed or pretended to believe that a Papal claim of property or of feudal rights existed. From the imperial seneschal, Duke Markwald of Romagna, he required homage for the Mark of Ancona, and on his refusal to comply took possession of the Mark, with the assistance of the inhabitants, who were dissatisfied with the imperial government, and excommunicated Markwald, obliged the Duke Conrad of Spoleto to resign that duchy, and would also have taken Ravenna if the archbishop had not prevented him. He concluded treaties with many cities of Tuscany for the mutual protection of their liberties and those of the church. Thus he soon obtained possession of the ecclesiastical states in their widest extent. He conferred Naples on the widowed Empress Constantia and her minor son, afterwards the Emperor Frederick II., after having abolished all the privileges conceded by Adrian IV. in 1156, assumed the guardianship of the young prince after the decease of the empress, and frustrated all the machinations of Markwald to deprive him of his inheritance. In Germany Innocent favoured the election of Otho IV. against Philip of Suabia, crowned him in 1209 at Rome, but soon became involved in disputes with him on account of his violations of the promises which he had made to the church. He excommunicated Philip Augustus, king of France; laid the kingdom under an interdict in 1200 because Philip had repudiated his wife Ingeburga, and obliged the king to submit. He was still more decided in his treatment of John, king of England, who refused to confirm the election of Stephen Langton as Archbishop of Canterbury. Innocent laid the kingdom under an interdict, and in 1212 formally deposed him. John was finally obliged to submit, resigned his territories to Rome, and received them as a Papal fief from Innocent. Almost all Christendom was now subject to the pope, two Crusades were undertaken at his order, and his influence extended even to Constantinople. Innocent was one of the greatest popes and rulers; he acted in accordance with the principles laid down in his writings; he enforced purity of morals in the clergy, and was himself irreproachable in private life; yet the cruel persecution of the Albigenses in the south of France, which he encouraged, though without approving of all its rigours, and the inquisitorial tribunals established by him in 1198, from which the Inquisition itself originated, are stains on his pontificate, but partially effaced by a consideration of the spirit of the times and the disordered state of the Christian world. It has been said of his rule, as of that of Gregory VII., whom he most resembles, that in those times the power of the pope was salutary as a bond of union for Europe, in which the still firmer bond of a common civilization and knowledge did not, as at present, exist. His attacks on the secular power are to be considered as the struggle between the ecclesiastical and secular power, and prove how completely the Roman pontiffs had renounced the simple and disinterested spirit of Christianity, and given themselves up to schemes of worldly aggrandizement. In 1215 he held a

council, by which transubstantiation in the Lord's supper and auricular confession were established as dogmas, Frederick II. was acknowledged as German emperor, and the Franciscan and Dominican orders were confirmed. Innocent died soon after at Perugia on the 16th of July, 1216. Some of his works on legal and theological subjects were published in Cologne, 1575, folio. The best edition of his letters, important for the history of the time (eleven books), is that of Baluze, in two vols. folio (Paris, 1682). The Stabat Mater and Veni Sancte Spiritus, and other sacred hymns, are said to have been written by him. Honorius III. succeeded him.

INNOCENT XI. (Benedetto Odescalchi) was born at Como in 1611, served in his youth as a soldier in Germany and Poland, took orders at a later period, and rose through many important posts, until he was elected pope in 1676, on the death of Clement X. He was eminent for his probity and austerity; he zealously opposed nepotism and simony, restrained luxury and excess, and even prohibited women from learning music. Though hostile to the Jesuits, whose doctrine of probabilities he publicly disapproved, and attacked sixty-five of their opinions in the decree *Super quibusdam axiomatis moralibus*, yet he was obliged to condemn Molinus and the Quietists. He determined to abolish the privileged quarters (the ground for a considerable distance around the palaces of certain ambassadors in Rome, which was considered as foreign territory, in which criminals found the privileges of asylum); but Louis XIV. would not yield to so just a claim, occupied Avignon, and imprisoned the Papal nuncio in France; in consequence of which the authority, and particularly the acknowledgment of the infallibility of the pope, received a severe blow by the IV. Propositiones Cleri Gallicani in 1682. (See INFALLIBILITY and GALLICAN CHURCH.) These disputes were highly favourable to the English Revolution, as it induced the pope in 1689 to unite with the allies against James II., in order to lower the influence of Louis XIV. His conduct in this respect has led many Catholics to assert that he sacrificed the Catholic religion to his personal resentment; and it was sarcastically said, that 'to put an end to the troubles of Europe it was only necessary for James II. to become a Protestant, and the pope a Catholic.' Bayle, however, judiciously observes that the extreme predominance of any great Catholic sovereign is injurious to the interests of the Papacy, and mentions the similar conduct of Sixtus V., another able pope, in relation to Philip II. of Spain and Queen Elizabeth of England. Innocent died August 12, 1689, at the age of seventy-eight, leaving behind him the character of an able and economical pontiff, and of an honest and moral man. Had he not died an open rupture with France might have ensued. Alexander VIII. succeeded him.

INNOCENTS, FEAST OF, HOLY, variously styled Innocents' Day and Childermas, a festival observed in the Latin Church on the 28th, and in the Eastern Church on the 29th December, in commemoration of the massacre of the children at Bethlehem, 'from two years old and under,' by the order of Herod, with the purpose of destroying among them the infant Saviour. The Church of England at the Reformation retained it in its ritual among its anniversary festivals. St. Cyprian refers to these children as martyrs, as does St. Augustine with still greater explicitness. It is to them that the hymn of Prudentius, Salvete Flores Martyrum, is addressed. This feast is now a special holiday for the young, and in Catholic countries they assume for the day the clothing of the elders, and exercise a mock authority over the household. In nunneries the youngest sister is for this day sportively invested with supreme authority over the house and its superiors. The feeling of horror which the atrocity of Herod has always and everywhere evoked engendered a belief that Innocents' Day was unlucky, and formerly no work was begun on it, or undertaking entered on, that could possibly be avoided. A Childermas Day marriage was deemed especially inauspicious. To fix the memory of the Massacre of the Innocents more firmly in the youthful mind it was customary in ancient times to administer a smart whipping to the juvenile members of a family, but the whole affair ultimately resolved itself into a frolic. A lingering relic of the old belief in the inauspiciousness of the day is found in the aversion of the women of Cornwall to institute certain domestic proceedings on December 28.

INNSBRUCK, or INNSPRUCK (ancient *Oenipontum;* locally called *Schpruck*), a town in Austria, capital of the Tyrol, beautifully situated 59 miles north of Munich, on the banks of the Inn, near the confluence of the Sill, and almost in the centre of the valley of the Inn (Innthal), the sides of which are inclosed by mountains several miles distant, but so lofty (7000 feet to 8500 feet) as apparently almost to overhang the town. It consists of the town proper, situated on the right bank of the river, and of five suburbs. It is for the most part well built. The houses are generally of a limestone breccia, and from four to five stories high, and built in the Italian style. The buildings most deserving of notice are the Hofkirche, containing the tomb of the Emperor Maximilian I., one of the most splendid monuments of the kind in Europe, though he himself is not interred in it; and the tomb of Hofer; the church of St. James, with a painting by Lucas Cranach; the Jesuits' church, considered the handsomest in the town; the Capuchin church, with good paintings; the new palace, built by Maria Theresa, a very extensive edifice, with gardens which stretch along the side of the Inn, and form an excellent promenade; the old palace, in which the Archdukes of Tyrol and several of the German emperors used to reside; the chancery or register office (Kanzlei-Gebäude), with the Golden Roof, a sort of oriel window roofed with gilt copper, and projecting in front of it; the town-house, and the custom-house; the university, founded in 1677, and re-established in 1826, well endowed, provided with a library, botanical garden, and cabinet of natural history, and attended by about 1000 students; a gymnasium, and several other important educational establishments; and the museum, called Ferdinandeum, rich in all the productions both of art and nature within the limits of the Tyrol. The manufactures include woollen, silk, and cotton tissues, gloves, glass, &c. The trade, chiefly transit, is of considerable importance. As the capital of the Tyrol, Innsbruck is the place of assemblage for its states, and the seat of superior appeal, civil, and criminal courts, and of many important public offices. Many of the spots in the immediate vicinity have become memorable for the noble exploits which the Tyrolese peasantry performed in the war of Independence. Pop. (1890), 23,325; (1900), 27,056.

INNS OF COURT are certain societies exclusively invested with the right to call to the English bar. The colleges of the English professors and students of common law are called *inns*, the old English word for the houses of noblemen, bishops, and others of extraordinary note, being of the same signification as the French *hôtel*. It is not possible to determine precisely the antiquity of the establishment of inns of courts. The received opinion is, that societies of lawyers, which before the Conquest held their chief abodes for study in ecclesiastical houses, began to be collected into permanent residences, soon after the court of common pleas was directed to be

held in a fixed place,—a stipulation which occurs in the great charters both of King John and Henry III. In these houses exercises were performed, lectures read, and degrees conferred; that of barristers, or, as they were first styled, *apprentices* (Fr. *apprendre*, to learn), answering to bachelors; that of serjeants (L. *servientes ad legem*) to doctors. Fortescue, lord-chancellor of England in the reign of Henry VI., says in his treatise De Laudibus Legum Angliæ, that in his time there were about 2000 students in the inns of court and chancery, all of whom were gentlemen born. In the reign of Queen Elizabeth, Sir Edward Coke did not reckon above 1000 students, and the number at present is very considerably less. The inns of court are governed by masters, benchers, stewards, and other officers, and have public halls for dining, readings, &c. These societies have not any judicial authority over their members; but, instead of this, they have certain orders among themselves which have, by consent, the force of laws. For light offences persons are only excommoned, or not allowed to dine in hall; for greater, they are expelled the society; and, when once expelled from one society, they are never received into any of the others. For criminal offences barristers may be disbarred or prohibited from practising. The gentlemen in these societies may be divided into benchers, king's counsel, utter or outer barristers, and students. There was formerly a class of barristers known as serjeants-at-law, but these no longer exist. The four inns of court are: the Inner Temple and Middle Temple (formerly the dwelling of the Knights Templars, and purchased by some professors of law more than three centuries since); Lincoln's Inn and Gray's Inn (anciently belonging to the Earls of Lincoln and Gray). Each inn is self-governing, and all have equal privileges. Each possesses considerable property of its own, consisting mostly of sets of chambers, which are rented almost exclusively by members of the inns. The Inner Temple and Lincoln's Inn are the wealthiest of the four. There is also a common fund to which each contributes annually the sum of £360, the fees paid by the students being also added.

At the present day, previously to being called to the bar and thus obtaining the status of *barrister*, a person must first be admitted a member of one of the inns of court. The regulations are now the same in all the inns as to admitting to membership and calling to the bar. Any person who has passed a public examination at any university in the British dominions, or the examinations for a commission in the army or navy, for the Indian Civil Service, the consular service, &c., may be at once admitted as a student to any of the inns. Generally speaking, every other person before admission as a student must pass an examination in the English and Latin languages and English history before a joint board of examiners appointed by the four inns. No attorney at law, solicitor, writer to the signet, notary public, clerk in chancery, &c., or clerk to such, or to any barrister, conveyancer, &c., can be admitted as a student to be called to the bar or practise at the bar until such person ceases to act in any of these capacities and has taken his name off the roll of any court on which it may stand. A form of application for admission recognizing the above conditions is to be signed by the candidate; and a certificate of his respectability, and of his being a proper person for admission to the bar, annexed to the form, must be signed by two barristers; the application has also to be approved by the treasurer or by two benchers. One guinea is paid for the form of application. Each student, on admission, pays five guineas, entitling him to attend the lectures on the several branches of legal science, given by a staff of teachers designated readers and assistant readers, so long as he shall continue a student. Attendance is not compulsory on students either at lectures or private classes; nor is it essential to study the practice of the law in the chambers of a barrister or pleader, though this is recommended. Candidates, however, besides passing the necessary examination, must go through the ceremony of 'keeping terms', the year being divided into four terms. A term is kept by the student being present at six dinners during the term in the hall of the society to which he belongs, and attendance during the whole of the dinner is essential. But students who at the time are members of any of the universities of Oxford, Cambridge, Dublin, London, Durham, the Queen's University in Ireland, St. Andrews, Aberdeen, Glasgow, Edinburgh, &c., may keep terms by dining in the halls of their respective societies any three days in each term. The student must keep twelve terms before he can be called to the bar, though the terms may be dispensed with in certain cases. Thus, a student who, previously to his admission as such, had been a solicitor in practice for not less than five years may be examined and called to the bar without keeping any terms. Every student before being called to the bar must be twenty-one years of age, and must have passed a public examination to the satisfaction of the Council of Legal Education, and must have received a certificate to this effect from the Council. There are four examinations for calls to the bar in each year, one being held before each term, and the examinations are by written papers, or *viva voce*, as the examiners judge desirable. Besides the various branches of English law and equity, the examinations embrace Roman law, international law, constitutional law, &c. Two studentships of £105 per annum each, to be held for three years, are awarded annually to the two students who pass the best examination, and honour certificates are also granted.

INO, in Greek mythology, daughter of Cadmus and Harmonia, second wife of Athamas, king of Thebes, drew upon herself the anger of Hera by nursing the young Dionysus (Bacchus), the son of her sister Semele. In order to favour her own children she projected the murder of her step-children, Phryxus and Hellē. Being warned by their mother, Nephelē, who appeared to them in a dream, they saved themselves by flight. Hera was still more highly incensed against Ino by this attempt; she made Athamas, the husband of Ino, mad, and in his frenzy he dashed his eldest son by Ino, Learchus, against a rock. Ino fled with her youngest son, Melicertes, and threw herself with him into the sea. The body of the boy was carried by a dolphin to the shore, where King Sisyphus caused it to be buried, and instituted in honour of him the well-known Isthmian games (which see). Ino and Melicertes were made sea deities at the prayer of Dionysus. Ino was worshipped under the name of *Leucothea*.

INOCULATION, in medicine, is the introduction into the system, usually by a series of scratches on the skin or by injection under the skin, of some specific material, which, either by exciting a mild attack of some specific disease or in some other way, shall protect the person from a violent attack of that disease. It is only in infectious diseases that this system is possible, the class of diseases in which one attack usually protects against a second, and the method was first practised for small-pox. This disease appears to have been unknown to the ancient Greeks and Romans, as no mention is made of it in

their writings. It is said to have existed in Asia at an early period, and to have showed itself in Europe and England about the time when the Crusaders returned from the wars of the Holy Land; the mortality which resulted from it being then excessive. And in 1520, when it visited for the first time some of the provinces of South America, it proved fatal to not less than one-half of the population there.

The practice of inoculation, although known for centuries to various Asiatic peoples, and long followed in some obscure parts of Wales, seems to have been scarcely known throughout England till the early part of the eighteenth century, and its adoption was chiefly due to the exertions of Lady Mary Wortley Montagu, whose admirable letters are so well known. The small-pox had been raging with great mortality in Turkey for some time previous to her ladyship's going thither; and the practice of inoculation, which had been long known and followed by the poorer classes of European Greeks, had lately been had recourse to by the wealthier inhabitants. Her ladyship had her own son inoculated at Pera with success; and on her return to England exerted herself to procure its adoption at home.

For many years the practice met with the greatest opposition, both from the medical profession and the clergy; and several mistakes of a serious nature happened, owing to the nature of the operation being but little understood. In 1724 Dr. James Jurin, an eminent physician and man of science, published a pamphlet entitled An Account of the Success of Inoculating the Small-pox in Great Britain, and in each of the next three years he issued similar works dealing with the cases and statistics of the preceding year. Dr. Jurin stated that the number of deaths in London for forty years preceding had been 903,798, of which 65,079 were occasioned by the natural small-pox; and that more than one-fourteenth part of mankind died from this disease. Of those who were seized with small-pox, two in seventeen, or nearly one in nine, were carried off by it; and indeed the mortality from natural small-pox in some families of the poor had even amounted to one in five or six; while, on the contrary, of those inoculated, the proportion of fatal cases was not greater than one in sixty. The practice of small-pox inoculation in general, and Dr. Jurin's defence in particular, was assailed by, amongst others, Isaac Massey, who wrote A Short Account of Inoculation (1723) and Remarks on Dr. Jurin's Last Yearly Account of the Success of Inoculation (1727); Francis Howgrave, who published a work entitled Reasons Against Inoculation, in a Letter to Dr. Jurin (1724); and Dr. William Douglass, author of A Practical Essay concerning the Small-pox (1730). Among other supporters of inoculation were Drs. Mead and Frewer. In consequence of the arguments of Jurin and others, public establishments were started in London, for the purpose of diffusing the benefits of this practice, in the year 1746. About the year 1767 the attention of the public was excited by a new and more successful method of inoculation introduced by Mr. Sutton, a surgeon in Essex. It consisted chiefly in shortening the period of medicinal preparation from a month to a few days, and in keeping his patients much in the open air during the progress of the disease. A low scale of diet was enjoined immediately previous to and during the course of the disease. This system was in vogue only for a time, however, and gradually doubts as to the value of inoculation made themselves felt, especially after Dr. Jenner began to advocate the superiority of the method of vaccination. For one thing, though inoculation induced a mild form of the disease, and secured complete immunity for the future to the person undergoing the operation, yet other persons not inoculated were liable to be infected with the real disease from those who were inoculated, and thus the number of persons attacked was actually increased. Latterly vaccination quite superseded inoculation, which was prohibited in 1840 by 3 and 4 Vict. cap. xxix., while in 1853 vaccination was made compulsory (16 and 17 Vict. cap. c.). (See SMALL-POX, VACCINATION.)

Inoculation has been employed since about 1881 in the treatment of splenic fever. The bacillus of this disease was discovered by Koch in 1876 and investigated in subsequent years by Pasteur, who found that if a weakened cultivation of the bacillus were injected into an animal the animal was very slightly affected for a short time, but was rendered incapable of acquiring the fatal form of the disease. A crucial test in 1881 confirmed his assertion, and since then the practice of inoculating against this disease in cattle, sheep, &c., has spread widely. The same method of treatment has been applied by Pasteur to hydrophobia. The spinal cords of rabid animals are exposed in a sterilized atmosphere for various periods from one up to ten days, and extracts are prepared from them. If an animal or a human being be inoculated successively, at intervals of a day, with these extracts, beginning with the longest exposed and weakest and proceeding to that exposed for the shortest time and therefore strongest, immunity from the disease is conferred. In 1891 Dr. Koch introduced *tuberculin*, a substance prepared from the pure cultivated bacillus of tuberculosis, as an injection for curing persons in the early stages of that disease. The inoculative treatment has not, however, proved generally successful in the case of tuberculosis, but tuberculin is still much used as a diagnostic agent, especially in milch cows. These immunizing preparations are known as *anti-toxins*, and the anti-toxic mode of treatment has been applied to several other diseases. In the case of diphtheria the anti-toxic preparation is made from the blood of a horse which has been rendered immune by inoculation. Among other diseases which have been treated in this manner are erysipelas, tetanus, some forms of blood-poisoning, and poisoning from snake-bite; and serums for protective inoculation against the plague have also been prepared.

INOSITE ($C_6H_{12}O_6$) (from Greek *is, inos*, a nerve, a muscle) is a sugar first discovered in the muscular substance of the heart, but since discovered in the liver, brain, kidneys, and other parts of the body, both in health and in abnormal amount in disease. A substance identical with inosite, though originally considered different, exists also in a number of plants, such as foxglove, potato, kidney-bean, acacia, asparagus, cabbage. Though identical in composition with glucose, inosite differs from it in having no effect upon polarized light, in not fermenting with yeast, and in not acting upon an alkaline solution of copper. See GLUCOSE.

INOWRAZLAW, or JUNG-BRESLAU, a town of Prussia, in the province of Posen, 14 miles south-east of Bromberg, on a height in a fertile district. It has salt-works, foundries, a distillery, brewery, &c. Pop. (1900), 26,141, about the half of whom are Poles.

IN PARTIBUS INFIDELIUM, an expression literally meaning 'in parts belonging to infidels', is the title which has been given since the thirteenth century to those nominal bishoprics appointed by the pope in countries where his sway is not recognized. The bishops called *episcopi in partibus infidelium*, or

episcopi titulares, are fully invested with the episcopal office, but they have no proper diocese, and take their title from a territory which may have once formed a see, but does so no longer; thus Roman Catholic bishops in Britain formerly had such titles as 'Bishop of Nicopolis,' 'Bishop of Anazarba.' Such bishoprics reach back to the time of the Crusades. The provinces conquered by the Crusaders received bishops from Rome, and when these provinces were again lost, and consequently ceased to form proper sees, the popes continued to appoint bishops with corresponding titles, partly from the hope of recovering them, and partly by way of protestation against their seizure. Roman Catholic bishops in Britain had all at one time such foreign titles, and in 1850 the parcelling out of Britain into dioceses, with territorial titles, gave rise to the passing of the Ecclesiastical Titles Act, prohibiting the establishment of such Roman Catholic dioceses. This act was never enforced, and was repealed in 1871.

INQUISITION. The immediate cause of the erection of the tribunals of faith was the sect of the Albigenses, the persecution of whom in the twelfth and thirteenth centuries made the south of France a scene of blood. (See ALBIGENSES.) The project of extirpating the rebellious members of the church, and of extending the Papal power at the expense of the bishops by means of the Inquisition, was conceived by Pope. Innocent III. (who ascended the Papal chair in 1198), and was completed by his immediate successors. This tribunal, called the *Holy Inquisition*, or the *Holy Office* (*sanctum officium*), was under the immediate direction of the Papal chair; it was to seek out adherents of false doctrines, and to pronounce sentence against their fortune, their honour, and their lives, without appeal. The accused was obliged to be his own accuser; suspected persons were secretly seized and thrown into prison. No better instruments could be found for inquisitors than the mendicant orders of monks, particularly the Franciscans and Dominicans, whom the pope employed to destroy the heretics, and inquire into the conduct of bishops. Pope Gregory IX. in 1233 completed the design of his predecessors, and as they had succeeded in giving these inquisitorial monks, who were wholly dependent on the pope, an unlimited power, and in rendering the interference of the temporal magistrates only nominal, the Inquisition was successively introduced into several parts of Italy, and into some provinces of France; its power in the latter country being more limited than in the former. It never managed to establish itself in England at all. The tribunals of faith were admitted into Spain in the middle of the thirteenth century; but a firm opposition was made to them, particularly in Castile and Leon, and the bishops there maintained their exclusive jurisdiction in spiritual matters. But a change afterwards took place; and while in other countries of Europe the Inquisition could never obtain a firm footing, but in some fell entirely into disuse, as in France, and in others, as in Venice, was closely watched by the civil power, an institution grew up in Spain towards the end of the fifteenth century, which was the most remarkable of all the inquisitorial courts in the middle ages, and differed much from the rest in its objects and organization.

Ferdinand of Arragon and Isabella of Castile having united their power made many efforts to break the strength of the nobles, and to render the royal authority absolute. The Inquisition was used as a means of effecting their plans. In 1477, when several turbulent nobles had been reduced in the southern part of Spain, Queen Isabella went to Seville with the Cardinal Pedro Gonzalez de Mendoza: there this prelate, as Archbishop of Seville, made the first attempt to introduce the Inquisition. At his command punishments were publicly and privately inflicted, and it was discovered among other things that many citizens of Seville of Jewish origin followed in private the manners and customs of their fathers. The cardinal charged some of the clergy privately to enlighten the faith of these people, and to make the hypocrites true sons of the church. These teachers brought back many to the faith; but many who persevered in their opposition to the doctrines of the church were condemned and punished.

After this prelude the design was disclosed of extending the Inquisition over the whole country, and Mendoza laid the project before Ferdinand and Isabella. They approved of an institution which, at the same time, suited the persecuting spirit of the age, and could be used as a powerful engine of state. The design was by means of this institution, which was to be entirely dependent on the court, to oppress those who were either secretly or openly Jews or Mohammedans, to enrich the royal treasury, to which the property of the condemned was confiscated, and to limit the power of the nobles, and even of the clergy. In the assembly of the states held at Toledo, 1480, the erection of the new tribunal was urged by the cardinal. After the superior branches of administration—the supreme Council of Castile, the council of state, the board of finance, and the Council of Arragon—had been confirmed by the estates, the cardinal declared that it was necessary to establish a permanent tribunal, to take cognizance of matters of faith, and administer the ecclesiastical police. In spite of all opposition it was determined to establish a tribunal under the name of the General Inquisition (*Inquisicion Suprema*), and the new court was soon opened in Seville (1481). Thomas de Torquemada, prior of the Dominican convent at Segovia, and father-confessor to the Cardinal Mendoza, had already been appointed by Ferdinand and Isabella the first grand inquisitor in 1478. He had 200 familiars and a guard of fifty horsemen, but he lived in continual fear of poison. The Dominican monastery at Seville soon became insufficient to contain the numerous prisoners, and the king removed the court to the castle in the suburb of Triana. At the first *auto de fé* (act of faith; Portuguese, *auto da fé*) seven apostate Christians were burned, and the number of penitents was much greater. Spanish writers relate that above 17,000 gave themselves up to the Inquisition, more than 2000 were condemned to the flames the first year, and great numbers fled to the neighbouring countries. Many Jews escaped into Portugal, Africa, and other places.

The pope, however, had opposed the establishment of the Spanish Inquisition, as the conversion of an ecclesiastical into a secular tribunal. Soon after the appointment of the new inquisitor he had directed the Archbishop of Toledo, a warm enemy of Mendoza, to hold a solemn court upon a teacher in Salamanca, who was charged with heretical opinions, and the inquisitor-general was repeatedly summoned to Rome. Torquemada, however, did not obey the summons, but sent a friend to defend his cause. The contest between the pope and the Spanish court was carried on with heat until 1483, when Sixtus IV. was obliged to yield, and acknowledge Torquemada as inquisitor-general of Castile and Leon. He was also authorized by the Papal bull to establish inferior courts at pleasure, to remove those judges who had been appointed by the pope, and to regulate the manner of proceeding in inquiries respecting matters of faith according to the new plan. A later bull subjected Arragon, Valencia, and Sicily, the hereditary dominions of Ferdinand, to the inquisitor-general of Castile; and thus the Inquisition was the first

tribunal whose jurisdiction extended over the two Spanish kingdoms of Castile and Arragon; the Arragonese Estates, at their session at Tarragona in 1484, being obliged to swear to protect the Inquisition.

The introduction of the new tribunal was attended with risings and opposition in many places, excited by the cruelty of the inquisitors, and encouraged, perhaps, by the jealousy of the bishops; several places, particularly Saragossa, refused admission to the inquisitors, many of whom lost their lives; but the people were obliged to yield in the contest, and the kings became the absolute judges in matters of faith; the honour, the property, and the life of every subject was in their hands. They named the grand inquisitor; and by them, or under their immediate influence, were his assessors appointed, even the secular ones, two of whom were of the supreme council of Castile, laymen being permitted to hold the office. This tribunal was thus wholly dependent on the court, and became a powerful instrument for establishing the arbitrary power of the king on the ruins of the national freedom; for putting down the clergy, who had previously acknowledged only the jurisdiction of the Roman see; for oppressing the bold nobles, and taking away the privileges of the estates. The property of those who were condemned fell to the king; and, although it had been granted to the Inquisition, it was still at his disposal. Ferdinand and Isabella, indeed, devoted a part of this property to found convents and hospitals; but the church, notwithstanding, lost many possessions by means of the Inquisition; and an ordinance, drawn by Torquemada (1487), proves that it was a source of revenue to the king, supplying the treasury, which was exhausted by the war: the inquisitorial chest was indeed at that time drained by so many royal draughts, that the officers could not obtain their salaries.

The first ordinance, by Torquemada, dedicating the tribunal to the service of God and their majesties, bears date 1484. Among other articles are the following, showing the political importance of the institution. In every community the grand inquisitor shall fix a period, from thirty to forty days, within which time heretics, and those who have relapsed from the faith, shall deliver themselves up to the Inquisition. Penitent heretics and apostates, although pardoned, could hold no public office; they could not become lessees, lawyers, physicians, apothecaries, or grocers; they could not wear gold, silver, or precious stones, or ride, or carry arms, during their whole life, under penalty of being declared guilty of a relapse into heresy; and they were obliged to give up a part of their property for the support of the war against the Moors. Those who did not surrender themselves within the time fixed were deprived of their property irrevocably. The absent also, and those who had been long dead, could be condemned, provided there was sufficient evidence against them. The bones of those who were condemned after death were dug up, and the property which they had left reverted to the king.

Torquemada died in 1493, and was buried in the Dominican convent at Avila, which had been built with the property taken from heretics, and was a monument of his cruel zeal. He had resigned his office two years before, being afflicted with the gout. According to another account, Torquemada did not retire so quietly from the stage. It is said that, suspecting that Ferdinand and Isabella, whom the wars with the Moors had involved in great pecuniary embarrassments, would be moved by the great sums which were offered them to limit the privileges of the Inquisition, and, being disturbed by this apprehension, he went to the royal palace, with a crucifix under his mantle. 'I know your thoughts,' said he boldly to the sovereigns; 'behold the form of the crucified one, whom the godless Judas sold to his enemies for thirty pieces of silver. If you approve the act, yet sell him dearer. I here lay down my office, and am free from all responsibility; but you shall give an account to God.' He then laid down the cross, and left the palace.

At first the jurisdiction of the Inquisition was not accurately defined; but it received a more regular organization by the ordinance of 1484, establishing branches in the different provinces of Spain, under the direction of the inquisitor-general. In later times the supreme tribunal was at Madrid. The inquisitor-general presided. Of the six or seven councillors whom he appointed on the nomination of the king, one, according to an ordinance of Philip III., must be a Dominican. He had a fiscal, two secretaries, a receiver, two relators, and several *officials*, as they were called, who were appointed by the grand inquisitor, in concurrence with the king. The inquisitorial council assembled every day, except on holidays, in the royal palace; on the last three days of the week two members of the Council of Castile were present at the meeting. It was the duty of some of the officers (*calificadores*) to explain whether any act or opinion was contrary to the doctrines of the church; others were lawyers, who merely had a deliberative voice. The sentence of the Inquisition was definitive. It was the duty of the fiscal to examine the witnesses, to give information of criminals, to demand their apprehension, and to accuse them when seized. He was present at the examination of the witnesses, at the torture, and at the meeting of the judges, where the votes were taken. It was the duty of the registers, besides the preparation of the necessary papers, to observe the accuser, the witnesses, and the accused, during their legal examination, and to watch closely the slightest motion by which their feelings might betray themselves. The officials were persons sent by the court to arrest the accused. A *secuestrador*, who was obliged to give sureties to the office, kept an account of the confiscated property. The receiver took the money which came from the sale of sequestrated property, and paid the salaries and drafts on the treasury. It is computed that there were in Spain above 20,000 officers of the Inquisition, called *familiars*, who served as spies and informers. These places were sought even by persons of rank, on account of the great privileges connected with them. As soon as an accuser appeared, and the fiscal had called upon the court to exercise their authority, an order was issued to seize the accused. In an ordinance of 1732 it was made the duty of all believers to inform the Inquisition if they knew any one, living or dead, present or absent, who had wandered from the faith, or who did observe or had observed the law of Moses, or even spoken favourably of it; if they knew any one who followed or had followed the doctrines of Luther; any one who had concluded an alliance with the devil, either expressly or virtually; any one who possessed any heretical book, or the Koran, or the Bible in the Spanish tongue; or, in fine, if they knew any one who had harboured, received, or favoured heretics. If the accused did not appear at the third summons, he was excommunicated.

From the moment that the prisoner was in the power of the court he was cut off from the world. The prisons, called *holy houses* (*casas santas*), consisted of vaulted apartments, each divided into several square cells, which were about 10 feet high, and stood in two rows, one over the other. In the upper cells a dim ray of light fell through a grate; the lower were smaller and darker. Each dungeon had two doors. The inner, which was bound with iron, had

a grate, through which food was introduced for the prisoner. The other door was opened, early in the morning, to air the cell. The prisoner was allowed no visits from his friends or relations; no book of devotion was given him; he was compelled to sit motionless and silent in his dark cell. Only one captive was usually placed in each cell, unless for the purpose of making discoveries. At the first hearing the accused was called upon to confess his guilt. If he confessed the crime of which he was accused he pronounced his own sentence, and his property was confiscated. If he declared himself innocent, contrary to the testimony of the witnesses, he was threatened with torture. The advocate who was appointed to defend him could not speak to him except in the presence of the inquisitors. The accused was not confronted with the accuser nor the witnesses before the court, neither were they made known to him; and he was often subjected to the torture to extort a confession, or to explain circumstances which had not been fully explained by the witnesses. Those who escaped death by repentance and confession were obliged to abjure their errors, and to swear to submit to all the pains and penalties which the court ordered. Imprisonment, often for life, scourging, and the loss of property, were the punishments to which the penitent was subjected. He was made infamous, as well as his children and grand-children. Wearing the *san-benito* (the blessed vest of penitence, a sort of coarse, yellow tunic, with a cross on the breast and back, and painted over with devils) was a common method of punishment. An accused person who was fortunate enough to escape before the officers of the Inquisition could seize him was treated as an obstinate heretic. Summonses were posted up in all the public places calling on him to appear. If he did not do this within a certain time, and if the evidence of the witnesses proved the charges, he was delivered over to the secular power, and burnt in effigy. Persons who had been dead more than forty years were condemned, and, though their children retained possession of the property they had inherited, yet they were dishonoured, and rendered incapable of holding any public office.

When sentence of death was pronounced against the accused, the holy *auto de fé* was ordered. This usually took place on Sunday, between Trinity Sunday and Advent. At daybreak the solemn sound of the great bell of the cathedral called the faithful to the dreadful spectacle. Men of high rank pressed forward to offer their services in accompanying the condemned, and grandees were often seen acting as familiars to the Inquisition. The condemned appeared barefooted, clothed in the *san-benito*, with a conical cap (*caroza*) on their heads. The Dominicans, with the banner of the Inquisition, led the way. Then came the penitents, who were to be punished by fines, &c.; and after the cross, which was borne behind the penitents, walked the wretches who were condemned to death. The effigies of those who had fled, and the bones of the dead who had been condemned, appeared in black coffins painted over with flames and hellish forms; and the dreadful procession was closed by monks and priests. It proceeded through the principal streets of the city to the church, where a sermon was preached, and the sentence was then pronounced. The convicted stood during this act before a crucifix, with an extinguished taper in their hands. As 'the church never pollutes herself with blood,' a servant of the Inquisition, when this ceremony was finished, gave each of those who had been sentenced a blow with the hand, to signify that the Inquisition had no longer any power over them, and that the victims were abandoned (*relaxados*) to the secular arm. A civil officer, 'who was affectionately charged to treat them kindly and mercifully,' now received the condemned, bound them with chains, and led them to the place of execution. They were then asked in what faith they would die. Those who answered the Catholic were first strangled; the rest were burned alive. The *autos de fé* were spectacles to which the people thronged as eagerly as to the celebration of a victory. Even kings considered it a meritorious act to be present with their courts, and to witness the agonies of the victims.

In this manner did the Inquisition proceed in the times of its most dreadful activity. The Spaniards found their personal freedom so much restrained, even in the early period of the existence of this office, that one of the principal requests of the disaffected in the reign of Charles I. was that the king should compel the Inquisition to act according to the principles of justice. But the important influence which this court had in the course of the following century, both on the state and on the moral character of the Spaniards, could not at that time have been anticipated. This noble and high-spirited people were more debased by the dark power of the Inquisition than by any other instrument of arbitrary government, and the stagnation of intellectual action which followed the discovery of America concurred, with other fatal causes, to diminish the industry of the people, to weaken the power of the state, and to prevent for a long time any progress to higher degrees of moral and intellectual improvement. In more modern times, when the spirit of persecution was restrained in almost all other countries of Europe, the original organization of the Inquisition was but little changed; still the dread of this dark court gradually diminished. The horrible spectacle of an *auto de fé* was seldom seen in the eighteenth century, and the punishments of the Inquisition were confined in a considerable degree to those men who had become obnoxious to justice. In 1762, the grand inquisitor having, contrary to the express will of the king, published a bull excommunicating a French book, was exiled to a monastery at a distance from Madrid. A royal decree forbade the Inquisition to issue any commands without the consent of the king, and required the grand inquisitor in the condemnation of books to conform to the laws of the land, and to make known his prohibition only by virtue of the power given him by his office, and not with the citation of bulls. The decree also ordered that before prohibiting any book the author should be cited that his defence might be heard. In 1770, during the administration of Aranda, the power of the Inquisition was limited to the punishment of obstinate heretics and apostates, and it was forbidden to imprison any of the king's subjects without first fully proving their guilt. In 1784 it was determined that if the Inquisition instituted a process against a grandee, a minister, or, in short, against any officer of rank, its acts must be subjected to the royal inspection.

If we consider the principal acts of the Inquisition during the eighteenth century, we shall see that, notwithstanding the restraint exercised over it, it still remained an instrument which, under favourable circumstances, might exert a terrible influence. There were sixteen provincial inquisitions in Spain and the colonies, all subject to the supreme tribunal. As late as 1763 we find that at an *auto de fé* at Llerena some obstinate heretics were committed to the flames, and in 1781 a poor woman of Seville was declared guilty of witchcraft, and was burned alive at the stake. With all the limits which had been set to its power; with all the mildness of the tribunal, whose principal officers under the preceding reigns had been mostly men of intelligence and moderation, still the odious spirit of the institution and the unjust form

of procedure survived; and until it was abolished by Napoleon, December 4, 1808, the Inquisition continued to be a powerful obstacle to liberty and progress. After a temporary revival it was finally abolished in 1834. According to the estimate of Llorente the number of victims of the Spanish Inquisition from 1481 to 1808 amounted to 341,021, 31,912 being burned, 17,659 burned in effigy, and 291,456 subjected to severe penance.

In Portugal the Inquisition was established, after a long contest, in 1557. The supreme tribunal was in Lisbon; inferior courts, established in the other cities, were subject to this. The grand inquisitor was nominated by the king, and confirmed by the pope. As the Spaniards took the Inquisition with them to America, so the Portuguese carried it to India, and established it at Goa. In the eighteenth century the power of the Inquisition in Portugal was restrained by the ordinance which commanded that the accuser of the court should furnish the accused with the heads of the accusation and the names of the witnesses, that the accused should be allowed to have the aid of counsel, and that no sentence of the Inquisition should be executed until confirmed by the royal council. In 1815 it was abolished in the Portuguese dominions. The Inquisition, abolished for Italy by Napoleon in 1808, restored in Rome by Pius VII. in 1814, still exists, nominally at least, as one of the 'congregations'. It used to have the censorship of the press. Among the best works on the Inquisition are Llorente's Histoire critique de l'Inquisition d'Espagne (Paris, 1815–17; in English, London, 1827); and Lea's History of the Inquisition (three vols., 1887–88).

INSANITY, Mental Derangement, Unsound Mind. A recent American writer, mentioning the difficulties which surround the study of insanity, says, 'Certainly it should not be the reproach of science, if it be not given to man, with his mundane qualities, to comprehend the mysteries of the Creator'—and it is in this spirit that the study of insanity should be approached. Endless in its varieties, infinite in its human interest, and a disorder that may at any time attack the best and strongest, it is surely one of the most absorbing and most interesting of human studies. To a certain point we can go, but beyond that who can say what causes the mysterious change that produces the phenomena of unsoundness of mind, the mental derangement that we call insanity. We can discover lesions of the spinal cord and the brain, thickenings of membranes, excess of fluids, hardness, deficiency of convolutions, and the smallest microscopic alterations in the minutest cells of the brain, but we cannot hope to fathom the mystery that envelops the actual demonstrations of these lesions in the living man, nor can we say why recovery may take place in so many instances, while other cases are hopeless from the first. Many causes have been adduced for insanity, but when concentrated together they seem very much to contain one special attribute, and that is selfishness, in the sense of self-concentration on self. This may at the outset seem a strange theory, but it bears some little truth on the face of it, for from the earliest beginnings, from the selfish irrationality of the morbidly bad-tempered child or hysterical woman, who during their paroxysms are for the moment insane, who take no heed of time, place, surroundings, or the convenience of others, can we not trace it through pubescent and adolescent insanity, through the morbid self-concentration of the melancholic, and the reckless selfishness of the general paralytic, to its culminating point in the cowardly, half-devilish selfishness of the homicide and suicide. The greatest trait of the sound mind is endurance, the most pitiful point in the unsound is lamentable deficiency of power of enduring anything. The healthy mind rebounds and reacts in trouble; the morbid mind is crushed, and yields to the pressure in varying ways and in varying degrees, and the distortion remains more or less. It seems as though all the crises of life, *e.g.* the commencement of education, the production of teeth, the onset of puberty, the period of reproduction, the access of responsibility, the cessation of reproduction, and the advance of decay and dissolution were all able to affect certain minds, which, escaping some of them, fall victims to the others. For these it is hardly right to blame entirely the individual, but it will be found nevertheless that it is hardly fair to throw all the blame upon the crisis, for so much depends on the care he or she has taken to fit themselves for it when it comes. It is here, of course, that example, training, and environment are so much concerned, all of which affect the mind imperceptibly, but no less surely. It is here that the selfishness of former generations comes in, for it is certain that debauchery, disease, dissipation, and other faults in the parents will, to say the least, diminish the power of their offspring's resistance to the pressure of the crises of life.

The causes of insanity, considered categorically, have been described as moral and physical. The moral causes are the so-called passions, joy, grief, anger, fear, anxiety, and such things as social upheavals of religious and revolutionary origin; the physical are such things as diseases, wounds or injuries, sensual indulgence, masturbation, drink, privation, heat and cold, while climate and the seasons of the year are also mentioned. In England the sexes are fairly equal in their liability, but in the last Blue-book females are in the majority. The same volume states that the 'known' lunatics now amount to one in every 301 members of the estimated population.

The old division of Esquirol of the varieties of insanity into mania, melancholia, dementia, and idiocy was a simple and useful one, but it has been found inadequate, and the latest classifications seek to indicate other forms that do not exactly fit in with either of these, and the Medico-Psychological Association of Great Britain and Ireland has printed the following:—

1. Congenital or infantile mental deficiency, (*a*) with epilepsy, (*b*) without epilepsy.
2. Epilepsy (acquired), *i.e.* from convulsions, injuries, &c.
3. General paralysis of the insane.
4. Mania—recent, chronic, recurrent, from drink, puerperal, senile.
5. Melancholia—recent, chronic, recurrent, puerperal, senile.
6. Dementia—primary, secondary, senile, organic, *i.e.* from tumours, coarse brain disease.
7. Delusional insanity.
8. Moral insanity.

To describe these in detail would exceed the limits of this article. The list is given to show how many and varied are the kinds of insanity met with, and the extreme difficulty of arrangement of them in anything more than types, for as no two men are exactly alike, so no two cases of insanity are exactly similar.

Nos. 1 and 2 are partly dealt with under the heading Idiot. No. 3 is one of the most insidious disorders that attacks civilized mankind, which runs a certain definite course, beginning with alteration, mania, and exaltation, with grandiose ideas and delusions, going on to dementia with or without epileptiform seizures, and ending in fatuity and paralysis in from two to five (or even more) years.

4. *Mania* (Greek, *mania*, madness). The vulgar

idea of a 'madman', is more realized in this than in any other variety of insanity, distinguished as it is by disorder of conduct, of motion, and of faculties, accompanied by extravagance of gesture, speech, and language, with here and there some approach to occasional sense. The varieties almost explain themselves. Recent or acute mania may come on suddenly from any of the physical or moral causes, and mania as a rule attacks those who are past childhood. Recovery may take place under treatment, and usually does unless there is great exhaustion, or great mismanagement of the case. It may, however, recur, and that several times, and a condition of chronic mania, or feeble-mindedness ensue. Mania from drink is characterized by hallucinations of sight, and delusions of persecution. All maniacal states are generally ushered in by alteration of conduct, and especially by want of proper sleep, and all, especially puerperal mania, need the most careful nursing and feeding, and as, in the majority of cases, enmity against those nearest and dearest is conspicuous, removal from home is generally advisable, and a well-organized institution is generally necessary. Modern science insists that nursing, feeding, quiet, and rest are essential in these cases.

5. *Melancholia*, so called from the old idea of the ancients that 'black bile' (Greek, *melas, cholē*) was the cause, is infinite in its varieties and in the seriousness of its onset. It attacks all ages and both sexes, the female sex more than the male. There are nearly always delusions somewhere, and they ought, if possible, to be discovered, for melancholia is the usual prelude to suicide or suicidal attempts—and no effort should be spared to counteract this. The difficulty is to know when to interfere, and this hesitation has much to do with the appalling suicide statistics of this modern time. The melancholic can, and does, disguise his symptoms, and rarely, except in so-called active melancholia, does he give any disordered expression to his trouble; he will rather alter in his usual habits, withdraw from society, abandon his pursuits, or be observed to shun daylight, to avoid anything pleasurable, or to neglect himself and his affairs. So he nurses his griefs till control breaks down, and then he either tells them to others and begs for help, or does some rash and selfish act. Every case of melancholia thinks his or her own case the worst that ever existed, and self and egotism enter largely into the delusions and ideas developed. Physical ill-health, insomnia, morbid religious ideas (committal of the unpardonable sin and so on), anxiety and overstrain in the pursuit of wealth and ambition, and the puerperal and characteristic conditions in the female, are the most common causes. The worst time is the morning after waking, and the cloud sometimes lifts towards evening, to return again at times, at bed-time or in the night. They accuse themselves of crime, of loss of affection and natural feeling for anyone, and even call themselves devils and fiends; but many acute cases recover, and continue well for many years. Every variety of delusion is to be met with; fears of poison and the like may lead to refusal of food, and ideas of persecution to acts against others. Bodily ailments of all kinds are complained of, and in the more chronic conditions long-continued silence, apathy, and indifference to everything, or some constant movement with reiteration of a word or sentence may be noticed. Cases of melancholy often recover (sometimes almost suddenly) after long periods—and recover completely,—but some bear traces of the disorder, and may be liable to its recurrence or to attacks of mania alternating with it. If death ensues it is from some intercurrent disorder as a rule, and pneumonia and tuberculosis are often the cause. Treatment depends greatly on the intensity of the symptoms. Removal from home is essential, and the danger of suicide must never be lost sight of. Success largely depends on the proper estimation of the necessities and capacities of the individual case.

6. *Dementia.*—Except for a rare disorder, the primary dementia of the young adult, often recovered from, dementia is the sequel of other disorders of the brain, and may mark the close of general paralysis, be the result of recurrent attacks of mania or melancholia, or, as the list implies, be the outcome of coarse disease of the brain. Cases of dementia form a large portion of the population of our asylums.

7. *Delusional Insanity—Paranoia*—is the most difficult to understand of all the insanities. The popular mind cannot grasp the idea that a man or woman can go about the world to all outward seeming little different from anyone else, and yet be the victims of delusions and ideas that govern and control his or her life. Delusional insanity is essentially the disorder of the degenerate, and heredity plays a large part in its causation. Beginning with introspection, probably always with sexual perversion of some kind, shyness, and eccentricity, the victim of this disorder goes on through phases of mistrust and suspicion of others, becomes more wrapt in himself, seeks reasons for everything however trivial that he feels, or thinks he feels, gets perversions of senses, and by degrees, in seeking to account for these, develops delusions of persecutions and extraordinary ideas of his own importance. He will collect proofs of government, secret society, and social conspiracies against himself, and eventually either ends by becoming dangerous to others or to society generally, and so, after many escapades, in which Platonic and other affection of morbid character may take part, and the lives of many placed in jeopardy, is at last confined as chronically insane. He may even remain at large, give out that he is the bringer of some new message to mankind, and may actually secure a following who suppose him to be of great importance, perhaps great sanctity. This is not an imaginary picture; these cases exist, and in large numbers.

8. *Moral insanity*, Dr. Prichard wrote in 1853, 'consists in a morbid perversion of the natural feelings, affections, inclinations, temper, habits, moral dispositions, and natural impulses, without any remarkable disorder or defect of the intellect, or knowing and reasoning faculties, and particularly without any insane illusion or hallucination'. It has been well said by another writer that the child has to subordinate the gratification of its desires to the wishes of its parents, and so the man comes to know that 'present gratification and pleasure must be controlled in order to attain more distant good'. It is those who seem unable to realize this that are comprised under this head: men who voluntarily reduce their minds by drink, who, from any cause that seems to give them gratification, alter their usual habits, take a less healthy view of things, set convention at defiance, or consort with those whose society they before loathed. Though it may be said that such persons have no intellectual defect as expressed by delusion, yet by their insanity of conduct and their perversion they reduce themselves to a level which may vary in degree, but which nevertheless shows unsoundness of mind. Under this head come not only the drunkard, the drug-taker, and the 'ne'er-do-weel', but that large class to whom affection spells lust, to whom gratitude is unknown, and who never heard of sympathy or self-command, or in whom these qualities, and the satis-

faction they bring, have changed and become perverted. See also LUNATIC ASYLUM.

INSCRIPTION, in archæology, is used to designate any monumental writing intended to commemorate some remarkable event, to preserve the name of the builder of a monument, or of the person in whose honour it was erected, &c. Inscriptions are one of the most important sources of history, particularly for the earlier periods of nations, when other written documents are rare or entirely wanting, and tradition is the only medium of historical knowledge. After the invention of an alphabet the earliest application of the art of writing will probably be by engraving on wood, stone, or metals; and after other and more convenient materials have come into common use this method is often preferred for many purposes on account of the greater durability of the material. We have inscriptions therefore from all nations who have arrived at a certain stage of civilization, on walls of temples, tombs, triumphal monuments, tablets, vases, &c., containing laws, decrees, treaties, religious legends, moral, philosophical, or scientific precepts, chronological tables, &c., generally contemporary with the events they commemorate. Indian, Persian, Egyptian, Phœnician, Etruscan, Grecian, Roman, &c., inscriptions have been diligently studied, and have made important revelations in the hands of learned and ingenious men. The decipherment of the Egyptian hieroglyphics and of the cuneiform inscriptions of Assyria, Babylonia, and Persia may be ranked among the chief achievements accomplished by the scholarship of the nineteenth century. No satisfactory interpretation of the Etruscan inscriptions has as yet been given to the world, though more than one scholar has professed to have found the key. See CUNEIFORM WRITING, HIEROGLYPHIC WRITING, PALÆOGRAPHY.

INSCRIPTIONS, ACADEMY OF. See INSTITUTE OF FRANCE.

INSECTIVORA, 'insect-eaters', an order of mammals which are plantigrade, have a clavicle, whose incisor teeth are larger than the canine, and whose molar teeth have several pointed cusps. They are separated from the Carnivores by the smaller canines, the pointed crown of the molars, and by the placenta being discoid, not zonular. The order has points of resemblance to several other groups. Thus, the hedgehog corresponds to the rodent porcupine, the shrew to the rodent mice; the tupaya or banxring to the squirrel and to the lemurs; the mole to Spalax, &c. The Erinacei include the European hedgehog and the later tertiary species. The living hedgehogs are characterized by the cutaneous spines, amid which is abundant woolly hair, and by the capacity to roll the body into a ball, or rather to pull the dorsal skin into a sac by means of the *cucullaris* muscle. The Sumatran genus *Gymnura* has not this power. The *Centetina* form two groups, one with no tail, or only a short one, as *Centetes*, the tanrec; the tendrac, *Ericulus*, Geoff.; and the *Echinogale*, all peculiar to Madagascar. Of the last genus a species is found fossil in Auvergne. The other group with tails not less than the length of the body comprises *Potamogale* of Lower Guinea, and the *Solenodon* of Cuba. The arboreal *Cladobates*, *Tupaia*, and *Hylomys* are all peculiar to the Malayan Archipelago and Peninsula. The jerboa-like *Macroscelides* represents a group confined to Mozambique. The small mouse-like shrews form two sub-families: one, *Soricina*, of terrestrial habits, the other *Myogalina*, aquatic and possessing webbed feet. The moles, *Talpina*, whose anterior limbs are modified for digging purposes, have a wide distribution in space, and range in time from the Miocene period. See plate at CHEIROPTERA.

INSECTS. Having already, in the article ENTOMOLOGY, given an account of the classification of insects, with special reference to the plates, we shall here give some information as to the affinities of the class. This group of articulated animals shows an advance in organization as compared with the Arachnidans or the Crustaceans, in so far as the three segments of the body, head, thorax, and abdomen, are in almost all distinct; the thorax alone has locomotive limbs and wings. The head contains the first part of the alimentary canal, the first pairs of ganglia, and the sense organs, while the digestive organs are lodged in the abdomen, except, of course, the œsophagus and salivary ducts when present. Further, while the number of distinct rings of which the body is made up is obscured, so that the abdomen, and frequently the thorax, seem to consist of an undivided mass, a corresponding reduction in the number or fusion of nervous ganglia is met with. The respiration is aerial and effected in nearly all by tracheal tubes, which only show saccular dilatations in insects of rapid or long-sustained flight, as the bees. The relations of this group to the other articulated animals are interesting. The wings, which, when present, distinguish insects from all other invertebrate animals, are wanting in some orders, as the lice, or, as in the aphides, are only developed in sexually mature forms, which appear towards the end of summer; are of normal dimensions in the male of the glowworm, but rudimentary in the female; or, as in *Stylops*, are absolutely wanting in the female, which is wormlike and parasitic in the bodies of hymenopterous insects. These appendages, thus variable, are at first saccular prolongations of the integument, which, after the insect escapes from the pupa-case, harden so as to be useful in flight. They find their counterparts in the lamellar gills which project from the sides of the larvæ of the May-flies, dragon-flies, and such beetles as *Gyrinus*, which spend the earlier part of their lives in the water. As one genus, *Polymema natans*, uses its wings in swimming, and as in *Chloëon*, one of the Ephemeræ, the branchiæ are kept in constant vibration, there is cumulative support for the view that the wings are branchial appendages which have been in the first instance used as locomotive organs in water and moist soil, and later employed for flight. The stigmata, or openings which permit the access of air to the interior of the tracheal tubes, by which it is conveyed to every part of the economy, are, in the case of the aquatic larvæ above mentioned, in the position of the branchiæ, which drop off as maturity is attained. The replacement of the one system by the other is simple, and is explained by such cases as the *Aeshna*, one of the dragon-fly family, which possesses tracheal lungs, or respiratory tubes to which the air, separated from water, has access through the intestine. The closure of the intestinal orifice and the opening of the stigma would coincide with the change from aquatic to aerial life. This hypothesis involves the tracing back of the insects to some common ancestral form of aquatic habits and provided with gills on the thoracic and abdominal rings or somites, such common form having a tracheal system one end of which communicates with the cavity of the intestine. Lubbock (Lord Avebury) has pointed out that among the *Collembola*, an obscure group of wingless insects, *Campodea* presents a form nearly approaching that of the hypothetical ancestor, the thoracic and abdominal somites being similar. The absence of all traces of external gills from these forms is explicable by reference to the law which Darwin has established, that parental peculiarities tend to be developed in the offspring at successively earlier periods for each generation, so that ultimately the gills would not appear at all while the stigmata corresponding to

their position were opened. This is a condition exactly parallel to that of the mammals, birds, and reptiles, as compared with the amphibians and fishes; for whereas the last two groups have gills at some period of life, the first three never have, yet the arches from which the gills projected are present in all alike, their number being, however, least in the mammals. The claim of *Campodea* to be regarded as representing the ancestral insect form is strengthened by two considerations. In the first place, that genus approaches the annulose type, recalls the worms properly so called in the number of similar segments of which it is composed; this tendency to greater simplicity of type being presumably the index of greater antiquity. In the second place, the *Campodea* form is in general terms that of a Myriapod in which the head only illustrates the fusion of rings, so that their primitive distinctness is lost sight of, though of course the hexapod character, that is the presence of three pairs of thoracic limbs, reduces the resemblance to a general one. But the chief argument is that founded on the character of the masticatory apparatus. Two groups have been defined by this test: A. *Mandibulata*, those having cutting apparatus: Coleoptera, Orthoptera, Homoptera, Hymenoptera, Strepsiptera. B. *Haustellata*, those in which the oral appendages form suctorial tubes: Hemiptera, Diptera, Aphaniptera, Aptera, Lepidoptera. Agassiz pointed out that the caterpillar of the butterfly had a cutting oral apparatus, whereas the adult, the butterfly, had the appendages so modified as to constitute a long suctorial proboscis. Now, as the jaws of insects are only locomotive limbs modified so as to serve for mastication, their condition in the caterpillar is more nearly that of the embryo than is the suctorial tube. Agassiz therefore arranged the insects so that the Coleoptera or beetles with hard cutting jaws were at the bottom of the scale, the Lepidoptera, or butterflies and moths with suctorial tubes, at the top, and the Hymenoptera or bees, &c., held an intermediate place. Westwood has arranged the insects in two groups: Heteromorpha, in which the young differ greatly from the adult; and Homomorpha, in which the amount of change is less. But this arrangement rests upon the change of form; Agassiz urged that even though the larval beetle was not very like the adult winged insect, yet in essentials the change was not so great; both adult and young consumed solid food, and in elongation of body, greater distinctness of somites, and simplicity of nervous system the adult differed less from the larva than it did from a butterfly, still less than the butterfly differs from the caterpillar. But Lubbock's observations on *Campodea* place that form as intermediate between the Mandibulate and Haustellate group; these two being thus derived, not the latter from the former, but both being modifications of one common form. This view seems more probable than that urged by other writers, that perfect insects existed before larvæ and pupæ, in other words, that these stages in the development of perfect insects were the product of later times, were, indeed, adaptations to altered external conditions. According to this view metamorphosis had reference to greater drought, or wet, or cold, or other condition which delayed evolution for a time, and during this time vitality had to be maintained; the metamorphosis enabled the young to overpass the time of danger, and therefore became a permanent possession of the race. But there are two types of larvæ, the one vermiform, the other Campodea-like, a wingless hexapod larva; the former, being inferior in every way in organization, may be a later product; but the latter may be held by every analogy to represent an ancestral type. Campodea has long passed the aquatic era of its existence; other groups of living insects still pass through such a period. In development, therefore, the latter are still behind the former; they repeat more nearly the ancestral habits. There has been, in fact, great difference in the *rate* of evolution. The geological evidence is similar. Lepidoptera appear in Tertiary strata; Diptera, Hemiptera, Hymenoptera in the Oolitic, Coleoptera in the Carboniferous, Neuroptera and Orthoptera in the Devonian rocks. In insects, therefore, as in other groups, some forms early attained the organization which they have since retained, others only recently acquired high specialization, while some have departed but little from the original type.

INSESSORES (Latin, *insideo*, I sit upon), a term denoting the 'perching' birds, and applied to distinguish an order of the bird-class which includes the vast majority of the smaller and more familiar members of that group. The term Insessores is seldom used in modern systems of classification, because the group denoted by it is a purely arbitrary one. Besides the birds now classed as Passeres or Passeriformes, it includes many of the Picariæ and some of other orders. The *insessorial* birds are distinguished from the other orders of birds chiefly by their negative characteristics—that is, they want the positive and definite characters which distinguish these orders.

The form of the beak varies widely throughout the order, and four sub-orders or sub-divisions of the group have been founded upon the differences in conformation of this structure. The *Conirostres*, or 'conical-beaked' Insessores, are represented by the families of the Crows (*Corvidæ*), the *Buceridæ* or Hornbills, the Starlings (*Sturnidæ*), the Crossbills (*Loxiadæ*), the Finches, Larks, &c. (*Fringillidæ*). The birds of this division are distinguished by the conical shape of the beak, and by the fact that the upper mandible bears no distinct serrations or teeth-like processes. The second division is that of the *Dentirostres* or 'toothed-beaked' perchers, in which the hooked upper mandible is distinctly notched or toothed at its tip. The predaceous type is most strongly developed in these of all the insessorial forms. The *Laniidæ* or Shrikes, Fly-catchers or *Muscicapidæ*, Warblers or *Sylviadæ*, Tits (*Parinæ*), and Thrushes (*Merulidæ*) represent this group. The third sub-order, or *Tenuirostres*, are so named from the slender conformation of the beak, and in these birds there is a slender conformation of the toes also. In this group are included the Hummingbirds (*Trochilidæ*), the Creepers (*Certhidæ*), the Hoopoes (*Upupidæ*), the Honey-birds (*Meliphagidæ*), and the Sun-birds (*Promeropidæ*). The last subdivision is that of the *Fissirostres* or cleft-beaks, distinguished by having the 'gape' or line of separation of the mandibles carried far back into the head, the gape extending backwards even under the eyes. The sides of the gape are usually provided with 'vibrissæ' or stiff bristly filaments, which assist in the capture of the insect prey. The sub-order includes the *Meropidæ* or Bee-eaters, the *Alcedinidæ* or Kingfishers, *Hirundinidæ* or Swallows and Martins, the *Cypselidæ* or Swifts, and the Goat-suckers (*Caprimulgidæ*).

INSIGNIA, the name given to outward marks of power and dignity, such as the crown and sceptre of a king, the mitre and ring of a bishop, &c.

INSOLVENCY. See BANKRUPT.

INSPIRATION, in theology, is the infusion of ideas into the human mind by the Holy Spirit. By the *inspiration of the Scriptures* is meant the influence of the Holy Spirit exercised on the understandings, imaginations, memories, and other mental faculties of the writers, by means of which they were qualified for communicating to the world divine revelation, or the knowledge of the will of God, without error or

mistake. Theological writers have enumerated several kinds or degrees of inspiration, which are founded upon the supposition that God imparted to the sacred penmen that measure and degree of assistance which was just suited to the nature of the subjects which they committed to writing, and did not supersede the use of their natural powers and faculties, and of their acquired knowledge, where these were sufficient. The measure of divine assistance which enabled Moses to give an account of the creation, Joshua to record with exactness the settlement of the children of Israel in Canaan, David to mingle prophetic information with the varied effusions of gratitude, contrition, and piety, Isaiah to deliver predictions respecting the Messiah, and the evangelists to relate in their several styles and ways the life and transactions of Jesus Christ, has been termed inspiration of direction. In some cases inspiration only produced correctness in narrating past occurrences, and preserved the writers generally from relating anything derogatory to the revelation with which it was connected. This has been termed inspiration of superintendency. Where, indeed, it not only communicates new ideas, but has also imparted greater strength and vigour to the efforts of the mind than the writers could otherwise have attained, this assistance has been called inspiration of elevation. Further, when the prophets or apostles received such communications of the Holy Spirit as suggested and dictated minutely every part of the truths delivered, this, which is the highest degree of divine assistance, is called inspiration of suggestion. All orthodox theologians agree in ascribing divine assistance to the scriptural writers, but the mode of inspiration, the degree and extent of it, are all questions of dispute. The advocates of *plenary* inspiration assert that every verse of the Bible, every word of it, every syllable, every letter is the direct utterance of the Most High. It is further held by this school that what God has so inspired he must have miraculously preserved. Inspiration is essentially intermitting; it is a divine afflatus controlling the soul at some moments, abandoning it at others; it may visit the ignorant or the learned, the good or the bad; the words pronounced under its influence are held infallible, not so those spoken in ordinary circumstances. In opposition to this theory some writers confine inspiration to all that is directly religious in the Bible, to all that is matter of direct revelation, leaving out of the question all that belongs to the domains of science or ordinary history, all that can be known by ordinary intellectual application. Other authorities attribute inspiration only to the spirit, ideas, or doctrines of the Scriptures, exempting the strict form or letter. Some go yet further, and include in the fallible sections the mode of argument and expository details. In support of this theory numerous passages from the Bible have been quoted which appear contradictory or show ignorance of history or science. Notwithstanding all the learning and acumen devoted in modern times to this topic, there is no general agreement regarding inspiration, though comparatively few now accept the doctrine of plenary inspiration, and many refuse to believe that the Bible is in any special sense inspired. The Bible itself gives little that is definite regarding inspiration, but it is clear that Christ and the writers of the New Testament regarded the Old Testament as in a special sense God's word, and a similar view regarding the New Testament has been held from the earliest times.

INSTANCE. On the European continent a court is said to be of the *first instance* when it has original jurisdiction of a case; of the *second instance* when it has appellate jurisdiction from a lower court; of the *third instance* when it has appellate jurisdiction from courts of the second instance. In some cases, generally criminal, a court may be of the first or second instance according to the place where the process was begun; for instance, if a man is tried in Prussia for a high crime and found guilty, he appeals, and the case is sent to another criminal court, chosen by the government, which in this case is of the second instance; while in the next case, perhaps, the situation of the two courts may be reversed. To *absolve ab instantia* means to absolve a person from an accusation without carrying through the process.

INSTERBURG, a town of Prussia, province of East Prussia, in the government of and 16 miles west from Gumbinnen, capital of the circle of same name, at the confluence of the Angerapp and Inster, which here form the Pregel. It has a superior court of law, several public offices, two churches, a castle, several superior schools, and an infirmary; manufactures of linen, leather, and earthenware; iron-foundries, a distillery, brewery, and a trade in corn, cattle, pigs, yarn, &c. Pop. (1895), 23,544; (1900), 27,287.

INSTINCT is, according to some writers, that impulse produced by the peculiar nature of an animal which prompts it to do certain things without being directed, in acting thus, by reflection, and which is immediately connected with its own individual preservation or with that of its kind. Thus, we are told by one school of philosophers the new-born duck hastens to the water, the infant sucks without being taught to do so. All the instincts of animals appear in the selection of food, avoiding of injurious substances, taking care of their young and providing for them before they are born. According to other authorities instinct embraces all the unconscious intelligent acts of animals, and there are actions of all grades from the most instinctive to the most rational. All intelligent acts are done at first consciously; by constant repetition the voluntary effort gradually decreases, until at last none is necessary, and then the habit becomes an unconscious intelligent act or instinct. According to this theory, therefore, instincts are simply habits which have been repeated for a long period of time. The great objection to this theory is that instincts are possessed by individual animals which by no possibility can have contracted confirmed habits, nor even learned them from their parents, as for instance the acts of the chick to break the egg in which it is inclosed. It is, however, suggested that habits and instincts are transmissible from one generation to another by inheritance, in which case instincts will be merely the habits which the species or line of descendants have repeated for the longest time and with the greatest frequency; and evidence abounds in zoological works of habits of every degree of tenacity, from the action of the moment to the instinct of centuries, and of the newly contracted habits of an individual being transmitted to its progeny. There has been a tendency hitherto to underestimate, even to ignore, the acquired knowledge of animals, and it has become a matter of wonder that they should be able to do instinctively what man requires an education to perform. We are as yet ignorant of how far imitation can operate in the lower animals, or to what extent they can derive instruction from the elders of their tribe. The analogies of the human feelings, intellect, and will might to a considerable extent explain their conduct without driving us to the supposition that a special revelation is made to them at every turn of their career by which they unerringly choose what is beneficial and avoid what is injurious—a provision denied to the highest form of the animal organization.

INSTITUTE OF FRANCE. This learned body, which was organized after the first storm of the French Revolution, during which all the academies

of learning and arts in France had been suppressed, was formed by the decree of the 25th October, 1795, to replace the Académie Française, the Académie des Sciences, and the Académie des Belles Lettres et Inscriptions. Its object was the advancement of the arts and sciences by continual researches, by the publication of new discoveries, and by a correspondence with the most distinguished scholars of all countries, and especially by promoting such scientific and literary undertakings as would tend to the national welfare and glory. The Institute was composed of a number of members residing at Paris, and an equal number of associates (*associés*) in the different parts of the republic. Each class could also choose eight learned foreigners as associates. It was at first divided into three classes, each of which was subdivided into several sections. The first class embraced the physical and mathematical sciences, the second the moral and historical, and the third literature and the fine arts. The number of active members, exclusive of the *associés*, was limited to 144. The National Institute received, however, its final organization by a decree of the 3rd Pluviose of the year 11 (January 23, 1803). It was then divided into four classes—1, the class of the physical and mathematical sciences, consisting of sixty-five members; 2, the class of the French language and literature, consisting of forty members; 3, the class of history and ancient literature, of forty members; and 4, the class of the fine arts, with twenty-eight members. In the last years of the imperial government the title of the National Institute was exchanged for that of the *Imperial Institute*. The restoration of the Bourbons gave rise to new changes in this learned body, which restored it in some degree to its original condition. A royal ordinance of March 21, 1816, first restored the former names of the classes, so that the name of *Institute* was applied only to the whole body collectively. The same ordinance assigned the first rank to the Académie Française, as being the oldest; the next rank to the Académie des Inscriptions et Belles Lettres; the third to the Académie des Sciences; and the last to the Académie des Beaux Arts. These united academies were under the personal direction of the king, and each had an independent organization and a free disposition of the funds committed to them. To each academy were attached ten honorary members, who had merely the right of being present at the meetings. Such of the former members as had returned became again members of their respective academies. In 1832 the old class of Sciences Morales et Politiques was reconstituted as a separate academy, so that there are now five academies.

The *Académie Française* had for its chief object the cultivation of the French language, and was charged with the composition of a French dictionary, the merits of which have been often disputed and its plan condemned. As every one who has brought a *vaudeville* on the stage with success thinks himself entitled to a place among the forty members of 'the Academy', these places afford the most fruitful subjects for squibs and satire, and the disposal of the vacant chairs has been often by no means regulated by the best taste and judgment, Molière and La Bruyère being rejected, while the shallowest court favourites were accepted.

The *Académie des Inscriptions et Belles Lettres* has forty members, ten free academicians, and eight foreign associates. It has forty correspondents at home and abroad, and devotes itself chiefly to subjects of an historical nature. The most distinguished scholars, both in and out of Europe, are, or have been, connected with it. Committees of this academy superintend the erection of public monuments and the preservation of those already in existence. Works brought out under its auspices are: Histoire Littéraire de France, Recueil des Historiens de France, and Corpus Inscriptionum Semiticarum.

The *Académie des Sciences* has for its province the various branches of knowledge connected with the physical and mathematical sciences, natural history, medicine, &c., there being in all eleven sections. It has 66 members, 10 free academicians, and 100 correspondents. The number of its *associés étrangers* is limited to eight. Among former *associés étrangers* we may mention Faraday, Brewster, Sir J. W. Herschel, and Sir Richard Owen.

The *Académie des Beaux Arts* has 40 members, 10 free academicians, 10 foreign associates, and 61 correspondents. A committee of this academy was charged with the publication of a dictionary of the fine arts, of which some volumes have appeared.

The *Académie des Sciences Morales et Politiques*, has 40 members, 10 free academicians, 6 foreign associates, and 48 correspondents.

This distinguished body, after having been called *National*, *Imperial*, and *Royal* at different times, is now the *Institut de France*. Members are elected for life by ballot, and have an annual salary of 1500 francs.

INSTRUMENT, in music, any sonorous body, artificially constructed for the production of musical sounds. Musical instruments may be divided into three main kinds—wind-instruments, stringed instruments, and instruments of percussion, and of these there are various subordinate divisions. Thus, of wind-instruments there are wood-winds and brasses; among stringed instruments some are played with the fingers, as the harp, others with a bow, others by means of keys and hammers, as the piano. Instruments of all the chief kinds are of extreme antiquity, and it is impossible to say how old some sort of flute or pipe, or some sort of lyre or harp, may be. But of course it took long to perfect a complicated instrument like the piano. The modern stringed instruments include the violin, viola, and violoncello; the harp, mandoline, and guitar, the piano, &c.; wind-instruments, the flute, clarinet, oboe, cornet, horn, trumpet, ophicleide, organ, &c.; those of percussion, the drum, tambourine, cymbals, triangle, &c. See ORCHESTRA.

INSTRUMENTAL MUSIC, music produced by *instruments*, as contradistinguished from *vocal* music. For the composition of instrumental music not only is a high musical faculty indispensable, but also a long patient training, combined, if possible, with some ability to perform on several of the chief instruments. Without a proper knowledge of the various instruments of the orchestra the composer may write a passage inconvenient, even impossible, to be played on the instrument. Instrumentation is quite a modern art, and may be said to have been first cultivated to any purpose among the Italians, after whom came the French and Germans. In Germany, Haydn and Mozart deserve the credit of carrying the art to a perfection up to their time undreamed of. Among more modern names may be mentioned Schubert, Weber, Berlioz, Wagner. See Berlioz, Traité d'Instrumentation (1844); R. Hofmann, Praktische Instrumentationslehre (Leipzig, 1893); Lavoix, Histoire de l'Instrumentation (1878); and E. Prout, Instrumentation (1876). See also ORCHESTRA, MUSIC, OPERA.

INSULATOR, a body used to separate an electrified conductor from other bodies, and which offers very great resistance to the passage of electricity. Thus, when an electrified brass sphere has a support of dry glass, and is surrounded by dry air, it is insulated from the floor and the walls of the room in which it is placed. In a damp atmosphere a glass

support, unless coated with shellac-varnish, soon becomes covered with moisture, and ceases to be an insulator. Glass, shellac, resins, sulphur, ebonite, gutta-percha, silk, and baked wood are notable insulating materials.

Wires in which currents of electricity are passing are often arranged in coils. To prevent the lateral passage of electricity from one coil to another the wires are usually covered with silk and shellac. Telegraph wires are carried on wooden posts, placed from 190 to 330 feet apart. The insulator on the post, to which the wire is attached, is usually made of porcelain or stoneware. Water and dust on the surface of the porcelain, and spiders' webs, act as conductors between the wire and post, and have to be guarded against in designing these insulators. In a telegraph line of 400 miles, 54 per cent. of the electricity allowed to enter at one end escapes by the posts, and 46 per cent. arrives at the other end. Underground telegraph wires are usually of copper, insulated by means of a coating of gutta-percha or india-rubber, and protected by tape or iron wire, metal tubes, or wooden troughs filled with bitumen. Submarine cables are made with great care, as the occurrence of a fault in the insulation gives rise to much expense. The core of a cable consists of a copper wire insulated by a covering of gutta-percha whose weight is greater than that of the wire. The core is well wrapped with hemp; near the outer parts, and well surrounded with hemp and tar, are a number of iron and steel wires, which proceed spirally round the cable. See TELEGRAPH.

INSURANCE is a contract whereby, for a stipulated consideration, called a *premium*, one party undertakes to indemnify another against certain risks. The party undertaking to make the indemnity is called the *insurer* or *underwriter*, and the one to be indemnified the *assured* or *insured*. The instrument by which the contract is made is denominated a *policy;* the events or causes of loss insured against, *risks* or *perils;* and the thing insured, the *subject* or *insurable interest*. *Marine* insurance relates to property and risks at sea; insurance of property on shore against fire is called *fire* insurance. *Life* insurance, in its widest sense, is a contract entered into by the insurer to pay a certain benefit contingent upon the duration of one or more lives. Besides these classes of insurance there are many others; the traveller may insure himself against loss entailed from damage by rail or sea; the farmer from the inroads of disease among his live-stock; the employer from the fraud of a dishonest cashier, &c. Our attention will, however, be confined to the first three divisions.

The practice of marine insurance seems to have long preceded insurances against fire and upon lives. It is impossible to state the precise period of its introduction, but it is probable that it dates from the end of the fourteenth or beginning of the fifteenth century. It is, however, contended, on the authority of Livy, that traces of the practice may be found during the second Punic war, when the contractors employed to transport provisions and ammunition to Spain stipulated that the Roman government should indemnify them against such losses as might be sustained from the acts of the enemy or tempests of the sea; while other writers, founding on a passage of Suetonius, ascribe the introduction of the principle to the Emperor Claudius, who, to encourage the importation of corn during a period of scarcity at Rome, took upon himself all the loss or damage it might sustain from storms during its transit. Coming nearer our own day, there are extant rules of sundry guilds or social corporations of the Anglo-Saxons, whereby, in consideration of certain contributions, the members guarantee each other against loss from fire, water, robbery, or other calamity. Insurance, viewed in its commercial aspect, however, seems to have been first undertaken in Flanders some time about 1300, although we can find no Flemish law on the subject earlier than 1537. Beckmann seems to have thought that the practice originated in Italy, but priority has been claimed for Barcelona, the magistrates of which issued an ordinance relative to the subject in 1435, whereas the earliest Italian law is dated 1523. It is probable that insurance was introduced into England by the Lombards early in the sixteenth century, as mention is made in the statute 43 Eliz. cap. xii. that it was customary among merchants English and foreign, when they made any important venture, to effect insurance on their ships and goods. Few insurance questions appear to have been brought before the Westminster courts till after the middle of the 18th century. The decisions of Lord Mansfield may indeed be said to have in a great measure formed and fixed the law on this subject. He expelled from this branch of law the narrow quibbling and technical doctrines with which it had been infested. His judgments were founded on the broad principles of public justice and convenience which had been sanctioned by universal experience. He obtained his extensive information by consulting the most intelligent merchants and the works of foreign lawyers, and by a careful study of the French Ordinance of 1681, the most admirably digested code of maritime law any country can boast of. From the excellence and comprehensiveness of his decisions, they have justly commanded great respect in all countries.

While all fire and life assurances are made at the risk of companies which contain within themselves the requisites of security, wealth, and numbers, a large proportion of marine insurances is made at the risk of individuals called underwriters. Until 1824 the only companies that could grant marine insurances were the 'Royal Exchange' and 'London Assurance;' yet though the monopoly of these offices then came to an end, and many other companies sprang up, the force of custom is so strong that the individual underwriters have secured a large share of the business. The London underwriters form an influential society known as Lloyd's, from having originally met in a coffee-house kept by a person of that name in Abchurch Lane. The joint affairs of the subscribers are managed by a selected committee, the insurance companies being included in the list, as they depend on the office entirely for their information. Agents are stationed at all the principal ports of the world, who send in accounts of ships entered and cleared at their ports, as well as of losses and other casualties. These accounts are regularly filed, and are accessible to all the subscribers; and the principal arrivals and losses are posted in two books placed in conspicuous parts in the room, and in another book in an adjoining room for the use of the general public. In addition to this there is a register which professes to give an account of the tonnage, build, age, repairs, and quality of almost all the vessels that frequent British ports. As a small number of risks would not secure a safe average to the individual insurer, owing to the great hazard property at sea is exposed to, he prudently takes but a fractional part of the entire risk on himself, and this is effected by subscribing or *underwriting* the stipulated proportion on a policy drawn out for the entire sum to be covered. The necessity for circulating the policy and negotiating the insurance has given rise to the business of the *insurance broker*, with which, however, that of the underwriter is frequently combined. Marine insurance differs from an ordinary fire insurance in respect that in case of partial loss

the insurer pays only such a proportion of the sum insured as the damage sustained bears to the full value of the property at the time of insurance. In indemnifying for a partial loss, it is usual to deduct a certain proportion of the nominal value of the repairs, the owner having, it is considered, received an equivalent in the substitution of new work for old. Policies are either *valued*, where the insurance is based on a specific bill of lading, or *open*, where, in the case of loss, the value of a vessel with her stores is estimated as at the date of sailing, her freight at the amount she would have earned had the voyage been successfully accomplished, and her cargo at its invoice price, adding premium and all charges. The insurance is binding although the ship may have been lost at the time the policy was executed; but any warranty, if false, is held to nullify the insurance, even though the misstatement is not material to the risk. The losses against which the insured is not protected are:—1. Acts of our own government, such as an embargo laid upon the ship, and the merchant obliged to unload his goods, or the goods condemned to be destroyed in quarantine, or at sea by some of our cruisers. 2. Breach of the revenue laws. 3. Consequences of deviation from the terms of the policy: for instance, if the ship is described as going from Hull to Lisbon, and calls at Havre, and is afterwards lost, the insurer is not liable. 4. Breaches of the law of nations, such as attempting to run a blockade, and being taken in the attempt. 5. Unseaworthiness, such as want of repairs, insufficient crew or stores, want of nautical instruments, or incompetency of the master. 6. Loss arising from unusual protraction of the voyage. 7. Liability for doing damage to other vessels. 8. Average clause. See AVERAGE.

Fire insurance is a contract of indemnity by which the insurer, in consideration of a certain premium (received by him in a gross sum, or more usually by annual payments), undertakes to indemnify against all loss or damage in buildings, stock, goods, &c., by fire during a certain period. Insurances of this nature are hardly ever made by individuals, but almost invariably by corporations and joint-stock companies, of which there are a great number established all over the world. Fire insurance has been practised in Britain for above two centuries, but was introduced considerably later on the European continent and in America, and it is only in late years that it has there experienced any active development. At an early period after its institution it was considered a legitimate subject for taxation. The amount of the tax in England varied till 1815, when the duty was fixed at 3*s.* per cent. on the sum insured, at which it remained till 1864, when it was reduced for insurances on stock in trade to 1*s.* 6*d.* per cent. In the following year it was reduced to that sum on every class of property. Being a tax on prudence, it was long and loudly objected to, but being easily collected it was a favourite tax with chancellors of the exchequer. It was, however, at last abolished in 1869 by 32 and 33 Vict. cap. cxxi. s. 12. Fire offices insure against loss or damage by fire all descriptions of buildings, including mills and manufactories, and goods and merchandise in the same; ships in harbour or in dock; river-craft, and the goods on the same; waggons going by road or rail, with their contents; and farm-stock of all kinds. Insurances are generally divided into common, hazardous, and doubly hazardous. Common insurances comprehend all buildings of brick or stone, covered with slates, tiles, or metal, and wherein no hazardous trade is carried on or hazardous goods stored; the household goods in such buildings, plate, jewels in private use, apparel, printed books, liquors in private use, merchandise, stock and utensils in trade not hazardous. The premium upon these is usually 1*s.* 6*d.* per cent. per annum. Hazardous insurances are buildings of timber, or of timber and plaster, or not wholly separated by partition walls of brick or stone, or not covered with slates, tiles, or metal; thatched buildings having no chimney, nor adjoining any building having such; buildings falling under the description of common insurance, but containing hazardous goods, or wherein a hazardous trade is carried on; ships and craft, with their contents (lime-barges excepted). The rate for such is generally 2*s.* 6*d.* per cent. Doubly-hazardous are all thatched buildings having chimneys, or adjoining to buildings having such; all hazardous buildings in which hazardous goods are deposited, or a hazardous trade carried on; all hazardous goods stored in hazardous buildings: the insurance for such is 4*s.* 6*d.* per cent. Insurance may also be made by special agreement on the following risks, not comprehended in the above heads:—Mills of all kinds, and the stock and utensils within them; buildings containing steam-engine, oven, or kiln; laboratories, theatres, carpenters, letterpress printers; soap, candle, rope and sail, cotton, woollen, and linen manufactories; medals, curiosities, pictures, prints, statuary, &c. Gunpowder, and buildings wherein it is made, cannot be insured; nor writings of any kind, account-books, ready money, bonds, bills, or other securities for money. Nothing can be recovered from the insurers in the event of loss unless the party insuring had an interest or property in the subject insured at the time the insurance was effected and when the fire happened. Sometimes no single office will insure to the required amount; in such a case it is done by different offices. To prevent fraud by insuring the full value with various companies, there are in the proposals issued an article requiring notice of any other insurance upon the same subject, that each office may bear its proportion of loss. Fire insurance being a contract of indemnity, it is only the actual loss that can be recovered: thus if property be insured to the extent of £500, and the damage done only amounts to £50, this latter sum only is recoverable. It is often provided that the annual payment of the premium may be paid within fifteen days after the expiration of the previous year, but it is dangerous to postpone the payment so long, for should a fire happen in the interval the insurer will not in general be liable. The premises must not be materially altered during the risk, otherwise the policy will be void; but the policy often stipulates that alterations may be made on giving notice. The policy will also be vitiated should there be any misrepresentation or omission in the description of the subject insured; neither do the insurers hold themselves liable for loss or damage by foreign enemy, riot, civil commotion, or military or usurped power.

Life insurance is a much simpler contract in many respects than either of the preceding. There can be but one loss, that caused by death, and therefore there is no partial loss nor average. The three important elements to be taken into consideration in the calculation of premiums are the rate of interest which is to accrue from their investment; the mortality returns, with which the future experience of the insured is expected to agree; and the proportion to be added to the net rates to pay working expenses and yield a profit to the insurer. The rate of 3 per cent. has generally been adopted as a basis for such calculations, as the nearest to what can be expected to be realized on good security for transactions extending over many years. The mortality table long generally adopted was that first published by Mr. Milne, derived from the observations of Dr. Heysham on the rate of mortality in Carlisle during the nine

years 1779 to 1787 inclusive, and hence known as the Carlisle table. Tables constructed on wider and more accurate data are now in general use. Life insurance companies are divided into three classes. The first consists of corporations or joint-stock companies, who undertake to pay fixed sums upon the death of the party insuring with them; the profits of such societies are wholly divided among the proprietors. The second class is formed on the basis of mutual insurance, the members themselves being the company, and liable to each other for all claims. Here, in the absence of a large capital, it is usual to adopt a scale of premiums known to be in excess of what is required to meet the sums insured. The profit accruing therefrom is ascertained from time to time, and allotted to the insured, generally in the form of *bonuses*. The third class, or mixed companies, are proprietary companies charging such increased rates as will yield a bonus, but which, in return for the working expenses and guarantee of their capital, reserve a stipulated portion of their profits for their proprietors. Each of these classes has its advantages —the large capital of the first forming a thoroughly reliable security; the second having no proprietors to draw away the profits of the society; and the third combining partially the advantages of both. It is, however, impossible to say with certainty which is the preferable form. As life insurance is an important matter, the bargain extending probably over fifty years, the greatest caution should be shown by the party to be insured. Little reliance should be placed on attractive statements as to low premiums, large bonuses, &c., unless they are backed by the pledges of men of capital, respectability, and special business knowledge. Life insurance not being a contract of indemnity, a person may insure in as many offices as he likes, and his executors will recover the full amount from each of the insurers. To prevent gambling upon life assurance it was enacted by 14 Geo. III. cap. xlviii. that no insurance shall be made by any person, bodies politic or corporate, on the life of any person, or any other event wherein the person for whose use and benefit, or on whose account such policy shall be made, shall have no interest, and every insurance made contrary to this act is null and void. It is perfectly legal for a wife to insure her husband's life, as she is dependent upon him for support; or for a husband to insure his wife's if she has an annuity or property settled upon her for life in which he has an interest; or for a creditor to insure his debtor's life. Should the creditor's claim be settled before the debtor's death he is still entitled to recover if the policy is kept up. All offices either insert in their policies, or refer in them to a declaration signed by the insured setting forth his age, or the age of the party upon whom he is making an insurance, and if he is afflicted with any disorder that tends to the shortening of life, &c. It may be useful for applicants to remember that if they state anything untruly, although innocently, it may and will probably void the policy. The policy is also void where the person whose life is insured is killed in a duel, is hanged, or commits suicide, unless in this latter case he was insane at the time. Life insurances are often assigned as a security for debt: the assignor binds himself to pay the premiums; failing payment by him the assignee is generally authorized to pay them himself, and recover the amount from the assignor. By 33 and 34 Vict. cap. lxi. every life insurance company is bound to prepare a yearly statement of its revenue and of its balance-sheet according to prescribed forms, and shall cause certain periodical investigations to be made into its affairs, and prepare and furnish to shareholders and policy-holders periodical statements of its business.

INTAGLIO (Italian), a stone or gem on which a figure is hollowed out so that the impression from it may be in relief. Seals are thus engraved. See GEM SCULPTURE.

INTEGRAL CALCULUS. See CALCULUS.

INTELLECT, the thinking part of the mental constitution. Mind is made up of three elementary constituents—emotion, volition, and intelligence. When we experience pleasure or pain we are said to feel, a condition which is referred to the emotions; when we act to obtain the one or escape the other, we exert our will; when we remember, compare, or reason, intelligence is brought into play. The powers or properties of the intellect have been variously classified. Reid's classification is perception by the senses, memory, conception, abstraction, judgment, reason. To these Stewart adds consciousness, attention, imagination, and the association of ideas. Sir William Hamilton adopted the following division into six faculties:—1. The presentative faculty, or the power of recognizing the different aspects of the world without and the mind within (external perception, self-consciousness). 2. The conservative faculty, or memory proper, the power of retaining impressions to be subsequently reproduced as occasion demands. 3. The reproductive faculty, the means of recalling the dormant impressions into consciousness. 4. The representative faculty, or imagination, which determines the greater or less vividness of the impressions or ideas thus reproduced. 5. The elaborative faculty, or power of comparison, by which classification, generalization, abstraction, and reasoning are effected. 6. The regulative faculty, or the cognition of the *à priori* or instinctive notions of the intellect, as space, time, causation, necessary truths, &c. This is equivalent to what the German philosophers call *Vernunft* (reason), as contrasted with *Verstand* (understanding), which deals with experienced or contingent truth. Other classifications are memory, reason, and imagination, which is, if not the most correct, the most popular. The classification adopted by Bain is—1. Discrimination, or the consciousness of difference. 2. Retentiveness, the property whereby impressions once made persist after the fact, and can be afterwards recovered without the original cause, and by mental forces alone. 3. Similarity or agreement. These three properties, in combination with emotion and volition, he holds are adequate to explain all the recognized faculties. Memory is almost a pure case of retentiveness, aided now and again by similarity; perception by the senses is only another name for discrimination; and judgment is either discrimination or similarity, according as it discovers difference or agreement in the object.

INTEMPERANCE. See TEMPERANCE.

INTENSITY, in physics, a term often vaguely employed to indicate magnitude. Voltaic cells, arranged to send the strongest current through a great length of wire (the zinc of one cell being joined to the copper of the next), were said to be joined for intensity; many practical telegraphists still use this term, which originated in an erroneous theory. The following technical terms are of importance. The intensity of a magnetic field at any point is the force which would act on a unit magnetic pole at that point. The intensity of magnetization of a magnet is the ratio of its magnetic moment (the strength of one pole multiplied by the distance between the two poles) to its volume. The intensity of a current of electricity, or the strength of the current, or more simply *the current*, is the quantity of electricity which flows through any cross section of a conductor in a unit of time.

INTERCOLUMNIATION, in architecture, the space between two columns measured at the bottom

of their shafts. Vitruvius mentions five varieties of intercolumniation, and assigns to them different proportions, expressed in measures of the inferior diameter of the column. These are the *pycnostyle* of one diameter and a half, the *systyle* of two diameters, the *diastyle* of three diameters, the *areostyle* of four diameters, and the *eustyle* of two and a quarter diameters. It is found, however, on examining the remains of ancient architecture that they rarely agree with the Vitruvian dimensions, which must therefore be regarded as arbitrary; and indeed the words themselves convey no idea of an exactly defined space, but are in their very vagueness more applicable to the remains of ancient art.

INTERDICT, an ecclesiastical censure in the R. Catholic Church, the effect of which, taken in its most extended sense, was, that no kind of divine service was celebrated in the place or country under the sentence; the sacraments were not administered, the dead not buried with the rites of the church. This interdict is called *local*, whilst the personal interdict regards only one or more persons. We shall here speak of the former. Even Catholic writers admit that the interdict has been often abused for interested purposes, and has produced licentiousness in the countries and provinces subjected to it, by depriving them of religious service for a length of time. And no one acquainted with history can deny that interdicts have been productive of rebellion and all kinds of disorder; although it is alleged that in the dark ages they occasionally served as a check against the power of the monarchs. It is a mistake to suppose that Gregory VII. was the inventor of this mighty engine of ecclesiastical power. It can be proved to have existed before his time; but it is true that he used it oftener and more tyrannically than any of his predecessors. The eleventh century was pre-eminently the century of interdicts. Adrian IV. laid Rome itself under an interdict, for the purpose of compelling the senators to expel Arnold of Brescia and his followers. Innocent III. laid France under an interdict in 1200, and England in 1208. Popes or bishops sometimes mitigated the rigour of the interdict. Thus we read in the Chronicle of Tours that the viaticum and baptism were allowed to be administered during the interdict under which France was laid, as above-mentioned, and which lasted nine months. Innocent III. finally permitted preaching and confirmation to take place during this period, and even the administering of the eucharist to Crusaders and foreigners. And Gregory IX., about 1230, on account of the 'great scandal' caused by the interdicts, permitted mass to be said once a week without ringing the bells, and with the doors closed. Boniface VIII. (1300) ordered the mass to be said without singing, every day, with closed doors, except on Christmas, Easter, Pentecost, and Assumption, when ringing the bells, singing, and open doors were allowed. Magdeburg was four years under an interdict, because the archbishop of the city had been murdered. John XXII. took off the interdict by a bull. Interdicts were gradually recognized to be inconsistent with the spirit of the time; and when Paul V. laid Venice under an interdict in 1606 the churches were not closed, nor divine service interrupted, and only a minority of the bishops acknowledged it. In the beginning of the same century some interdicts, pronounced by bishops, excited much attention. It was not unfrequent in the middle ages for princes to request bishops to lay the territories of their vassals under an interdict. The interdict must be announced, like the excommunication, in writing, with the causes, and is not to be imposed until after three admonitions. The penalty of disobedience to an interdict is excommunication. Writers of the Gallican Church say that the pope has no right to lay France under an interdict, and the parliaments refused to register them. Interdicts are not to be confounded with the simple *cessatio a divinis*, or the disuse of religious ceremonies, which takes place when a church has been polluted, for example, by a murder committed in it.

INTERDICT, in Scotch law, is an order of the Court of Session, or of a subordinate court, for stopping or prohibiting a person doing an act complained of as unlawful or wrongful. In the Court of Session the interdict is obtained on presenting a note of suspension and interdict to the lord ordinary on the bills; in the subordinate courts by a summary petition to the inferior judge. The party applying for it must have both title and interest. It may be resorted to as a remedy against all encroachments either on property or possession. It corresponds to what is termed in England a writ of injunction. See INJUNCTION.

INTEREST is the allowance made for the loan or forbearance of a sum of money which is lent for, or becomes due at, a certain time; this allowance being generally estimated at so much per cent. per annum, that is, so much for the use of £100 for a year. The money lent or forborne is called the *principal;* the sum paid for the use of it, the *interest.* The interest of £100 for one year is called the *rate per cent.*, and the sum of any principal and its interest together, the *amount.* Interest is either *simple* or *compound. Simple interest* is that which is allowed upon the principal only, for the whole time of the loan or forbearance. *Compound interest* is that which arises from any sum or principal in a given time by increasing the principal, at fixed periods, by the interest then due, and hence obtaining interest upon both interest and principal. The rate of interest, supposing the security for the principal to be equal, depends obviously on what may be made by the employment in various industrious undertakings, or on the rate of profit. Where profits are high, interest is high, and *vice versa.* In fact, the rate of interest is simply the net profit on capital; whatever returns the borrower is by his skill or advantages of situation and connection enabled to obtain beyond the interest he agrees to pay, accrue to him. But besides this, the interest on each particular loan must further vary according to the supposed risk of the lender, the supposed solvency of the borrower, &c. No sane person would lend on the personal security of a man of doubtful character, and on mortgage over a valuable estate at the same rate of interest. Yet obvious as this may seem, governments have in many cases attempted to regulate the terms of loans. This interference with the natural course of commercial freedom has been justified by a reference to the Mosaic law (Exodus xxii. 25); but it is sometimes argued that lenders are unproductive consumers of part of the profit which is procured by labour. This idea leaves out of sight the fact that production is impossible without capital, and that all capital is accumulated and employed with a view to profit. Again it is declared that if the legislature did not protect the unfortunate or imprudent borrower, he would be at the mercy of the designing lender. But if, by any enactment, the trade of the lender is interfered with, borrowing will not certainly cease or diminish; the business will fall into less scrupulous hands. When the rate fixed by law is less than the market or customary rate, lenders and borrowers are compelled to resort to roundabout ways of evading the law; and as these devices are always attended with extra trouble and risk, the rate of interest must be increased. In Europe the imposition of interest was alternately prohibited and permitted, the clergy being generally unfavourable to the practice. Calvin was among the

first to expose the error and impolicy of prohibition. In 1546 it first received a parliamentary sanction in England, and it was fixed at 10 per cent; in 1624 it was reduced to 8, in 1651 to 6, and in 1724 to 5, at which rate it remained till 1854, when all usury acts were repealed. In the United States the legal rate generally prevailing is 6 per cent on the sum lent.

In England, when a debt has become overdue, the debtor is not legally bound by common law to pay any interest, though the sum has been fixed, and often claimed. If interest is to be paid, an express agreement must be entered into. Bills and notes, by the usage of trade, carry interest from the date they become due; such interest being recoverable as damages, but the jury are not bound to give it. By 3 3 and 3 4 Vict. cap. xxviii. s. 17 the taxing officer may allow interest on sums disbursed by the attorney or solicitor for his client, and on moneys of the client in the hands of his solicitor or attorney, and improperly retained. In Scotland interest is due on bills of exchange, on the price of lands sold, on borrowed money, on the price of goods sold, if the usual term of credit has expired, and generally on all debts which have become overdue. In the United States, interest is generally awarded by the courts on overdue debts.

INTERFERENCE, a phenomenon accompanying wave motion. When the surface of the sea is looked at from the deck of a vessel at anchor, towards which the waves are advancing, we find that a floating cork never changes its distance from us, it merely moves up and down. When the cork is on the front of a wave it is in the act of rising, it ceases to rise when it is on the crest of a wave, it is in the act of falling when it is on the back of a wave, and it ceases to fall and begins to rise when it is in the trough of a wave. We say that the cork, when rising and when falling, is in different *phases* of its vibratory motion, or that the phase of the wave at the cork is continually changing.

Every action of the cork is imitated a little later by another cork which happens to float somewhat nearer us, thus the up-and-down motion (or vibration) is communicated from one cork to the other, but the corks themselves are always at sensibly the same horizontal distance apart. We see, then, that the propagation of a wave is the propagation of a form or of a motion, and does not mean the transference of the substance of which the wave is composed. When there is a regular succession of waves the distance from the crest of one to the crest of the next is called a *wave-length*. Thus a wave-length is the distance through which the wave is propagated whilst a particle of water changes its phase and returns to the same phase again. If we observe the wave-length to be 30 feet, and if a cork vibrates up and down five times in one minute, it is evident that the wave is travelling at the rate of 150 feet per minute.

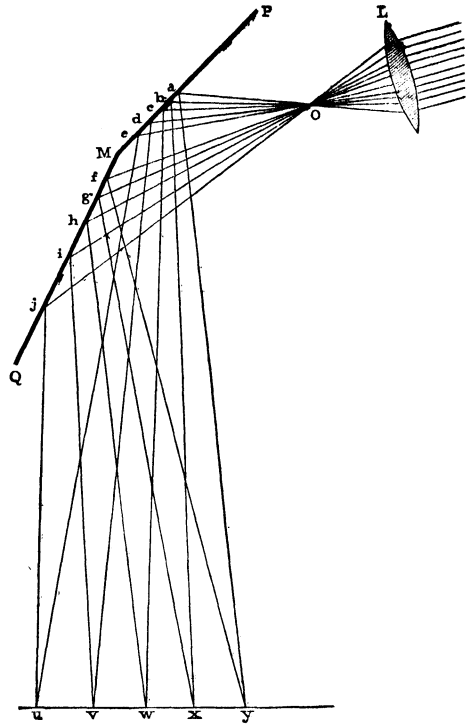
Suppose that two stones drop at the same instant into a pond of water at some distance apart, and produce waves of the same kind, we know that each wave will be propagated to the sides of the pond as if it existed alone. Consider a point at which the crests of two waves cross each other; at this point a crest will exist of twice the usual height. At a point where two troughs cross each other a trough will be formed of twice the usual depth; but at a point where a crest of one wave happens to cross a trough of the other, the rise which would be produced by one wave is completely destroyed by the fall which would be produced by the other, and the water neither rises nor falls; thus at the point the two disturbances produce rest. This phenomenon is called *interference;* it occurs wherever waves of the same kind meet in different phases. Two sounds may interfere, and produce silence at a certain point; and two rays of light may interfere, and produce darkness, just as two waves in water may interfere and produce rest. Let readers prove and carefully remember the following rule:—If regular series of waves of the same size and length start simultaneously from two points A and B, a double crest or trough will be formed at any point P if the distances AP and BP differ by an *even* number of half wave-lengths, and the water will be at rest at the point P if AP and BP differ by an *odd* number of half wave-lengths.

INTERFERENCE OF SOUND.—When the atmosphere is disturbed at any point, the vibratory motions given to particles of air at this point are communicated to all parts of the atmosphere by waves going out in all directions. The particles of air forming the propagated waves merely vibrate for short distances to and from the point of disturbance, some moving in one direction whilst others are moving in the opposite direction, and thus some parts of the atmosphere are in a state of condensation whilst others are in a state of rarefaction. In fact a wave of sound consists of spherical shells of condensed and rarefied air whose diameters get larger and larger. When there is a regular succession of waves, the length of a wave of sound is the distance from one shell of condensed air to the next; thus a wave-length is the distance through which the wave is propagated whilst the air at any place changes from a certain state of condensation, and returns to the same state again. The propagation of a wave of sound merely means the propagation of states of condensation and rarefaction, and does not consist in the transference of the air itself.

Imagine two long tubes C and D leading from the point A to the point B. If a pure musical note is produced at A, the sound is carried in air waves along the tubes C and D to the ear at B. Let us suppose that each tube conveys the same amount of sound. Now if D is longer than C, the sound travelling by D has farther to go than that by C; if it happens that a condensed wave coming by D arrives at the ear at the same time as a condensed wave by C (that is, if the waves arrive at B in similar phases), the note is heard; but if a condensed wave arrives by one tube at the same time as a rarefied wave by the other (that is, if the waves arrive at B in opposite phases), they evidently destroy each other's effects, and silence is the result. Thus if the lengths of the tubes differ by an *even* number of half wave-lengths, a sound is heard; if they differ by an *odd* number of half wave-lengths, the sounds which they convey interfere, and produce silence. It is known that when the fundamental note of a bell is sounded, the bell divides into four vibrating segments; two of these are moving inwards when the others are moving outwards. To a person situated at the middle of the bell the sound-waves from the segments interfere, and produce only a moderate loudness; whereas to a person at a short distance outside the edge the loudness is intolerable. When a tuning-fork vibrates, if one limb is inclosed in a tube so that it is prevented from influencing the air, the sound of the fork to some of the persons listening is materially increased, for in ordinary cases the waves of sound from the two limbs interfere with each other. When the air in an organ-pipe is set in vibration, waves run from one end to the other; at the ends of the pipe the waves are reflected; the reflected waves interfere with the direct ones, so that at some parts (called *nodes*) of the tube the air is always at rest. The same phenomenon occurs in vibrating strings.

When a tuning-fork vibrates it fills a room with sound-waves; when two similar tuning-forks sound together the waves from one coincide with the waves

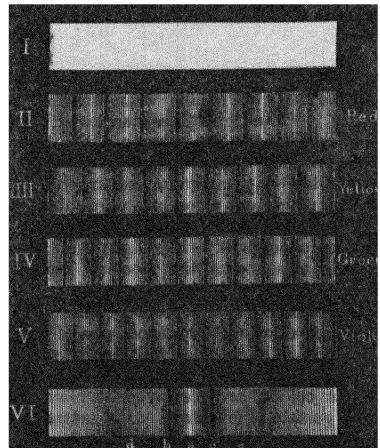
from the other, and a louder note of the same pitch is the result. If now with a piece of wax we fasten to a limb of one tuning-fork a small weight, this fork will vibrate more slowly than before. Let us suppose that one fork vibrates 101 times in a second, and the other 100, and that at a certain time the



phases of the waves from the two forks are similar; then at the end of one second the phases of the waves are again similar, so that they increase each other's effects, and one fork has made one vibration more than the other; but when only half a second had elapsed, the waves from the forks were in opposite phases, and interfered with each other. Thus at the end of every second there is an increase of loudness, and there are times of silence between the times of loudness; in fact one *beat*, as it is called, is produced every second. When forks which differ in their rates by thirty vibrations per second sound together, thirty beats are produced every second, and create a disagreeable roughness.

INTERFERENCE OF LIGHT. — An experiment of Professor Young,[1] in which two rays of light which have come from a luminous point by paths which differ in length produce darkness when they fall together upon a screen, cannot be explained according to the emission theory of light. Young ascribed the phenomenon to interference of waves, and showed that light must be the rapid propagation of waves in a medium which fills interstellar space, and which exists among the particles of all bodies. The nature of the vibration of particles of the luminiferous ether we shall not here consider. (See POLARIZED LIGHT.) From experiments on polarized light we find that it resembles the up-and-down motion of a cork on the surface of water more than the to-and-fro motion of air transmitting sound. Fresnel's improvement on Young's experiment is shown in a greatly distorted form in the accompanying cut. O is the end view of a luminous line, the focus of a cylindric lens L for rays from the sun. The rays from O are reflected from two plane mirrors M P and M Q, which are inclined to one another at an angle of nearly two right angles; $u\,y$ represents the end view of a screen placed to receive the rays of light after reflection; in reality $u\,y$ is a very small screen, usually placed inside a microscope and viewed through magnifying glasses. Let a piece of red glass be placed between L and the sun: it is found that when either of the mirrors is covered with black velvet a band of red light (I, see fig. below) is thrown on the screen; when both mirrors are allowed to reflect light a number of dark spaces make their appearance as in II. When instead of red light we allow blue light to be reflected, similar phenomena occur, but in this case the black spaces are nearer each other. When white light is used, II, III, IV, V seem to be superposed on one another, that is (VI), in the centre at a there is a white line red at the outer edges; at b and c are dark spaces; at d and e we have impure spectra, the blue ends being inside and the red outside. Beyond these are other impure spectra, which gradually get confused and become white light.

The explanation according to the undulatory theory of light is as follows. Each red ray from O to the screen is really the direction of propagation of a wave of light. The waves travelling along the lines $o\,c\,w$ and $o\,h\,w$, to fall on the screen at w, travel paths of exactly the same length, their *phases* at w are exactly the same when they meet, so that they increase each other's effects. The waves travelling along the path $o\,f\,y$ have farther to go than the waves travelling along $o\,a\,y$, but if the lengths of these two paths differ by one wave-length of red light, the waves, when they meet, are in the same phase, so that they illuminate the screen. In fact, all points such as w, u, and y are illuminated, because the waves which meet there are in the same phase. Again, x is dark, for the path $o\,g\,x$ is one half of a wave-length longer than $o\,b\,x$; and so the waves meeting at x are in opposite phases; there is darkness at all points such as x and v where waves meet which have travelled paths differing by an odd number of half wave-lengths,

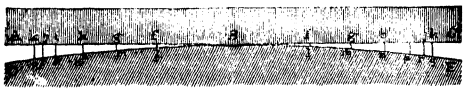


and which are, therefore, in opposite phases. Assuming that the above explanation is correct, and we find ourselves confirmed in this belief by experience,

[1] Verdet shows that Grimaldi's arrangements could not have led to the effects described by him.

when the small distance $w\ y$ is measured with a micrometer, and when the inclination of the mirrors and their position and that of O relatively to the screen are known, we can calculate the wave-length. The wave-length for mean red light is found to be 0·0000244 of an inch, and for mean violet light 0·0000166 of an inch. Dividing the velocity of light by the wave-length we find that mean red light consists of 497 millions of millions of vibrations per second.

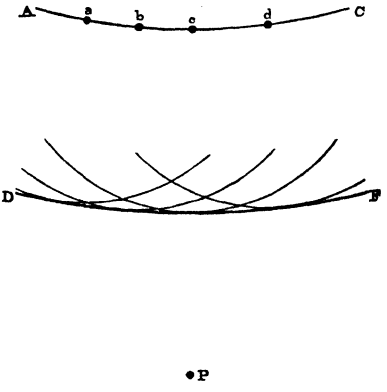
Newton's Rings.—A B C is a plate of glass touching the convex (almost flat) glass lens D B E. Suppose red light to fall on the plate of glass and let us take into consideration the light which penetrates to the underside of the plate. Part of this light will be reflected at the underside A C; part of it will pass through to the surface D B E, some of this will be reflected at D B E and the rest will pass through the lens. We have to do with the light reflected from A C and that reflected from D B E. Suppose that two waves of light meet in the eye of the observer, one coming from f and the other from l; they have travelled different distances, and if one is one wave-length behind the other they meet in the eye in the



same phase, and do not interfere, so that all points at which the thickness of the film of air between the plate and the lens is equal to $f\ l$ send visible rays of light to the eye; all such points are equally distant from B, and appear as a bright ring with B as centre and radius B f. If the thickness $h\ n$ is three times $f\ l$ there is a second ring of light with B as centre, and radius B h. In fact, light is seen wherever, as at h, j, &c., the thickness of the film of air is three times, five times, seven times, &c., $f\ l$. Again, if $g\ m$ is such that waves of light, reflected from g and m to the eye, arrive in opposite phases, they will interfere with each other and g will be dark. Thus all points, such as g, i, k, where the thickness of the film of air is equal to $g\ m$ or is equal to twice, three times, four times, &c., $g\ m$, are dark, so that a number of dark rings separate the bright rings from one another. The thickness of the film of air $f\ l$ which produces a difference of one wave-length in the two reflected rays is evidently less for violet than for red light; hence, when violet light is employed all the rings are smaller than when red light is employed. White light gives a series of beautiful rainbow-coloured rings, for, wherever the thickness of the film is just sufficient to produce opposite phases in light of any particular colour, this light is absent at the place, and when any particular light is absent the received light is really a mixture of all the other components of white light (for instance, when red light is absent the received light has a green tinge).

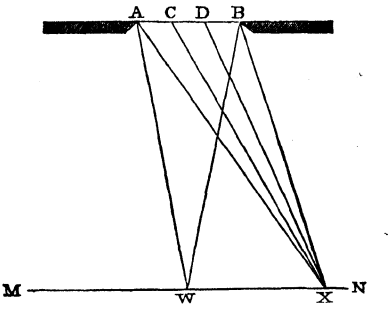
All transparent films (thin flakes of mica, talc, &c., for instance) produce similar phenomena of interference. If a drop of turpentine falls on the surface of water, as it spreads it exhibits brilliant coloration, for particular colours are destroyed at places where the film has certain thicknesses. For instance, if at a certain place the thickness of the film is such that the green reflected rays from its upper and under side destroy each other, the film at that place will appear to be coloured red. The thickness of a soap-bubble decreases from the top downwards, and hence the soap-bubble exhibits a series of iris-coloured rings when illuminated by white light and a series of bright and dark rings when illuminated by monochromatic light.

Huygens's Principle.—Let us suppose that a single disturbance is made in a pond; A C shows part of the crest of the wave produced; now every particle of water in the wave is vibrating, and therefore every particle becomes the centre of a new system of waves. Choosing the points a, b, c, d, &c., and drawing the small waves which would exist at the end of one second, we know that, in reality, these small waves



produce the large wave D F, so that they interfere with each other everywhere inside D F. Huygens deduced from this his principle;—that the disturbance at any point of a wave may be regarded as the resultant effect produced at that point by the separate disturbances of every particle in the wave when in a previous position. Thus, if we consider any point P, imagine all the points a, b, c, &c., of a previous wave to be centres of disturbance, and find the effect which each of them produces on P at the end of any given time; the resultant of all these effects is the effect on P.

Diffraction.—Let the sun's light which has passed through a narrow slit and a piece of red glass fall on a second slit A B, and pass through it to a screen M N. The screen receives a red image of the slit, but it is also found to receive a number of fainter images, so that the light seems to bend round corners. To explain this according to the undulatory theory, A B is the front of a wave of light arriving at the



slit, that is, A B is a line of ether particles each of which is in the same phase of vibration; they are in a straight line, since the origin of the light is the sun, which is at a great distance. The illumination of the screen is produced by waves proceeding from every point in A B. Now W is so far away from A B that waves from every part of the slit reach it in

almost exactly the same time, no one having to travel much farther than another. Hence these waves reach W in nearly the same phase, and W is illuminated. X is a point such that A X is longer than B X by three half wave-lengths. Divide A B into three equal parts at C and D. A particle at B and a particle at D differ by half a wave-length in their distances from X, therefore their waves will interfere with each other; for every particle in the space B D a particle exists in the space D C such that their distances from X differ by half a wave-length; so that their waves must interfere at X. Thus the particles from B to D, and the particles from D to C send waves to X which completely interfere with one another, so that the waves from the particles in A C illuminate X. In the same way it can be shown that the screen is illuminated at any point P if the distances A P and B P differ by an odd number of half wave-lengths, and that the screen is dark at the point P if the distances A P and B P differ by an even number of half wave-lengths. With violet light the dark spaces are nearer each other, so that when the light is white a number of impure spectra are to be seen. These very interesting diffraction phenomena may be observed in a telescope when a slit or other small aperture is in front of the object-glass, and we direct it to a luminous line or point. When a luminous point throws a shadow of a small object, such as a hair, on a screen, iridescent colours, due to diffraction, may be seen near the boundaries of the shadow. When a luminous point is viewed through a glass plate on which lycopodium dust has been sprinkled, or through a glass plate with a great number of fine parallel scratches, or when its light is reflected from a ribbed surface, such as polished mother-of-pearl, or a piece of glass, or polished metal, on which a great number of fine parallel scratches have been drawn, the iridescence exhibited is due to interference.

The dark spot in the centre of Newton's rings, the appearance of the diffraction fringes produced by apertures and obstacles of different shapes, the interference of rays of polarized light, and many other phenomena of great importance we cannot here describe. Newton's ingenuity enabled him to explain the colours of thin plates by his emission theory of light, but only the undulatory theory can give an explanation of diffraction phenomena. The complete explanation of phenomena of interference requires mathematical treatment, such as may be found in Airy's Treatise on the Undulatory Theory; or in Verdet's Leçons D'Optique Physique.

INTERIM (of Augsburg). After the overthrow of the League of Schmalkalden, the emperor Charles V., in order to place Germany in its former condition in regard to religion as well as politics, issued a decree, to be observed until a general council should be assembled. This decree was therefore called the *interim*, and settled, for the time, the constitution, the doctrines and discipline of the church in Germany. At the Diet of Augsburg (1548) it received the force of a law of the empire. Nothing was conceded to the Protestants but the cup in the Lord's supper and the marriage of priests; in every other respect the doctrines and ceremonies of Catholicism, from which they had been free for more than twenty years, were to be restored. The Protestants, however, contrived to gain time by negotiations and compliances, until the Treaty of Passau (1552) and the Peace of Augsburg (1555) secured to them complete religious freedom.

INTERJECTIONS, literally 'things thrown in between,' is the name given in grammar to those words or particles which serve to express any strong feeling or emotion without involving any act of conception, and which consist for the most part of an exclamation, for example, of astonishment, as ah! or oh! of pain or lamentation, as alas!

INTERLAKEN ('Between the Lakes'), a village in Switzerland, in the canton, and 26 miles S.E. of the town of Berne, 1 mile E.S.E. of Unterseen, beautifully situated near the left bank of the Aar, in the valley of Boedeli, between the lakes of Thun and Brienz. It contains a beautiful old castle and numerous hotels. It is visited annually by 80,000 to 100,000 tourists. Pop. 2500.

INTERLUDE, a short dramatic scene, generally accompanied with music, exhibited between two performances of a more serious character, to vary the entertainment. The interlude is not an invention of the moderns; the ancients were acquainted with certain short pieces, loosely connected, which served to make an easy transition from one play to another, and to occupy the interval between the two. In church music, interlude means a short piece seldom exceeding a few bars, performed on the organ between the verses of a canticle, hymn, psalm, &c.

INTERMENT. See FUNERAL RITES.

INTERMEZZO, in dramatic literature, nearly the same as interlude. A short musical piece, generally of a burlesque character. Many pieces, not merely intended for introduction between two more lengthy performances, are designated by this name by the French and Italians.

INTERMITTENT FEVER. See AGUE.

INTERNAL WORK. When heat is added to a mass of matter it generally expands and rises in temperature, so that (1) work is done against the forces of external agents which resist the expansion; for instance, if an iron column supporting a structure is heated it expands lengthways and laterally, lifting the structure and also forcing back, through a very small space, the air which surrounds it; (2) work is done in separating the molecules of the body and in causing them to turn about their axes or otherwise to assume new positions; this is called *internal* work: it is very different in different substances, and in masses of the same substance in different states, and becomes very important when a solid melts or a liquid vaporizes; it is very great in solids and liquids, and very small in gases, for the molecules of gases are widely separated, and move about among each other; (3) the body rises in temperature, that is, part of the heat given to the body is expended in giving those motions to the molecules which indicate a rise in temperature; when air is heated in a closed space which cannot get larger, no heat is expended in doing internal work because the body heated is a gas, no heat is expended in doing external work because the volume of the gas remains the same, therefore the heat is wholly expended in raising the temperature of the body. An idea of the influence of internal work in affecting specific heats may be obtained from an examination of tables of specific heats. See SPECIFIC HEAT.

INTERNATIONAL LAW. See NATIONS (LAW OF).

INTERNATIONAL SOCIETY, a social and political organization of the working-classes formed in 1862 in London through the combined efforts of representatives of the French socialists, English trades'-unionists, extreme radicals, and political refugees of all nationalities. In that year a body of French workmen were sent over to England by Napoleon III. to visit the exhibition, and to fraternize with their English fellows. They were accompanied by two socialists, Folain and Eccarius, who brought them speedily into communication with the republican sections of the British artisans, and the various knots of political adventurers resident in London. At a banquet held in the Freemasons' Tavern arrangements were made

for more frequent and regular meetings, and in the course of two years the plan was formed of a powerful society of workmen of all nations, having its centre in London. Its original purpose was to prevent needless competition among workmen, to regulate the conditions of strikes, to establish common interests among the working-classes in different lands, and generally to amend their condition by all practicable means. At the great meeting in St. Martin's Hall, 25th September, 1864, under the leadership of Karl Marx, Odger (the first president of the society), and others, a new character—that of political action—was given to it. The conference at Lausanne bore this character still more strongly. In 1868 the French section underwent a prosecution by government, during which the names of Assi, Duval, and Varlin started into prominence. The wealth and influence of the society continuing to increase, its aims became more distinctly revolutionary, and some of its advanced members began to announce that it aimed at the abolition of religion, the substitution of science for faith, of human for divine law, and the suppression of marriage; also at direct legislation for the people by the people, the abolition of inheritance, and the constitution of land as collective property. This society threw all its influence on the side of the Communists during the frightful struggle in Paris in the spring of 1871, and many of its leaders perished fighting bravely, or were subsequently executed or banished by order of the triumphant constitutional party. At a meeting of the congress of the association at the Hague on the 4th September, 1872, under the presidency of Marx, it became plainly evident that a great diversity of sentiment and opinion reigned within the society. The leaders aimed at making a political engine of it; the masses desired simply an international trades'-union. The end of it was the breaking up of the council, and the virtual emancipation of the constituencies. The general council split up into two sections; the minority, composed of British, Swiss, Spanish, and Italian representatives, deciding to form a European confederation apart from the extreme section under the leadership of Marx and the French Communists, and passing a resolution to transfer its head-quarters from London to New York. Not long after the society ceased to exist, at least under its former name.

INTERPOLATION FORMULÆ. To explain the use made in physics of these formulæ, let us suppose an experimenter to have made a number of observations of the temperature and pressure of saturated steam; he wants from this limited number of observations to arrange some method of finding what is the pressure corresponding to *any* temperature. One common plan is, draw on a sheet of paper two straight lines at right angles to one another, find a number of points such that their distances from one of the lines represent the observed temperatures, and their distances from the other line represent the observed pressures, draw a regular curve passing as nearly as possible through all these points; it is easy to measure on the curve the pressure corresponding to *any* given temperature. But this method of measurement is cumbrous, it is better to have for reference a copious table giving a great number of temperatures, say at intervals of $\frac{1}{10}$th of a degree, the corresponding pressure being written opposite each temperature. The curve mentioned above will not generally be a simple mathematical curve, that is, no simple algebraic formula represents the relation between its co-ordinates (the co-ordinates of a point in the curve are its distances from the two straight lines) at all places. But we may find a formula suitable to one part of the curve, and other formulæ suitable to other parts, and each of these formulæ will enable us to interpolate a great number of temperatures and pressures in our tables between the *observed* temperatures and pressures.

INTERPRETATION, the explanation of the true meaning of an author or instrument. On the continent of Europe, if a law is interpreted by the legislative power, it is called *interpretatio authentica;* if by the unwritten usage, *interpretatio usualis;* if in a scientific way, *interpretatio doctrinalis*, which may be *interpretatio grammatica* if the meaning is found out from the words according to grammatical rules, or *interpretatio logica* if the meaning is found by internal reasons, or *interpretatio critica* if obtained by correcting the text. The *interpretatio logica* is called *extensiva* if it extends the law beyond the literal meaning of the words, or *restrictiva* if it restricts the application of the law to fewer cases than the words would imply, and *declarativa* if it settles vague expressions. In the interpretation of laws it is of the first importance to ascertain the meaning of the lawgivers; the intention of the person who drew up an instrument in the nature of a contract is not so decisive, because there the intention of the party with whom the contract was made is equally important. Furthermore, the meaning which words bore at certain periods is important in the explanation of old laws, and a knowledge of local usages is often essential for interpretation. In former times laws and instruments were drawn up with a profusion of words, to avoid, as far as possible, leaving anything to construction; but experience has proved this view to be erroneous, for nothing is clearer than the simplest language; and though there will always be room left for interpretation, except in mathematics, yet this increases with the profusion of words and the endeavour to embrace every detail.

INTERSTELLAR ÆTHER, sometimes called LUMINIFEROUS ÆTHER, a very elastic medium of small density, believed by physicists to fill the universe, and to exist among the particles of bodies, transmitting waves of light and heat and other forms of energy (see UNDULATORY THEORY OF LIGHT). It is believed that electrified bodies induce a peculiar state of stress, and that electro-magnetic induction is the propagation of a peculiar motion in this medium. From the phenomena of the action of magnets on polarized light Professor Clerk Maxwell has suggested that light is really an electro-magnetic disturbance of the æther. He shows that the velocity of propagation of an electro-magnetic disturbance is a velocity well known to electricians, 288 millions of metres per second, and this differs very little from the velocity of light as determined by M. Foucault. Although the æther presents no appreciable resistance to the motion of the denser heavenly bodies, it is probable that the well-known diminution of the periodic time of Encke's comet is due to retardation produced by the æther.

INTERVAL, the difference in point of pitch between any two sounds. Thus, in the natural scale, from C to D the interval is a second; from C to E a third; from C to F a fourth; and so on. The interval of a tone and a semitone (as D to F) is called a minor third. See HARMONICS and MUSIC.

INTESTACY, in law, the condition of a party who dies without having left any will at all, or having left one not legally valid, or such a will that nobody becomes heir under it. For real estate see DESCENT. In the case of personal estate, if the intestate leave a widow and no children, the widow inherits one-half, the rest going to the crown when there are no blood relations. If a wife and a child or children survive the intestate, the wife takes one-third, and the rest goes to the child or children or their lineal descendants, but any estate settled on any of the children by the intestate during his life-

time must be taken into account. An heir-at-law, however, does not bring real estate into account. In Scotland one-third goes to the wife, one-third in equal shares to the living children, and the rest to the lineal descendants of deceased children, subject to a condition similar to that given above, but without the exception in favour of the heir-at-law. A wife and father inherit in equal shares, and in English law the same rule applies to a wife and mother; but in Scotland, in the latter case, the wife gets one-half, the mother one-sixth, and the rest goes to the crown, if there be no other blood relations. In the case of a wife, mother, nephews, and nieces, the wife gets one-half, the mother one-fourth, and the others the remainder; in Scotland the proportions are one-half, one-sixth, and two-sixths. If in addition to these there be brothers and sisters, the division is made very similarly. If the survivors be a wife, a brother or sister, and children of a deceased brother or sister, the proportions are respectively, in England, one-half, one-fourth, one-fourth, in Scotland, one-half, one-sixth, two-sixths. If the intestate leave neither wife nor child the estate goes to the next of kin and their legal representatives. If he leave children by one or more wives, and lineal descendants of deceased children, they all inherit equally in England; but in Scotland a half is divided equally among living children, the other half being then divided equally amongst the living children and the issue of dead children. In the case of a husband, with or without children, all goes to him; and in England a mother inherits all if there be no wife, child, father, brother, sister, nephew, or niece, but in this case the Scots law makes two-thirds go to the crown. If a mother and a brother or sister be left, the estate is divided equally in England, but in Scotland the brother takes two-thirds. If a father together with brothers and sisters survive the deceased, the English practice gives all to the father, but the Scottish only one-half. When there is a child and a grandchild, the former receives one-half, in Scotland three-fourths. If there be a brother or sister, and children of a deceased brother or sister, the brother or sister receives half. A brother inherits to the exclusion of a grandfather or an aunt, but shares equally with a wife. A grandfather inherits all if there be no nearer relation, and a father's father and a mother's mother share equally. A grandmother in England inherits to the exclusion of an uncle or aunt, but in Scotland a paternal uncle or aunt would in such a case take all. In Scotland a nephew and niece exclude two aunts, but in England the four share equally. A brother's or sister's grandchildren in Scotland exclude an uncle's or aunt's children, but in England there is equal division. A nephew by a half-sister shares equally with a nephew by a brother in England, but in Scotland the former is excluded. Posthumous children inherit just as if they were born in their father's lifetime. In England, brothers and sisters of the half-blood, whether on the mother's or the father's side, share equally with those of the whole blood; but in Scotland brothers and sisters german and their issue exclude brothers and sisters consanguinean and their issue, and these in turn exclude brothers and sisters uterine and their issue. If a man dies intestate, leaving a widow but no issue, and if he leave real and personal estate to the value of not more than £500, his widow inherits all; and if his real and personal estate exceed £500 in value, she is entitled to £500, absolutely and exclusively besides her legal share in the remainder.

INTESTINE (Latin, *intestinum*, from *intus*, within), the name given to the convoluted membranous tube extending from the stomach to the anus, which receives the ingested food from the stomach, retains it for a longer or shorter period, mixes it with the bile, pancreatic juice, and intestinal secretions, gives origin to the lacteal or absorbent vessels which take up the chyle and convey it into the current of the blood, and which, lastly, conveys the fæcal or indigestible products from the system. The intestines are contained within the cavity of the abdomen, and from their comparative size and calibre, as well as from structural conformation, are divided into the *large* and *small* intestines. In man the small intestine, consisting of the *duodenum*, *jejunum*, and *ileum*, extends from 16 to 26 feet in length; the duodenum is about 12 inches, two-fifths of the remaining length is made up of the jejunum, and the ileum forms the rest. Three distinct coats are to be distinguished in the structure of the small intestine; these, named from without inwards, are known as the *serous*, *muscular*, and *mucous* coats. In connection with the mucous coat the following structures are to be noted. Firstly, the *valvulæ conniventes*, or closely folded transverse plaits, largest in the duodenum, numerous in the jejunum, and finally disappearing near the middle of the ileum. These plaits or folds appear to serve materially to increase the digestive surface of the intestine, to ensure the slow and gradual passage of the food through the canal, and, lastly, to thoroughly mingle the ingesta with the secretions. The *villi* constitute the next structure of importance. The villi are exclusively found in the small intestine, and are most numerous in the duodenum. Each villus, when microscopically examined, is found to be simply an outstanding process of the mucous membrane, supported by a delicate inner network of fibrous tissue, and covered outwardly by a layer of 'columnar epithelium' cells, which repose on a so-called 'basement membrane'. Internally the villus contains an artery which gives off minute ramifications through its structure, and a vein is also to be noted by which the venous blood is returned. And lastly, the lacteal or absorbent vessel enfolded in a muscular layer is found in the interior of the villus. As the chyle or fluid product of digestion passes along the intestine, propelled by the peristaltic action of the intestinal walls, it is pressed against the villi, the outer cells of which are believed to possess a selective power, and by these cells the chyle is transmitted to the lacteal vessels within the villi, and through these absorbent vessels is ultimately carried to the current of the blood. The *glands* of the small intestine consist of three varieties, two named after their respective discoverers, Lieberkühn and Brunner. The third variety, though called glands, are lymph follicles. They occur singly scattered up and down the small and large intestines, and are then called the 'solitary glands' of the large and small intestine. In certain situations, however, they occur in groups, and are then known as the 'agminated glands', or glands of Peyer. The glands of Lieberkühn occur uniformly throughout the mucous membrane of the small and large intestines; whilst Brunner's glands are confined to the duodenum. Lieberkühn's glands, largest in the rectum, secrete the intestinal juice, whose exact function is not accurately known. Peyer's glands occur on the side of the intestine farthest from its attachment to the mesentery. The Peyer's patches measure from 1 to 3 inches in length, and the separate glands of which each is composed are seen to consist each of a little oval sac or follicle imbedded in the submucous tissue of the gut, but extending also, as a rule, through the whole thickness of the mucous layer, and projecting beyond the line of the general surface. They average about three-

fourths of a line in diameter. Each gland is further surrounded by a capsule of blood-vessels, which appear to enter the substance of the gland. Each little oval body consists of a mass of adenoid tissue, which is composed of an exceedingly delicate reticulum or network of connective tissue, in the meshes of which are great numbers of round cells, white in colour and with one or more nuclei. These cells are indistinguishable from white blood corpuscles or from lymph cells. They exist in such numbers as almost entirely to obscure the reticulum in which they lie. This fine connective tissue and round cells have been called "lymphatic elements;" and, indeed, the structure of these so-called glands of the intestine is, in its essence, identical with that of lymphatic and mesenteric glands, and with that of the spleen and other organs usually classed as blood glands. These glands of the intestine have, like the blood glands, no duct; and it is quite certain that they possess no secretory function. In typhoid fever, Peyer's glands are the seat of a peculiar and specific ulceration, which forms at once one of the marked symptoms and characteristic dangers of that disease, since the ulceration may eat its way through the whole thickness of the bowel wall, and lead to hæmorrhage by opening into blood-vessels, or inflammation of the abdominal cavity by the escape into it of contents of the bowel. Brunner's glands, found only in the duodenum, occur in the submucous layer of the intestine. Each gland is a minute lobulated structure, consisting of a large number of minute vesicles, which terminate in a duct opening on the intestinal mucous surface.

The duodenum lies in the epigastric region, and ascending as high as the gall-bladder it descends in front of the right kidney, and terminates after crossing the spine at the level of the second lumbar vertebra. It makes three turnings, and between its first and second flexure receives, by a common opening, the bile-duct (*ductus communis choledochus*) and the pancreatic duct. The conversion of the chyme from the stomach into chyle is thus accomplished in the duodenum. The jejunum, commencing at the left side of the second lumbar vertebra, becomes insensibly and gradually continuous with the ileum, this latter portion of the intestine being less vascular than the jejunum. The jejunum and ileum together make many convolutions, and are attached to the backbone and supported by a broad fold of the peritoneum, known familiarly as the 'web,' and scientifically as the 'mesentery.' The jejunum was so named from its being generally found empty after death (Latin, *jejunus*, empty); and the ileum, terminating the small intestine, becomes continuous with the large intestine in the right iliac fossa—or the hollow of the haunch-bone of the right side. Here we find the ileum opening into the *colon*, or first portion of the large intestine, which is known by its constricted or sacculated appearance, and by the presence of a valve dividing the small from the large intestines, and known as the *ileo-cæcal* valve, or as the *valve of Tulpius*. Below the point at which the ileum opens into the colon we find a short blind sac continuous with the colon, and known as the *cæcum* or *caput coli;* and attached to the lower extremity of the cæcum, and communicating with the cæcal cavity, we find a little closed tube, to which the name of *appendix vermiformis* is applied. This little process is about 3 inches in length, and as thick as an ordinary quill. It may be coiled up behind the cæcum itself, or may depend loosely into the pelvis. The cæcum and its appendix vermiformis thus forms in reality the first portion of the large intestine. We next find the colon to ascend in the right lumbar region, in front of the kidney. This portion is known as the *ascending colon*. It then crosses the abdominal cavity to the left side, and becomes the *transverse colon;* and finally descends, as the *descending colon*, in front of the left kidney into the left groin, where, after making a curve like the letter S—*sigmoid flexure* of the colon—it terminates in the last portion of the intestinal tract. This last portion is known as the *rectum*, and is so named from its somewhat *straight* disposition, although the bowel at this part adapts itself to the curves of the sacrum upon which it lies. The rectum finally terminates in the anus. The large intestines measure from 5 to 6 feet in length; the small intestines together measure from 16 to about 24 or 26 feet in length; so that the entire intestinal tract in the human body may be regarded as being about five or six times the length of the body itself.

The constricted or sacculated appearance of the large intestines has already been referred to. This appearance is caused by the contraction and shortening of the longitudinal muscular fibres of the gut. The three coats of the small intestine are repeated in the large intestine, a variation in the disposition of the longitudinal muscles giving rise to the sacculated appearance just referred to. The large intestines are also known by the presence of small fatty bodies termed *appendiculæ epiploicæ*, attached to them by portions of the peritoneum. The function of these bodies is entirely unknown. The mucous or inner coat is not elevated to form villi in the large, as in the small intestine, and only two kinds of glands are to be distinguished in the large intestine. These are the *glands of Lieberkühn*, and the lymph follicles or *solitary* glands, the structure of which has already been described. The functions of the tubular glands of Lieberkühn, so far as is known, have been already indicated. Some degree of digestion probably goes on in the large bowel, effected by the secretion from the Lieberkühnian glands. The function of the large bowel is, however, chiefly excretory, that is the large intestine serves as a means of conveyance from the system of the indigestible parts of the food. But there can be no doubt that a certain power of absorption is also exercised by its mucous surface. The food is propelled along the entire intestinal tract by the alternate contraction of the longitudinal and circular muscular fibres, by which means it is gradually pushed along the tube with what is known as a *vermicular* or *peristaltic* movement.

The ileo-cæcal valve serves to prevent regurgitation of matters into the small intestine, after they have passed into the colon. The valve is composed of two crescentic flaps of mucous membrane, arranged so as to inclose a transverse slit between them. The muscular fibres of the ileum are continued on to the cæcum and its valve; and when the cæcum and colon are distended, the margins of the folds of the valve are brought closely together, so as to close the central and included aperture, and thus effectually to prevent the escape of matters backwards into the ileum.

The *mesentery* is the term given to the fold of peritoneum by means of which the small intestines are attached to the spine. It exhibits various folds and dispositions, which, however, are too technical to admit of popular description. The blood-vessels supplying the intestinal tube are the *superior* and *inferior mesenteric arteries* and their branches, derived from the *abdominal aorta*. The veins of the intestines empty their contents into the *vena portæ*, which distributes itself through the liver, and from the blood of which the bile is secreted by the hepatic or liver cells. The nerves of the intestines are derived from the eighth pair and intercostal nerves, and the *sympathetic* or *ganglionic system* of nerves is also in-

timately concerned in the regulation of the movements and correlation of the intestines and viscera generally.

INTONATION, in music, relates both to the consonance and to the strength or weakness of sounds. Intonation not only includes the tuning of the voice —the singing in tune or out of tune—but the giving to the tones of the voice that occasional impulse, swell, and decrease, on which, in a great measure, all expression depends. A good intonation is one of the first qualifications in the higher walks of execution.

INTONING, the practice of delivering prayers in the recitative form. Intoning differs little from chanting: in the latter case the cadence is more developed, the divisions more rhythmical, and the music in continuous harmony. In intoning the greater part of the prayer is recited on one note, and when sung by several voices in unison, the closing words of the sentence being sung to the proximate notes of the scale and in harmony. The practice of intoning prevails in the Greek, Roman, Anglican, and Lutheran Churches.

INTOXICATION, the state produced by the excessive use of alcoholic liquids. It comes on gradually, and several stages may be noticed in its progress. In the first stage the circulation of the blood becomes somewhat more rapid, and all the functions of the body are exercised with more freedom. The excitement, however, is not so great as to produce a surcharge of blood in the head or lungs. In this state some of the powers of the soul seem to act more freely; the consciousness is not yet attacked; the fancy is more lively; the feeling of strength and courage is increased. In the second stage the effect on the brain is more decided. The peculiarities of character, the faults of temperament, which, in his sober moments, the individual could control and conceal, manifest themselves without reserve; the secret thoughts are disclosed, and the sense of propriety is lost. In the next degree consciousness is still more weakened; the balance of the body cannot be kept, and dizziness attacks the brain. In the next degree the soul is overwhelmed in the tumult of animal excitement; consciousness is extinguished; the lips utter nothing but an incoherent babble; the face becomes of a glowing red; the eyes are protruded; sweat streams from the pores; and the victim of intoxication falls into a sleep resembling the stupor of apoplexy, from which he does not usually awake for a considerable time. See DRUNKENNESS.

INTRENCHMENT, any work that fortifies a post against the attack of an enemy. The word is generally used to denote a ditch or trench with a parapet. Intrenchments are sometimes made of fascines with earth thrown over them, of gabions, hogsheads, or bags filled with earth to cover the men from the enemy's fire.

INTRODUCTION, in music, is, strictly speaking, the piece of music with which an opera begins, and which immediately follows the overture. Several composers have given the introduction a more important place, making it in fact serve instead of an overture, as Meyerbeer in Robert le Diable, Donizetti in Don Sebastian, and Gounod in most of his works. In a wider sense introduction is a short prelude or preface prefixed to a symphony, rondo, waltz, &c.

INTROMISSION, in Scots law, the assumption of the possession and management of property belonging to another, either on lawful grounds or without authority. It is therefore of two kinds, legal and vicious. It is legal where the party is expressly or impliedly authorized by deed or adjudgment to interfere, as by collecting rents or debts; vicious where a person not named by a will collects the property of the deceased as if he were regularly appointed. By so doing he incurs the responsibility of having to pay all claims against the testator.

INTUITION (from the Latin *intueor*, I look steadfastly at, gaze upon; in German philosophy, *Anschauung*) would mean, according to its etymology, in its narrowest sense, an image in the mind, acquired directly by the sense of sight. The German *Anschauung*, which literally signifies the same as *intuition*, is used to signify any notion directly presented by an object of sense. The transcendental philosophy acknowledges also intuitions which live in us (distinct from ideas obtained by reasoning) in consequence of the direct perception of the internal sense, as the intuition of the Divine. Kant distinguishes empiric intuitions (those conveyed by the senses from external objects) and pure intuitions (*reine Anschauungen*), or intuitions *à priori*, which are the basis of the former—for instance, *space* and *time:* as nothing can be perceived by our senses except either in space or time, our notions of these must precede the empiric intuitions. English philosophers sometimes use the term in the same way as the German equivalent, and at other times mean by it an *à priori* knowledge of first principles. Thus they speak of a knowledge of the distinction between right and wrong derived by intuition.

INULIN, $n(C_6H_{10}O_5)$, the name of a substance analogous to starch, a mode of extracting which from the tubers of the dahlia has been already mentioned under DAHLIN. It has also been obtained from artichoke, chicory, colchicum, dandelion, elecampane, potato, sunflower, and other plants; but whether the substance got from these sources is absolutely identical appears doubtful; especially is this the case with that from elecampane, which has usually been regarded as the same as that from the dahlia. Inulin is a soft, white, hygroscopic powder, without taste or smell. It is soluble in hot water, but does not gelatinize like starch. By prolonged heating with water, as well as by dilute acids, inulin is converted into sugar. By strong acids it is oxidized or decomposed and charred. It is not fermentable, and when acted on by iodine it is tinged brown, and not blue like starch.

INVALIDES, HÔTEL DES, a splendid military hospital at Paris, in the s.w. quarter of the city, erected by Louis XIV. between 1670 and 1673. A fine church forms a feature of the institution. Guards are stationed, and all other forms observed which are customary in fortified posts. A soldier, to be received into this hospital, must be of good conduct and character, and must have a pension. Other conditions are, the loss of eyesight or other serious infirmity, and that the candidate be sixty years of age. Latterly the inmates have greatly decreased in number. This institution suffered very much at the great revolution; but during the imperial government it was put in a better condition than ever. The architect of the hospital was Bruant. It is composed of five courts surrounded by buildings. A vast esplanade, bordered by rows of trees and decorated with a fountain, gives the principal façade, towards the Seine, a noble perspective. The institution has a library of 30,000 volumes. The church is considered a *chef-d'œuvre* of French architecture; its dome, constructed by Mansart, supports a lantern, which is surmounted by a cross 308 feet high. From the dome were formerly suspended 3000 colours, taken from different nations; but they were taken down and burned by the invalids at the time when the allies entered Paris that they might not be retaken. Works in statuary and painting by Lafosse, Boullongne, Coypel, Coustou, Coysevox, &c., adorn the ceilings, niches, and other parts of the buildings.

In vaults under the dome lie the remains of Turenne and several other great French commanders, including those of Napoleon I., deposited in a grand subterranean mausoleum.

INVENTION. See PATENT.

INVENTION OF THE CROSS. See CROSS.

INVERARAY, a royal burgh and seaport of Scotland, capital of the county of Argyle, beautifully situated near the head of Loch Fyne, 42 miles north-west of Glasgow. Inveraray Castle, the chief residence of the Duke of Argyle, is in the immediate vicinity. Besides the castle, the ancient sculptured cross of stone, the court-house, a monolith called the Battle Stone, and the scenery are the chief attractions. It unites with Ayr, Campbeltown, Oban, and Irvine in sending a member to Parliament. Pop. (1891), 816; (1901), 785.

INVERCARGILL, a town of New Zealand, capital of Southland county, in the south of Otago provincial district, at the mouth of the New River, about 139 miles from Dunedin. It is well built, has an athenæum, hospital, public halls, tramways, breweries, flour-mills, rope-works, boot manufactures, &c. It is connected by rail with Campbelltown, 17 miles distant, its port at the entrance of Bluff Harbour, where there is excellent accommodation for large vessels. The surrounding district is pastoral and agricultural. Invercargill is the starting point for the lake district of South Island. Pop. (1896), 9996; (1901), 9945.

INVERKEITHING, a royal and parliamentary burgh and seaport of Scotland in the county of Fife, finely situated on an eminence overlooking the sea, 9 miles north-west of Edinburgh. There are an old market-cross, a town-hall, music-hall, &c. The harbour admits vessels of 200 tons. Coals are exported, and timber, &c., imported. There are manufactures of ropes, leather, paper, and fire-clay goods. Inverkeithing is a royal burgh of very ancient date. It has a charter from William the Lion confirming another still older. It unites with Stirling, &c., in sending a member to the House of Commons. Pop. in 1891, 1663; in 1901, 1909.

INVERNESS, the largest county of Scotland, stretching diagonally across the island from sea to sea, and including on the west the island of Skye, several smaller islands, and all the outer Hebrides, with the exception of the north part of Lewis. It is bounded south by Argyle and Perth; north by Ross and the Beauly Firth; north-east and east by Nairn, Moray, Banff, and Aberdeen; west by the Atlantic. Length, north-east to south-west, about 85 miles; breadth, 55 miles. Area, 4289 square miles, or 2,784,884 acres, of which more than 1,500,000 acres are mountain and heath land used for grazing. Fully 150,000 acres are occupied with woods and plantations, and about 64,000 acres are in permanent pasture. The area under corn and green crops forms a very small proportion of the total area of the county, which is chiefly pastoral, rearing large numbers of cattle and sheep. It is divided by Glenmore or the Great Glen of Albyn, which intersects it north-east to south-west, or from the town of Inverness to Fort-William, and through which passes the Caledonian Canal, formed by uniting a series of considerable lakes which stretch along the bottom of the valley. The south-west shores of the county are indented with numerous arms of the sea called *lochs*, but on the north-east the only indentation is the Beauly Firth, which in part separates it from county Ross. The surface generally is extremely mountainous; but is equally distinguished for its beautiful and extensive glens or straths, which contain nearly all the fertile and arable portions of the county; the remainder consisting of heath and pasture. The most extensive mountain-range is the Monadlia (Gray Mountain), or Monagh Lea Mountains, which extends from the confines of Lochaber in the south-west part of the county, north-east for 80 miles, until it terminates in the vicinity of Nairn. This great ridge is in some parts 30 miles broad, and has elevations of 3000 feet above sea-level. The Benalder range, in the south-west part of the county, is equally lofty with the former, and far more picturesque in appearance, presenting some of the finest mountain scenery that can well be conceived. There are, besides these more remarkable ranges, many smaller systems, most of them distinguished by magnificent scenery, and various isolated peaks of great height; the most conspicuous of which is Ben Nevis, 4406 feet high, the loftiest mountain in Great Britain. The geological structure of the greater part of the county is of crystalline and metamorphic rocks, consisting chiefly of gneiss and mica-slate, with granite, porphyry, and trap rocks. Limestone is found in several districts, and in some approaches to the nature of marble. The lower division of the county, bordering the Moray Firth and extending along the margin of Loch Ness, is composed of old red sandstone. Some veins of lead and silver have been discovered, and also iron ore in small quantities. The principal rivers are the Spey, Ness, and Beauly, on all of which there are valuable salmon fisheries. The lakes are numerous, some of them of considerable size, and many of them surrounded by scenery of the most picturesque description. The largest is Loch Ness; among the others of note are Lochs Arkaig, Lochy, Laggan, and the greater part of Loch Ericht, the remainder being in the county of Perth. The forests of this county are of great extent, and were anciently of still greater. In these forests and the neighbouring mountains the red and roe deer roam at will. The climate is various, often wet and stormy on the west coast, severe in the interior, and comparatively mild and dry on the Moray Firth. The arable and productive land lies chiefly on the sea-coast, and on the banks of the lakes and rivers, particularly along the innermost part of the Moray Firth and along the Spey. Besides the Caledonian Canal, the Great North of Scotland, Highland, and West Highland Railways also furnish means of communication. Gaelic is the prevailing language. The principal town is Inverness. Inverness-shire sends one member to Parliament. Pop. in 1881, 90,454; in 1891, 90,121; in 1901, 90,182.

INVERNESS, a royal, parliamentary, and municipal burgh in Scotland, capital of the county of the same name, and of the North Highlands, one of the most beautifully-situated towns in Scotland. It stands, partly on a plain and partly on a gentle acclivity, on both sides of the Ness (over which is a large suspension bridge), the larger portion being on the right bank, about a mile above its confluence with the Moray Firth, and at the north-east end of the Caledonian Canal. The principal ecclesiastical building is the handsome Gothic Episcopalian cathedral; other buildings include the county buildings, a fine castellated structure, containing the court-house; the county prison, a turreted building adjoining; the town-hall, a handsome building in the Scottish style with Flemish features; the Highland Club, infirmary, Assembly or Northern Meeting-rooms, music-hall, market buildings, barracks, Bell's Institution, &c., besides several handsome banks and hotels. Amongst the more important schools are the Royal Academy, endowed by the Mackintosh fund, the college, on the plan of an English public school, and the high school, &c. (under the school board). There is a woollen

manufactory of some size; the other branches of industry include ship-building, rope-making, tanning, iron and brass founding, distilling, brewing, &c. Inverness carries on a considerable trade, which is much augmented by the traffic through the Caledonian Canal. It has regular communication by sea and canal with Glasgow, Liverpool, Aberdeen, Leith, &c. Large vessels can unload at the quays. The imports are coals, pig-iron, provisions, wines, manufactured goods, &c. The exports are grain, potatoes, wool, woollen cloth, ropes, dairy produce, and whisky. Inverness is the centre of a system of railways connecting it with Caithness, Perth, Edinburgh, Aberdeen, &c. It received a burgh charter from William the Lion in the twelfth century, and unites with Forres, Nairn, and Fortrose (the Inverness burghs) in sending a member to Parliament. Pop. in 1891 (parl. burgh), 19,211; in 1901, 21,193.

INVERTEBRATA, a collective term applied to indicate all the great lower divisions or sub-kingdoms of the animal series, and used in contradistinction to the highest group of the animal kingdom, to which the name *Vertebrata* or *Vertebrate* animals is given. Lamarck was the first to map out this general and broad subdivision of the animal realm, but since his day many and important changes have taken place in the constitution of the subordinate groups included in the Invertebrate section of the animal world. Thus Cuvier mapped out the *Radiata*, *Articulata*, and *Mollusca* as the three great *Invertebrate* sections, whilst the *Vertebrata* formed the fourth and concluding section of the series. Succeeding naturalists, from a fuller and more perfect consideration of the structure of the Invertebrates, split up the Cuvierian *Radiata* into the sub-kingdoms *Protozoa*, *Cœlenterata*, and *Echinozoa*, and at the same time redistributed and rearranged many of the forms which the Radiate division contained. Particularly was this process effected with regard to the lower animals, many of which were removed to a much higher place in the animal series, from a consideration of their structure and analogies. The primary divisions of the animal kingdom, or 'sub-kingdoms,' as they are technically called, which are now included in the *Invertebrate* section of the animal world, may be tabulated as follows, commencing in order with the lowest division:—

I. Protozoa (*protos*, first; *zoön*, animal), represented by many microscopic animalcules (*Foraminifera*, *Infusoria*, &c.)

II. Cœlenterata (*koilos*, hollow; *enteron*, the bowel), represented by Hydræ, Zoophytes or Polypes, *Medusæ* or Sea-blubbers, Sea-anemones, Coral-polypes, &c.

III. Echinozoa or Annuloida (*echinos*, a spiny animal; *zoön*, animal; *annulus*, a ring; *eidos*, likeness), including Star-fishes, Sea-urchins, Lily-stars, Tape-worms, Thread-worms, Wheel-animalcules, &c.

IV. Annulosa (Latin, *annulus*, a ring), Worms, Insects, Spiders, Crabs, Lobsters, &c.

V. Mollusca (Latin, *mollis*, soft), represented more especially by Mussels, Oysters, Whelks, Snails, Cuttle-fishes, &c.

The above five divisions constitute the *Invertebrate* animals, whilst the *Vertebrata* include forms, beginning with the Fishes, as the lowest Vertebrates, and passing upwards through Amphibians (Frogs, &c.), Reptiles, and Birds, to the Mammalia, of which latter class man is the head, as well as of the entire animal series.

The characters by which the Invertebrates are distinguished from the Vertebrata are chiefly negative features as applied to *vertebrate* structure. By briefly enumerating these positive and vertebrate features we may therefore gain an idea of the negative characters of the lower section of the animal series. Thus, firstly, the Vertebrata all possess an internal skeleton, of which the spine or backbone is the chief element, and which serves to support the soft parts, and for the attachment of muscles. Where the vertebrate skeleton is rudimentary (as in the case of some lower fishes—for example, the lancelet—*Amphioxus*), we at any rate find the spine to be represented by a cellular or fibrous rod-like structure, lying in the back or spinal region, and known as the *notochord* or *chorda dorsalis*. This *notochord* is merely the spine in an immature state of development, and is present in the early life of every Vertebrate. Therefore the presence, either of an internal skeleton, or of a notochord, is the first grand characteristic of vertebrate animals. Indeed the name Vertebrata is derived from the term *vertebra*, applied to each of the joints of which the spine is composed. And the term *vertebra* is derived from the Latin verb *vertere*, to turn, applied to this present point in reference to the degree of mobility usually permissible between the various joints of the spine. In Invertebrates no structure analogous or corresponding in any sense to the vertebrate spine is found. Where hard parts exist in the Invertebrata they are generally placed on the outside of the body, and thus constitute an *exo-skeleton*, or outer *skeleton*—a term used in contradistinction to the true *endo-skeleton*, or internal skeleton of the Vertebrata. The shell of the crab or lobster, or the horny covering of beetles and other insects, familiarly exemplify the condition of the skeleton in Invertebrates. In Vertebrates the chief centres of the nervous system, consisting of the brain and spinal marrow, are inclosed in the spine, which thus forms a tube separating the nervous centres from the other organs and systems of the body. In Invertebrates no such specialization or setting apart of the nervous system occurs, these centres being contained in the same cavity as the other systems, and in no wise separated from the other viscera. The limbs of Vertebrates are never more than four in number, whilst those of the Invertebrata may be very numerous, and may exist in pairs (as in Vertebrates), or be single and median organs. The vertebrate limbs are further supported by an internal skeleton, forming an appendage of the internal skeleton of the body, and are turned away from that side of the body on which the nervous system is situated. In Invertebrates the limbs are not so supported, the hard parts of the limbs, if present, being external to the limb. The jaws of Vertebrates are always parts of the head adapted for mastication. In Invertebrates the jaws may be formed by modified limbs, or by hard structures developed in the lining membrane of the mouth, or of the digestive system. The relative positions of the various systems of the vertebrate body present characteristic differences from the arrangement and situation of the systems of the invertebrate. Thus in the vertebrate the chief masses of the nervous system are situated in the *dorsal* or *back* region; the digestive system occupies the *middle* of the body; and the heart lies *ventrally*, or on the lower surface of the animal. The position of the systems varies in Invertebrates, but in none is this definite special arrangement of parts to be discerned. In all Vertebrates, except the little fish known as the *lancelet*, a distinct heart is found; but a heart is frequently wanting in the Invertebrate groups. Then further, no Invertebrate possesses a system of *absorbent vessels*, or *lacteals*, by which the digestive products are taken up from the alimentary system and poured into the current of the circulation. The lacteal or absorbent system of vessels is therefore distinctive of *Vertebrata*. And in Vertebrates a large portion of the blood which

is sent to the digestive organs, instead of being returned to the heart and breathing organs for purification, is carried to the liver by the *portal vein*, and from this blood the bile is elaborated. No similar arrangement is found in Invertebrates. And lastly, in regard to their *reproduction*, Vertebrates are to be distinguished from Invertebrata by the fact that the reproduction of the former group is purely and solely *sexual;* that is, the elements furnished by the two sexes are alone competent to produce new individuals. And in all Vertebrates the sexes are situated in different individuals. In Invertebrata, on the contrary, whilst true sexual reproduction is represented in many instances, *asexual* modes of the process are frequently observed. Thus, many Invertebrates reproduce their species by *gemmation* or *budding*, and by *fission* or division of the body-substance, whereby two or more new forms are produced by the division of the parent organism. And as a result, whilst many of the Invertebrata form *compound* colonies or *compound* organisms, all Vertebrates exist as simple and single individuals. The sexes in Invertebrates may further exist in one and the same animal, when the organism is then said to be *monœcious* or *hermaphrodite*.

Such are the characters, chiefly negative, which distinguish Invertebrate animals by contrast with the Vertebrata. The characters which are specially distinctive of each of the Invertebrate groups will be found under the respective headings of these groups; but the features here given will suffice to render the separation between the Vertebrates and Invertebrates sufficiently clear. In modern zoology, it may lastly be remarked, little stress is laid upon the Invertebrate division as a whole. It is found more convenient in every way to consider each of the larger sub-kingdoms separately, and with reference to the special characters by which it is distinguished from neighbouring groups.

INVERTING PRISM, a prism of glass whose cross section is a right-angled isosceles triangle. When a ray of light parallel to the hypotenuse of this triangle enters one side of the prism it is refracted, is reflected at the hypotenuse, is refracted at the other side, and emerges parallel to its old direction. A bundle of rays on emergence is found to be inverted, and this is due to the internal reflection; hence objects looked at through the prism appear to be inverted. As the refractions are equal there is no *dispersion*. Right-angled prisms are often used in telescopes instead of small plane mirrors; rays are allowed to enter one side normally, they suffer total reflection at the hypotenuse, and emerge normally to the other side, so that they have been bent at right angles to their former direction. There is no refraction of the light, and therefore no dispersion.

INVESTITURE, in the feudal law, was the open delivery of a feud by a lord to his vassal, thus, by external proof, affording evidence of property. To use the words of Blackstone, 'Investitures, in their original rise, were probably intended to demonstrate, in conquered countries, the actual possession of the lord, and that he did not grant a bare litigious right, but a peaceable and firm possession. At a time when writing was seldom practised, a mere oral gift, at a distance from the spot that was given, was not likely to be long or accurately retained in the memory of by-standers, who were very little interested in the grant.' For this reason investiture was performed by the presentation of some symbol to the person invested, as a branch of a tree, &c. In the primitive church, after the election of a bishop, and his consecration, the early Christian emperors claimed a right of confirmation. The Gothic and Lombard kings exercised the same privilege. In the French monarchy the Merovingians affected the still greater power of direct nomination, and their control was supported by means against which the church was wholly inadequate to contend. The estates and honours which composed the ecclesiastical temporalities were considered to partake of the nature of fiefs, and therefore to require similar investiture from the lord. Charlemagne is said to have introduced this practice, and to have invested the newly-consecrated bishop by placing a ring and crosier in his hands. Gratian, indeed (Distinct. 63, cap. Adrianus), directly affirms that Pope Adrian positively conceded to the emperor the power of electing, even to the papacy, in 774; but neither Eginhard nor any other contemporary writer mentions this fact.

The custom, however, existed, nor does it appear to have been objected to or opposed during the lapse of two centuries from his reign. The disorderly state of Italy, which succeeded the death of Charlemagne, frequently interrupted the exercise of this right by the Carlovingians; but even so late as 1047, when the empire had passed to another line, Henry III. received an explicit admission of his prerogative, and repeatedly used it. The investiture in the lesser sees followed as a matter of course. Alexander II. issued a decree against lay investiture in general, which was revived by Gregory VII. (Hildebrand), who, having succeeded in annulling the prerogative of the emperors to nominate or confirm popes, sought to disjoin entirely the ecclesiastical from the civil rule. He complained loudly of the humiliation to which the church was subjected by dependence upon the patronage of laymen, and condemned with far more reason the mercenary and simoniacal exactions which ecclesiastics suffered from temporal princes as the price of the benefices which they conferred. In 1075 he issued a bull forbidding under penalty of excommunication lay investiture and the enfeoffing of prelates with the ecclesiastical temporalities. Henry IV., at that time Emperor of Germany, responded to this bull by holding a synod of the clergy at Worms, which he persuaded to pronounce the deposition of the pope as a tyrant who had laid hands upon the Lord's anointed (Jan. 24, 1076); but in return he saw himself excommunicated by the pope, and deserted by his subjects, who had been released by the pope from their oath of allegiance, in consequence of which he was obliged to submit and perform severe penance for his acts of opposition (1077). The quarrel was, however, renewed as soon as Henry returned to Germany, and the convulsions which followed continued to deluge Italy with blood for a long series of years; for the struggle then commenced by Gregory with Henry IV. was zealously carried on by his successors, among whom Urban II., and Paschal II., especially distinguished themselves. It was not however until the papacy of Calixtus II., in 1122, that the question was terminated, as it appears, materially to the advantage of the holy see. By a concordat then arranged at Worms Henry V. resigned for ever all pretence to invest bishops by the ring and crosier, and recognized the freedom of elections: the new bishop, however, was to receive his temporalities by the sceptre. In France, even under the papacy of Hildebrand, the right of investiture does not appear to have been made a subject of open quarrel. In spite of the protests of the holy see, the kings exercised the power, but at length relinquished the presentation of the ring and crosier, and contented themselves with conferring investiture by a written instrument, or orally, upon which they were left in peaceable possession of the power. But in England Paschal II. was engaged in a contest little less fierce than that which he maintained with the emperor. Anselm, the primate, refused to do homage to Henry I. for his see


IRELAND
BY J. BARTHOLOMEW, F.R.G.S.
British Miles
Kilometres
Railways
NORTH CHANNEL
IRISH SEA
ST GEORGE'S CHANNEL
SCOTLAND (Campbeltown)
Rathlin I.
Mull of Cantyre
Sanda I.
Benmore or Fair Hd
Torr Hd
Malin Hd
Ballyhillin
Inishtrahull
Tory I.
Horn Hd
Sheep Haven
Malvey Bay
Lough Swilly
Fanad Hd
Bloody Foreland
Inishbofin
Inishdoo
Inishfree I.
Crohy Hd
Mt Errigal
Rathmelton
Carland
Cardonagh
Greencastle
Moville
Lough Foyle
Culdaff Bay
Inishowen Hd
Portrush
Coleraine
Limavady
Garvagh
Londonderry
Kilrea
Dungiven
Carntogher
Maghera
Castle Dawson
Magherafelt
Moneymore
Cookstown
Draperstown
Glenarm
Larne
Lough Larne
Island Magee
Ballymena
Portglenone
Slemish
Ballycastle
Torr Hd
Fair Hd

The king seems to have asserted an unqualified right of investiture, which the pope, who was appealed to, as unqualifiedly denied. After a protracted struggle, and continued threats of excommunication, the controversy ended in England, as it did afterwards in Germany, by compromise. Paschal offered to concede the objections against homage provided Henry would forego the ceremony of investiture. To this he agreed (1107).

INVOCATION OF SAINTS. See SAINTS.

INVOCAVIT, the first Sunday in Lent, so called because the primitive church began their worship on that day with the words of Ps. xci. 15, '*Invocavit me et exaudiam eum.*' It is also called *Quadragesima*, or the fortieth day, because it is forty days before Good Friday, the day when Lent ends.

INVOICE, an account in writing of the particulars of merchandise, with their value, charges, &c., transmitted by one merchant to another. By sending an invoice along with goods a merchant gives official advice to his correspondent of the understood terms of a purchase or contract. If the goods are received and the invoice retained this will be held valid evidence in law of the contract.

INVOLUCRE, in botany, a collection of bracts round a circle of flowers. In umbelliferous plants it consists of separate narrow bracts placed in a single whorl; in many composite plants these organs are imbricated in several rows. The same name is also given to the covering of the sori of ferns.

INVOLUTION, the calculation of any power of a quantity, that is, the multiplication of a quantity by itself any number of times. Thus $2 \times 2 \times 2 = 8$; here 8, the third power of 2, is found by involution. Logarithms are of great use in finding powers of large numbers; thus if a^n has to be calculated where a is a number which is to be raised to the nth power, look for the logarithm of a in a book of tables, multiply by n and find the natural number corresponding to the product, this natural number is the nth power of a. *Evolution* is the finding of a quantity which, when multiplied on itself a certain number of times, will be equal to a given quantity. Thus the cube (or third) root of 8 is 2 for $2 \times 2 \times 2 = 8$. The nth root of a is found by dividing the logarithm of a by n and obtaining the natural number. In algebra, the binomial theorem enables us to write down any power or root of certain algebraic quantities.

IO, in Greek mythology, a daughter of Inachus; according to others of Iasus or Peiren. Zeus (Jupiter) fell in love with her. At first she would not listen to his wishes; but being enveloped by him with a thick cloud, she yielded herself to his embraces. Hera (Juno), notwithstanding, perceived the infidelity of her husband, and resolved to be revenged on both. Zeus, to protect Io from the jealousy of Hera, changed her into a beautiful white heifer. Hera was not deceived, and begged the heifer of her husband. Apprehending no evil, he granted her request; but she immediately placed it under the custody of the hundred-eyed Argus Panoptes, who kept her tied to an olive-tree in a grove at Mycenæ. Zeus now regretted that he had complied with her request, but it was too late; he therefore sent Hermes (Mercury) to kill Argus, and set Io at liberty. This commission Hermes successfully executed, having first, according to Ovid's account, lulled the watchful Argus to sleep by playing on the flute; but at the moment when Io thought herself again at liberty, the jealous Hera sent a gad-fly to torment her, and persecuted her without a moment's rest through the world. The wanderings of Io in this condition were a favourite subject with the poets of ancient Greece, who are, however, far from consistent with each other, and even in some cases with themselves, in the accounts which they give of them; but as geographical knowledge increased extended and embellished them arbitrarily to suit their own purposes. Numerous traditions connected her with various localities in widely different parts of the then known world. Thus the island of Eubœa (from Greek, *bous*, an ox) is said to have derived its name from her, and the Thracian Bosporus (passage of the ox), according to one legend, got its name from the fact that Io swam across it. Egypt is generally designated as the place where the wanderings of Io ceased. Here she is said to have regained her original form, and given birth to a son, Epaphus. At the instigation of Hera the Curetes concealed the child, and were in consequence struck with lightning by Zeus. After a long search Io found her son in Syria, and returned with him to Egypt, where she married the king, Telegonus. She was deified, and according to some authorities was the goddess whom the Egyptians worshipped under the name of *Isis*. In Prometheus Bound, Æschylus introduces Io as one of the characters, and describes her as coming in her wanderings to the place where Prometheus is bound, and receiving from him a minute prophetic account of the toils which she has still to undergo.

IODINE. In the year 1812, as M. Courtois, a manufacturer of saltpetre at Paris, was evaporating the liquor obtained by lixiviating burned sea-weed, he noticed that the metallic vessels containing the liquor were corroded, and also that the more concentrated the liquid became, the more energetic was this corrosive action. On adding a little sulphuric acid to this liquor M. Courtois noticed that violet vapours were evolved. This was a new fact never before noticed. This fact in the hands of Clement, and latterly of Gay Lussac and Sir Humphry Davy, led to the discovery of the new element iodine. The elementary nature of this substance was not fully established until some time after its discovery; the investigations of Davy showed conclusively that the new body was an element, and that it was closely related in chemical properties to chlorine, a substance which Davy had some years previously proved to be, not a compound with oxygen as had been until then supposed, but an elementary substance.

Iodine, as its name implies (Greek, *iōdēs*, violet-coloured), is possessed, when gaseous, of a violet colour; when solid it has a bluish-black colour, a metallic lustre, is soft and easily pulverized, and exhibits a crystalline structure. The finest crystals are obtained by the spontaneous evaporation in the air of an ethereal solution of iodine; these crystals belong to the trimetric system, having their axes in the ratio of 4 : 3 : 2. When iodine is cut into very thin slices it becomes transparent, and then appears red by transmitted light. Iodine melts at 107° C., and boils between 175° and 180° C. It volatilizes at ordinary temperatures, especially if moist; its vapour has a smell somewhat resembling that of chlorine, but yet easily distinguishable from this. The colour of iodine vapour is violet, but if it be present in tolerably large quantities it is so deep coloured as to obstruct the sun's light. The density of iodine vapour is very high, it is 8·716 times heavier than air. If a small quantity of iodine be vaporized, the vapour appears of a purple-red colour, but in large quantities the vapour (as before remarked) appears very dense. These different appearances are found to be due to the different lights transmitted by the vapour under the varying conditions mentioned. The purple-coloured vapour absorbs the green rays of the spectrum (see SPECTRUM and LIGHT), and transmits the blue and red; while the dense vapour transmits only the blue rays, the others being entirely absorbed. The vapour of iodine is hence dichroic. See DICHROISM.

If the vapour of iodine be passed through a glass tube heated nearly to redness, it becomes, according to Salet, self-luminous, and emits a red light, having a continuous spectrum. Iodine is sparingly soluble in water, 1 part being dissolved by 7000 parts of water at ordinary temperatures; if the water contain an iodide in solution, it is able to dissolve a much larger quantity of iodine. Ether and alcohol dissolve iodine much more easily than water; it is also very soluble in carbon disulphide.

By taking advantage of the blue-coloured compound which iodine forms with starch, its presence in any liquid is easily detected; if the iodine exists in combination with a metal, it must be liberated before the blue colour is produced. Iodine destroys colouring matter slowly, being much less energetic in this respect than chlorine, and does not decompose water under the influence of the sun's rays. Organic tissues, as the skin, are destroyed by iodine, therefore if it be swallowed it brings about ulceration of the stomach, death subsequently ensuing. Nevertheless this substance is administered in medicine in small doses, especially as a cure for glandular swellings, with good effect.

Iodine may be obtained from the ashes of seaweeds (see KELP), which draw their supplies from sea-water. The amount of iodine which exists in sea-water is so small that it could not be profitably extracted therefrom; the sea plants, however, concentrate the iodine within themselves, and from them it may be prepared by a process which will be subsequently described. Certain land plants, for example, tobacco and a species of *Salsola* growing near Mexico, also contain iodine; various marine animals contain this substance, as also cod-liver oil, in which, according to De Jongh, the iodine amounts to about ·03 or ·04 per cent. Iodine is also found in certain minerals, such as iodide of mercury and iodide of silver from Mexico, in the rock-salt of Halle as iodide of sodium, &c. The water of certain rivers, especially those occurring in volcanic districts, has been found to contain iodine, so also has the rain-water of several towns, as Paris, Pisa, and Florence.

The iodine of commerce is manufactured partly from kelp, and now partly also from Chili saltpetre (cubic nitre). The kelp having been broken into pieces, is lixiviated with water, whereby about 60 per cent of it goes into solution. This liquor is evaporated, on cooling it deposits the potassium chloride and sulphate, and sodium chloride which it contains; potassium iodide, being more soluble than those salts, remains in solution along with potassium sulphide and carbonates and thiosulphates of the alkalies. On adding sulphuric acid to the liquor decanted from the crystallized potassium and sodium salts, the sulphides, carbonates, and thiosulphates are decomposed with evolution of sulphuretted hydrogen and carbon dioxide and deposition of sulphur. To the remaining liquor more sulphuric acid is added along with black manganic oxide, and the whole subjected to the action of heat in a large leaden distilling apparatus. The reaction which ensues consists in the formation of sodium and manganese sulphates, together with water and free iodine, which last substance distils over, and is collected in a series of suitably-arranged earthenware receivers. It is found that in working by this method some of the iodine generally remains in the distilling apparatus; it is difficult to obviate this, as, if the heat be raised too high, volatile iodine chloride is formed. Another method, by which all the iodine present in the mother-liquor is obtained, consists in distilling this liquor with ferric chloride, whereby ferrous chloride, sodium chloride, and free iodine are formed; the iodine is carried over with the steam and deposited in the form of a black powder at the bottom of the receivers. By adopting Stanford's process for preparing iodine from sea-weed a saving is effected, as the tarry and gaseous products of the weed are not lost, as is the case in the manufacture of kelp. For some time iodine has been prepared from crude Chili saltpetre, which contains about ·28 to ·36 per cent of this substance. The iodine is usually separated from its combination with metals in this salt by the action of sulphurous or nitrous acid. Before being sent into the market, iodine, as prepared by the above-mentioned processes, is purified by sublimation. This process is carried on in stoneware retorts set in a sand-bath, and adapted to receivers, in which the sublimed iodine condenses.

Iodine is largely used in photography in the form of *potassium iodide*. This important substance is a white body without smell or colour, crystallizing in cubes, and soluble in water and in alcohol. It may be obtained from hydriodic acid by the action of carbonate of potash; by the action of iodine on caustic potash, evaporation of the solution, and subsequent fusion with charcoal, in order to reduce all the iodate of potassium present to iodide; or by the action of carbonate of potash on iodide of iron, prepared from iron borings and iodine. The last is the usual manufacturing method, but the second is that employed for medical purposes. Common impurities in potassium iodide are potassium iodate, a poisonous body, detected by the blue colour which it produces when tartaric acid and a solution of starch are added; water; potassium sulphate, tested by barium chloride; carbonate of potash; the chlorides of potash and soda, &c. The iodide of potash is the best solvent for iodine.

Iodine and potassium iodide are both much used in medicine. Iodine is used externally for its powerful irritant action on the skin and mucous membranes, being applied for its stimulating property, and also for its disinfectant property, to foul and discharging sores. It is also used as a blister, and is often painted over the skin of inflamed joints after the acute inflammation has passed, for the removal of thickening, &c., in the joint, and on the chest following pleurisy and inflammation of the lung, to promote absorption of fluid or inflammatory products. It is used on the skin over enlarged glands, when there is no active inflammation going on in the gland. Internally, iodine is usually administered as the iodide of potash or syrup iodide of iron.

The compounds of iodine are numerous, and many of them important. Iodine forms two compounds with chlorine, the monochloride, I Cl, and the trichloride, $I Cl_3$. The first may be prepared by passing dry chlorine over dry iodine, but it is easier to obtain it by distilling iodine with potassium chlorate. As thus prepared, iodine monochloride is a deep-red liquid, which, when recently distilled, may be cooled to $-6°$ without solidifying, although its melting-point when solid is $24·7°$. After keeping for several days it cannot, however, be cooled many degrees below its melting-point without crystallization setting in. If this monochloride be distilled it is partly split up into the trichloride and free iodine. The trichloride is an orange-yellow solid which crystallizes after fusion in long needles. Its melting-point lies between 20° and 25°.

With hydrogen iodine forms but one compound, known as hydriodic acid (HI). This acid is best prepared by the action of water upon phosphoric iodide; for this purpose a flask is fitted with a funnel tube, and also with an exit tube leading into the bulb of a retort, which is set with its beak passing vertically through one of the openings of a two-necked bottle to a depth of about ½ inch beneath the surface of

water in this bottle; 5 or 6 grains of amorphous phosphorus are placed in the flask and gently heated along with about 60 grains of iodine; the two substances unite to form phosphoric iodide. When the flask is perfectly cold a gentle stream of water is allowed to flow through the funnel tube on to the phosphoric iodide, which is decomposed with the formation of hydriodic acid, which passes into the retort, and thence into the water in the bottle, where it is condensed. As this gas is very soluble in water it is sometimes absorbed so quickly as to cause a partial vacuum in the retort into which the water rushes, but before the body of the retort is filled with water the surface of that liquid in the two-necked bottle has fallen below the beak of the retort, so that no more water can enter. This acid may also be prepared by passing hydrogen along with iodine vapour through a red-hot tube, when the two gases combine. Hydriodic acid is a colourless gas, it reddens litmus strongly, and produces dense white fumes in moist air. Its density is 4·442; this, referred to hydrogen as unity, is very nearly equal to 64, which is the theoretical density calculated for equal volumes of iodine and hydrogen combined without condensation of volume. An aqueous solution of hydriodic acid easily undergoes decomposition, if heated to 180° it acquires a faint violet colour, which goes on increasing in intensity as the temperature is raised, and as more and more iodine is set free. Hydriodic acid decomposes many chlorides, as phosphorus or arsenious chloride, hydrochloric acid being formed; on the other hand, certain iodides, for example, silver iodide, are decomposed by hydrochloric acid with evolution of hydriodic acid. The products of the action of hydriodic acid upon compounds of carbon are very interesting, but they cannot well find a place here. (Berthelot's papers upon this subject appeared in the Bull. Soc. Chim. [2] ix. 8, 91, 178, 265.)

Of the oxygen compounds of iodine the most noteworthy are the two acids iodic and periodic. *Iodic acid* (HIO_3) is most easily prepared by oxidizing iodine by nitric acid. This acid forms colourless crystals, which at 170° are resolved into water and *iodic anhydride*, I_2O_5, which is itself at a higher temperature split up into iodine and oxygen.

The salts of this acid are called *iodates*. *Periodic acid* forms three series of salts which may be regarded as the salts of three acids, ortho-, pyro-, and metaperiodic acid, corresponding to the three phosphoric acids. See PHOSPHORUS.

IOLE, the daughter of Eurytus, king of Œchalia. See HERACLES.

ION, (1) the fabulous ancestor of the Ionians, the son of Apollo and Creusa, the wife of Xuthus. He is said to have been concealed after his birth by his mother in a cave, from which he was taken by his father, who removed him to Delphi, where he had him brought up by one of the priestesses of the temple. Afterwards, it is said, Xuthus and Creusa came to consult the oracle of Apollo at Delphi as to the means of obtaining an heir, and that the answer was given that they should take the first person they met as their son, and this turned out to be Ion. The secret of his birth was made known to Creusa, but Xuthus was kept in ignorance of it. Xuthus, however, ultimately became himself the father of two sons, Dorus and Achæus, who were the fabulous ancestors of the Dorians and Achæans, as Ion was of the Ionians. There was a further tradition current in Ægialus or Ægialea (afterwards Achaia, the northern part of the Peloponnesus), the inhabitants of which were Ionians, to explain their connection with the common ancestor of that race. It is to the effect that when Ion was on the point of waging war against Selinus, king of the Ægialeans, the latter gave him his daughter Helice in marriage, and that after the death of Selinus Ion became king of the district. (2) A tragic poet of Chios, who flourished about the eighty-second Olympiad (452 B.C.) His tragedies were represented at Athens, where they met with great applause. He is mentioned and greatly commended by Aristophanes and Athenæus, &c. (3) A rhapsodist, a native of Ephesus, introduced in Plato's dialogues as reasoning with Socrates.

IONA (ancient *I-Colm-Kill* or *I-columb-cill*, 'the isle of Columba's retreat or cell'), an island in Scotland, one of the Inner Hebrides, in the county of Argyle, separated from the south-west extremity of Mull by the Sound of Iona, 1¼ mile wide, and about 7¼ miles south-west of Staffa. Iona is about 3 miles long by 1½ mile broad; area, 2000 acres, of which 600 acres are under cultivation, the remainder being hill pasture, morass, and rock. On the west side the coast is for the most part rocky, but on the east it is more level. In some places the soil is fertile, yielding good crops of barley and potatoes; oats also are partially raised, but the rearing of black cattle and fishing form the chief occupations of the inhabitants. Facing the sound is the small village of Iona, consisting of a row of about forty thatched cottages skirting the shore. This little island derives its interest and celebrity wholly from its history and its ancient ruins, and especially from its connection with Saint Columba, who took up his residence here after the middle of the sixth century (565). The existing ruins are all, however, of a much more recent date than the time of that venerated saint, whose structures were of very slight materials. The principal ruins are those of the cathedral church of St. Mary, of a nunnery, five chapels, and of a building called the Bishop's House. St. Oran's Chapel, as it is called, is supposed to be the most ancient; it is very small, being only 60 feet by 20 feet. Attached to it is a burying-ground, in which most of the families of distinction in the Highlands had at one time places of sepulture. Numerous kings of Scotland, Ireland, and Norway are likewise said to have found their last resting-place in the island. Next to this edifice in point of antiquity may be reckoned the nunnery, which may probably be referred to a period beyond the twelfth century. The most extensive ruin (now partially restored) is the cathedral, which is cruciform, surmounted at the intersection of the nave and the transept by a square tower of about 70 feet in height. The length of the transept is 70 feet, and that of the body of the church, east to west, 160 feet. In the interior are several interesting sculptured tombstones, one of which, dated 1500, is that of Abbot M'Kinnon, the oldest in the cathedral. Pop. 213.

IONIA, or IONIS, that part of the seaboard of Asia Minor which was inhabited by Ionian Greeks. This beautiful and fertile country extended north to south from Phocæa to Miletus along the shore of the Ægean Sea opposite the islands of Samos and Chios. Ptolemy makes it extend only from the Hermus in the north to the Mæander in the south, thus excluding both Phocæa and Miletus. According to tradition the colonists who inhabited this region came over from Attica after the death of Codrus about the middle of the twelfth century B.C. They founded twelve towns, which, though mutually independent, formed a confederacy for common purposes. These towns were Phocæa, Erythræ, Clazomenæ, Teos, Lebedos, Colophon, Ephesus, Priene, Myus, Miletus, and Samos and Chios in the islands of the same name. To this number was afterwards added Smyrna by treachery. Commerce, navigation, and agriculture early rendered these cities wealthy and flourishing. The league was afterwards made tributary by Crœsus, king of Lydia, and later by Cyrus, king of Persia.

The towns composing it remained subject to the Persians until they recovered their independence in consequence of the unsuccessful wars which Darius and Xerxes, kings of Persia, waged against Greece at the beginning of the fifth century B.C. Their liberty was, however, sacrificed by the Peace of Antalcidas, 387 B.C., which again rendered them subject to Persia, in which condition they remained till the overthrow of the Persian monarchy by Alexander the Great, 334–1 B.C., when they became a part of the Macedonian Empire. Ionia, at a later period, became part of the Roman province of Asia. It was afterwards totally devastated by the Saracens, so that few vestiges of its ancient civilization remain. Numerous colonies on the shores of the Mediterranean and the Black Sea owed their origin to the Ionian cities of Asia Minor.

IONIAN DIALECT. See Greek Language, under the head of GREECE.

IONIAN ISLANDS, a number of islands belonging to the Kingdom of Greece, in the Ionian Sea, off the coast of Albania and the western and southern shores of Greece, the most southern, Cerigo, and its dependent islets being off the south-eastern extremity of the Morea. The principal islands, seven in number, are, reckoning from north to south, Kerkyra (Corfu), Paxos, Levkas (Santa Maura), Ithaki (Ithaca), Kephallenia (Cephalonia), Zakynthos (Zante), and Kythira (Cerigo). To each of these larger islands a number of smaller, scattered along their respective coasts, are attached, and included in their several local jurisdictions. Area of the whole, 1097 square miles. All these islands, both large and small, belong to the same great calcareous formation which prevails over Greece. They are extremely mountainous, so much so that they do not contain a sufficient quantity of arable land to produce the corn required by the population; and were it not for the vine, olive, and currant, especially the last, which some of them produce in great abundance, they could support but a small number of inhabitants. The climate generally resembles that of the neighbouring mainland, except that the sea renders it more uniformly temperate and humid. Snow often falls in the winter, and lies on the mountains, but rarely on the plains. Sudden and furious squalls are frequent; and the sirocco or hot south wind occurs at certain periods. The staple exports from these islands are oil, currants, valonia, wine, soap, and salt. The few manufactures that they possess are chiefly textile and ornamental. The religion is that of the Eastern Greek Church, to which four-fifths of the population belong. Each island has its own bishop, and at the head of the whole is an exarch or primate. The Ionian Islands, so called from lying in that part of the Mediterranean anciently known as the Mare Ionicum or Ionian Sea, often figure in the ancient history of Greece, but only singly, not collectively. In 1386 the island of Corfu voluntarily surrendered itself to Venice, and soon after all the other islands placed themselves one by one under the protection of the same power. The Venetians governed by a proconsul, and made Italian the official language. In 1797 the French became masters, and laboured with assiduity and considerable success in spreading their democratic principles. In 1800, Russia and Turkey having, by their combined forces, expelled the French, while retaining a protectorate, left the inhabitants to make an attempt at self-government. Anarchy and confusion were the result, and in 1807 Russia, by a secret article in the Treaty of Tilsit, ceded the islands to France. In 1809–10 all the islands were overrun by the British troops except Corfu, which did not come into the hands of the British till it was assigned to them by the Peace of Paris in 1814, and the possession of the British was finally fixed and regulated by another treaty concluded at Paris in 1815. The seven islands were then formed into a republic, under the protectorate of Great Britain. On numerous occasions, however, the inhabitants showed how strong their desire for independence was. During the great struggle against Turkey in 1821 attempts at insurrection were made, and again in 1849. Parliamentary and other reforms were conceded in 1851 to the people; but in 1857 an almost unanimous wish was expressed by their representatives for reunion with Greece. Upon the deposition of King Otho, and the choice of the son of the King of Denmark to succeed him, advantage was taken of the opportunity by the British government to relinquish its ungrateful protectorate, and the islands, with the consent of the other European powers, were transferred to the Kingdom of Greece in 1864. As part of the Kingdom of Greece the Ionian Islands are divided into four nomarchies, exclusive of the island of Kythira, which is included in the nomarchy of Lakonia. The four nomarchies are Kerkyra, pop. in 1896, 94,686; Kephallenia, pop. 70,077; Leukas, pop. 43,178; and Zakynthos, pop. 45,032. The population of Kythira was 12,306, so that in that year the whole population of the Ionian Islands amounted to 265,279.

IONIAN ORDER. See ARCHITECTURE.

IONIAN PHILOSOPHY, the earliest school of Greek philosophy, a school which attempted to explain the phenomena of nature from the forces and attributes of matter itself. In order to do this the philosophers of this school followed two courses, some assuming a single original substance as the ground of all things, and explaining the development and formation of the phenomenal world by a process of condensation and rarefaction which they conceived as affecting the mode of existence of that substance; while others considered all things as formed by separation and combination out of a permanent and unalterable primitive form of matter. According to the view of the first class of Ionian philosophers, therefore, the original material principle was conceived as itself liable to change, and the changes which take place in it were held to give rise to the forms by which the world is known to us; while according to the view of the second class of Ionian philosophers the original material principle was looked upon as in its own nature and qualities unchangeable, and everything was explained by a change of external relations in space. To the first class belong Thales (flourished about 600 B.C.), who took water as the first principle; Anaximenes (about 520 B.C.), and Diogenes of Apollonia (about 530–460 B.C.), who took air; and Pherecydes (about 444 B.C.), who took the æther (the purer air of heaven) and earth: and to the other class belong Anaximander (born 610 B.C.), a pupil of Thales, who referred everything to an undefined infinite primary substance, neither air, earth, fire, nor anything else deemed by the ancients a material existence; and the atomists Leucippus and his pupil Democritus (about 460 to 370 B.C.), who thought that the world arose from the combination of simple indivisible and unalterable constituents called atoms. Heraclitus (about 500) may also be reckoned among the Ionian philosophers, inasmuch as he assumes the existence of a primary substance which changes by a self-derived force, but he differs from them in that he holds the law of the course of the world, the law of constant change or becoming, to be alone permanent. Anaxagoras, too, who lived between 500 and 428 B.C., resembled the Ionian atomists in his doctrine of the existence of atoms, which he calls homœomerids, but is distinguished from them by ascribing different qualities to the atoms which form different substances (such as gold, earth, water, &c.), and more especially

by ascribing the first movements of this matter, not to a blind force residing in the atoms themselves, but to an intelligent principle (*nous*).

IONIANS. See GREECE—History; and IONIA.

IONIAN SEA, the ancient name of that part of the Mediterranean which lies between the south part of Italy and Greece.

IONS, a name given by Faraday to the components into which an electrolyte is divided by the passage of an electric current. See KATHION.

I O U, a written acknowledgement of debt, usually made in this form:—'To Mr A. B. I O U Ten Pounds.—C. D. May 12th, 1891.' Not being either a receipt, an agreement, or a promissory note, an acknowledgment of debt made in this form requires no stamp. When the name of the creditor is stated such a document is evidence of a debt of the amount stated due to him by the person whose signature it bears. In the absence of the name of the creditor the document is *primâ facie* evidence of such a debt being due to the holder of the document. It is not negotiable. The letters I O U are of course used instead of the words 'I owe you', on account of the similarity of sound.

IOWA, one of the central United States, bounded on the north by Minnesota; east by Wisconsin and Illinois, from which it is separated by the Mississippi; south by Missouri; and west by Nebraska and S. Dakota, from which it is separated by the river Missouri; length along the 42nd parallel of latitude, 285 miles; breadth along the 91th meridian of W. longitude, 190 miles; area, 56,025 square miles. Excepting the portion on the banks of the Missouri, the state slopes south-east; its streams east of lon. 95°, the principal of which are Des Moines, Skunk, Iowa, the Red Cedar, a branch of the Iowa, the Maquoketa, and the Wapsipinicon, flow diagonally into the Mississippi; west of the 95th meridian the streams, such as the Big and the Little Sioux, Floyd River, and the Boyer, flow to the Missouri. The surface is undulating, nearly four-fifths consisting of luxuriant prairies covered with a rich coat of coarse grass, forming excellent pasturage. The weather is variable and sometimes severe, but the climate is healthy. Winter continues from December to March; the summer heat is tempered by frequent showers. The soil is in general good, consisting of a deep black mould, intermingled in the prairies with sand, red clay, and gravel. The principal crops are Indian-corn, oats, wheat, barley, rye, potatoes, and hay (the product of the native grasses). Pumpkins, melons, and all the ordinary fruits and vegetables, thrive well. Crab-apples, wild plums, strawberries, and grapes are indigenous and abundant. The east portion of Iowa is rich in minerals. Lead is wrought to some extent, and zinc and iron are found. Coal is plentiful. The bituminous coal-fields occupy 18,000 square miles, and the annual output is about 6,000,000 tons. Limestone, gypsum, and clay are abundant. Wood is scarce except on the banks of the rivers, but the state is engaged in planting forests. Millions of fruit trees have already been planted, and horticulture has made great progress. The dairy interest is already of immense importance. Other industries include the manufacture of farm implements, flour-milling, pork-packing, &c. The state possesses an extensive system of railways, with a total length of 9000 miles. The state also possesses exceptional advantages for river trade, and the numerous smaller streams supply abundant water-power. The settlement of Iowa commenced about 1832, when the first purchase of land from the Indians took place; its territorial government was instituted in 1838, and it was admitted into the Union in 1846. It is divided into ninety-nine counties. The capital is Des Moines; the other principal towns being Sioux City, Dubuque, Davenport, Burlington, Council Bluffs, Cedar Rapids, Keokuk, and Ottumwa. The government is vested in a governor and congress, consisting of a senate of fifty members elected for four years, and a house of representatives of 100 members elected for two years. In the general Congress of the United States Iowa is represented by eleven members in the House of Representatives, and, like all the other states, two in the Senate. Pop. in 1890, 1,911,896; in 1900, 2,251,829. A large part of the population consists of Germans and Scandinavians.

IOWA CITY, in the United States, capital of Johnson county, Iowa, on the river of the same name, 120 miles E. of Des Moines. It is finely laid out, and contains the state university, situated in a handsome Doric edifice, which was formerly the state capitol previous to the transference of the seat of government to Des Moines. There are several flour-mills, and also manufactories driven by water-power from the river. Pop. (1890), 7016; (1900), 7987.

IPECACUANHA, a medicine obtained from the root of a plant called *Cephaëlis ipecacuanha*, belonging to the natural order *Cinchonaceæ*. It is a creeping, half-herbaceous plant, found in damp shady forests in Brazil. It was first brought to Europe about the middle of the seventeenth century; but was not generally used till about the year 1686, when it was introduced under the patronage of Louis XIV. Its taste is bitter and acrid, covering the tongue with a kind of mucilage. It is a safe and mild emetic, and is administered as a powder, in the tincture, or infused in wine. It is also sudorific and expectorant.

IPHICRATES, a famous Athenian military commander in the fourth century before the Christian era. He was born in obscurity, but raised himself to eminence in his profession by his courage and talents early in life. In the war of Corinth (393–392 B.C.) he opposed with success Agesilaus, the warlike king of Sparta. His next military operations were at the Hellespont, where he was sent to act against Anaxibius, but in spite of a victory which he gained over that general he was unable to prevent the conclusion of the Peace of Antalcidas (387 B.C.). After this he went to Thrace, where he aided Seuthes, king of the Thracians, in recovering his dominions. In 374 B.C. he commanded a body of auxiliary troops which co-operated with those of Pharnabazus, satrap of the Hellespont under Artaxerxes Mnemon, in an expedition to Egypt; but in consequence of a dispute with Pharnabazus returned to Athens without having accomplished anything of importance. In 369 B.C. he was appointed to the command of the troops sent by the Athenians to the assistance of Sparta at the time of the invasion of Epaminondas, but allowed the Theban general to withdraw unmolested from the Peloponnesus. In the Social War (357–355) he was one of the commanders of the fleet fitted out by the Athenians for the recovery of Byzantium, when, being accused of treachery by one of his colleagues, he defended himself with such spirit that he was acquitted by his volatile countrymen; but though he lived to a great age, he did not again engage in active service. The date of his death is not known. Iphicrates was a strict observer of discipline, and was the author of some important improvements in the arms and accoutrements of the Athenian soldiery. He was accustomed always to fortify his camp in the field even in a friendly country; and when once asked why he took so much trouble, he answered, 'Because if, contrary to probability, I should be attacked, I may not be obliged to make the disgraceful excuse that I did not expect it'.

IPHIGENIA, daughter of Agamemnon and Clytemnestra (according to some an illegitimate daughter

of Theseus and Helen, adopted by Clytemnestra in childhood), was to have been sacrificed to Artemis (Diana) at the advice of the prophet Calchas, when the goddess, enraged with Agamemnon because he had slain in hunting her consecrated hind, detained the Greek fleet in Aulis by a calm. Under the pretence that she was to be married to Achilles, Iphigenia was taken from her mother, and led to the altar. But in the moment when the priest was about to give the death-blow Iphigenia disappeared, and in her stead a beautiful hind was substituted, whose blood gushed out on the altar. Artemis had relented, and conveyed her in a cloud to Tauris, where she became the priestess of the goddess. Conformably with the cruel law of the country, she was obliged to sacrifice every Greek that landed there. While she was serving as priestess there her brother Orestes came to the place to bring away the image of Artemis, as he had been advised by an oracle to do, that he might get rid of the madness to which he had been subject since the murder of his mother. He also was to be sacrificed, but Iphigenia having recognized him as her brother, the two contrived a means of escape, and carried off with them the image which Orestes had come in quest of. Iphigenia is said to have taken the image of Artemis to the town of Brauron, near Marathon, in Attica, where she died as priestess of the goddess. Pausanias says that her grave was shown at Megara. The story of Iphigenia has been dramatized by Euripides (who composed two plays upon the subject—Iphigenia in Aulis and Iphigenia in Tauris, the former of which was translated into German by Schiller) and Goethe, and it is also the subject of two operas by Gluck.

IPSAMBOOL, EBSAMBOOL, ABUSAMBUL, or ABUSIMBEL, a village in Africa, Nubia, on the left bank of the Nile, 56 miles south-west of Derr; lat. 22° 22′ N., lon. 31° 40′ E.; remarkable for containing two of the most perfect and magnificent specimens of Egyptian rock-cut temples existing. Their fronts have been fashioned out of two distinct faces or walls of sandstone, and their interiors excavated in the solid rock. They are of different dimensions, the one having a front of 90 feet, the other of 120 feet. The smaller stands 20 feet above the present level of the Nile, and is as perfect as when first completed; the larger 100 feet. The façade of the latter, smoothed perpendicularly in the face of the rock, overlooking the Nile, is 120 feet in length and about 90 feet in height, surrounded with a moulding, and adorned with a cornice and frieze. Attached to this façade are several stupendous colossal statues of Rameses II. (the Great). They are represented as seated on thrones, including which their total height may be between 60 and 70 feet. These gigantic statues are four in number; but the head and shoulders of the third from the north, having been shattered by a rocky avalanche descending from the mountain above, now lie on the ground in front. In the interior besides numerous smaller chambers, is a vast hall adorned on either side with an imposing range of massive square pillars, each with a gigantic statue 17 feet in height attached to it in front. This magnificent excavated temple extends inwards from the entrance 200 feet. The façade of the smaller temple, which was dedicated to Hathor or Athor, is adorned with several statues in prominent relief, and the interior is divided into a hall of six square pillars, a transverse corridor with a small chamber at each extremity, and an adytum. These temples were first visited by a European (the Chevalier Drovetti, consul-general of France in Egypt) in 1816. The larger of the two was first entered by Belzoni, who caused some of the statues found in the interior to be conveyed to England.

IPSARA. See PSARA.

IPSWICH, a parl., municipal, and county borough and river-port in England, capital of the county of Suffolk, on the north side of a semicircular reach of the Orwell (or estuary of the river Gipping), 65 miles north-east of London. It is pleasantly situated on a gentle declivity sloping to the river. The town has greatly increased in recent years, so that a large part of it is new, while many alterations have been made in the older parts. It still contains many old houses, however, and its streets exhibit interesting specimens of mediæval architecture. The public buildings include a fine town-hall, new post-office, a large public hall, a masonic hall, a custom-house, new corn-exchange, county court-house, barracks, hospital, convenient market-place, county jail, an assembly-room, a museum, free library, art gallery, a theatre, &c. There are also numerous churches, several of them recently restored or rebuilt; an endowed grammar-school dating from the fourteenth century; several well-endowed charity schools, and numerous other charitable foundations, a mechanics' institution with a good library attached, a literary institution, &c. There are two extensive establishments for the manufacture of agricultural implements, machinery, and other varieties of iron work; artificial stone and artificial manure works, a silk manufactory, tanneries, rope-yards, lime and cement works, breweries, a large manufactory of railway permanent-way fittings, and a good deal of ship-building. There is a dock with an area of 32 acres connected with the Orwell and admitting vessels drawing 18 feet. The shipping trade of the port is considerable. The principal exports are grain, machinery, and artificial manures; the chief import is coal. The other imports are timber, stone, slates, &c. The timber is chiefly brought from Norway. In 1902 the number of vessels entered was 4459, of 408,711 tons; cleared, 4419, of 410,478 tons. There were 112 vessels of 6880 tons burden belonging to the port. Ipswich is a town of great antiquity. A mint existed in it as early as 964, which continued in operation till the reign of Henry III. According to Camden Ipswich was originally called Gippeswich, from the neighbouring river Gippen or Gipping. It was destroyed by the Danes, but was subsequently restored by King John, who gave it its first charter. It sends two members to the House of Commons. Pop. in 1881, 50,546; in 1891, 57,360; in 1901, 66,622.

IPSWICH, a thriving town of Queensland, on the river Bremer, 23½ miles west of Brisbane, situated on the slopes of three hills, in a district in which coal-mines are now profitably worked. It is well built, lighted with gas, well supplied with water, and has a woollen factory, saw-mills, foundries, &c. Pop. (1891), 7625; (1901), 9937.

IQUIQUE, a seaport in Chili, in the province of Tarapacá, 8½ miles west by south of Tarapacá, till quite recently merely a small fishing village, but now a town of about 34,000 inhabitants. It owes its prosperity to the export of nitrate of soda and borax, the former of which especially is found in great quantities in the pampa of Tamarugal. At present the annual export of nitrate amounts to about 850,000 tons, and that of borax to about 1500 tons. Iodine is also exported. The pampa of Tamarugal still contains, it is estimated, about 60,000,000 tons of saltpetre. In 1868, and again in 1877, the town was almost entirely destroyed by an earthquake. In 1879 it was bombarded and captured by Chili from Peru; and in 1891 it was much damaged by the insurgent Chilians.

IRAK AJEMI (ancient *Media Magna*), a large province in Persia, bounded on the north by Azerbijan, Ghilan, and Mazanderan; on the east by

Khorasan, on the south by Farsistan and Khuzistan, and on the west by the Turkish dominions; greatest length from east to west, about 440 miles; greatest breadth, 340 miles. Although not equal to some of the other provinces in fertility and cultivation, it contains fine valleys and rich plains with excellent pasturage, and considerable tracts of cultivated land. The valleys are of indefinite length, but seldom exceed 10 or 15 miles in width. When well watered, as many of them are, they produce ample crops of rice, wheat, sesamum, and other grains; with fruits, opium, tobacco, cotton, saffron, and silk. The great emporium of trade is Ispahan, the former capital of Persia; besides which it contains Teheran, the modern capital of the country, Kashan, Hamadan, &c.

IRAK ARABI, the district lying between the rivers Tigris and Euphrates, at the lower part of their course, corresponding pretty nearly to the ancient Babylonia.

IRAN, more properly ERAN (Old Persian, *Aryana;* Zend, *Airyana*, that is, land of the Aryans), was the name given by the ancient Persians to their native land, in opposition to Aniran (that is, Not Iran), the land of the barbarians, by which term were meant principally the Turco-Tartaric tribes bordering on the north. The Persian rulers of the dynasty of the Sassanidæ call themselves, in inscriptions on monuments and elsewhere, kings of Iran and Aniran. At the present day the name is used in contradistinction to Turan, the name applied to the more depressed regions of Asia inhabited by the Turco-Tartaric tribes, to designate the great table-land of Asia, which, at a mean elevation of from 3500 to 4000 feet, extends from the chains of Hindu Kush, Northern Khorasan, and Elburz, to the Persian Gulf and the Indian Ocean, and in the east embraces Afghanistan and Beloochistan (East Iran), and in the west consists of Persia Proper (West Iran). On the east the table-land descends abruptly towards the Indus, while in the west, from the Persian Gulf to the Armenian plateau, it is bounded by a succession of mountain ranges called by the ancients Zagros, and by modern geographers the Mountains of Kurdistan. The central portion of this table-land consists of an extensive salt-desert.

IRANIAN LANGUAGES, the name given, from the locality in which they are spoken, to a family of the great stock of the Indo-European languages, a family closely allied to the Indian group, and called by some philologists Persian, from the best-known member of the family. The two oldest known Iranian languages are the Old Persian and Old Bactrian. The former—that of the cuneiform inscriptions of the Achæmenian dynasty, and the language of the Persians proper—has only become known in its chief traits at a comparatively recent date through the deciphering of those inscriptions. The Old Bactrian or Zend is the language in which the so-called Zend-avesta, the sacred writings of the Parsees, are composed. By the term Middle Iranian languages the Huzvaresh or Pehlevi and the Parsi principally are understood, which are preserved in the commentaries to the Zend-avesta. The latter approaches pretty closely to the modern Persian. The dialect of the so-called Pehlevi coins, as well as the inscriptions of the time of the Sassanian dynasty, also belong to this section. The most important of the New Iranian languages is the Persian, in which has been produced a very rich and celebrated literature, and which as a cultivated literary language (Deri, that is, court language) is distinguished from the dialectic varieties of the different regions of Persia (Talish, Ghilek, Mazanderani, Tat, &c.), which European scholars are as yet only partially acquainted with. The Afghan or Pashtu, and the dialects of the Kurds, form separate branches of the Iranian family. The isolated Ossetes of the Caucasus also speak an Iranian language. The Armenian is a very ancient branch of the same stock, and contains many peculiar elements. The philological investigation of the Iranian languages did not commence till about the close of the third decade of the 19th century. Among scholars in this department are Olshausen, Lassen, Bopp, Brockhaus, Oppert, Haug, F. Müller, and Justi in Germany, Burnouf and Darmesteter in France, and Westergaard in Denmark.

IRBIT, a town in Russia, in the government of Perm, and 270 miles east by north of the town of Perm, at the confluence of the Irbit and the Niza. It is very poorly built. It is noted for an annual fair, which lasts from 15th February to 15th March, and is attended not only by Russian and Siberian, but also by foreign merchants. Steam packets run between Irbit and towns on the Tobol, Irtish, and Obi. Pop. (1897), 20,064.

IRELAND (Irish, *Erin*; Latin, *Hibernia*), the more westerly and less important of the two principal islands of which the United Kingdom of Great Britain and Ireland is composed. For the geography of this part of the United Kingdom, including a description of the physical features, a statement of population and area by counties, &c., see BRITAIN. The total population in 1901 was 4,456,546.

Agriculture.—The climate of Ireland is very favourable to vegetation. Its mild temperature and humid atmosphere enable several delicate plants, which usually, in the same latitude, can only be cultivated in sheltered gardens, to flourish here with vigour in the open air; and not unfrequently forest trees continue to retain their foliage after they have lost it in the warmer parts of England. So far, then, as nature is concerned, no country ought to be richer in forest scenery than Ireland; and it would seem that, in early times, large tracts of magnificent timber were spread over its surface; but the grossest waste and mismanagement have prevailed, trees have almost disappeared everywhere except from the parks of the gentry, and what ought to have been among the best, is perhaps the worst wooded country in the middle latitudes of Europe. One somewhat equivocal advantage resulting from this is, that large tracts, which might have been otherwise occupied, now give employment to the plough or the spade, and serve to swell the gross amount of agricultural produce. Notwithstanding the great extent of her dismal moorland wastes few countries have, in proportion to their area, raised more human food, on an average of years, than Ireland. This is owing to the fertility of the soil. After deducting mountain and moorland there remains a vast extent of arable surface, covered with a deep friable loam of remarkable richness. Seldom so light as to degenerate into sand, or so heavy as to contain an undue mixture of stubborn and impervious clay, the soils of Ireland possess that happy medium texture which at once facilitates the operations of husbandry, and insures it an abundant return. In addition to the vegetable mould, which forms one of their most important ingredients, they consist, generally, either of the decomposed trap, so widely spread over the north of Ulster, or of calcareous matters derived from the limestones which prevail in almost every other quarter. Thus in point of staple they cannot be surpassed, and justify the eulogium of Arthur Young when he says they 'will fat the largest bullock, and at the same time do equally well for sheep, for tillage, for turnips, for wheat, for beans; and, in a word, for every crop and circumstance of profitable husbandry.' But there is perhaps no country in Europe where agriculture, considered as a system, has made less progress. The holdings,

originally too small to be occupied by farmers of capital and enterprise, have been allowed in far too many cases to become almost infinitesimally subdivided, until they have been reduced to the smallest patches on the produce of which a family could manage to subsist. The result of this is that the holders are reduced to the necessity of raising as much as possible in each year for immediate use, without regard to the ultimate effect of this mode of farming upon the land. Over-cropping is thus an evil which prevails very widely, and competent authorities have borne witness to the fact that the soil of Ireland has deteriorated under this treatment. Yet the deterioration would seem to have ceased some time ago (perhaps as a result of the decrease in small holdings), for if we compare some of the years between 1850 and 1860 with some of those near the present day the average produce of the soil per acre will be found to have increased rather than diminished. The table shows a great decrease in the area under cereal and green crops, and a great increase in the area under meadow and clover, and the change

Table showing Extent under Crops in Ireland and Estimated Produce in 1856 and subsequent Years.

Year.	Extent under Cereal Crops.	Produce.	Extent under Green Crops.	Produce.	Under Meadow and Clover.	Produce.
	acres.	qrs.	acres	tons.	acres.	tons
1856	2,785,208	11,755,566	1,547,746	9,779,573	1,302,787	2,492,732
1857	2,786,828	11,528,938	1,591,216	8,679,970	1,369,892	2,566,644
1858	2,748,380	11,612,486	1,603,464	10,075,784	1,424,495	2,701,006
1859	2,652,780	10,425,329	1,619,325	8,094,396	1,437,111	2,321,779
1875	1,916,808	10,025,576	1,370,155	9,952,346	1,944,676	4,354,517
1876	1,848,788	9,240,570	1,363,692	9,734,626	1,861,128	3,458,239
1877	1,862,595	7,867,868	1,355,009	6,287,563	1,924,917	4,331,163
1878	1,831,521	8,531,187	1,317,863	8,302,930	1,942,804	4,417,344
1879	1,761,867	6,887,192	1,294,690	3,786,418	1,937,255	3,598,580
1880	1,766,477	8,462,764	1,241,253	8,406,280	1,909,825	3,795,003
1881	1,766,877	8,512,470	1,268,817	7,856,331	1,998,402	3,989,834
1882	1,756,737	7,776,403	1,248,963	6,293,005	1,962,152	4,115,162
1885	1,594,903	7,530,600	1,213,540	7,770,748	2,034,768	4,156,095
1886	1,590,704	7,533,465	1,221,312	7,663,568	2,094,209	4,428,732
1891	1,402,763	8,063,883	1,191,424	8,779,427	2,059,529	4,342,852
1892	1,494,788	7,606,176	1,174,863	7,924,389	2,142,810	4,501,228
1898	1,376,318	7,899,081	1,105,026	9,114,722	2,775,215	5,277,623

in this direction is still going on. Between 1851 and 1881 the farms of 1 to 15 acres decreased in number by 66,363. The total number of holdings in 1901 was 490,301, or 3436 more than in 1891. Of these 29,037 (10,794 more than in 1891) did not exceed 1 acre, 52,388 (decrease of 3166) were from 1 to 5 acres, 134,188 (5007 decrease) from 5 to 15 acres, 118,749 (1723 decrease) from 15 to 30 acres, and 155,739 (2338 increase) above 30 acres. The great increase in the number of holdings not exceeding 1 acre between 1891 and 1901 is due to the Labourers' Acts, which have been put in force chiefly in Leinster and Munster.

The Land Act of 1870 greatly improved the conditions of tenure in Ireland. The chief aims of the act were to provide compensation to tenants for arbitrary eviction and especially for improvements effected by them on their holdings in case of their being disturbed in their possession by the landlords, and to afford facilities to tenants for the purchase of their holdings. The act legalized what is called the Ulster tenant-right custom in all the districts in which it prevailed, and decreed the amount of compensation to be awarded in absence of such custom. In 1881 it was supplemented by a more thorough and comprehensive measure. The benefits conferred on Irish tenants by this act have been briefly summarized under the terms 'fair rent', 'fixity of tenure', and 'free sale'. By the first of these every tenant who objects to his rent, or the rent the landlord wishes to exact, is entitled to have a 'fair rent' fixed for him by a court. This rent remains unaltered for fifteen years, at the end of which period it may be readjusted, and either raised or lowered. By the principle of 'fixity of tenure' the law recognizes that the tenant has a certain right in his holding in virtue of which he is not to be arbitrarily removed from it without compensation, and which enables him on leaving his farm to obtain the best price he can get for yielding up his possession. The 'free sale' of this right of tenancy is restricted only in so far as that it must be to one person only (except under agreement with the landlord), that the landlord may object on sufficient grounds to the person purchasing, and that he also has the right of pre-emption. At the expiration of the fifteen years the landlord may resume possession of the holding on paying the tenant compensation for improvements effected by him, and also paying him the value of his tenant-right, both being determined by the court should the parties be unable to agree. A tenant who sells his tenant-right on quitting his holding is not to be entitled to compensation for disturbance, or if he has received compensation he is not entitled at that time to sell his tenancy. A tenant holding under the Ulster tenant-right may sell under that or under this system, but not partly under one and partly under the other. The scale of compensation for disturbance of tenancy is now fixed as follows: where the rent is £30 or under a sum not exceeding 7 years' rent; rent from £30 to £50 not exceeding 5 years' rent; from £50 to £100 not exceeding 4 years' rent; from £100 to £300 not exceeding 3 years' rent; from £300 to £500 not exceeding 2 years' rent; above £500 not exceeding 1 year's rent. The act also empowers the land commission to advance loans to tenants not exceeding three-fourths of the value of their holdings, to enable them to become proprietors, and such loans are repayable by an annual payment of £5 per cent for 35 years. Provision is also made for assisting emigration. A tenant whose holding, or the aggregate of whose holdings, is valued at not less than £150 is entitled by writing to contract himself out of any of the provisions of this act, or of the act of 1870. Another act passed in 1887 extends the privileges conferred by the act of 1881, and a third act passed in 1896 goes further in the same direction. In 1903 a great act was passed with the object of gradually putting an end to dual ownership: twelve millions sterling are to be advanced by the state to make landlords willing to sell, while corresponding inducements are arranged for tenants willing to purchase.

Manufactures and Trade.—The linen manufacture early took root in Ireland, and still continues to be its most important staple; and in every article, except lace and cambric, competes successfully with all other countries. It has increased in a remarkable manner within the last 40 or 50 years, and Belfast, its centre, has now become the first city of Ireland in population as well as in manufacturing industry. The linen manufacture, indeed, is of importance for the whole of Ulster, the number of hands employed being nearly 70,000. The cotton manufacture has had a very different history, the number employed in this industry having declined from 4000 in 1868 to 800. The woollen manufacture appears at the outset to have outstripped that of linen. It had at least made such progress as to

alarm the woollen manufacturers of England; who, in a spirit of petty jealousy, petitioned the English Parliament for its discouragement, and succeeded. The Irish were prohibited from sending their woollens abroad, and could not even send them into England without paying an oppressive duty. Had the manufacture been suited to the country it might have surmounted all this absurdity and injustice; and, at all events, when these ceased to operate, would have revived. But the woollens of Ireland continue to be of very secondary importance, and indeed the manufacture seems to have much decreased in recent years. The manufacture of Irish poplins (of woollen and silk, or woollen and flax or cotton) is very flourishing. There are about twenty mills engaged in paper-making. The brewing of porter and distillation of whisky form important items in the national production. Sewed muslins, cambric handkerchiefs made on hand-looms, lace, and hosiery may also be mentioned.

The Trade of Ireland is not at all proportioned to her natural capabilities, and to the admirable facilities afforded by the excellent harbours situated on her coasts. The most important article of export is raw produce, the greater part of which finds its market in Great Britain. It consists chiefly of grain and flour, live stock, salt and fresh meat, eggs, butter, &c. Manufactured articles, particularly linen, rank next in importance; but as the bulk of such articles is very small in comparison with their value, the trade, or at least the shipping connected with them, holds only a secondary place. The trade with foreign countries is also inconsiderable. The principal imports are colonial produce, woollen and cotton goods, wheat, wool, coals, and salt. Of the shipping employed in this trade only a mere fraction is Irish. The value of the exports direct from Ireland to foreign parts was about £906,618 in 1883, of imports from foreign parts, £10,633,324; in 1902 they were £1,435,000 and £13,121,000 respectively. In 1902 the number of vessels entered from the colonies and foreign parts was 1085 (1,097,207 tons); and cleared 376 (363,906 tons); entered coastwise 32,387 (6,491,688 tons); cleared 32,305 (6,988,414 tons).

Fisheries.—The salmon fisheries are very valuable, and are increasing in value every year. With an increased supply of fish high prices are maintained owing to the improved means of communication from remote districts with the best markets. In spite of this, however, these fisheries are not cultivated to anything like so high a degree as they might be. Still, the number of men engaged in the salmon fisheries in Ireland is over 13,000, the estimated value of the salmon exported being from £400,000 to £250,000 annually. The principal sea fisheries of Ireland are those of herring and mackerel. The herring fisheries in the Irish waters are prosecuted chiefly on the east coast by Irish boats from Howth, Arklow, and other places on the Irish coast, and by a fleet of vessels from Cornwall, Scotland, and the Isle of Man. The number of boats engaged in this branch of the sea fishery is much smaller than in Scotland, from which considerable quantities of cured herrings are imported. The total number of boats engaged in the sea fisheries is now between 3000 and 4000, the number of men and boys employed being about 24,000. The native fishermen, it is said, are now successfully competing with their rivals, yet the sea fisheries of Ireland on the whole have much declined, as shown by the decrease from 55,630 hands and 13,483 boats employed in 1860, to the figures just given.

Means of Communication.—The rivers of Ireland form excellent navigable channels. In several of them, however, when the water was low, the navigation became seriously impeded by rocky shoals. In removing these, or in making artificial cuts for the purpose of avoiding them, vast sums have been expended. Improvements of equal importance have been made by the construction of canals; but since the introduction of railways, canals have in Ireland, as elsewhere, sunk to a position of secondary importance. The principal canals are the Grand Canal (165¾ miles in length), the Royal Canal (96¼ miles), the Barrow Navigation (42¼ miles), the Newry Navigation (35 miles), the Lagan Navigation (26¼ miles). With the exception of the Barrow Navigation, the Grand Canal, and the Lagan Navigation, the dividends paid by the Irish canals in the possession of public companies are almost nominal. The Royal Canal yields a profitable return, but it is merged in the Midland Great Western Railway. The Grand and Royal Canals connect the important systems of the Shannon Navigation, in all 158 miles in length, with Dublin. The railway system of Ireland, although not approaching in proportional extent that of England, or even that of Scotland, has yet attained a considerable development. They are all constructed on a gauge of 5 feet 3 inches, which is compulsory. The average cost of construction, including carrying stock, was about £16,000 per mile. The principal Irish railways are the Belfast and Northern Counties Railway, with a total length of 249 miles; the Dublin, Wicklow, and Wexford Railway, 144 miles in length; the Great Southern and Western, 1074 miles, a system recently greatly increased in mileage by the amalgamation of the Waterford, Limerick, and Western (342 miles); the Midland Great Western Railway, 538 miles (including the Great Northern and Western, &c.); the Great Northern of Ireland, 533 miles (including the Dublin and Belfast Junction, 63 miles, and the Ulster Railway, 140 miles). There are a good many light railways besides, total length 230 miles. A certain number of the Irish railways do not pay any dividend; but those that do pay represent a large proportion of the capital invested in railways in Ireland, and some of them are very remunerative. The most profitable are a short one connecting Dublin with Kingstown, the Belfast and Northern Counties, and the Great Northern. At the end of 1901 the total length of railways open for traffic was 3208 miles. The total number of passengers for that year was 26,853,332; the total amount of minerals and general merchandise carried, 5,136,624 tons; the total receipts from passengers and goods amounted to £3,834,349.

Public Works.—Large sums have been advanced in loan by the sanction of the imperial parliament under various acts for public works, &c., in Ireland. The Irish Board of Public Works has charge of such grants and their expenditure, the objects to which they are applied including landed improvements and drainage; fishery piers and harbours; roads, bridges, and public buildings; tramways, light railways, and certain lines of inland navigation; the preservation of ancient monuments; and latterly, the commissioners may lend for the purpose of any work for which county or borough councils are authorized to borrow. Of £24,228,038 of loans advanced for purposes that have not yet been fully carried out ('current services') £13,531,079 has been repaid, besides interest amounting to £7,141,423, while the sum of £1,597,050 has been remitted. The largest item of this expenditure, namely £5,239,220, has been spent on the improvement of lands; river drainage and navigation have absorbed some £2,967,500, while on lunatic asylum buildings there has been spent £2,620,385, in schemes for the improvement of public health £2,690,278, under the Labourers' Acts £1,830,188 (to provide employment, &c.), on railways £1,200,127; in advances to occupants for improve-

ment of holdings £1,071,106, roads and bridges £1,008,244. Other sums have been spent on harbours and docks, reclamation of lands, dwellings for the poorer classes, teachers' residences, dispensaries, and, since the recent land acts, in advances to tenants for the purchase of their farms.

Religious Bodies.—The conversion of the Irish to Christianity is generally ascribed to St. Patrick, a native of Scotland, who is said to have received his mission from Pope Celestine, and to have been raised to the archiepiscopal chair of Armagh. It appears that till the twelfth century the pope's authority in Ireland was not recognized, and that long before that time a regular hierarchy had been established there, with numerous bishops. Until the arrival of the English in Ireland the number of its sees and the succession of its bishops, as well as the history of its ecclesiastical affairs, are involved in great obscurity.

The Reformation never made much progress in Ireland, and though a Protestant Episcopal church was established by law, it was only the church of a small minority. In 1869 it was disestablished.

Previous to this time the clergy were supported by a tithe rent-charge, the proceeds of the church lands, &c., the total annual income of the church, including the value of houses and lands in occupation, being £613,984. By the above act, taking effect from 1st January, 1871, the position of the church and clergy was entirely changed, though those holding be..efices at the time of its passing have not suffered loss. The property and tithes formerly belonging to the church are now vested in commissioners, who pay to all deprived of income by the act, so long as they continue to discharge the duties of their offices, such an annual sum of money as they would otherwise have received, deduction being made of curates' salaries, and other outgoings to which the parties would have been liable, and regard being paid to the prospective increase of incomes by the falling in or cessation of such charges; or instead of an annual sum, an equivalent single payment has been paid to such as have commuted their claims in that manner. The Irish Church accordingly is no longer a state church, and none of its bishops have now a seat in Parliament. It is still a vigorous and flourishing institution, however, and possesses funds amounting to over £8,128,000. Of this upwards of five millions has been voluntarily contributed by friends of the church since it was disestablished. While disestablishing the Irish Church, the act at the same time declared the cessation of the Maynooth grant and the *Regium Donum* (see below). The affairs of the Irish Church are now managed by the diocesan synods and by the general synod in conjunction with the representative body. The supreme legislative powers reside in the general synod, which meets in Dublin, and is composed of the archbishops of Armagh and Dublin and the eleven bishops, and of lay and clerical representatives from the different dioceses; the lay representatives being more than twice as numerous as the clerical. The representative body incorporated in 1870 consists of the archbishops and bishops *ex officio*, thirty-nine lay and clerical elected members (three for each diocese), and thirteen co-opted members elected by the other two classes conjointly. This body is empowered by its charter to hold church property, subject to the regulations of the general synod. The church uses the Book of Common Prayer, as revised in accordance with statutes passed by the general synod, and furnished with a preface containing an exposition of its formularies in the sense in which they are understood by the church.

At the head of the Roman Catholic Church in Ireland are four archbishops, who take the titles of Armagh, Dublin, Cashel, and Tuam, and twenty-four bishops. They are all nominated by the pope, generally out of a list of three names presented to him by the bishops of the province and the clergy of the vacant diocese. In many of the dioceses there are a chapter and cathedral corps, the dean being appointed by the cardinal-protector at Rome. The other dignitaries are the vicars-general, commonly one, two, or three to a diocese, according to its extent, who have special disciplinary and other powers; the vicars-forane, whose functions are more restricted, and of whom most dioceses have one or more up to ten; and the arch-deacons. All of these are nominated by the bishop, who has also the exclusive nomination of the parochial clergy. The Irish Roman Catholic clergy are supported by voluntary contributions. Their incomes are derived from fees paid at marriages, baptisms, and deaths, Easter and Christmas dues, and incidental contributions in money or labour. There are numerous monasteries and convents. The seminaries for the education of the priesthood are the College of Maynooth, founded in 1795, and formerly supported by an annual charge on the Consolidated Fund of £26,360, which was abolished by the Irish Church Act of 1869, a sum of £372,331 having been paid in compensation; and the colleges of St. Patrick, Carlow; St. Jarlath, Tuam; St. John, Waterford; St. Peter, Wexford; St. Colman, Fermoy; St. Patrick, Armagh; &c., all supported by voluntary contributions.

The Presbyterian Church of Ireland is chiefly confined to the province of Ulster, where it may be said, more especially in the counties of Down and Antrim, to be the leading religious denomination. Its ministers are supported by voluntary contributions, seatrents, and church funds. They were formerly aided by an annual grant from government, called the *Regium Donum*, the amount of which, paid in 1869, was £40,547. This annual grant, however, was abolished, as already mentioned, by the Irish Church Act of 1869, and was commuted to a single sum of £701,372 paid to the church. According to the census of 1901 there were in Ireland 3,310,028 Roman Catholics, 579,385 Protestant Episcopalians, 443,494 Presbyterians, 61,255 Methodists, and 56,703 members of other persuasions, besides 3769 Jews.

Education.—The principal educational institutions in Ireland are Dublin University and the three Queen's Colleges, upon which separate articles will be found. The Queen's Colleges were formerly connected with an examining and degree-conferring body (Queen's University), for which the Royal University of Ireland was substituted in 1882, in pursuance of the University Education (Ireland) Act, 1879; £20,000 being yearly granted from the surplus funds of the Irish Church. The Queen's Colleges, however, are not directly affected by this act. The Royal College of Science for Ireland was established under the authority of the Science and Art Department, London, in August, 1867. Its object is to supply a complete course of instruction in science applicable to the industrial arts, and to aid in the instruction of teachers for the local schools of science. There are professors of physics, chemistry, botany, zoology, agriculture, mining, geology, applied mathematics, &c. The course of instruction extends over three years. There is also the Catholic University of Ireland, established in 1854, and consisting of colleges at Dublin, Maynooth, Carlow, &c., sending up students for examination at the Royal University of Ireland; the General Assembly's Theological College, Belfast; the Magee College, Londonderry, a Presbyterian college opened in 1865, and embracing in its curriculum literature science, and theology; the College of St. Columba, near Dublin, founded for the purpose of establishing a system of instruction preparatory to

the university; &c. There are numerous schools, some of them of royal and private foundation and endowed, but the most prominent are those established since 1831 under the superintendence of the Commissioners of National Education. These schools are open to the children of parents of all denominations. The pupils are not required to attend any religious exercise or religious instruction of which their parents or guardians disapprove, and opportunity is given to pupils of each religious persuasion to receive separately at appointed times such religious instruction as their parents or guardians may approve of. Of these schools there were 8670 in operation in 1899, with 785,139 pupils on the rolls. The average daily attendance was small, being only 513,852. In 1892 an act was passed by which a beginning was made of free education, and a modified system of compulsion. In 1878 an act was passed for the promotion of the intermediate secular education of boys and girls in Ireland. By this act £1,000,000 from the Irish Church surplus fund was set apart, being invested in commissioners who are to apply the revenue arising from it to the purposes of the act, these being (1) the carrying on of a system of public examinations; (2) the awarding of exhibitions, prizes, and certificates to students; and (3) the payment of results fees to the managers of schools fulfilling certain prescribed conditions. The schools referred to in the act are of a grade superior to the national schools The subjects of examination are Latin and Greek, modern languages, Celtic, natural science, mathematics, &c.

Government, People, &c.—Ireland by the Act of Union became an integral part of the United Kingdom and shares in its legislation by means of twenty-eight representative peers in the House of Lords, and 103 representatives in the House of Commons. The representative peers are elected for life by the whole body of Irish peers. The lord-lieutenant, who represents the sovereign, holds his court in the castle of Dublin. Since the census of 1841, when the inhabitants of Ireland numbered fully 8,000,000, the population has almost steadily decreased. In 1846–47 a frightful famine, occasioned by the potato disease, broke out, and was followed by a visitation of fever and cholera. The population was in consequence greatly reduced, and since then emigration has taken the place of famine and disease in reducing it further. The extent of this emigration will be gathered from the following statement of the numbers that left the country between 1851 and 1899:—

Provinces.	Number of Emigrants between May 1, 1851, and Dec. 31, 1898.		
	Males	Females.	Total.
Leinster,	355,104	320,706	675,810
Munster,	673,106	640,092	1,313,198
Ulster,	590,314	475,761	1,066,075
Connaught,	282,532	306,616	589,148
Not specified	61,766	48,902	110,668
Total,	1,962,822	1,792,077	3,754,899

From the causes just referred to the total population of Ireland, which might by natural increase have amounted to at least 10,000,000, has dwindled away to 4,456,546 in 1901. The smaller number, however, live in far greater comfort than did the larger. Very much has been accomplished for the amelioration of the condition of Ireland, not merely by the improvement of the land, but by the erection of a better class of farm-buildings and homesteads and dwellings for the peasantry. That the standard of living is much raised throughout Ireland is shown by an immensely increased consumption of meat, bread, tea, coffee, and sugar, and by the improved dress of both men and women.

History.—The beginning of the history of Ireland is enveloped in fable. Among the ancients it was known at least as early as the time of Aristotle, who calls it *Ierne*. In Diodorus Siculus it is called *Iris*; in Strabo, *Ierne;* in Pomponius Mela, *Iverna;* in Pliny, *Hybernia*. Yet the information to be found about Ireland in the works of the ancient geographers and historians is altogether very scanty. The bardic historians of the country speak of Greek and Phœnician colonies, give lists of kings, &c., for which there is no authentic foundation. The vernacular language of the Irish proves that they are a part of the great Celtic race which was once spread all over Western Europe. The oldest and most authenticated Irish records were written between the tenth and twelfth centuries; some of them go back, with some consistency, as far as the Christian era; but there is no evidence that the Irish had the use of letters before the middle of the fifth century, when Christianity and Christian literature were introduced by St. Patrick. The new faith did not flourish till a century later, when St. Columba erected monasteries. The repose which at that time the island enjoyed while Southern Europe was overrun by Germanic hordes, favoured the growth of a learned class of monks. Even in the sixth century Ireland became the seat of western learning; and its monasteries were the schools whence the missionaries who disseminated the Christian faith throughout continental Europe proceeded. The monasteries founded by them on the Continent, principally in South Germany, long bore the name of Scotch monasteries, as some of them do still. In the eighth and ninth centuries the scholars of Ireland were among the most distinguished at the courts of the Saxon kings, and of Charlemagne. But when the Northmen commenced their descents on the coasts, the ecclesiastics took to flight; and it is evident, from the condition of the people at a later period, that the learning of the Irish clergy did not then extend beyond the walls of the monasteries. Divided among a number of barbarous and hostile chiefs, Ireland had been for a long time torn by internal wars, and for nearly two centuries ravaged by the Danes, when, in the beginning of the eleventh century, Brian Boroimhé (the Conqueror) united the greater part of the island under his sceptre, restored public tranquillity, and subdued the northern invaders. These latter had by this time been converted to Christianity, and at the synod of Kells in 1152 the whole island was subjected to the papacy, and the Archbishop of Armagh raised to the primacy. Before this time the Christian Church in Ireland had maintained complete independence of the papal see.

After the death of Brian the island had relapsed into its former state of division and anarchy. Frequent wars kept the inhabitants in a state of great barbarism, and rendered them weak against any foreign foe. In this state of matters Henry II. of England conceived the design of conquering the island, and came to an understanding with the pope, Adrian IV., regarding the enterprise, in consequence of which the latter, in 1155, granted him a bull giving him the right to conquer the island, and arranging for the division of the advantages of conquest between himself and the king. Owing to the internal troubles which then engaged the attention of Henry in England some time elapsed before he could take any steps to effect the conquest which the pope had authorized him to attempt; but at last a circumstance occurred which gave him the desired opportunity. Dermot, prince of Leinster, had carried off the wife of O'Ruarc, prince of Leitrim, who then secured the help of Roderick O'Connor, prince of Connaught, who claimed a certain measure of authority over the whole island, and with his aid drove Dermot out of

his dominions (1170). Dermot then went to Aquitaine, where Henry II. of England at that time happened to be, did homage to him as superior of the island, and obtained his permission to enlist English subjects to assist him in recovering his dominions. After Dermot had been restored to his possessions by the Welsh barons, Robert Fitzstephen and Maurice Fitzgerald, and Richard de Clare, earl of Pembroke, had made himself master of Waterford and Dublin, Henry himself appeared in person in Ireland in October, 1171, accompanied by 400 knights and 4000 foot soldiers; but he took no warlike means to establish his authority. As he supported his claims by a Papal bull, the clergy of Ireland were from the first disposed to favour them, and the princes of Leinster and Munster, won by Henry's cordial behaviour towards them, very speedily submitted, and acknowledged the English supremacy. The native chiefs still maintained their independence. In 1315 Edward Bruce, brother of the King of Scotland, landed in Ireland at the head of a Scotch force, and caused himself to be crowned king of the island; but not being vigorously supported by the Irish, who had invited his assistance, he was defeated by the English in a battle fought near Dundalk, in which he himself was slain, and the Scotch were obliged, in 1318, to return. The English territory in Ireland (generally known as "the pale") was governed by various nobles subject to a viceroy. The subjection was, however, sometimes little more than nominal. The nobles quarrelled among themselves, and were very often at open feud. The beginning of the reign of Edward III. (1327) was marked in Ireland by the outbreak of civil strife in every part of the English pale, advantage of which was taken by the Irish races for a general rising, which threatened the safety of the English colonists, and which the government found itself unable to subdue, until it yielded to the demands of the barons in Ireland, by granting them complete civil and military jurisdiction in their own districts. During the wars with France some Irish troops served in the English armies, and the common sympathies induced by that circumstance seemed likely to promote a better state of feeling between the two races, when the breach was made wider than ever by the celebrated statute of Kilkenny (1367), framed under the viceroyalty of Lionel, duke of Clarence, son of Edward III., forbidding, under severe penalties, intermarriages between English and Irish, the assumption of Irish names by persons of English blood, the use of the Irish language, the native (Brehon) law, &c. In consequence of this the disturbances between the Irish and English inhabitants of Ireland increased so greatly that the English viceroy found it necessary to protect the pale by payments of money to the Irish chiefs, and this state of matters continued during the reigns of Richard II., Henry IV., and Henry V., until, in that of Henry VI., Richard, duke of York, was appointed governor of the island, who succeeded by his politic measures in restoring peace. An attachment to his descendants continued to influence the Anglo-Irish during the reign of Henry VII., as appears from the aid which the impostors put forward by the adherents of the house of York derived from Ireland. In the reign of Henry VII. (1495) was passed Poyning's Act (so called from Sir Edward Poyning, lord-deputy of Ireland), which provided that all former laws passed in England should be in force in Ireland, and that no Irish Parliament should be held without previously stating the reasons on account of which it was to be summoned, and the laws which it was intended to enact. The power of the English government in Ireland was thus strengthened, but nothing was done to improve the condition of the native Irish, whom the oppressive severity of the English yoke embittered without subduing. At the beginning of the sixteenth century the greater part of the island still remained unconquered by the English. The native Irish still lived according to their old constitution under their own chiefs, and in manners and mode of life were still totally uncivilized. In 1542 Henry received from the Irish Parliament the title of King of Ireland, instead of *lord*, which he had before borne, as a vassal of the pope; but he did nothing to extend the English sway, or to improve the social circumstances of the people. The reformation which took place in England during this reign took but a slight hold upon Ireland even in the English districts; but the monasteries were suppressed, and the tribute to the Papal see abolished. Under Edward VI. the deputy proposed to the Irish Parliament the adoption of the reformation; but Mary was easily able to undo all the little that had been done in this direction by her two predecessors. Elizabeth, in 1560, caused the measures adopted in the reign of Mary to be abrogated, imposed a Protestant clergy upon the people, and in their behalf confiscated the entire ecclesiastical property of the Roman Catholics. She endeavoured to improve the condition of Ireland, and employed able men to effect her purposes, yet her reign was marked by a series of risings, which finally terminated in a general war against England, usually called the *rebellion*. Hugh O'Neil, who had been raised by the queen to the dignity of Earl of Tyrone, instigated by the pope, and supported by the Spaniards, was the leader in this war, which, though successfully begun, ended with the complete defeat of the insurgents, and the reduction of the whole island by the English (1603). More than 600,000 acres of land were taken from the Irish chiefs, and for the most part distributed among English colonists. The reign of James (1603–25) was, on the whole, favourable to Ireland; the arbitrary power of some of the chieftains was restrained, the administration of justice improved, &c.; but the means which he took to effect some of these improvements were certainly sufficiently tyrannical. He demanded from every Irish chief the document upon which he rested his claim to his property, and if it was not to be found, or contained even any formal error, his lands were forfeited to the crown. Of 800,000 acres of land which in this way came into the hands of the king in the north of the island, a large share was entirely withdrawn from the Irish, and divided among Scotch or English settlers. In addition to this, the Catholics, on account of the oath of supremacy by which all public officers were required to acknowledge the king as head of the church, remained excluded from all official appointments. The recusants were encouraged by the pope, who established a Roman Catholic hierarchy alongside of the Protestant one in the island. On the accession of Charles I. Wentworth, afterwards Earl Strafford, was appointed lord-lieutenant; and his administration was beneficial to the country. But the republican inclinations of the English residents, the hate which existed between them and the Irish Catholics, the influence of the Irish clergy, who were educated in foreign countries, with other circumstances, led, in 1641, to an attempt to shake off the English yoke. Dr. Lingard says of this insurrection that it has been usual for writers to paint the atrocities of the natives, and to omit those of their opponents, but that revolting barbarities are equally recorded of both, and that if among the one there were monsters who thirsted for blood, there were among the other those who had long been accustomed to deem the life of a mere Irishman beneath their notice. After the death of Charles Cromwell was appointed (Aug. 15, 1649) lieutenant of Ireland, and with his usual energy and promptl-

tude, but with great cruelty, reduced the whole country within nine months. All the possessions of the Catholics were confiscated, about 20,000 Irish were sold as slaves in America, and 40,000 entered into foreign service, to escape the severity of the conqueror. Charles II. restored the fourth part of the confiscated estates to the Irish, and James II. appointed Tyrconnel, a Catholic, lord-lieutenant of Ireland, and filled the Parliament with Catholics.

But the sudden deposition of James from the English throne changed the face of matters. Almost at the same time that information was received that William had ascended the English throne, and meant immediately to send troops and supplies into Ireland, intelligence came that James had landed in Munster with an army. On the 24th of March, 1689, he entered Dublin. His promises of protection to the Protestants were rendered very suspicious by the solemn procession with which the Catholic clergy welcomed him into Dublin, and in a very short time were unequivocally proved to be insincere. As the Protestant strength lay chiefly in the north of Ireland, James resolved to direct his march thither. Londonderry was to be first reduced. In this city Lundy commanded, a man suspected of attachment to James, but to whom William, in the midst of his embarrassments, had been obliged to commit this important place. The suspicion that attached to him was too well founded. He refused to defend the town; and had it not been for the skill and intrepidity of George Walker, a clergyman, James would instantly have gained admittance into it. The inhabitants, encouraged by him, resolved to defend the town, and elected Walker and a Major Baker their governors. From the 18th of April to the 31st of July the town was closely besieged, and although poorly provided for defence, it gallantly held out, enduring the last extremity of famine, till it was relieved on the latter date by some ships from England, which broke the boom that had been stretched by the besiegers across the river Foyle below the town. The inhabitants were now saved from famine, and as it was on famine alone that the besieged had trusted for success, they immediately retired. On the 13th of August in the same year Marshal Schomberg arrived in Ireland with troops from England, but little was effected till the following year (1690), when King William arrived in person, and on the 1st of July gained a decisive victory over the forces of James on the Boyne River not far from Drogheda. On the 13th of July, 1691, another victory was gained over the Irish at Aughrim in Galway, and on the 3d of October Limerick, the last place in Ireland that held out for James, capitulated, a treaty being concluded at the same time with General Ginkell on behalf of the English, according to which the Catholic Irish were to be allowed the free exercise of their religion, as had been granted by Charles II. More than 12,000 Irish that had fought on the side of James went into voluntary exile. The Treaty of Limerick was very ill kept by the English, a fact which is commemorated by the name which the Irish still give to the place at which it was concluded, 'The City of the Violated Treaty.' By a decree of the English Parliament upwards of 1,000,000 acres of land were now confiscated and divided among Protestants. In order to keep down every movement of the Catholic population cruel penal laws were passed against those who adhered to that form of religion. By these laws the higher Roman Catholic ecclesiastical dignitaries were banished from the island; the subordinate priests were not allowed to leave their counties; no Roman Catholic could hold a public office, acquire landed property, enter into a marriage with a Protestant, &c. &c. Although these laws were not always rigorously carried out by the Protestant officials, yet they naturally excited great bitterness of feeling among the Roman Catholics, and were the cause of most of the frequent revolutionary associations which mark the subsequent history of Ireland. About 1760 the Whiteboys Association was formed. It consisted of starving day-labourers, ejected farmers, and others in a like condition, who used to assemble at night to destroy the property of hard landlords or their agents, the Protestant clergy, or any others that had made themselves obnoxious in the neighbourhood. In many cases they did not confine their acts of aggression merely to plunder and destruction, but even went the length of murder. After accomplishing what they had been assembled for they secretly disappeared, and as no person could give evidence against them without having to fear their vengeance, they usually remained beyond the reach of the law. They took the name of Whiteboys from their wearing white shirts over their dress on their nightly depredations. They were also called *Levellers*, because one of their chief employments was to *level* the fences which had been set up round newly inclosed land. About the same time as that of the Whiteboys, the association calling themselves Hearts of Oak arose to resist the burdensome taxes imposed for the construction of roads. All this, however, did not ameliorate the general condition of the country, and it was not till the American War of Independence taught the English government the folly of attempting to govern a people by coercion that the severity of the laws relating to Ireland was mitigated. In 1778 the penal laws against the Catholics, although not repealed, were made much more lenient. Catholics were henceforth permitted to acquire landed property, to erect schools, and to observe their own religion under fewer restrictions. In 1783 Poyning's Act was repealed, and freedom of legislation allowed to the Irish. In spite of all these alleviations of their condition there was still at least one thing that was felt by the Catholics as a special grievance, and this was the payment of tithes for the support of the Protestant clergy, while they had at the same time to provide for their own church. The rigour with which many of the Protestant ministers exacted these tithes at last brought about the formation of a secret society, the members of which called themselves *Right Boys* (1786). They made the people promise upon oath not to pay these tithes, or at least not more than a certain amount, and punished those who broke their word. The outbreak of the French revolution had naturally a great effect on the minds of the Irish people. It called forth expressions of enthusiasm for the cause of liberty, and sympathy with the leaders of that revolution, and begot the most extravagant hopes for themselves. Out of a corps of volunteers which had been formed in 1779, but which had been dissolved a few years later, a society was formed calling itself the Society of United Irishmen, which included in it many Protestants, and which secretly endeavoured to bring about a revolution which should convert Ireland into an independent republic. The Catholics at the same time took advantage of the embarrassment of the British government to demand equal rights with the Protestants, and the government gave in to this demand so far as to remove the hindrances which had been placed by the law in the way of Irish trade and industry, and to repeal nearly all that remained of the penal laws against the Catholics, who now received the right of acting as counsel before the court, and of entering into marriages with Protestants. When further demands were refused, the Society of United Irishmen allowed its revolutionary aims to become more apparent, and the government then determined to quell the movement by

force. The Habeas Corpus Act, which had been introduced into the country in 1782, was repealed; the towns were strongly garrisoned, and the society dissolved and disarmed. But the conspirators, trusting to expected aid from France, were not discouraged. At the close of 1796 a considerable French fleet did actually appear off the Irish coast bearing 25,000 land troops, under the command of General Hoche; but owing to adverse winds, and the incompetence of the commanders, it was obliged to return without having accomplished anything. The only effect of this expedition was to induce the government to take still stronger measures in Ireland, the whole of which was placed under military law. The United Irishmen were thus prevented from taking any open steps for renewing the society, but they continued to pursue their ends in secret, and devised for themselves a very skilful military organization. At its head was a directory of five men, whose names were known only to those at the head of the provincial committees. In Jan., 1798, the society already numbered more than 500,000 members, when a treacherous member gave information regarding the society to the government, and several of the leaders were seized. In consequence of this the conspirators, not knowing the extent of the revelations that had been made, resolved to anticipate any further preventive measures on the part of the government, and rushed into premature action. In May, 1798, simultaneous risings took place at different parts of the island; but the government was fully prepared, and the main body of the insurgents suffered a decisive defeat at Vinegar Hill on the 21st of June. Flying columns traversed the island, and checked by the most violent measures any further outbreaks. In August a French squadron appeared in Killala Bay with 1500 men on board, under General Humbert; but the British troops were easily able to prevent the troops after they had landed forming a junction with the insurgents, so that they were soon compelled to surrender. Another French expedition which approached the Irish coast in September was overtaken and attacked by Admiral Warren, and nearly all the ships composing it were captured. Several subsequent attempts of the French were similarly frustrated.

The events of this insurrection brought the British government to form the resolution of uniting the Irish and English Parliaments, since in the state of feeling which that movement too plainly manifested as prevailing among the people, it was felt that the independence of legislation enjoyed by the country fostered the desire of political independence, and it was feared that new revolutionary efforts might thence derive a legal sanction. The first proposal to this effect which was made in the Irish Parliament was rejected with indignation. The government then resorted to bribery to secure its purpose. £1,600,000 was spent in buying up the rotten boroughs which had the majority of seats in the Irish House of Commons. The Irish lords were from the first more favourable to the project. By these means an act providing for the legislative union of the two countries passed the Irish Parliament on the 26th of May, 1800, and the British Parliament on the 2d of July in the same year, in virtue of which the union was effected on the 1st of January, 1801. But although this measure bound the destinies of Ireland still more closely to those of the sister island, yet it was far from putting an end to the religious and political troubles which had so long divided the two countries. In order to gain the masses the enlightened Pitt had promised a complete political emancipation of the Catholics; but the bigoted George III. could not be induced to make this concession. Enraged at this breach of faith the Irish Catholics in 1802 formed a Catholic Association, having for its object the accomplishment of this end; but it was not till the period of O'Connell's agitation, favoured by a change of public opinion in England, that the government was induced to bring in an Emancipation Bill, which after passing both houses of Parliament, received the assent of George IV. on the 13th of April, 1829. A new oath, which could be taken by Catholics as well as Protestants, was substituted for the one previously required from members of Parliament, and Catholics were thus enabled to take a seat in the house. They were also allowed to fill all public offices except that of lord-chancellor.

This victory was greeted by the Irish Catholics with great joy; but instead of satisfying them it only encouraged them to new demands. The efforts of the national party were now directed to the repeal of the Union, for which purpose O'Connell founded the Repeal Association, which caused the Grey ministry in 1833 to bring before Parliament the Irish Coercion Bill. When this bill became law the Lord-lieutenant of Ireland was empowered to forbid all assemblies of the people, and to proclaim military law throughout the island; and in order to give force to the act an army of 36,000 men, besides 6000 armed police, was sent over. The Coercion Act was indeed soon repealed, and from 1835, under the viceroyalty of Lord Mulgrave, a better feeling seemed to be growing up between the people and the government. But when the Tories came again into power in August, 1841, O'Connell began anew the repeal agitation, and with such boldness that in 1843 the authorities caused him to be apprehended on a charge of conspiracy and sedition, on which he was convicted and condemned to pay a fine and suffer imprisonment for a year. These proceedings were, however, declared illegal by the House of Lords, and O'Connell was released; yet they had the result of infusing a spirit of greater moderation into the agitators, and soon after the terrible famine which visited Ireland in the autumn of 1845, and still more severely in the summer of 1846, cast all other interests into the back-ground. To mitigate this calamity the British Parliament granted enormous sums of money; but in spite of all that could be done thousands died from starvation, and hundreds of thousands emigrated to America. Anarchical outbursts, agrarian murders, and other acts of violence distracted the land—the extremity of want had completely loosened the bands of the law. In the midst of this crisis O'Connell died, and the place of the party which he led was taken by one still more advanced, which received the name of Young Ireland. In these circumstances of political excitement the French revolution, which took place in February, 1848, had a great effect upon Ireland. The leaders of the Young Ireland party, Smith O'Brien, Mitchel, Duffy, Meagher, and others, entered into relations with the provisional government at Paris, and the people generally began openly to provide themselves with arms, and to exercise themselves in the use of them. But the measures of the government frustrated the designs of the conspirators. The Habeas Corpus Act was suspended, the insurrectionary newspapers suppressed, and Smith O'Brien, who had been hailed by the people as King of Munster, after a feeble attempt at a rising (August 5), was taken prisoner, and along with his associates condemned to death. This punishment was afterwards commuted to transportation. In a short time peace was restored; but the material distress remained undiminished. Famine and disease decimated the population. The agricultural holdings were deserted, whole districts remained uncultivated, and a constant and overflowing stream of emigration directed itself towards the United States. After this diminution of the population a general improve-

ment gradually became visible among the remainder of the inhabitants. Agriculture revived, and some of the manufacturing industries of the island began to compete with those of England. In 1849 were chartered the Queen's Colleges, offering the same advantages to Catholics as to Protestants; but these institutions have been taken comparatively little advantage of by the former. In 1852 telegraphic communication was opened with Great Britain. The year 1865 witnessed the discovery of a new conspiracy designed to effect a separation between England and Ireland. It had its origin in America among the members of a secret society calling themselves *Fenians* (see FENIANS), and soon spread to Ireland; but before the Fenians could take any overt action in that island their design was stifled by the proceedings of the British government (1865–66). An act to disestablish the Irish Protestant Episcopal Church was passed in 1869, and another to improve the tenure of land, in 1870. Since 1871 an agitation for what is called Home Rule has made itself prominent, the minimum demand of the Irish Home Rulers or 'Nationalists' being an Irish Parliament to deal with matters exclusively Irish. In 1880 Ireland became the scene of an agitation carried on mainly by a body which took the name of the Land League. The movement was marked by so much lawlessness that two special acts, a 'coercion' act and a peace preservation act, were passed. The former (in force 1881–82) gave extensive powers of imprisoning suspected persons, and many, including members of Parliament, were temporarily confined. Still further to redress Irish grievances a land act was also passed in Aug. 1881, the chief provisions of which have already been mentioned. The Land League was suppressed, but the National League was soon organized in its place. On May 6, 1882, the newly-appointed chief-secretary, Lord Frederick Cavendish, and Mr. Burke, the under-secretary, were murdered in the Phœnix Park, Dublin, and about a year elapsed before the assassins were brought to justice. These belonged to a secret society called the 'Invincibles', and five of them were hanged. This murder led to the passing of a stringent act for the suppression of crime in Ireland. In 1885, 86 Nationalist members, headed by Mr. C. S. Parnell, were returned to Parliament, and their pressure on the government led to the production of a scheme by Mr. Gladstone in 1886 by which Ireland was to receive a parliament of her own and the Irish members to be withdrawn from the Imperial Parliament. This scheme and the accompanying land purchase scheme were rejected by Parliament and the constituencies; and a permanent Crimes Act was passed in 1887. The charges made against Irish members by The Times led to the appointment of commissioners, who reported to Parliament in 1890, exonerating Mr. Parnell and his followers from the most serious charges, but finding others proved. Mr. Gladstone in 1893 introduced his second Home Rule bill, but though it passed the Commons, it was rejected by the Lords, and the constituencies soon after emphatically approved of its rejection. In 1898 the Local Government (Ireland) Act was passed. It established county and district councils in Ireland, and conferred on them important administrative functions. A Royal Commission on the financial relations between England and Ireland reported in 1896, and another on the Land Acts in 1898. Under an Act of 1899 a new department of agriculture and technical instruction was established. In 1900 the various sections of the Nationalist party were united under the leadership of Mr. John Redmond, and the party soon became more or less identified with the United Irish League, founded by Mr. William O'Brien in 1898, with such objects as self-government for Ireland, the abolition of dual ownership of land, &c. Under its auspices agrarian disturbances became frequent, resulting in the imprisonment (in 1902) of several Irish members and the proclamation of Connaught, most of Munster, and the city of Dublin under the Crimes Act. The Congested Districts Board, established under the Land Purchase Act of 1891, has been the means of carrying out various measures for the advantage of Ireland. The act of 1903 already mentioned was led up to by friendly conference between landlords' and tenants' representatives.

Language and Literature.—The Irish language, which is by far the most important Gaedhelic offshoot of the Celtic branch of languages (see GAEL), has five vowels, *a*, *e*, *i*, *o*, *u*, each of which may be either long or short. The difference of quantity indicated by an acute accent often determines the sense of two words. The number of alphabetic signs adopted for the consonants in their simple state is thirteen, namely, *b*, *c* or *k*, *d*, *f*, *g*, *h*, *l*, *m*, *n*, *p*, *r*, *s*, *t*; but the modifications of which most of these consonants are susceptible more than double the number of consonantal sounds, which the Latin alphabet has consequently been found insufficient to express. Such modifications take place only with initial consonants, and the consonants which are subject to them are, *c*, *p*, *t*, *g*, *b*, *d*, *m*, *f*, *s*. The letters *l*, *r*, *n* are unchangeable. The modifications or permutations referred to are of two kinds: aspiration, expressed by an *h* placed after the initial consonant, *h* itself never being initial; and the so-called *eclipse*, comprising the *soft*, and the *nasal eclipse*. Aspiration affects all the consonants that have already been mentioned as susceptible of permutation; eclipse affects all except *m*; but some of them differently from others, the letters *c*, *p*, *t*, *f*, *s* being subject to the soft eclipse, which makes them sound respectively as *g*, *b*, *d*, *v*, and *t*, and *g*, *b*, and *d* to the nasal eclipse, changing them into *n*, *m*, and *n*. The *ch* has the guttural sound which it has in the Scotch 'loch', *th* the sound of *th* in 'thigh', and *dh* the sound of *th* in 'this'. There are in the Irish language two genders and two numbers. In declension there are inflections, in the proper sense of the term, for only three cases, the genitive singular, and the nominative and the dative plural. The other cases are indicated by means of the article, by the permutation of the initial consonant, &c. The comparative is expressed by means of suffixes, and the superlative by particles. The language is rich in compounds, and the composition of words is sometimes carried to almost as great an extent as it is in Sanskrit. The Irish pronouns are indeclinable.

The modern varieties of Irish are spoken by the rural classes in Connaught and Munster, the more remote parts of Ulster, and the south of Leinster. The numerous Irish emigrants have carried it also to America, where Irish songs and poems sometimes appear in the newspapers. There are professorships or lectureships of Irish in Trinity College, Dublin, in Maynooth College, the Queen's Colleges of Cork and Galway, the Catholic Training College, Drumcondra, &c.; and Irish is a subject under the Royal University, the National Board of Education, and the Commissioners of Intermediate Education.

Irish literature is almost entirely confined (especially during its earlier period) to the bardic poems and the native authorities for Irish history, including ecclesiastical history. The oldest dialect of which specimens have come down to us is the Bearla Feine, in which the Brehon laws are written, and a hymn ascribed to St. Patrick. This hymn was printed in G. Petrie's History of Tara Hill, and is considered

as the oldest monument of the Irish language of unquestionable genuineness. The glosses written to Latin works by Irish ecclesiastics, in the monasteries on the Continent, founded during the seventh and eighth centuries, are also among the oldest specimens of this language. Of the bardic poems the oldest which have come down to us are a long panegyric on St. Patrick, by Bishop Fiech, who had been taught by St. Patrick himself, and a history of the castles of Ireland, composed in 544 by Amergin Mac Amalgaid. The first-mentioned of these is in rhyme, which is common among the Irish bards, and which is said to have been in use among them even before the introduction of Christianity. The poems of Eochadh Dallan, who wrote in the sixth century, very early became so obsolete in their language that later bards found it necessary to write commentaries upon them. In the ninth century lived Eochadh O'Flan, many of whose poems still survive. There are also many bardic remains belonging to the period of the English conquest, but after that date Irish poetry appears to have sunk. Many bards, however, were still maintained in the families of the native chiefs, both within and without the English pale, and these helped by their songs to keep up a national feeling, and a spirit of opposition to the English domination. Hence many severe laws were passed against them by the English sovereigns, particularly by Edward III., Henry VI., Henry VIII., and Queen Elizabeth. The true Irish bard may be said to have become extinct not long after the complete conquest of the island under William III. The last who is mentioned is Turlogh O'Carolan, who died in 1737. The few genuine Ossianic poems ought also to be classed among Irish remains.

The native authorities for Irish history are no older than St. Patrick at the very earliest. Many fragments in the Irish language relating to Irish history are found scattered through the older chroniclers, and most of these are ascribed to Cennfaelad, who died in 678. The oldest list of kings (and this only partly in the Irish language) dates from the middle of the eleventh century. About the same period one Gildas Modudius wrote upon the Christian kings of Ireland, and about 1072 Gildas Coemhain wrote a metrical chronology of Irish kings. The oldest and by far the ablest annalist, whose works have been at least partially preserved, is Tighernach (pronounced Tierna) O'Brian, who belonged to the royal family of the O'Connors of Connaught. He died in 1088. His chronicle, which comes down to the year of his death, is preserved in an imperfect MS. at Dublin, and was first published with a Latin translation by O'Conor, in his Rerum Hibernicarum Scriptores veteres Buckinghamiæ (1814–26). The other chief annals are the Annales Inisfalenses, so called from having been written in the monastery of Inisfail, on an island in the Lake of Killarney; the Ulster Annals; and the Annales IV. Magistrorum, also called Annales Donogallenses. Two different Annales Inisfalenses were published by O'Conor, the one from a MS. in the Bodleian Library, embracing (with some large gaps) the period from 428 to 1215, and the second from a Dublin MS., which embraces the period from 250 to 1320, but of which O'Conor published only as far as 1088. The Ulster Annals from 431 to 1131 were also published by O'Conor, as well as those of the Four Masters, which were compiled by four different authors about the year 1634, and go over a period beginning with the year 242 after the flood, and ending with the year 1171, the date of the English conquest. The principal ecclesiastical documents in the Irish language are the Book of Armagh, belonging to the ninth century; the Book of Hymns, of a somewhat later date; the metrical Festologies of Ængus Ceile De (ninth century) and the various martyrologies or calendars of native saints, such as that of Tallaght, that of Marianus O'Gorman, and that of Donegal. The last was published by the Irish Archæological and Celtic Society in 1864.

Besides the Bardic remains and those of the native historians there are several original treatises in Irish by native physicians of the fourteenth and fifteenth centuries, and also a number of Irish translations from foreign languages and mediæval Latin.

The most important Irish manuscripts are contained in the library of Trinity College, Dublin, in the Bodleian Library, and in that of the British Museum (in the collections of Harley and Sir Robert Cotton). Some of them are said to mount as high as the sixth century. The first work printed in Ireland was Alphabetum et ratio legendi Hibernicum et Catechismus in eadem lingua, printed by command of Queen Elizabeth in 1571. The first edition of the New Testament in Irish, in a translation by William O'Domhnuill, was published in 1603, the first of the Old Testament translated by W. Bedell, in 1686. Numerous editions have now been published through the agency of various societies. A translation of some selections from the Irish bards by Charlotte Brooke, was published in 1789, under the title Reliques of Irish Poetry; also by Hardiman in his Irish Minstrelsy (1831). Many old Irish texts have been published in recent times partly by the Royal Irish Academy and the Clarendon Press.

IRENÆUS, SAINT, presbyter, and at a later period bishop of Lyons, a learned and zealous man, a pupil of Polycarp and Papias. He was probably a native of Smyrna, and born between 120 A.D. and 140 A.D. He actively opposed the Gnostics, and especially the Valentinians. His works are all lost, except his Libri V. adversus Hæreses, of which we have fragments in the original Greek preserved by Epiphanius and other writers on heresies, and a Latin version, made, it is supposed, towards the end of the fourth century. He suffered martyrdom at Lyons, in the persecution under Septimius Severus in 202, and is honoured as a saint. His day is June 28.

There is another martyr of this name, and Irenæus Referendarius is the author of three amatory epigrams in the Greek Anthology, from a critical examination of which it is concluded that he lived under Justinian.

IRENE, an empress of Constantinople, alike famous for talent and beauty, and for her crimes, was born at Athens about 752 A.D., and in 769 married Leo IV., after whose death, caused, as is generally believed, by poison administered by her, she raised herself (780) and her son Constantine VI., then but nine years old, to the imperial throne. Her devotion to image-worship had led during the life of her husband to her banishment from the imperial palace; and in 786 A.D. a council of bishops at Constantinople assembled by her to re-establish the practice was broken up by the troops of the capital. In the following years, however, a council held at Nice under her auspices re-established image-worship in the Eastern Church. The Byzantine Empire was then threatened by Charlemagne, and ultimately Irene was totally defeated in Calabria in 788. When Constantine had grown up he refused to permit her to participate longer in the government, and actually reigned alone seven years, when he was arrested at the order of his mother, blinded and at last murdered. Irene was the first female who reigned over the Eastern Empire. Her triumphal entrance into Constantinople, her liberality, the freedom which she bestowed on all prisoners, and other artifices employed by her, were not sufficient to secure her from the consequences of her criminal accession. She had ordered many nobles

into banishment, and to secure yet more firmly the possession of the throne, had just resolved to marry Charlemagne, when Nicephorus, her treasurer, who had now gained the imperial throne, exiled her in 802 to the Isle of Lesbos, where she died in 803. Her zeal for image-worship has caused her to be regarded as a saint by the Greek Church.

IRETON, HENRY, an English commander and statesman, was born in Nottinghamshire in 1611. He was descended from a good family, graduated at Trinity College, Oxford, and was brought up to the law; but when the civil contests commenced he joined the parliamentary army, and by the interest of Cromwell, whose daughter Bridget he married in 1646, he became commissary-general. At the battle of Naseby he commanded the left wing, which was defeated by the furious onset of Prince Rupert, and was himself wounded and made prisoner. He soon recovered his liberty, and took a great share in all the transactions which threw the Parliament into the power of the army. He had also a principal hand in framing the ordinance for the king's trial, and sat himself as one of the judges. Ireton accompanied Cromwell to Ireland in 1649, and was left by him in that island as lord-deputy. He reduced the natives to obedience with great vigour, but not without cruelty. He died of the plague before the walls of Limerick on 26th November, 1651, and was buried in Westminster Abbey, 6th February, 1652. Hume calls him a memorable person, celebrated for vigilance, capacity, and a rigid exercise of justice during his unlimited command in Ireland. After the Restoration his body was taken up, and suspended from the gallows with that of Cromwell, and was buried in the same pit. He left one son and three daughters.

IRIDIUM, a metal discovered by Tennant in 1804 in the black scales which remain when native platinum is dissolved in aqua regia. In these scales it occurs alloyed with osmium as iridosmine. This metal also occurs mixed with about 20 per cent of platinum crystallized in octahedra. Iridium is separated from the other metals with which it is associated by a tedious process, the object of which is to obtain in the first place pure iridium chloride or ammonium chloriridiate, from the former of which the metal may be obtained by reduction by hydrogen at a high temperature, from the latter by simple ignition. The metal iridium is exceedingly infusible, more so indeed than any other body except ruthenium and osmium. Deville and Debray by a powerful oxyhydrogen blast-furnace fused it into a pure white mass having a density of 21·15. By pressing and calcining at a white heat in a forge the metal is obtained in hard lumps, which are however still porous, and whose density is only 16·0. In the state of powder, as after it has been reduced by hydrogen, iridium dissolves slowly in aqua regia, but after strong ignition it is insoluble in all acids. Iridium forms a number of alloys. One of these occurs native in the Ural Mountains, also in Brazil; it is called native iridium, and contains, besides that metal, platinum, rhodium, palladium, osmium, iron, and copper. The alloy with gold is malleable and much resembles gold in appearance, that with copper is very hard, pale-red in colour, and ductile. With mercury, iridium forms an amalgam. Platinum and iridium may be melted together in varying proportions. With tin it forms a crystalline alloy. The atomic weight of iridium is 198·2. This metal forms a series of compounds, none of which are, however, of much interest. Iridosmine and phosphor-iridium are used in the manufacture of pens and other articles.

IRIS, in Greek mythology, daughter of Thaumas and Electra (daughter of Oceanus), sister of the Harpies, the fleet golden-winged messenger and servant of the Olympian gods, especially of Zeus and Hera. Iris was originally the personification of the rainbow, though she does not appear in the Homeric poems as the goddess of the rainbow. She is sometimes represented as a beautiful virgin with wings and a variegated dress, with a rainbow above her, or a cloud on her head exhibiting all the colours of the rainbow. The physical appearance of the rainbow is the foundation of this fable, conformably with the custom of the Greeks. Iris is also represented with the herald's staff in her left hand, representative of her office of messenger.—The coloured circle around the pupil of the eye is called *iris*; and *iris-stones* are specimens of crystal or quartz which exhibit the colours of the rainbow.

IRIS, a genus of plants that give name to the natural order Iridaceæ. The species have six perianth-segments, the outer three being the larger and reflexed, and three petaloid stigmas, each of which covers a stamen. They occur in many localities over Europe, Asia, and America. Only a few are found within the tropics. They constitute one of the chief ornaments of the northern regions of the globe, and usually grow in wet places, bearing flowers of various colours, but the prevailing tint is blue. The common wild iris or flag (*I. pseudacorus*) has yellow flowers of large size and long sword-like leaves; the gladdon or stinking iris (*I. fœtidissima*) is another British species, with bluish flowers. Among favourite garden species are the English iris (*I. xiphioides*), the Persian iris (*I. persica*), the common iris (*I. germanica*), the snake's-head iris (*I. tuberosa*), and the Chalcedonian iris (*I. susiana*). Orris root consists of the root-stocks of the white-flowered *I. florentina* and some other species.

IRISH MOSS. See CARRAGEEN.

IRISH SEA, the sea between Great Britain and Ireland, north of St. George's Channel and south of the North Channel, 110 miles north to south, and from 60 to 150 miles east to west, with an area of about 7000 square miles. It contains the islands of Anglesey and Man, and on its coasts are Luce, Morecambe, Dundrum, Carlingford, and Dublin Bays, the Solway Firth, and the estuaries of the Ribble and Dee, &c.

IRITIS, inflammation of the iris of the eye. The symptoms of iritis are a zone of a pale-pink colour round the cornea, formed by vessels traversing the sclerotic; the iris undergoes a remarkable change of colour, a naturally dark eye becoming reddish-brown, and a light eye assuming a greenish tint. The change of colour is caused by the deposition of coagulating lymph, and if the inflammation be not checked suppuration may ensue. The patient experiences pain in the orbit of the eye, in the forehead, and side of the head, which frequently grows more intense at night. Iritis may arise from wounds in the iris, from long exertion and too prolonged continuous use of the eye, and from constitutional predisposition induced by syphilis, scrofula, gout, or rheumatism. In the treatment of the disease three things must be carefully attended to—1st, to allay the inflammation, which may be effected by blood-letting and the means usually adopted in cases of acute ophthalmia; 2nd, to prevent the effusion of lymph, which is most speedily effected by bringing the system under the action of mercury, the effect of which should be sustained till danger is over; and 3rd, to prevent adhesions, which is effected by keeping the pupil dilated with belladonna, or in its absence by henbane, but either of these applications will be useless if the acute

symptoms have not been previously subdued. In treating iritis constitutional differences and diseased conditions resulting from different maladies must be borne in mind, and the remedies selected accordingly.

IRKUTSK, a government in Siberia, bounded on the north and north-east by the government of Yakutsk, east by Lake Baikal and the Trans-Baikal province, south by Chinese Tartary, and west by the government of Yenisseisk; area, 287,061 square miles. The greater part of the government having a northern exposure, the climate is more severe than usual under the same latitude. The summer is of short duration, though very warm; the air generally clear and serene. A great part of the surface is occupied by forests, which furnish excellent timber, and abound with all kinds of game. The pastures maintain great numbers of cattle and sheep. The principal cultivated crops are rye and barley; hemp and flax also succeed well. There is not much fruit. The minerals are very valuable, and include gold, silver, lead, zinc, tin, and coal. Manufactures exist to a very limited extent, and consist chiefly of soap, leather, and glass. A considerable proportion of the Russian inhabitants are descendants of exiles from the west; but as the cause of exile was frequently of a political nature, the morals are much purer than usual in penal settlements. The natives in greatest number are Tunguses, Mongols, and Buriats. The religion of the Greek Church is generally professed, but many continue addicted to the practices of Shamanism. For administrative purposes the government is divided into five districts or circles, of which Irkutsk is the capital. Pop. (1897), 506,517.

IRKUTSK, a town in Siberia, capital of the government of the same name, in a plain nearly 1500 feet above the sea, on the Angara, nearly opposite the confluence of the Irkut. It is the finest town of Siberia, well built, and with wide, well-paved streets. One of the chief ornaments of the town is a noble quadrangular parade, one side of which is occupied by the residence of the governor, and other public offices. The principal buildings include a great number of churches, one of them a cathedral; a handsome exchange built of stone; an admiralty, with dockyards on the Angara; a school of medicine, a gymnasium, &c. The manufactures consist of woollen and linen cloth, hats, leather, soap, and glass. There are also several distilleries. The trade is in tea and other articles imported from China, and more especially in fur. Irkutsk is the see of an archbishop. Pop. (1897), 51,434.

IRON. Iron is the most important of all the metals. So dependent are we in our present state of civilization upon this substance, so many things which have become part and parcel of our everyday life are formed from this metal, that it is hard even to imagine a world without iron. That it has been possible to put iron to so many uses is no doubt owing in the first instance to the great abundance of this metal in the earth's crust, and to the comparative ease with which the ores of iron can be worked, and various products thereby obtained, each one of which has its own peculiar, but in all cases useful properties.

In iron we possess a substance which is at once extremely hard and yet malleable; which bears a great strain, and yet can be made very brittle; which is inflexible, but from which the most elastic springs can be formed; which can form the thick heavy ribs of a man-of-war, or the slender blade of the surgeon's knife; which is, in a word, possessed of properties so many, so various, and so useful, as at once to give it the dominant place among metals. The above statement, however, involves the use of the word 'iron' in a general sense, and so includes steel, which will be treated in a separate article. The question naturally arises, What is the definition of iron? because the presence of a small amount of carbon entirely changes its properties and converts it into steel. Iron may be distinguished from steel by the fact that it will not, from a practical point of view, harden when quenched from a temperature exceeding 650° C. Even this definition is not entirely accurate, as the properties of even the purest iron which has as yet been obtained are sensibly altered by quenching. The tenacity, for instance, is slightly increased. The history of the views as to the difference between iron and steel is interesting, and may be briefly stated. It may be sufficient to begin with the work of Torbern Bergman, the great professor at the University of Upsala, who in 1781 showed that steel mainly differs from iron by containing about $\frac{2}{10}$ per cent of plumbago. Read in connection with modern research his work seems wonderfully advanced. He was forcibly impressed by the fact that the great difference in the mechanical properties of different specimens of iron is due to the presence of small quantities of impurity, and that the properties of iron do not vary, as he says, unless by chance the iron contains a decided proportion of foreign matter, 'nisi forte peregrinum paullo uberius inhæreat metallum'. We find, even, the dawn of the view that under the influence of small quantities of foreign matter iron becomes, as he calls it, 'polymorphous', and may play the part of several metals —'queat polymorphum ferrum plurium simul metallorum vices sustinere'. Unfortunately he confounded the plumbago or carbon he had isolated with phlogiston, as did Rinman in 1782, which was strange, because in 1774 the latter physicist had shown that a drop of nitric acid simply whitens wrought iron, but leaves a black stain on steel. Bergman tenaciously held to the phlogistic theory in relation to steel; it was inevitable that he should. The true nature of oxidation had been explained, no wonder that the defenders of the phlogistic theory should seek to support their case by appealing to the subtle and obscure changes produced in iron by such apparently slight causes. Bergman's view was, however, combated by Vandermonde, Berthollet, and Monge, who showed in a report communicated to the Académie des Sciences in 1786, that the difference between the main varieties of iron is determined by variation in the amount of carbon, and further, that steel must contain a certain quantity of carbon in order that it might possess definite qualities. Bergman died in 1784, and the report to which reference has been made is full of respect for 'this great chemist,' as its authors call him, 'whom science had lost too soon'. The whole history is of great interest, but all that can be stated here is that Bergman taught us that the difference between pure iron and steel consists in the fact that steel contains $\frac{3}{10}$ to $1\frac{1}{2}$ per cent of carbon, while iron does not.

It is impossible to suppose that so important a metal should not have been known from very early times; that some, at least, of its uses were known, and that the method of working in iron was taught in extremely remote times, is evident from that verse in Genesis which tells us of Tubal Cain, who was 'an instructor of every artificer in brass and iron'. 'The wisdom of the Egyptians' certainly included a knowledge not only of the working of iron, but also of the application of this metal to many articles used in ordinary life. Thus, we read in the Pentateuch of iron tools used for cutting stone, of iron swords, iron axes, and of iron knives, and that the ideas con-

nected with iron working had become part of the common knowledge of the Israelites before they left Egypt is evident from the expression in Deuteronomy, 'Out of the iron furnace, even out of Egypt'. This early knowledge of iron on the part of the Egyptians furnishes us with another proof of the advanced state of civilization among that remarkable people compared even with such a nation as Greece; for several centuries after the time of Moses the heroes of the Trojan war are represented by Homer as armed with swords of copper hardened by tin; and one of those same heroes, namely, Achilles, proposes as a most valued prize at the games a ball of iron, which, we are told, was so large as to supply a farmer with iron for years:—

> 'Who farthest hurls it takes it as his prize;
> If he be one enriched with large domain
> Of downs for flocks and arable for grain,
> Small stock of iron need that man provide,
> His hinds and swains whole years shall be supplied
> From hence; nor ask the neighbouring city's aid
> For ploughshares, wheels, and all the rural trade'.
> Iliad, bk. xxii. 984-990 (Pope's trans.).

It must be remembered that the liability of iron to be corroded by rust may, to some extent, account for the fact that no iron weapons or implements belonging to a very early period exist, while those of bronze are comparatively common. The Assryians appear to have been well acquainted with the use of iron.

From Pliny we learn that the ancients were acquainted with many deposits of iron ore, but his accounts of the methods of smelting these ores are very vague. Pliny, who tells us that when steel is quenched in water it becomes hard, also knew that the difference between the waters of various rivers can be recognized by those who harden steel. He states that oil may be used with advantage for hardening certain varieties of steel. From ancient sources it appears that steel was manufactured directly from its ore at Noricum; the best steel, however, came from China, while that of Parthia ranked second. Some of the medicinal properties of iron, as also its employment as a cauterizer, were known to the ancients. As regards the early use of iron by the ancient Britons, Cæsar certainly did not do justice to the metallurgical skill of this people, for the employment of iron by them was more extended than he realized.

Iron occurs chiefly in the earth's crust in combination with oxygen, but it is also found in combination with several other elements, and sometimes, although rarely, in the metallic state.

A. Native Iron.—There are two varieties of native iron found scattered here and there over the earth's surface:—

1. *Telluric Iron.*—This species of iron occurs in small grains and plates, or massive and disseminated; it is generally associated with other metals, such as copper, lead, gold, and platinum, but *not* with nickel; sometimes it occurs associated with carbon in mica slate, as, for instance, at Canaan in Connecticut; at other times it is found associated with silicon and sulphur, as is the case at the Leadhills; near Grenoble native iron is associated with brown hematite and quartz; it also occurs disseminated through certain basaltic rocks, as in West Greenland, and in volcanic scoriæ at Gravenière in Auvergne. In all instances, excepting the case of West Greenland just referred to, this species of iron is found only in minute quantities; it exhibits a foliated texture, hackly fracture, and a steel-gray colour; its specific gravity varies from 7·0 to 7·8.

2. *Meteoric Iron.* Masses of this species of iron have been found at various places on the earth's surface, chiefly at points situated within two zones, the western or American zone being comprised between the 33rd and 44th parallels of N. lat., and extending to about 25° in length; while the eastern zone is about twice the length of the western, and extends about 10° farther north.

These masses of meteoric iron all contain nickel, and generally also cobalt, besides other metals, such as copper, manganese, magnesium, and in some instances tin. Minute particles of crystalline carbon or diamond have been met with in certain specimens. A mass of meteoric iron weighing 85 lbs. was found in Eldorado county, California, in 1869, which contained the metals aluminium, chromium, and potassium, in addition to those already mentioned.

The largest mass of meteoric iron hitherto discovered is that found in 1871 near Disco Bay in Greenland by Nordenskjöld; it weighs about 20,000 kilogrammes, or nearly 20 tons. This sample is remarkable for the oxygen which it contains; indeed it has been supposed by Daubrée that the mass is not of meteoric origin, but has been thrown up from a great depth in the earth. This view, however, is scarcely in keeping with the fact that the iron contains a considerable amount of carbon, which would volatilize at the high temperature to which, judging from the presence in it of crystallized silicates, the mass has been exposed.

Three remarkable specimens of meteoric iron were removed from the coast of Greenland to New York in 1897. These showed on analysis an average of 91 per cent of iron, 8 per cent of nickel, and ·5 per cent of cobalt, while copper, sulphur, phosphorus, and carbon were present in small quantities. It may be interesting to note that meteorites, which closely resemble ultra-basic rocks, have an average density of 5·5, a figure practically identical with Prof. Boy's determination of the density of the earth (5·53), thus pointing to the supposition that the interior of the earth may consist of similar 'basic' or unoxidized material.

Meteoric iron is very malleable, generally cellular, but sometimes compact. When polished and immersed in nitric acid the different portions of the surface are unequally acted upon, and a series of lines crossing each other in three different directions are developed; narrow bands, which retain their polish, being unacted upon by the acid, also appear. These bands generally contain more nickel than the other parts of the mass; hence it has been supposed that this striated appearance (known as Widmannstätt's figures) is due to the segregation of the nickel in the lines of the crystalline mass. On the other hand, Laurence Smith and others have shown that these Widmannstättian figures are generally not exhibited by specimens of meteoric iron containing much nickel. Smith supposes that the phosphorus, which is almost invariably present in such iron, is eliminated during the cooling of the mass to the boundaries of the crystals, and that thus the homogeneity of the mass is destroyed, and its different parts become unequally sensible to the action of chemical reagents.

B. Iron Ores.—It has been already mentioned that iron exists in the earth's crust chiefly as oxide; it is also found combined with sulphur, and also existing as carbonate, phosphate, titanate, chromate, arsenate, tungstate, sulphate, oxalate, and silicate. The most important ores are the various oxides, the carbonates, and the sulphides; from these, especially from the two former, almost all the iron of commerce is obtained. The following list exhibits the names and chemical formulæ of the principal natural oxides carbonates, and sulphides of iron:—

Magnetic iron ore	$FeO.Fe_2O_3 = Fe_3O_4$.
Hematite or specular iron ore	Fe_2O_3.
Brown iron ore	$Fe_2O_3.H_2O$ and $2Fe_2O_3.3H_2O$.
Bog do.	$Fe_2O_3.H_2O$.
Spathic do.	$FeCO_3$.
Clayband do.	$FeCO_3$, with varying amounts
Blackband do.	of coaly matter.
Franklinite do.	$(Fe.Zn.Mn)O.(FeMn)_2O_3$.
Pyrites do.	FeS_2.
Arsenical do.	$FeAsS_2$. FeS_2 or FeAsS.

Before proceeding to deal with each of the above ores in detail, a few general remarks may be made on the distribution of iron ores throughout the world. In Great Britain the earliest centres of the iron industry were in the forests of Sussex, Surrey, Gloucestershire, and South Wales. The Home Counties have long ceased to be productive, while at the present time the chief activity of the iron trade prevails in the districts of Cleveland, South Staffordshire, South Wales, Lancashire, and in the Forest of Dean. Considerable quantities of iron ore now treated in Great Britain are imported from both Spain and Sweden. In the latter country the chief districts are the ancient workings of Grandesberg and the more recently-developed districts of Kurunavaara and Luossavaara, and Gellivara in Lapland. Swedish ores chiefly consist of magnetite. The ores produced from the latter-named districts differ from the usual type of Swedish ore in being highly phosphoric. They are, however, likely to prove of great utility to the Cleveland smelters, who have relied for some years to a great extent on the Spanish ores, which of late years have shown a falling off in quality. With regard to the Spanish ores, these are chiefly derived from the Biscayan deposits, which comprise the districts of Bilbao and Santander. The total yearly output of these districts approaches three million tons. The ores are for the greater part hematites and spathic ores, which are usually classed under four heads: first, the Rubio or brown hematites; second, the Vena dulce or soft rich earthy hematites, suitable for special purposes, such as the Chenot process or Catalan forge; third, the Campanil or red hematite, which, however, is now almost exhausted; last, the spathic ores, or 'carbonato de lierro'. The ore masses in these districts lie principally in the Cenomanian beds of micaceous limestone. Besides Spain and Sweden, other portions of Europe furnish considerable amounts of iron ore. In Russia the Ural Mountains, especially the southern portions, are rich in limonite and spathic ores, and yield a million tons of ore per annum. Unfortunately, the scarcity of coal is tending to weaken the industry in this district, while the Donetz region in Southern Russia, where coal is more abundant, is being proportionately developed. One of the largest deposits of iron ore in Europe is that of the Erzberg, in Upper Styria, which consists almost entirely of spathose. Numerous magnetite deposits occur in Hungary and Austrian Silesia, while certain portions of Western Europe, such as districts of Belgium, Northern France, and German Lorraine, between the Vosges and the Ardennes, furnish large quantities of hematite and magnetite. The United States consumed in 1897 over seventeen million tons of iron ore, including half a million tons imported chiefly from Quebec and Ontario, in which districts the scarcity of coal renders smelting unprofitable. Of the ores produced in the States, 99 per cent are mined east of the Mississippi and the remainder in the Missouri district. At present, therefore, the iron industry is confined to the region drained by the Mississippi and Ohio. In the Lake Superior district the ores, which are non-titaniferous, a feature greatly in their favour, are mined in the well-known localities on the southern shores, namely, Vermillion, Gogebic, Menominee, and Marquette. All the important iron ores are associated with Palæozoic, or even still more ancient rocks. The older rocks have been divided into distinct groups or terrains, each of which furnishes a variety of ore peculiar to itself, but consisting essentially of magnetite and brown hematite. Decomposition of crystalline rocks originally containing pyrites has given rise to lenticular beds of limonite. Above the older crystalline rocks, much ore is obtained from the Palæozoic rocks. These ores are chiefly spathose, blackband, and limonite.

The iron-making resources of Greater Britain are practically unlimited, although at the present time they are to a great extent untouched. The lack of suitable fuel in the immediate neighbourhood of their occurrence has in many cases hitherto prevented any great developments being effected, but with increasing facilities for transport this difficulty may be surmounted. For instance, Western Australia is capable of furnishing rich hematite and limonite ores; South Australia and Queensland possess an unlimited supply of similar classes of ore; while in New South Wales enormous quantities of magnetite, hematite, clayband, and chalybite occur, together with coal and limestone to the east of Sydney. Work commenced in New Zealand was unfortunately misapplied to the treatment of refractory iron sands, but deposits of limonite, spathose, and clayband exist, although they are as yet unworked. Canada is extremely rich in iron. Those deposits near the coal are in Nova Scotia, British Columbia, the Lake Winnipeg district, and the North-West Territories. British Columbia affords magnetites, while the ores in the Lake Winnipeg district are chiefly limonite and its modification, bog iron ore. Quebec and Ontario yield rich magnetites and chrome iron ore, but owing to insufficiency of coal considerable amounts are exported to the United States. In Cape Colony, iron ores are mined to some extent in the Stormberg and Molteno localities, while in Natal the red hematite, magnetite, and limonite, occurring in close proximity to coal, constitute a valuable resource for the needs of South Africa in the future. The possibilities of India in the direction of iron manufacture are being strenuously advocated, and the abundant supply of iron ore, coal, and cheap labour should prove great factors in the successful development of its resources. The chief districts in which, at present, iron ore is being mined and treated are those of Jabalpur, Hyderabad, Chanda, and the Madras Presidency, where the prevailing types of material are red hematite and limonite.

1. *Magnetic Iron Ore* (*Magneteisen, Oxyde magnétique*).—This, the richest of all the ores of iron, contains, when perfectly pure, 72·41 per cent of metallic iron. The localities where it chiefly occurs are Sweden, Norway, Russia, and North America; it is also found in the west of England, and at Rosedale in Yorkshire. In Sweden the principal mine of this ore is situated at Dannemora, where immense quantities are dug out of an open quarry. After smelting the ore a very fine iron is obtained, large quantities of which are exported to England for making steel. In Lapland very large masses of this ore are found; in some places it forms entire mountains, as in the famous Gellivara district. In North America a very thick bed of magnetic ore occurs, situated in the mountains on the western side of Lake Champlain; and in New Hampshire a deposit is found exactly similar to the celebrated Dannemora ore. Magnetic iron ore is generally found in igneous or metamorphic rocks, sometimes

in distinct crystals, at other times disseminated throughout the mass. It also forms beds in gneiss, chlorite, mica, hornblende, &c., but rarely occurs in veins. A common name for it is *black oxide of iron.*

Some specimens of this ore form natural magnets, hence the name *native loadstone*; others again only exhibit polarity after contact with strong magnets.

This variety of ironstone is extremely infusible, and is with difficulty dissolved by strong mineral acids. Its specific gravity varies from 4·42 to 5·4. The only drawback to the employment of magnetic iron ore is the comparatively large quantity of pyrites which it so often contains, and which, when present, seriously impairs its good properties. This difficulty has, however, in recent times been largely overcome by the increasing application of elaborate methods of magnetic separation to this class of ore.

2. *Hematite or Specular Iron Ore* (*Rotheisenstein, Fer Oligiste*).—This mineral in its purest state contains about 70 per cent of iron. The finest crystals are furnished by the ancient mines of Elba, where they occur associated with mica and quartz; the Vosges, the Hartz, and the Ural Mountains also afford very fine crystalline specimens of this ironstone. In volcanic districts, as in Auvergne, on Vesuvius, Etna, and the Lipari Islands, this ore is met with. It also occurs in Norway, and a variety of it is found near Liége. In Great Britain the principal deposits of hematite are in Cumberland, Lancashire, Devonshire, Cornwall, and the Isle of Man. Hematite occurs in the veins and seams of the older rocks, especially gneiss and granite. According to the locality where it is found, and the nature of the deposit, it passes under various names. The hard crystallized variety is known as *specular ore.* This mineral consists of anhydrous ferric oxide; its colour is dark-red, inclining to black; its specific gravity varies from 4·8 to 5·3; the crystals belong to the hexagonal system. Specular ore occurs chiefly in Elba, where it has been worked for upwards of 3000 years. This variety often contains titanium, sometimes existing as oxide (*rutile*), at other times in combination with iron oxide, forming the mineral *ilmenite*, $m\mathrm{FeTiO_3}.n\mathrm{Fe_2O_3}$.

That which is usually known as *hematite iron ore*, or *red hematite*, is not so distinctly crystallized as the specular ore. It is sometimes hard, sometimes soft and friable; at one time it is found massive, at another earthy, and very often in lumps, with a radiating fibrous structure and smooth surface known as 'kidney ore'. The red hematite ores which are generally worked in Great Britain are found for the most part in the carboniferous limestone formations; they contain varying amounts of iron oxide associated with many other salts. When these ores contain a considerable amount of water they form what is known as *ochrey iron ore*, a variety of which is known as *pea ore.* Other names are given to varieties of hematite expressive of the substances with which the iron oxide is mixed.

3. *Brown Iron Ore* or *Limonite* (*Brauneisenerz, Hématite brune*).—This variety consists essentially of hydrated ferric oxide, and contains when pure about 60 per cent of iron, along with about 16 per cent of combined water. Brown iron ore occurs plentifully in France, Germany, and Belgium, and also in England, chiefly in the Forest of Dean in Gloucestershire, and in Devonshire, Lincolnshire, and near Durham. Brown hematite is generally a yellow powder, sometimes passing into a brown or velvet black. Before the blowpipe it becomes magnetic, but after calcination and cooling the powder becomes red, and in this state is much used for polishing metals. As in the case of red hematites, so there are many varieties of brown hematite, to which distinctive names are applied. Thus we have the *globular*, the *reniform*, the *pisiform*, and the *fruticose* brown iron ore, so called from differences in the forms assumed by the mineral. *Bog iron ore* is a variety of brown hematite which occurs in Sweden and Lower Canada, where it furnishes good iron. In Britain it is also found, but generally associated with so much phosphorus as to be nearly useless for iron-making purposes. Other uses are, however, found for it, such as its employment in the purification of coal-gas from sulphuretted hydrogen. The so-called *ætites* or eagle stones are also varieties of this ore. These stones are formed of concentric coats or layers, the outer layers being very hard, while the inner ones become softer and softer towards the centre, which is generally earthy.

4. *Spathic Iron Ore or Chalybite* (*Spatheisenstein, Fer Spathique*). This mineral consists essentially of ferrous carbonate, and contains in its purest state 48·27 per cent of iron; it occurs in the older rocks and in limestone strata in veins and beds. The chief deposits of this mineral are in Styria and Westphalia, where it constitutes entire mountains, and where it is for the most part worked in quarries. In the Hartz it forms large veins; it also occurs in large deposits in the Pyrenees, in New Grenada, and in England, viz. in Devon, Northumberland, and Somersetshire, and, mixed with coaly matter, in Lanarkshire and other parts of Scotland. Spathic ironstone is very often found crystallized in forms derived from an obtuse rhomboid. These crystals may contain varying amounts of calcium carbonate, and yet retain their original form. Spathic ore also occurs massive in broad foliated and granulated masses, also in fibrous botryoidal shapes, whence it has received the name of *spherosiderite.*

This ore is very valuable for making steel, being generally found unassociated with substances which act injuriously on the physical and mechanical properties of the product.

Spathic ironstone is often associated with considerable quantities of clayey and coaly matter; when the former predominates the ore is known as *argillaceous* or *clay-band ironstone*; when the coaly matter is present in large quantities the ore is called *carbonaceous* or *black-band ironstone.* These varieties of spathic ore occur in all the coal-fields of Great Britain with the exception of those of Northumberland, Durham, and Lancashire; indeed they supply the greater part of the iron produced in Britain. The clayey carbonates of the coal measures also occur in France, and are worked at the coal-fields of the Gard, of the Aveyron, and to a limited extent near St. Etienne. In America this ore occurs widely distributed, but it has not as yet been much worked. The colour of the clayey carbonates of iron varies from reddish-brown through yellowish-brown to dark brownish-black; the fracture is close-grained; they are easily scratched, have a slightly argillaceous odour when breathed upon, and adhere to the tongue. The substances which accompany the clay-band and black-band ironstones of Britain do not generally interfere with their usefulness; sometimes, however, these ironstones contain considerable quantities of pyrites and phosphorus, the former of which, unless easily separable by mechanical means, renders the ore unsuitable for working, while the presence of the latter will render the iron produced from it phosphoric.

5. *Iron Pyrites* (*Eisenkies, Pyrite*). This mineral, when pure, consists of 53·33 per cent of sulphur combined with 46·67 per cent of iron. It is the most widely distributed of all the ores of iron, occurring in gneiss and mica slate, also associated with

the ores of lead and copper; it is frequently found in the coal seams, and also associated in veins with blende, arsenical iron, &c. Some of the finest specimens of this mineral come from Elba, Saxony, and the Hartz; in the United States it forms immense deposits, and is sometimes worked for the sake of the small amount of gold which is at times associated with it. This ironstone is chiefly used as a source of sulphur, but lately the residue, after the sulphur is burned away, has been treated by a chlorination process, whereby any copper present is removed, along with the last traces of sulphur, and a pure oxide of iron remains. This oxide, known as 'purple ore' or 'blue Billy', is employed as a 'fettling' for puddling-furnaces.

The remaining ores of iron are not of much interest from the manufacturing point of view. *Magnetic pyrites*, or *pyrrhotite*, is a mineral of bronze-yellow to copper-red colour. In the Sudbury district of Canada it is being extensively mined for the nickel which it contains. *Arsenical Pyrites* is a grayish-white mineral, containing, when pure, about 33 per cent of iron, which is, however, often replaced by cobalt, and sometimes by gold or silver. *Tungstate of Iron*, or *Wolfram*, is found with tin ore, forming fine crystals, in Saxony, in Bohemia, in France, and in Cornwall.

Having thus considered the principal ores of iron, we now proceed to describe the processes by which metallic iron is obtained from these ores, after which we propose to consider the methods employed for converting the crude iron so obtained into malleable iron.

The treatment to which the ores of iron are subjected in order to obtain cast or crude iron from them consists of—1, *Calcination*; 2, *Smelting*.

1. *Calcination.*—The object of this process is to separate water, carbonic acid, sulphur, and other volatilizable substances from the ore, and at the same time to convert the ferrous into ferric oxide, thereby rendering the ore more porous and the iron more suitable for successful furnace working. The ores are calcined either in the open air or in kilns; if the former be the method adopted, a stratum of large pieces of coal is laid on the ground, and over this is piled up a layer of ironstone mixed with small coal; the fire is lighted at the windward end, and the heap gradually extended at the other extremity, so that the process is continuous. It is found that this method requires more coal and does not proceed with so much regularity as the other method, in which the ironstone is placed over a coal-fire burning at the bottom of a kiln shaped like the ordinary lime-kiln; when the layer of ironstone is red-hot a fresh layer, mixed with coal, is laid on to the depth of 8 or 9 inches, and on this, when hot, another layer is spread, and so on until the kiln is filled, when the lowest layer is cold, and may be drawn; the process is thus a continuous one. During the process of calcination the ironstone loses from 25 to 30 per cent of its weight; its colour after calcining has changed to light red, it is cracked in all directions, adheres to the tongue, and has become magnetic. The ironstone is now carried to the blast-furnace, where it is smelted.

2. *Smelting.*—This process has for its object the reduction of the iron to the metallic state, and the separation, as far as possible, of earthy and other foreign materials which accompany it. There are two main processes: first, the reduction of the iron from its ore in a more or less fusible non-carburized state; and second, the production of a readily fusible carburized product known as 'pig-iron'. The first case will now be considered. This of course was the method adopted from the earliest times until the introduction of the blast-furnace and the principle of puddling. Instances of its survival are, however, met with in certain localities, and the use of the Catalan forge in Southern Europe will be briefly described. (See Plate I.) It consists essentially of a cavity lined with refractory sandstone, and having its front wall or face curved outwards at the top to increase the capacity. The usual dimensions are 2 feet square by 16 inches deep. The hearth is provided with a 'tuyere' or tube of sheet copper, which is introduced through the back wall on a level with the top and inclined downwards. Through this a blast of air produced by a 'trompe' is admitted. This trompe, or primitive blowing-engine, consists of an arrangement by which the fall of water down a vertical pipe or hollowed tree-trunk drags in air through holes in the sides of the pipe, so that air enters the furnace through the tuyere under pressure. The method of working is briefly as follows:—Rich, easily-reducible ores are placed in the furnace on the side opposite the tuyere, and then the remaining portion is filled up to the tuyere level with charcoal and ignited. Commencing with a gentle blast, this is gradually increased until a spongy mass of iron collects at the bottom covered by slag, which is purposely allowed to take up considerable amounts of unreduced oxide to ensure its remaining fluid, and therefore easily separable from the iron or 'bloom'. The latter is then removed to the hammer, where it is forged or shingled to a rough bar. A modification of this process is the American Bloomary Process, which only differs essentially in the fact that owing to the method adopted of charging in fine material the operation is rendered continuous. Various suggestions have been made from time to time with the object of producing wrought iron direct from the ore, and in this connection the names of Chenot, Blair, and Sir W. Siemens deserve prominent mention. The efforts of the two former were mainly directed towards the production of spongy iron in vertical retorts by the aid of gaseous fuel. Sir W. Siemens, however, adopted the principle of the reverberatory furnace, and conducted the operation of reduction in a gas-fired wrought-iron cylinder capable of being revolved on its axis, and to which he gave the name of the 'rotating furnace'. Owing to the heavy masses of material set in movement, the method possesses obvious disadvantages, especially when the necessity for providing a suitable lining has to be considered. So far none of these direct reduction methods have met with commercial success, although the possibilities of such a method used in conjunction with the 'Open Hearth' steel process are considerable. The anxiety of steel manufacturers to employ the pure variety of iron, which is the result of reducing iron from its ores at a low temperature, explains the persistency with which attempts have been made to perfect direct-reduction methods. Among the more recent attempts prominent reference should be made to that of Husgavfel in Finland. The furnace in which the operation is conducted is a modification of the old 'Stuckofen' or high-bloomary furnace, rendered capable of continuous working by the adoption of a movable hearth into which tuyeres pass, as well, of course, as into the furnace itself. This plan admits of effectual control, since the bloom which collects in the hearth can be subjected to the action of a hot blast at different levels, and so brought into the condition most suitable for subsequent work. The furnace, which resembles a small charcoal blast-furnace in its method of working, is constructed entirely of iron, the shaft having an annular space traversed by a spiral partition through which the blast is passed. This effects the double purpose of preventing the walls from

becoming overheated, and at the same time enables the blast to be heated and kept under control so as to meet the varying conditions of work.

Particles of pure or nearly pure iron are infusible at the temperature of the blast-furnace, but they possess the property of welding together at this temperature; on the other hand, iron, when exposed to the action of carbonaceous matter, or of gases containing carbon at a high temperature, forms a (comparatively) easily fusible mass of iron. The action of the blast-furnace is based upon these two facts. The objects aimed at in blast-furnace smelting are therefore chiefly these—(1) to reduce iron oxide to metallic iron; (2) at the same time to allow the reduced iron to take up such an amount of carbon as to form therewith a fusible mass; (3) to remove the foreign ingredients of the ironstone. The conditions under which the foregoing problems are to be worked out may be summed up as follows:—

(1) A due admixture of the most suitable ores of iron.

(2) The use of the most suitable fuel, and the regulation of its amount.

(3) The maintenance of a high temperature, with the use of the minimum of fuel, throughout the operation, involving therefore the continuity of the process.

(4) The admixture of such materials as shall form with the non-essential constituents of the ironstone a slag which shall be fusible at a proper temperature, and while it must not combine with any considerable portion of the iron, it has to combine with and remove all hurtful ingredients, and also be so liquid as to float on the surface of the molten iron and flow easily from it. These materials at the same time supply the iron with the carbon, with which it may form a fusible mass.

(5) A definite arrangement of the furnace, by which these conditions may be best fulfilled, and by which the greatest economy of all subsidiary products may be attained. The first condition is fulfilled in different ways in different countries or in different districts. In Great Britain the greater part of the ironstone used consists of varieties of the clayey carbonates, mixed in some districts with red hematite; what mixture of poor and rich ores yields the best product can only be determined by experience. The most hurtful ingredients in ironstone used to be sulphur and phosphorus, but the latter element has, owing to the introduction of the basic process of decarburization, ceased in certain cases to be an enemy of the iron-maker.

The fuel employed was originally wood charcoal, but of late years this has been almost entirely superseded either by coke or by coal. Wood charcoal is porous and bulky, it is also entirely free from sulphur and phosphorus, and is thus well suited for use as fuel in iron smelting; but the great abundance of coal, its cheapness, and the fact that it almost invariably occurs associated with the ironstones, points it out as the most suitable fuel for the iron smelter. If coke be used, it is prepared either by igniting a large heap of coal piled up in the open air, allowing the combustion to proceed for some time and then extinguishing the fire by water thrown on the heap; or more economically by conducting the combustion in closed furnaces, whereby a higher percentage of coke is obtained, and the volatile products in many cases collected and utilized.

For the purpose of calculating the amount of fuel required to reduce a given weight of ferric oxide, it may be assumed that the reduction is brought about by the action of carbon monoxide (CO) at a high temperature. The equation expressing this reducing action will be

$$Fe_2O_3 + 3\,CO = 3\,CO_2 + 2\,Fe.$$

From which we learn that 1·429 parts of ferric oxide require for their reduction 0·3214 parts of carbon, existing as carbon monoxide, and that there is hereby produced 1 part of iron. Taking the amount of carbon in good coal as equal to 80 per cent, we find that about 8 cwts. of coal is theoretically required to produce 1 ton of iron; but besides this coal, which is employed in reducing the ferric oxide, a large amount of fuel is also required to produce and maintain a sufficiently high temperature for fusion, the coal thus used amounts to 1 or 2 or sometimes even to 3 tons for each ton of iron produced. Economy in fuel means a cheaper production of iron; and the question of the consumption of fuel is therefore a most important one for the iron smelter. The consumption of fuel varies with the nature of the fuel itself, and with the shape and size of the furnace, but depends chiefly (within certain limits) upon the temperature of the air blown into the furnace. By referring to the equation already given, it is seen that every ·3214 parts of carbon existing as carbon monoxide require ·4285 parts of oxygen for their complete oxidation; now this amount of oxygen is equivalent to 1·863 parts of air, hence we learn that for every ton of iron produced, 1 ton 17 cwts. 29 lbs. = 54,443 cubic feet of air are required; but we have found that a much greater amount of fuel than that expressed by the equation referred to is required, hence a much greater amount of air than the quantity mentioned above will be necessary to burn this fuel. The nitrogen brought into the furnace acts solely as a diluent except in the lower portions of the furnace, but most of the nitrogen in the blast remains unchanged.

As regards the actual reactions which occur in the furnace, these may be briefly indicated by the following set of equations, which are taken from Sir W. Roberts-Austen's Introduction to the Study of Metallurgy, a work which should be consulted for the explanation of the thermal equations here given together with the chemical ones. These indicate the number of *calories* which are involved in any given equation, and the signs − or + at the end of the equation show whether the reaction has been an 'endothermic' or an 'exothermic' one. The latter are represented by a plus sign at the end of the equation and the former by a minus one. Thus the sum of the reactions

$$\underset{199\cdot4}{Fe_2O_3} + \underset{3\times29}{3\,CO} = \underset{}{2\,Fe} + \underset{3\times97}{3\,CO_2} = +4\cdot6$$

is accompanied by evolution of heat and the final sign is +, while the reaction

$$\underset{199\cdot4}{Fe_2O_3} + 3\,C = 2\,Fe + \underset{3\times29}{3\,CO} = -112\cdot4$$

is attended by an absorption of heat and the final sign is −.

$$\underset{199\cdot4}{Fe_2O_3} + \underset{3\times29}{3\,CO} = 2\,Fe + \underset{3\times97}{3\,CO_2} = +4\cdot6$$

$$\underset{199\cdot4}{Fe_2O_3} + 3\,C = 2\,Fe + \underset{3\times29}{3\,CO} = -112\cdot4$$

$$\underset{265\cdot8}{Fe_3O_4} + \underset{4\times29}{4\,CO} = 3\,Fe + \underset{4\times97}{4\,CO_2} = +6\cdot2$$

$$\underset{265\cdot8}{Fe_3O_4} + 4\,C = 3\,Fe + \underset{4\times29}{4\,CO} = -149\cdot8$$

$$\underset{66\cdot4}{FeO} + \underset{29}{CO} = Fe + \underset{97}{CO} = +1\cdot6$$

$$\underset{66\cdot4}{FeO} + C = Fe + \underset{29}{CO} = -37\cdot4$$

$$\underset{2\times66\cdot4}{2FeO} + \underset{97}{CO_2} = \underset{199\cdot4}{Fe_2O_3} + \underset{29}{CO} = +121\cdot6$$

$$\underset{}{2Fe} + \underset{3\times97}{3\,CO_2} = \underset{199\cdot4}{2\,Fe_2O_3} + \underset{3\times29}{3\,CO} = -4\cdot6$$

$$\underset{}{4Fe} + \underset{3\times97}{3\,CO_2} = \underset{2\times199\cdot4}{2\,Fe_2O_3} + 3\,C = +107\cdot8$$

$$\underset{}{Fe} + \underset{29}{CO} = \underset{66\cdot4}{FeO} + C = +37\cdot4$$

At any given point of the blast-furnace the chemical tendencies indicated in the equations are at work simultaneously. These are, it will be seen, iron-oxidizing tendencies, and by inverse reactions iron-reducing ones. But the ore and fuel do not descend very far in the furnace before a sort of compromise is effected, and the result is that the iron-reducing tendencies prevail over the oxidizing ones, and metallic iron is the result. In the middle region of the furnace the iron-reducing tendencies are almost balanced by the iron-oxidizing ones, whilst the carbon-depositing tendencies are equalled by the carbon-oxidizing ones, and consequently though reduction does take place it is not active. In the lowest region of the furnace the reduction of the residual oxide of iron is completed and the reduced iron takes up a certain amount of finely-divided carbon in contact with it, and carburized or cast iron issues from the furnace.

We have already said that the consumption of fuel is chiefly dependent upon the temperature of the air blown into the furnace. The heat generated by the combustion of the fuel in the blast-furnace is expended partly in heating a further quantity of fuel, partly in heating the gaseous products of combustion mixed with atmospheric air, and partly in heating the surrounding ironstone and other substances. If, therefore, a stream of cold air be blown into the furnace, it will absorb a great quantity of heat before its temperature is equal to that of the burning fuel, and as fresh supplies of cold air are supposed to be continually playing upon the burning mass, it is evident that while the air supplies the fuel with oxygen, and so enables it to burn, it at the same time carries away a great part of the heat which might otherwise do work in maintaining the temperature of the furnace at a high point. Although, therefore, no more heat is actually produced by using a hot in place of a cold blast of air, the temperature of the furnace is nevertheless much greater in the former than in the latter case, because the air being at as high, or nearly as high, a temperature as the burning fuel, does not absorb any of the heat produced by the burning fuel, almost all of which is therefore expended in heating the furnace. The zone of reduction in the furnace begins lower down, and the furnace becomes effective through a greater vertical distance, and the output is consequently increased. Among other advantages accruing from the use of the hot-blast may be mentioned the fact that it ensures the combustion of the iron, it affords a good method of regulating the working of the furnace, and lastly, it has the effect of diminishing the actual quantity of heat carried off by the effluent gases. It is evident that to maintain the high temperature of the blast-furnace there must be no cessation in the work; the same furnace must be kept constantly working until it is worn out or in need of repair.

Before the way in which the temperature of the furnace is maintained, and the method adopted for removing the extraneous ingredients of the mixture in the form of slag, can be explained, it will be necessary to consider some of the mechanical appliances by which the various conditions of the iron manufacture may be best fulfilled, and chief among these stands the blast-furnace itself. Formerly the blast-furnace was a heavy conical mass of masonry some 30 feet high. At present, however, the form taken is a much lighter structure of wrought iron casing lined internally with firebrick, and having a total height varying from 70 to 100 feet. (Plate I.) The main portion or shaft is carried on a ring supported by cast-iron pillars. Here the furnace has its greatest internal diameter, a region known as the *boshes*, from which the furnace tapers to the hearth or cylindrical portion at the base, in which the molten material collects. In front of the hearth an opening extends from the bottom to a little above the level of the tuyeres. The arch above the opening is called the *tymp*-arch. The sides of the opening are prolonged outwards in a rectangular cavity, the forehearth, which is bounded in front by a firebrick wall called the dam. In the top edge is a semicircular notch for the passage of the slag. The molten metal is withdrawn through the taphole, a narrow vertical slit in the bottom of the dam. The tuyeres (usually from five to eight) enter the furnace through the upper portion of the hearth, and each is surrounded by a hollow, truncated cone through which water circulates, thus preventing the nozzles from being melted by the intense heat to which they are exposed.

The measurements of the various parts of the furnace differ considerably in different works. The following table gives comparative data of the dimensions and workings of four typical blast-furnaces used for the smelting of iron:—

	Cubic Capacity.	Total Height.	Diam at Hearth	Diam. at Boshes.	Diam. at Throat.	Daily Out-turn.	Time in Furnace	Fuel p ton of Metal.
Edgar Thomson, "F", Pittsburg, U.S.A.	18,000	85	11	22	16	270	21	1863
North Lonsdale, No. 3, Lancashire	14,000	75	8	21	14	107	36	2130
Midland, Missouri, U.S.A.	2,000	50	5½	10	5½	48	8	1870
Ferdinand, Austria	1,000	37½	5½	7	3	20	7	1585

There are blast-furnaces now (1904) in the United States which will produce 690 tons of pig-iron in twenty-four hours, with a consumption of little over 15·4 cwts. of coke per ton of iron. Of late years the diameter of the *throat*, or opening of the furnace, has been made considerably wider than formerly, and may now be as much as 19 feet. The object is to allow the materials thrown in to distribute themselves equally in their descent, and to prevent the heated gases escaping so rapidly as to cool this part of the furnace too much. The more modern furnaces have also generally a greater diameter in the boshes than the old furnaces, this diameter being as great as 16, 19, or even 23 feet; the narrowing of the furnace at the hearth or crucible is also not so marked. The furnace is first of all dried by burning a quantity of wood-charcoal in it; it is then filled with fuel, the blast turned on, and a charge of slag, mixed ore, and limestone, or other flux, alternating with fuel, added from time to time. The ferric oxide is reduced chiefly by the action of carbon monoxide, the limestone is decomposed and forms a fusible slag with the silica, &c., of the iron ore, which falls down to the crucible, where it is run off over the dam-stone. The reduced iron takes up carbon and sinks as a molten mass to the bottom of the hearth, from whence it is run out into moulds formed in sand, or conveyed to casting machines. We have already said that the gases rising from the mouth of the furnace carry with them a large amount of heat, and also that they contain a considerable amount of carbon monoxide, which is capable of undergoing combustion, and so generating a further quantity of heat. Various methods are adopted by which these

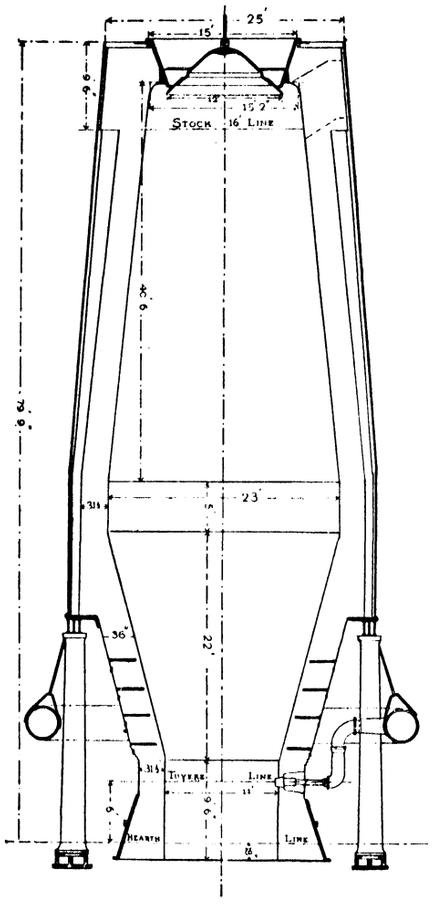


Fig. 1.

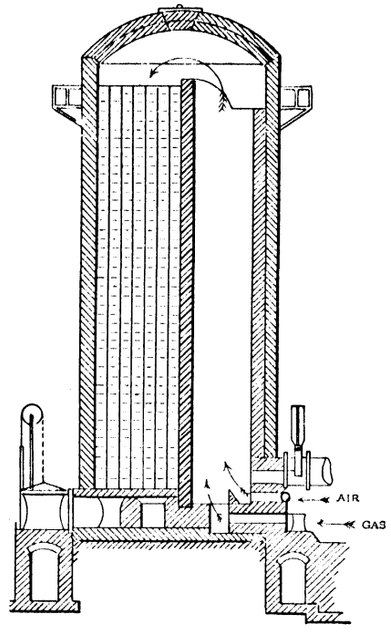


Fig. 3.

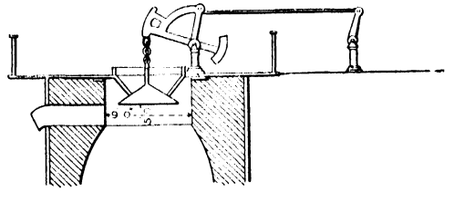


Fig. 4.

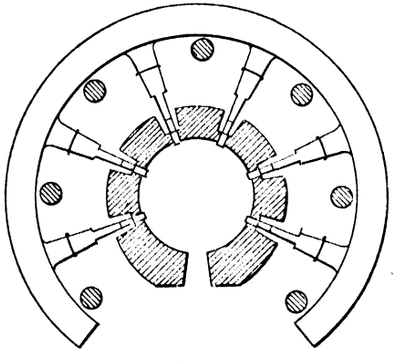


Fig. 2.

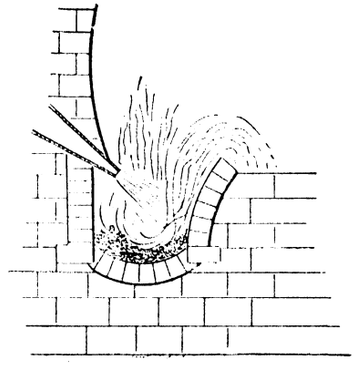


Fig. 5

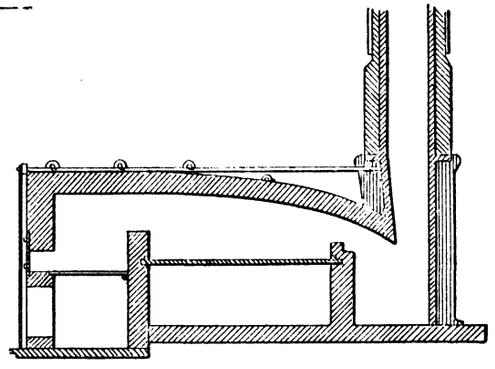
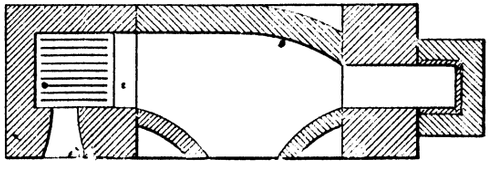


Fig. 7.



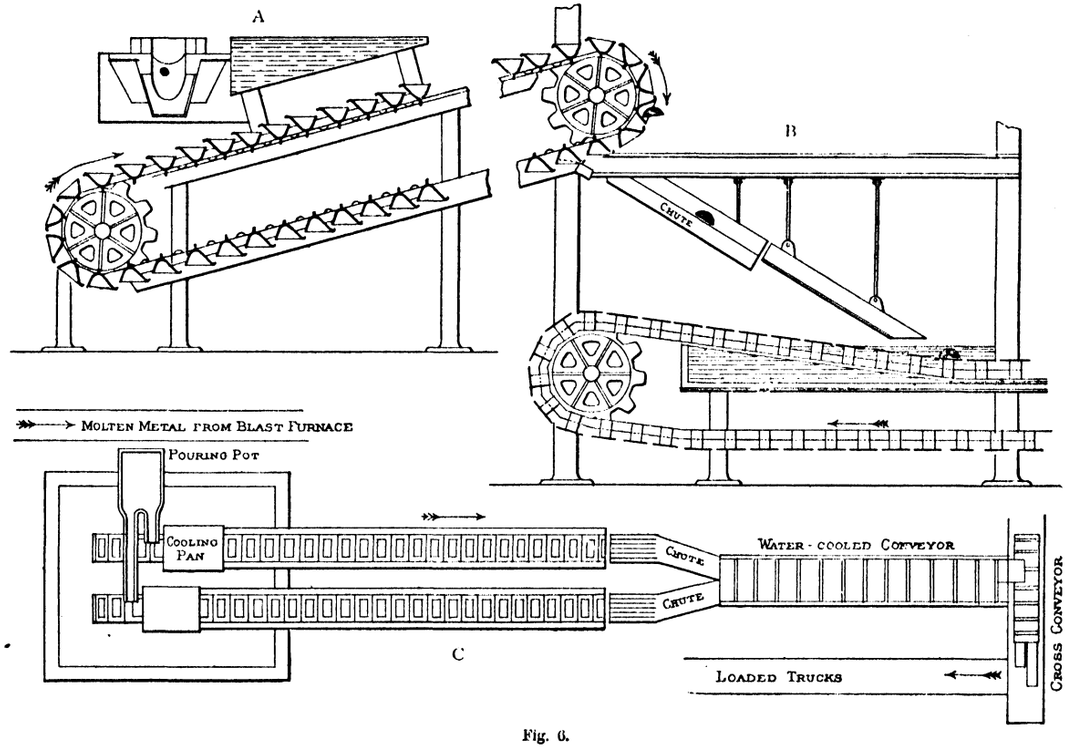


Fig. 6.

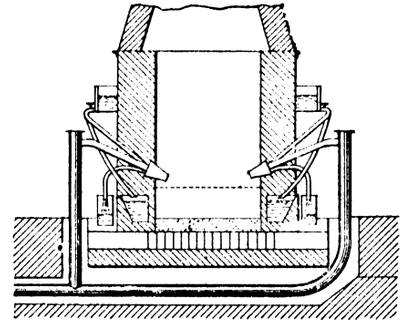


Fig. 9.

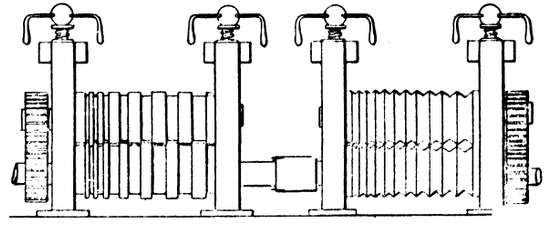


Fig. 10.

gases are collected. Generally the gases are drawn off through openings in the side of the furnace near the throat and are passed into kilns, where they are used for calcining the ore, or more generally, into regenerative stoves used for heating the blast, and quite recently to gas-engines used for producing the blast. The mouth of a furnace is provided with a hopper, which is closed with an inverted cone of sheet-iron, suspended by a chain passing over a pulley, and balanced by a weight. (Pl. I., fig. 4.) The cone is lowered periodically for the admission of fresh charges which have been placed in the hopper. When the cone is in its normal position the effluent gases find an exit through the tube or pipe leading to the stoves.

These gases are generally burned, and the heat thus produced is employed in raising the air to be sent through the tuyeres to a high temperature. We shall refer to this point again in speaking of the distribution of heat in the furnace.

At this stage a few brief remarks may be made on the more recent improvements adopted in blast-furnace practice and the utilization of the by-products. The tendency to increase the height and arrange that the change in shape from the boshes to the hearth shall be more gradual has already been referred to. Modern advance has mainly consisted in perfecting mechanical contrivances for the reduction of manual labour. The extremely arduous nature of the work involved in breaking and removing the iron from the pig-beds has always been a serious problem in blast-furnace practice. With modern plant, and consequent enormous increase of output, however, the difficulty of removing the iron quickly so that the furnace may be tapped at regular intervals has become proportionately greater. With a view to combat this difficulty and to ensure steady work, at the same time rendering it independent of excessive manual labour, various machines have been devised for dealing with the molten metal as it issues from the blast-furnace.

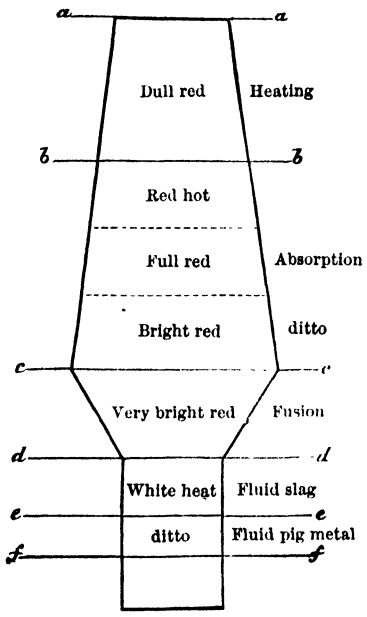
In the form of appliance shown in fig. 6, Pl. I., the molten metal is conveyed in a huge ladle by a travelling crane from the blast-furnace to a pouring-pot, whence it is discharged into moulds which constitute an 'endless chain' passing over sprocket wheels. The metal in each mould solidifies during its passage from end to end, where, as each is inverted in turn, it falls on to chutes, and thence passes to a long tank containing water, along which it is carried by a conveyer to the railway wagons.

Of the advantages accruing from this method of dealing with the metal, the elimination of expensive manual labour and the ability to deal with larger outputs has already been mentioned. The production in this way of a sandless pig, however, is regarded by some, for foundry purposes, as a doubtful advantage, although, as in the case of the Open-hearth Steel process, the use of 'chilled' or sandless pig will, sooner or later, be universally adopted.

At Dowlais, where the method of casting in sand moulds is still retained, the difficulties of breaking the pigs by manual labour is overcome by the use of a breaking machine, to which the whole casting is carried by a travelling crane. Mechanical handling of the materials on the charging floor is becoming general. The universal adoption of closed tops for the furnaces and the utilization of the furnace gases has proved of great economic value. Not only are these gases employed for heating the hot-blast stoves, but also for raising steam to drive the blowing engines, and latterly, after removing the greater portion of the dust, for use in gas-engines. A vertical section of a Cowper stove is shown in fig. 3, Plate I. The Ford and Moncur modification of the Cowper stove has been largely adopted in this country. The temperature of the blast has been equalized by what is essentially the interpolation of a stove through which the blast from each stove has to pass before entering the furnace. Further, this temperature has been controlled and regulated by pyrometric methods, and autographic records are obtained of the variations in temperature, such as are shown in fig. 10, Plate II. As regards the uses to which the products have been put, reference has already been made to the gases. The slag is largely employed in metallurgical processes and for making slag bricks, building stone, and cement. Slag wool is also an important commercial product, obtained by impinging a jet of steam on to a stream of molten slag. Its utility depends on its properties of non-conduction of heat and sound.

We are now in a position to examine the theory of the chemical action of the blast-furnace, and also to recognize the difficulties which must be overcome before a good yield of iron is obtained from the materials employed.

The general process which goes forward in the furnace is as follows: the iron ore, fuel, and limestone being introduced into the furnace, which is at a full heat, gradually sink downwards; at first the materials are exposed to a moderate heat whereby they become thoroughly dried. This part of the



furnace is included in the zone marked *a b* in the accompanying sketch, the temperature of which is 'dull red'. The materials then arrive at th reduction zone *b c*, the temperature of which increases from 'red hot' to 'bright red'; here the principal reducing agents at work are carbon monoxide, together with small quantities of hydrogen, carburetted hydrogen, and probably some alkaline cyanide. The iron is reduced near the point marked 'full red' in the sketch, and sinking lower absorbs carbon, and begins to fuse, the fluid slag collects at the point marked 'white heat', and floats upon the top of the molten metal which has now fallen to the very bottom of the hearth.

We have already considered the amount of air necessary to carry on the combustion of the fuel, and the advantages gained by substituting the hot for the cold blast; we have also learned that a great amount of available heat escapes from the furnace without doing any work, and that the greater part of the carbon is burned only to carbon monoxide before leaving the furnace, but that the potential energy may in both cases, by suitable mechanical arrangements, be converted into actual work. It now remains to trace the chemical action of the gaseous products along with the limestone upon the ironstone at the various temperatures of the blast-furnace.

It has until recently been generally supposed that the action of the hot-blast air upon the highly-heated coke is to produce carbon dioxide, but that this gas, meeting in its upward passage with a quantity of carbon at a high temperature, is thereby decomposed with the formation of carbon monoxide. Professor Tunner, in 1860, expressed a doubt as to the truth of this supposition, and more recently Sir Lowthian Bell has published the results of a series of experiments, tending to show that the amount of carbon dioxide produced by the direct combustion of the fuel is very small indeed, the principal, if not the only product being carbon monoxide. His analyses of the gases at the tuyeres are as follows:—

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
Carbon dioxide.....	0·76	1·1	0·8	1·8	1·7
Carbon monoxide ..	37·6	31·7	33·3	35·2	35·0
Hydrogen.....	..	0·4	1·0	..	0·3
Nitrogen.....	61·64	66 8	64·9	63·0	63·0
	100·0	100·0	100·0	100·0	100·0

We may therefore conclude that, practically, we have to deal only with the production in the lowest part of the furnace of carbon monoxide. Passing upwards we meet the descending charge of fuel, ironstone, and limestone; at the great temperature of this point, perhaps above the point *c* in the cut, the latter substance will be decomposed with evolution of carbon dioxide, so that we have now to deal with a gaseous mixture of carbon monoxide and dioxide. Taking the average results of analyses of the gases from different parts of the furnace, we find that between 15 and 30 feet from the tuyeres the amount of carbon dioxide increases as we pass towards the mouth of the furnace, but that after this point it diminishes until a distance of about 40 feet from the tuyeres is reached, when it again begins to increase. The marked increase of carbon dioxide in the first zone mentioned above can only be attributed to the decomposition of the limestone, the subsequent decrease being probably due to the action of highly heated carbon upon the carbon dioxide. When the ascending gases therefore meet the highly heated ironstone, they are probably essentially composed of a large quantity of carbon monoxide together with a smaller amount of carbon dioxide. Now we have already found that the formula which expresses the action of carbon monoxide upon ferric oxide at a high temperature is

$$3CO + Fe_2O_3 = 3CO_2 + Fe_2$$

But from the experiments of Sir Lowthian Bell, it seems that carbon dioxide begins to oxidize metallic iron at about 400° C.; hence the above reaction is impossible for all temperatures above 400°, unless the carbon dioxide produced be at once removed from the sphere of action. But in the furnace we have a mixture of carbon monoxide and dioxide meeting with ferric oxide at a temperature fully as high as 400°, the above reaction cannot therefore take place. Sir Lowthian Bell has shown that at 417° the reduction of ferric oxide by carbon monoxide proceeds until the resultant gaseous products are in the proportion of 100 volumes of carbon monoxide to 50 volumes of carbon dioxide, when the action ceases. Of course the composition of the gases inside the furnace must vary considerably from time to time, even at one fixed point; the temperature will also vary, still we seem warranted in saying that the total reduction of the ferric oxide by means of carbon monoxide cannot take place. We may lay it down as a general rule that lowering the temperature or increasing the quantity of carbon dioxide present decreases the deoxidizing power of carbon monoxide upon ferric oxide. But besides its reducing action carbon monoxide reacts in another way with ferric oxide at high temperatures. When these two bodies are heated together to about 200° a reaction takes place, which may be thus formulated, $2CO = C + CO_2$; that is, by the influence of the ferric oxide the carbon monoxide is decomposed with formation of carbon and carbon dioxide. The temperature most favourable to this reaction is about 400° to 450°; if the temperature is increased to that of a red heat, the reaction diminishes rapidly; the presence of a greater proportion of carbon dioxide than 1 volume to 2 volumes of the monoxide likewise hinders, if it does not entirely stop, this action.

At that point of the furnace which we are considering we have ferric oxide, carbon monoxide, and a small quantity of carbon dioxide, the temperature being somewhere about 400°. At this temperature the carbon monoxide will rob the iron of part of its oxygen, while, at the same time, another portion of the above-named gas will probably be broken up, with deposition of carbon upon the iron oxide (probably a suboxide) which remains, both of these actions being accompanied by the formation of carbon dioxide. Whenever the amount of this latter gas gets beyond a certain point, both of these reactions which have been going forward will cease, the gaseous mixture of the two oxides of carbon will pass up the furnace, while the partially-reduced iron, containing finely-divided carbon, will sink downwards. As the iron, accompanied by the other ingredients of the ironstone, and mixed with lime from the decomposition of the limestone, comes within the range of the great heat prevailing near the bottom of the furnace, it is probable that the oxygen still combined with the iron will take up a part of the carbon which we have seen is deposited in a finely-divided state in the iron, leaving a mass consisting of iron and carbide of iron, which fuses and collects at the bottom of the crucible. Accompanying this last deoxidation of the iron a similar action will take place, probably also through the influence of the carbon upon the oxides of silicon, phosphorus, and sulphur, which elements then pass into the fused mass.

In the lower part of the crucible the silica, lime, alumina, &c., also combine together to form a fusible slag which floats upon the top of the molten iron.

In the above sketch of the reduction of ferric oxide to metallic iron in the furnace, we have taken into account only the carbon monoxide which is present. Besides this gas there must always be more or less free hydrogen, produced by the decomposition of gaseous vapour, carried in by the blast at the high temperature of the crucible. This hydrogen may rob the ferric oxide of a small quantity of its oxygen at the temperature at which these two substances come into contact, but at a high

temperature its reducing action also probably consists in decomposing carbon dioxide, thereby at once increasing the amount of carbon monoxide and decreasing that of the dioxide. The influence of the small quantity of hydrogen in the blast-furnace gases is, however, insignificant, as the gases issuing from the blast-furnace contain as much free hydrogen as is brought in by the blast. There are also generally present cyanides of the alkalies, the formation of which may be accounted for by considering that the high temperature of the hearth will cause combination to take place between the metals of the alkalies existing in the ironstone or limestone, the nitrogen of the air, and the carbon which is present. The cyanides thus formed we may suppose to act as reducing agents by taking up oxygen from the ferric oxide to form cyanates, which may be again decomposed, and so on. As already stated, however, a very large proportion of the nitrogen, in fact practically the whole of it, acts merely as a diluent, and is found unchanged in the effluent gases.

The above account of the processes going on in the blast-furnace being accepted as giving, so far as we know at present, a correct representation of what actually takes place, let us now consider the conditions most suited for producing the greatest amount of iron with the minimum consumption of fuel.

The heat of the furnace comes chiefly from three sources:—

(1) From oxidation of the fuel with production of carbon monoxide.

(2) From further oxidation of this monoxide to dioxide accompanied by reduction of ferric oxide.

(3) From the blast.

From careful experiments Sir Lowthian Bell has found that the total heat thus produced in a good furnace is almost equal to the amount of heat absorbed by the reduction of the ferric oxides, the decomposition of carbon monoxide, the expulsion of carbon dioxide from the limestone, the fusion of the slag and of the iron, &c., together with that carried off in the gases escaping from the furnace. Now, if the fuel be completely burned, and if the reduction of ferric oxide by means of carbon monoxide be carried on until the resultant carbon dioxide accumulates so as to stop the reaction, we get the full amount of heat from these two sources; the excess of heat required must therefore be furnished by the blast. But, on the other hand, if the oxidation of the carbon monoxide be not carried as far as possible, there will be a deficiency of heat here which must be supplied by an increased temperature being given to the blast. But if the blast is to be extremely hot, say 700°, the air must be passed over a very large heated surface, and the dimensions of the furnace must also be large. According to Sir Lowthian Bell, when a very large furnace is worked with an exceedingly hot blast the oxidation of carbon monoxide is never complete, so that a considerable amount of heat passes away which might have been made to do work in the furnace; this carbon monoxide may of course be burned outside the furnace, and the heat so generated employed to raise the temperature of the air for the blast; but it is easier and less costly to burn the gas inside the furnace and to lower the temperature of the blast. A discussion of the best dimensions for furnaces, the exact amount of fuel to use, &c., cannot well find a place in this article; we must therefore content ourselves with pointing out the theoretically perfect furnace, in which every source of heat within the furnace being economized to the utmost, the heat to be supplied from without is lessened, while at the same time no by-products are allowed to be wasted, but every part works harmoniously with all the rest.

Having thus sketched the processes involved in preparing cast-iron, let us now turn our attention to the iron itself, and then consider the methods by which it is converted into malleable iron.

The molten iron, as it runs from the furnace, is conducted along channels excavated in strong binding sand into moulds of the same material, in which it solidifies, forming what are known as *pigs*. These pigs of iron are generally about 3 feet long and 4 inches in diameter, and weigh 2½ cwts. The molten iron is run off, or a *cast* is made, from ten to twenty times in twenty-four hours, 5 to 7 tons being about the usual quantity of pig-iron obtained at each *tapping*.

Pig-iron may be classified under the two heads of gray and white iron. The former exhibits a gray or blackish-gray colour, its texture is granular or scaly, its specific gravity averages about 7, and it exhibits some slight degree of malleability; white iron, on the other hand, varies in colour from that of tin to pale gray, its texture is crystalline and lamellar, its fracture is shining, it is very hard and brittle, and its specific gravity varies from 7·58 to 7·68. The difference between gray and white cast-iron becomes more apparent when analyses of each kind are compared; there it will be seen that while the carbon in white iron is almost entirely in combination with the iron, that in gray pig is generally in the free or *graphitic* condition, that is to say, it is not chemically combined with any other element.

Analyses of Cast Iron.

	No. 1 Pig.	Specular Iron.	Dannemora.		Gray Pig.		Cold Blast.
Iron	90·584	..	92·906	95·57	94·89	94·86	94·95
Carbon { combined.	..	4·100	4·809	4·20	..	..	..
Carbon { graphitic..	2·795	..	..	..	2·87	3·34	3·21
Silicon	4·414	0·230	0·176	0·08	1·16	1·18	1·54
Titanium	trace.	..	..	..	..	..	..
Sulphur	0·039	0·030	trace.	trace.	1·08	0·07	0·07
Phosphorus	0·099	0·073	0·122	0·05	..	0·55	0·28
Manganese	1·887	2·370	1·987	0·10	..	..	..
Nickel, cobalt, copper, and lead.	traces.	0·014	..	..	..	..	..

Some of the later work on the micro-structure of carburized iron tends to throw doubt on the theory that the carbon in white iron is wholly in chemical combination with iron. White iron, according to the most recent view, is really a mixture of crystals of Fe_3C (carbide of iron) set in a matrix which consists of alternate laminæ of carbide of iron and iron. This will be alluded to farther on. In gray iron the carbon is plainly visible in crystalline patches, which indeed give its characteristic colour to the pig. If white pig-iron be melted and very slowly cooled it is converted into gray iron; during the

slow process of cooling the carbon has time to arrange itself in a crystalline form and to separate out from the liquid mass, so that after cooling, the carbon becomes visible to the eye. This is due to the fact that the carbide of iron, Fe_3C, is decomposed at about 1100° C. On the other hand, gray iron may be transformed into white by heating it to a very high temperature, considerably above its melting-point, and then suddenly cooling it, under which conditions the carbon does not separate as graphite, but remains either dissolved in, or chemically combined with, the iron. Gray cast-iron melts at a higher temperature than white iron, but when melted it is much more fluid than the latter, and is then more suited for taking casts. Gray iron is more easily oxidized than white iron, probably because of its containing more metallic iron than the white variety. White iron is harder than gray, but gray is stronger than white. For foundry purposes gray iron is almost exclusively employed. It is very fluid when melted, and so penetrates into all parts of the mould; when solidifying it expands slightly, and so takes a very perfect impression; it is strong and not liable to break.

On the other hand, white or forge iron is used for making malleable iron, a process to be hereafter described.

The normal product of a good furnace is gray iron, the presence of white pigs, unless the furnace is specially working for white iron, shows that something is wrong; probably the amount of fuel is too small or the temperature is too low. The production of white iron seems to be chiefly a function of the temperature; it is also brought about, according to some authorities, by the presence of sulphur, which sulphur is derived from pyrites in the iron-stone or in the fuel. The element which causes the chief difference in varieties of cast-iron is plainly carbon; sulphur also we have seen may cause a decided change in the pigs. The presence of phosphorus seems to render cast-iron harder, but if it exists even in minute quantities it weakens the iron. It appears, however, that phosphorus may exist in two forms in iron, and that one form is less prejudicial than the other. Manganese favours the production of white iron, perhaps by forming a carbide of manganese which does not decompose, with separation of carbon, at high temperatures, and promotes the solubility of carbon in the iron. The presence of silicon above a small amount is generally regarded as prejudicial to cast-iron, although its presence in small quantities is of great utility in foundry practice as a softening agent, also as a means of preventing the formation of blow-holes in castings. Certain observations seem to point to the existence of two forms of silicon in iron, just as we have seen that carbon exists therein in two modifications.

We now proceed to describe shortly the way in which cast-iron is employed in the foundry. Although gray iron is that most commonly employed for foundry operations it is sometimes mixed with white iron, which imparts a degree of hardness that would not otherwise be obtained. For certain purposes also the molten iron is poured into thick iron moulds so as to chill the outer surface quickly and thereby produce a skin of hard white iron, while the interior of the casting consists of the softer but stronger gray iron. The cast-iron is melted generally in the cupola furnace. This apparatus consists of a cylindrically shaped furnace, varying from 7 to 10 feet high, and having an internal diameter of about $3\frac{1}{2}$ feet; in such a furnace 5 tons of iron may be melted. The furnace is composed of thick iron plates strongly riveted together, protected inwardly by a layer of binding sand about 9 inches thick, the whole being lined with fire-clay bricks. A small space is usually left between the iron casing and the lining. This is filled with finely ground cinders and fire-clay, thus avoiding strains due to expansion and contraction of the lining. Openings are provided in the lower portion of the cupola for inserting the nozzles of the tuyeres conveying a blast of hot air; there are generally three or four of these tuyeres in each furnace. When the metal is completely melted it is run out through an opening into iron ladles, in which it is conveyed to the moulds. A wooden pattern is first made of the desired casting. The mould is made generally in fine sand or loam, which must be very sharp, and yet retain its form when pressed together. This latter condition is realized by mixing the sand with a little powdered coke and then slightly wetting it. The sand thus prepared is rammed into an iron box or frame, which is without either top or bottom, and is made in two or more pieces; for the sake of simplicity let us consider the box to be made of two pieces only. The pieces being taken apart the pattern is partly pressed into the sand in one of them, the other piece is laid on the top of this, and the sand is tightly rammed in; the box being now inverted, the upper half is removed, when the pattern appears partly imbedded tightly in, and partly rising out of, the sand in the lowest part of the box. The sand having been removed from the remaining half of the box, this is placed over the lower part and rammed full of sand; on now removing the upper part a true impress of the half of the pattern appears in the sand, the other half of the impress being obtained by withdrawing the pattern from the lower portion of the box. The parts of the box are once more fitted together, then after the mould has been dusted with blacking, holes are made to admit the molten iron and to allow the air to escape, and the iron is poured in from the ladle. Moulder's blacking consists of finely-ground wood (generally oak) charcoal; the gas evolved from the blacking when the hot iron is poured into the mould forms a layer which prevents the molten metal from actually coming in contact with the mould. The method employed for casting such things as a hollow pillar consists in taking an impression of the pillar from a solid wooden pattern, and then inserting into this mould a *core* of clay or sand equal in external diameter to the internal diameter of the hollow pillar; on running in the iron it solidifies around this central core, which may then be removed, and so leave the casting hollow.

The operations in the foundry are very important, but we cannot in this article go into details of the various processes there conducted, beyond indicating briefly a few modern improvements in foundry work. The use of the hot-blast has now been generally adopted in foundry work, while the questions of gas-firing, induced draught, and utilization of the escaping gases have not been neglected. Various labour-saving appliances have been introduced for handling pig-iron. Moulding machines and mechanical rammers have replaced, to some extent, manual work, while the use of the sand-blast and pneumatic percussive tools has rendered the cleaning and dressing of castings less laborious and more efficient than heretofore. Reverberatory furnaces are often employed in conjunction with cupolas, and serve as reservoirs for the molten metal when a large cast is to be made. Used independently, they have been successfully employed for producing sound castings. Regarding the presence of elements other than carbon in the iron to be used for foundry work, the importance of silicon has been widely recognized.

Its utility both as a softening agent, tending to prevent the formation of white iron, and in enabling the occurrence of blow-holes to be avoided, renders its presence indispensable to the production of sound castings. The percentage of silicon which should be present depends greatly on the size of the casting. The thicker it is the more slowly it cools, and the less silicon is required. It need not usually exceed 1·0 to 1·5 per cent. For thin castings, however, the silicon should be present to the extent of about 2 per cent. Where it becomes necessary to add silicon, it is effected through the agency of ferro-silicon. Manganese tends to make the iron white, and to increase the contraction on cooling. Its presence assists in preventing the oxidation of the silicon on remelting, itself being oxidized, but its amount should not exceed 0·7–1·0 per cent. Phosphorus undoubtedly produces brittleness in castings, and should never exceed 0·7 per cent. In foundry iron the percentage of sulphur rarely exceeds 0·1 per cent; but if it is allowed to rise during melting by the use of coke high in sulphur, or by the failure to keep the slag basic by the use of an insufficient amount of limestone, the iron will show a tendency to become white, and will be lacking in fluidity. The following table gives an idea of the specifications required for foundry castings:—

	Silicon.	Sulphur not to exceed.	Phosphorus not to exceed.	Manganese not to exceed.
Hard.. ..	1·20 to 1·60	0·095	0·70	0·70
Medium .	1·40 to 2·0	0·085	0·70	0·70
Soft	2·20 to 2·8	0·085	0·70	0·70

Before passing on to consider the production of malleable or wrought iron, it will be well to point out the great strength of cast-iron. The following table exhibits the difference in strength of cast-iron according as it is prepared by the hot or the cold blast:—

Kind of Iron.	Direct Tenacity.	Resistance to direct crushing.	Modulus of Rupture of square bars.	Modulus of Elasticity.
	In pounds per square inch.			
Cold Blast	from 12,694 to 18,855	56,455 102,408	36,693 39,609	14,000,000 17,036,000
Hot Blast.....	from 13,434 to 23,468	72,198 104,881	29,889 48,497	11,539,000 22,738,000
Toughened cast iron..	from 23,461 to 25,764	129,876 119,457	.. ..	.. ..

It has been said that the use of the hot-blast in the cupola lowers the quality of the iron, but actual experiments show that although its use may very slightly lower the strength of some of the superior qualities, it nevertheless undoubtedly increases that of the inferior classes of pigs; at the same time the introduction of the hot-blast in the blast-furnace has enabled the iron-smelter to make use of ironstones which, in the days of the old cold-blast, were thrown aside as unworkable.

The next point to be considered in our review of the iron manfacture is the production of malleable or wrought iron from cast-iron. As we have already learned, cast-iron consists essentially of metallic iron mixed with varying amounts of carbon, silicon, phosphorus, and sulphur. These latter substances tend to lessen the tenacity of the iron, and so to make it unfit for rolling into bars or plates. The object of the manufacturer of malleable or wrought iron is to remove these substances, except a little carbon, and so produce nearly pure metallic iron. *Nearly* pure iron, it must be remarked, not perfectly pure, otherwise it would be too soft. The presence of a certain proportion of carbon is essential to the formation of good malleable iron. If the amount of carbon exceed 1·4 or 1·5 per cent, the tenacity and malleability of the iron are so small as to render it unfit to be wrought; the carbon in wrought iron must therefore be confined within narrow limits, and rarely exceeds 0·1 per cent. The presence of other substances, however, influences the amount of carbon.

The means by which the elimination of foreign materials from pig-iron is effected, while at the same time a small amount of carbon is retained, will now be indicated. The method consists in the partial oxidation of the iron, succeeded by the removal of the foreign substances in the form of oxides, partly by volatilization and partly by combination with the already oxidized iron in the form of slag. White cast-iron is the material used for the preparation of malleable iron, because when melted it does not at once become liquid, but remains for a considerable time in a semi-fluid state, in which it can be more easily *rabbled*, and the whole mass thus exposed to the oxidizing influence of the air and the rich iron slags, constituting what is known as the 'fettling'. The carbon contained in white iron is also more easily oxidized than that existing in gray iron. The conversion into malleable iron generally takes place in three stages. In the first of these the cast-iron is submitted to the *refining* process, which is followed by the *puddling* process; last of all, the puddled iron goes through the *reheating* or *mill furnace*. The first of these stages is generally omitted. The *refining furnace* or *running-out fire* consists essentially of an oblong cast-iron trough, three sides of which are formed of double walls, between which water circulates; this trough is about 3 feet long, 2 feet wide, and 2½ feet deep. (Pl. I., figs. 7, 8, 9.) A number of pipes (three, four, or sometimes six) are so placed that a current of air may be directed through them directly on to a mixture of white cast-iron and coke or charcoal on the floor of this furnace. At the high temperature the metal melts, and is partially converted into oxide by the blast of air; this oxide in turn reacts upon the carbon, silicon, sulphur, and phosphorus present, and converts them into oxides, in which state they combine with the excess of ferric oxide to form a fusible slag, which may be run off from the refined iron. The slag or *cinder* consists essentially of ferrous silicate; that which is produced towards the close of the refining operation is richer in iron than that formed in the earlier part of the work, and it is found that this rich slag is somewhat easily reduced by contact with pig-iron at a high temperature. It is therefore partly through the influence of this slag that oxygen is conveyed to the molten metal, from which it again passes to oxidize fresh quantities of silicon, phosphorus, &c., and so to form a further amount of slag.

The iron having passed through this preliminary process, which, as we have already said, is in modern practice generally omitted, is now treated in the puddling furnace. The principles involved in this operation are the same as those of the refining furnace, that is, iron oxide is made the means by which oxygen is conveyed from the air to the phosphorus and other impurities which it is desirable to remove, and those thus oxidized are removed as

Analysis of Slag from the Puddling Furnace, 'Tap Cinder.'

Wears	Chillington.	Dowlais.		
Ferric oxide	16·42	18·53	8·27	17·00
Ferrous oxide	60·14	57·67	66·32	58·67
Manganous oxide	2·29	0·78	1·29	0·57
Alumina	trace.	1·88	1·63	2·84
Lime	0·70	4·70	3·91	2·88
Magnesia	0·42	0·26	0·34	0·29
Silica	15·30	8·32	7·71	11·76
Iron sulphide	..	7·07	..	3·11
Sulphur	trace.	..	1·78	..
Phosphoric acid	4·66	7·29	8·07	4·27
Copper	..	trace.	trace.	..
	99·93	101·50	99·82	101·39
Percentage of iron	58·26	58·04	57·37	47·61

slag in combination with the excess of oxide of iron. The puddling furnace is shown in fig. 5, Pl. I. It consists of a hearth on which the pig-iron is placed; this hearth is generally made of cast-iron plates supported on cast-iron pillars; over it is built an arch of fire-brick, a bridge of the same material being built at the end of the hearth nearest the grate. This bridge prevents the fuel from passing over into the hearth. That end of the hearth which is nearest the chimney is also furnished with a brick ledge or *altar*, in order to prevent the metal from falling out of the hearth; beyond this is an inclined plane of fire-brick, down which the slag runs. At the broadest part of the hearth is situated the working-door, which is closed by an iron door suspended from a lever with a counterweight, so as to be easily raised or lowered. Through a hole about 5 inches square in this door the puddler thrusts the rake or *rabble*, with which he stirs up the mass of semi-fluid metal. From the figure it will be seen that the fuel is placed in the grate which is separated from the hearth, so that only the heated gases are allowed to play upon the surface of the iron. The shape of the furnace is designed to throw the heated gases down on to the surface of the molten mass on the hearth.

The hearth is first lined with a mixture of tap cinder, hammer scale, and other oxides of iron, this lining constituting the 'fettling' which plays an important part in the oxidation of the impurities in the metal to be treated. The pig-iron to be refined is broken into pieces, 4 or 5 cwts. of which are piled up on the hearth, where it is generally mixed with a quantity (sometimes as much as 25 per cent) of hammer scale or black oxide of iron. The door is now closed, the grate filled with coal, which is ignited, and the damper in the chimney raised so as to create a strong draught. After the metal begins to melt, the workman rakes the fragments on to a cooler part of the hearth, and exposes fresh quantities of metal to the action of the heated gases. When the whole mass has become semi-fluid it is worked by a long rake, so as to incorporate the oxide of iron on the surface with the rest of the material. This is the part of the process where the skill of the puddler comes chiefly into play. By properly regulating the temperature and stirring the mass it is possible to remove the greater part of the impurities by the action of the oxide of iron. The silicon is first oxidized, followed by the manganese, then the phosphorus and sulphur, and lastly the carbon. As the process of oxidation proceeds, bubbles of gas known as 'puddler's candles' (carbon monoxide) escape from the molten mass. When the escape of gas slackens it may be judged that the greater part of the carbon has been removed; this is also rendered evident by small lumps of the purified iron beginning to separate or *come to nature* throughout the mass, the temperature of which is not high enough to fuse the decarbonized iron. As the amount of purified iron increases, the mass gets more and more pasty, or, technically speaking, it works *dry* or *sandy*; at the same time the disengagement of carbon monoxide almost ceases. The puddler now works the iron together into balls or *blooms* weighing each about 60 lbs. When the whole of the metal has been collected into blooms the door of the furnace is closed, and the temperature is raised to a full welding heat. The blooms are then one by one carried on the end of a long rod either to a powerful squeezer or to a steam-hammer delivering about 100 blows per minute. The melted slag is thus forced out of the ball, which is at the same time welded into a compact mass of metal or *stamping*, which is then ready to go through the *puddling rolls*. These consist of grooved iron cylinders, between the grooves of which the hot iron is passed. (Pl. I., fig. 10.) The grooves are so arranged as to present a series of gradually-diminishing openings, the first set of grooves being oval or nearly so, while the next set are capable of rolling flat bars. The cylinders revolve in opposite directions, so that the metal in passing through them is powerfully compressed, whereby any slag remaining in it is squeezed out. The iron is now known as 'puddled bar'; while still hot it is cut into pieces by shears, which pieces are bound together by wire, and subjected to the final operation of *reheating* or passing through the *mill-furnace*. The bars are heated to a welding temperature in this furnace, which is so arranged that all the air passing over the hearth, on which the bars are placed, shall previously pass through the grate, and be thereby deprived of oxygen. The door by which the bars are introduced is also so arranged that the air passing in by it when it is opened is swept up the chimney, and so does not traverse the hearth of the furnace. After being heated in this furnace the bars are again passed through the rolling-mill, whereby they are converted into a single bar. This bar may be again bent upon itself and again rolled, thus producing what is known as *best bar* or *wire iron*. This iron is very tough and tenacious: it may be bent or even tied in a knot when cold without exhibiting the least sign of fracture.

Bar-iron possesses a specific gravity which varies from 7·3 to 7·9. Mechanical treatment alters the specific gravity considerably; thus, a bar having a specific gravity of 7·801 was rolled into a thin sheet, when its specific gravity was = 7·362. The melting-point of malleable iron is estimated as being about 1550° C.; its electric conductivity is much less than that of copper. The change which the puddled bars undergo when submitted to the reheating process seems to consist chiefly in rearrangement of their molecules, whereby a fibrous structure is produced. a bar of puddled iron, when polished and etched by dilute nitric or hydrochloric acid, exhibits an irregular structure. After reheating and rolling, the structure of the bar is more regular, fibres are seen arranged lengthwise along the bar. The best bar exhibits the same fibrous structure, but in a more marked degree, and the bar now presents the appearance of a bundle of fine fibres regularly laid side by side. The more fibrous the bar the more ductile and tenacious it will be; on the other hand, if the bar is made up of a mass of confused crystals, it is evident that it will be liable to break more easily. It seems to be pretty well proved that a series of repeated blows will determine the reconversion of fibrous into crystalline bar-iron. If iron

breaks off when bent in a cold state it is said to be *cold-short*; while if it stands this treatment, but becomes brittle at a high temperature so as to be unfitted for welding it is called *red-* or *hot-short*. The presence of foreign elements influences these two properties of iron in a marked degree; thus, a very small amount of sulphur, even such a quantity as ·05 per cent, causes bar-iron to become red-short. The best way of eliminating sulphur seems to be to use manganese in the blast-furnace, or to add ferro-manganese to the molten mass after it has been tapped out into a 'mixer'. By this means the greater part of the sulphur is removed. The addition of a basic and readily fusible mixture, consisting of quicklime and crude calcium chloride, to the molten metal has also proved successful as a means of removing sulphur. This is known as *Saniter's process*.

Phosphorus causes bar-iron to exhibit cold-shortness; a very small trace, about ·10 per cent, is said to increase the hardness of iron, but when the amount of phosphorus comes to be equal to ·50 per cent the tenacity of the iron is found to be considerably diminished. The presence of silicon exceeding 1·5 per cent also tends to render iron less tenacious; in this respect silicon acts even more energetically than phosphorus.

From the description already given of the puddling process it will have been seen how very hard such work as puddling must be; the men do not, as a rule, live to any advanced age, they must receive extremely high wages, and the wear and tear upon the furnaces is very great. To do away with hand labour and to substitute in its place mechanical appliances has long been the object of the iron puddler. For this purpose many furnaces have been invented, among the most successful being those constructed on the Danks' principle. This furnace consisted essentially of a rotating chamber in which the pig-iron was melted, and afterwards so thrown about by the movements of the chamber as to be worked up into balls. The great drawback to this furnace is the tear and wear upon the lining of the rotating chamber, caused by the great mass of iron which is thrown violently about. To overcome this difficulty a modification of the Danks' furnace was constructed with a double casing and a water jacket, so that all parts were kept perfectly cool and worked easily, and the furnace could be worked night and day, whereas single-lined furnaces usually work only by day. Commercially, however, this type of furnace has not proved a success and has been gradually abandoned. The rapid strides made by open-hearth processes for the production of mild steels or 'malleable' iron has in recent years tended to prevent any rapid increase in the demand for puddled iron, which has to a very large extent been replaced by these mild steels for structural purposes.

Having thus noticed the manufacture of cast and malleable iron, and discussed the chemical questions involved in their preparation, it remains for us to enumerate some of the statistics of this manufacture which is carried on on such a vast scale in Great Britain (though this country is now behind the United States). During the year 1899 the total quantity of iron ore raised in the United Kingdom amounted to 14,461,330 tons, representing in value at the mines £3,895,485. In addition to this, enormous quantities of ore are annually imported, the total quantity in 1899 being 7,054,578 tons, valued at £5,374,918. Thus the available iron ore for the year under consideration amounted to 22,041,788 tons. With regard to the ore raised in the United Kingdom, the amount contributed by England was 13,507,168 tons; by Scotland, 843,585 tons; Ireland, 102,262 tons; Wales, 8315 tons. In 1902, home output, 13,716,000 tons; import, 6,304,000.

Foremost among the iron-producing districts of Britain is that of Cleveland in North Yorkshire. Here the ore occurs as a bed of spathic ore, 10 feet thick, in the Middle Lias, and yields on an average 30 per cent of iron. The output from this district amounts to about 5½ million tons a year, accounting for two-fifths of the total output of the country. Next follow the counties of Lincolnshire, Northamptonshire, and Leicestershire, which may be conveniently classed together as giving a combined output of 4½ million tons a year, thus accounting for one-third of the output. In these counties the brown iron ore forms part of the Inferior Oolite, and the workings are mainly 'open', that is to say, the ore is largely quarried. The percentage of iron averages about 33. The districts of Cumberland and North Lancashire, where the iron ore occurs in huge irregular masses in the carboniferous limestone, have an annual output of barely 2 million tons, or about one-eighth of the total. Consideration, must, however be taken of the better quality of this ore, which averages from 50 to 60 per cent of metal. Most of the Staffordshire ore is taken from mines which also produce coal, and similar conditions obtain in Scotland. A comparison of the output and value of ore raised during the years 1873–1899 shows that, on the whole, the output has been uniform, with perhaps a tendency to decrease, but the value of the ore has decreased from £7,573,676 to £3,895,485.

Of the ore annually imported into this country by far the largest amounts are those which come from Spain, the Spanish imports having amounted to 6,186,022 tons out of a total of 7,054,578 tons in 1899, while the remainder was contributed by Greece (319,759 tons), by Algeria (231,361), and by Sweden (105,193 tons).

Having thus briefly considered the statistics relating to the ore, it remains to briefly summarize the pig-iron production. During the year 1899 the pig-iron produced from ores raised in the United Kingdom, together with those imported, amounted to 9,421,435 tons, of which 1,380,342 tons were exported, leaving 8,041,093 tons available for home consumption. The average price during the year varied from £3 to £3, 10*s.* per ton, according to quality. To produce this immense quantity of pig-iron 411 furnaces were in blast, and the amount of ore smelted was 22,820,302 tons, involving a consumption of 19,061,318 tons of coal.

It has been estimated that only about one-half of the total pig-iron is produced from British ores. A further examination of the statistics relating to pig-iron shows that in England 307 furnaces were in operation, resulting in the production of 7,605,278 tons, spread over the various districts as follows:—

North Riding (Cleveland), ...	66	furnaces.
Derbyshire, ...	39	,,
Cumberland, ...	28	,,
Durham, ...	30	,,
North Staffordshire, ...	20	,,
Lancashire, ...	23	,,

In Scotland 85 furnaces were in operation, producing 1,170,830 tons, the chief districts being Lanarkshire (55 furnaces) and Ayrshire (26 furnaces). The amount of pig-iron produced in 1899 and 1902 by the chief iron-producing countries may be stated as follows:—

	Tons in 1899.	Tons in 1902.
United Kingdom, ...	9,421,435	8,680,000
United States, ...	13,620,703	17,821,000
Germany (with Luxemburg),	6,290,434	8,518,000
France, ...	2,567,388	2,405,000

Without entering into an exhaustive consideration of the recent application of microscopical methods to the metallurgy of iron and steel, it will be necessary to offer a few remarks in explanation of the figures shown on Plate II. Briefly stated, *metallography*, as applied to the examination of iron and steel, depends on the recognition of certain typical structures, modified to a greater or lesser extent by the particular conditions of the case; the structure being developed by suitably etching a carefully polished surface. These structures in turn depend on the nature of and the extent to which the pure metal is associated with small quantities of other substances. For a given composition, the particular structure to which the mode of arrangement of the constituents gives rise is determined largely by the thermal and mechanical treatment to which the metal as a whole has been subjected before examination.

Fig. 1 shows the appearance of pure iron under high magnification (850 diameters). It is seen to consist of large grains, the difference of light and shade in adjacent grains being due merely to the different angle at which the light is reflected from each grain. This is caused by the different direction of orientation of the small cubic crystallites which make up each grain.

Fig. 2 also shows iron, but under a lower magnification (140 diameters) and of a less degree of purity. The grains in this case are surrounded by a fine mesh-work of dark carbide, and in places isolated patches of carbide are seen. This specimen of wrought iron when strained shows the structure of figs. 5 and 6. Here we find each grain of iron crossed by bands caused by the slip of the cubic crystallites, already mentioned, in the direction of their orientation. The presence of more carbide causes the mere mesh-work of fig. 2 to form patches of the constituent known as 'pearlite', which increases its proportion to iron until 0·85 per cent of carbon is reached, when the whole area of a polished section shows pearlite. Above this carbon percentage, the excess of carbide forms the bright constituent (Fe_3C) known as 'cementite', which becomes of more and more importance as the percentage of carbon rises to that of normal white pig-iron (fig. 3). In gray iron, however (fig. 4), the conditions of furnace working and of subsequent cooling have been such that very little of the carbon has been retained in the combined condition (as Fe_3C), but exists as graphite disseminated throughout the mass. A compromise between these two conditions is shown in fig 7, and the metal is then spoken of as 'mottled pig-iron' from the appearance of its fracture. Fig. 8 shows the lenticular appearance of a slag-flaw in imperfectly forged wrought iron.

Another important direction in which the study of iron and steel has in recent years been pursued is that involving pyrometric measurements. These measurements depend on the fact that nearly all molecular changes are accompanied by a net absorption or evolution of heat, so that an autographically recorded cooling curve of a mass of slowly but regularly cooling metal shows points of change in direction of the curve at temperatures at which the molecular changes occur.

Fig. 9 shows such a cooling curve of pure electrolytically deposited iron chosen for its freedom from carbon in order that the changes indicated may be safely regarded as being independent of the existence of other elements.

IRON, SALTS OF. Iron forms two series of salts, called respectively *ferrous* and *ferric* salts, the latter containing proportionately less iron than the former: thus, ferrous oxide contains 56 parts by weight of iron united with 16 parts by weight of oxygen, while in ferric oxide the same amount of oxygen is combined with 37·32 = (⅔ of 56) parts of iron. The following are the principal compounds of iron, with their respective formulæ:—

a. FERROUS COMPOUNDS.	*b.* FERRIC COMPOUNDS.
Ferrous Oxide, FeO.	Ferric Oxide, Fe_2O_3.
Ferrous Sulphide, FeS.	Ferroso-ferric Oxide, Fe_3O_4.
Ferrous Chloride, $FeCl_2$.	Ferric Sulphide, Fe_2S_3.
Ferrous Sulphate, $FeSO_4.7H_2O$.	Ferric Disulphide, FeS_2.
Ferrous Carbonate, $FeCO_3$	Ferric Chloride, Fe_2Cl_6.

1. *Ferrous Oxide*, FeO, may be obtained by precipitating a solution of a pure ferrous salt in water from which the air has been expelled by recent boiling, by means of an alkali also dissolved in deoxygenated water. The precipitation must take place in a vessel from which the air is excluded. The white precipitate thus obtained consists of hydrated ferrous oxide, which loses its water of hydration when boiled in a vessel from which oxygen is excluded. Ferrous oxide very rapidly absorbs oxygen, being thereby converted into ferric-oxide.

2. *Ferric Oxide*, Fe_2O_3.—By adding ammonia in slight excess to a solution of ferric chloride a bulky brownish-red flocculent precipitate is obtained, which, when dried at 100°, shrinks very much and leaves an oxide containing one molecule of water ($Fe_2O_3.H_2O$). If this hydrated oxide be heated at 320° C. for several hours it is entirely dehydrated, and pure ferric oxide (Fe_2O_3) remains. When exposed to a red heat ferric oxide undergoes a molecular change, after which it is almost insoluble in acids. A somewhat similar change may be brought about by long-continued boiling of the hydrate, produced by precipitating it from ferric chloride by ammonia in the cold.

We have already learned that ferric oxide is the leading constituent in a great many of the most valuable iron ores. By igniting ferrous sulphate (green vitriol), a residue, consisting of ferric oxide, is left, which is much used, under the names of *colcothar* and *rouge*, for polishing purposes. Hydrated ferric oxide, frequently as 'bog iron ore', is also used in gas-works for removing sulphuretted hydrogen from coal-gas; after this operation hydrated ferric sulphide ($Fe_2S_3.xH_2O$) remains, which by exposure to the air is again converted into hydrated oxide, sulphur being at the same time set free.

3. *Ferroso-ferric Oxide*, or magnetic oxide of iron, Fe_3O_4, occurs native, as we have already learned; it may be prepared by passing steam over red-hot iron-turnings. The formula of this oxide may be written thus: $FeO.Fe_2O_3$, which implies that this compound is in reality made up of ferrous and ferric oxide—in the proportion of one molecule of each; this view is supported by the fact that when treated with acids ferroso-ferric oxide yields a mixture of ferrous and ferric salts, thus—

$$Fe_3O_4 + 4H_2SO_4 = FeSO_4 + Fe_2(SO_4)_3 + 4H_2O.$$

4. *Ferrous Sulphide*, FeS. — Iron filings, when heated strongly with flowers of sulphur, combine with the latter to form ferrous sulphide, which melts and runs down in reddish-brown drops. The hydrated sulphide is formed by precipitating the solution of a ferrous salt by the solution of an alkaline hydrosulphide, thus: $2KHS + FeSO_4 + xH_2O = FeS.xH_2O + H_2S + K_2SO_4$. This hydrate rapidly absorbs oxygen from the air, ferric oxide being thus formed.

5. *Ferric Disulphide*, FeS_2. — When the last-named compound (ferrous sulphide) is mixed with half its weight of flowers of sulphur, and the mixture is exposed to a heat approaching redness, so

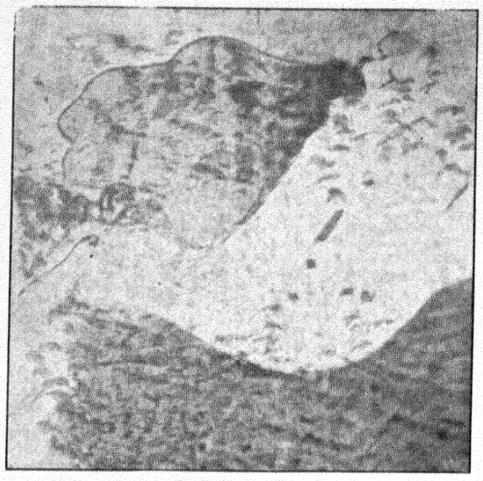


Fig. 1.

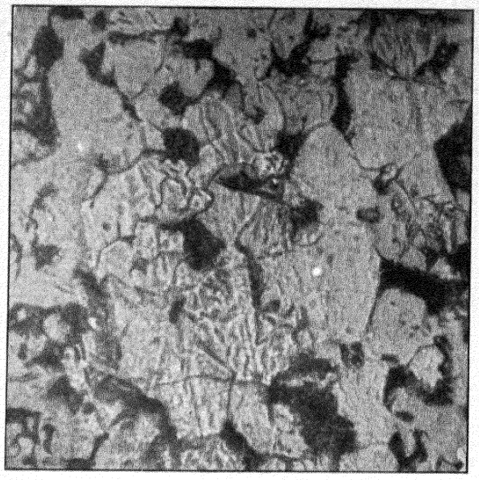


Fig. 2.

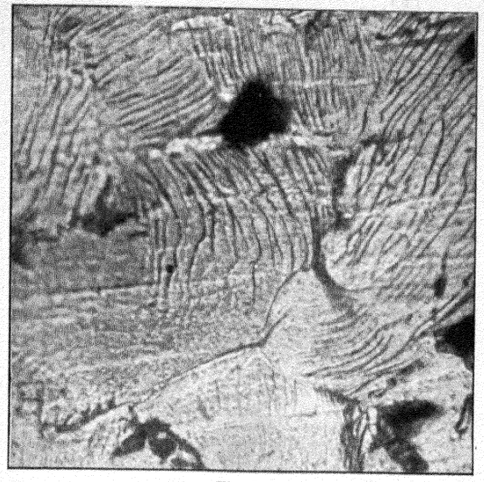


Fig. 3.

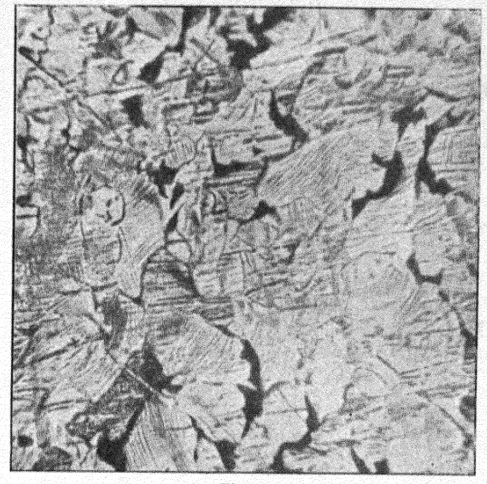


Fig. 4.

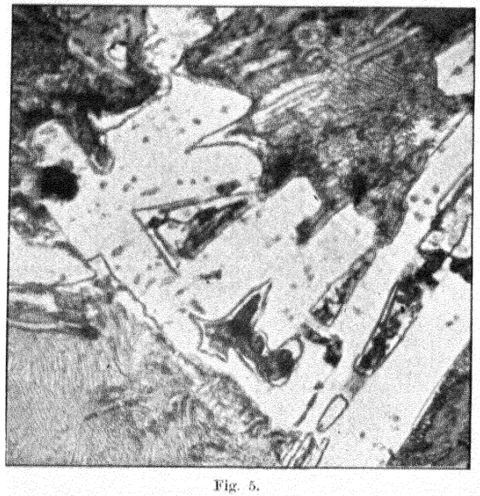


Fig. 5.

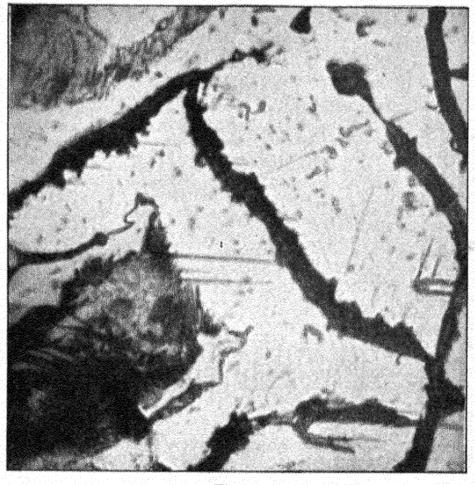


Fig. 6

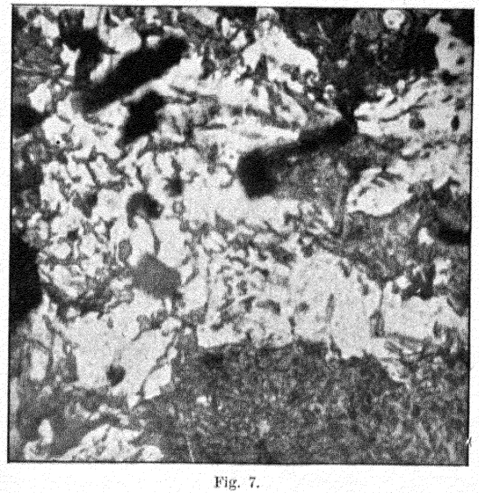


Fig. 7.

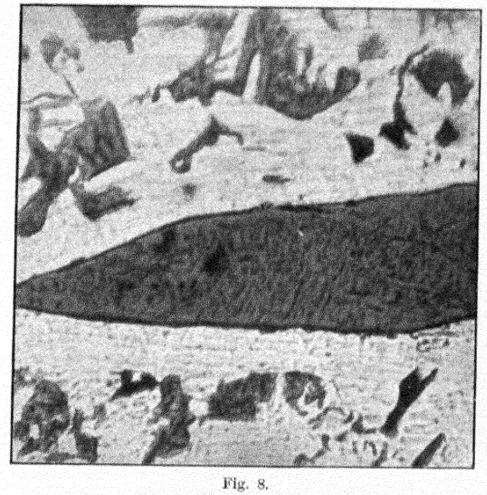


Fig. 8.

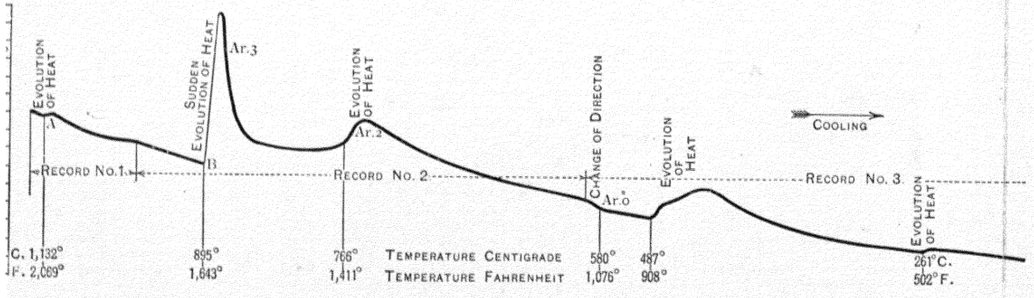


Fig. 9.

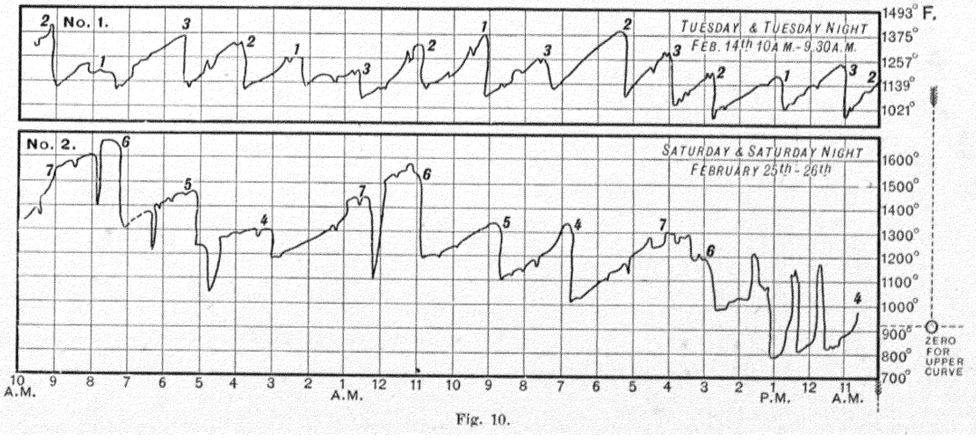


Fig. 10.

Fig. 1. Wrought Iron, showing crystals of "Ferrite" (×850). **2.** Wrought Iron (×140). **3.** Wrought Iron subjected to strain (×850). **4.** Wrought Iron subjected to strain (×140). **5.** White Pig-Iron (×850). **6.** Gray Pig-Iron (×850). **7.** Mottled Pig-Iron (×850). **8.** Slag Flaw. **9.** Autographic Record of the cooling of Pure Iron. **10.** Autographic Pyrometer records of the temperatures of Hot-Blast Stoves.

long as sulphurous fumes escape ferric sulphide is produced. We have already considered the variations in this sulphide as it occurs naturally.

6. *Ferrous Chloride*, $FeCl_2$.—This salt separates in green hydrated crystals from a saturated solution of iron in hydrochloric acid; when heated in the air ferrous chloride is first volatilized and then decomposed with the formation of chlorine and ferric oxide.

7. *Ferric Chloride*, Fe_2Cl_6.—If a solution of ferrous chloride be saturated with chlorine and evaporated it yields large red deliquescent crystals of hydrated ferric chloride ($Fe_2Cl_6.6H_2O$); these crystals cannot be rendered anhydrous by evaporation, as they are decomposed by heat. The anhydrous chloride sublimes in brown scales, when dry chlorine gas is passed over iron heated to redness. Ferric chloride dissolves easily in water. A solution of this salt in alcohol, and previously purified by dialysis, forms the medicine 'tincture of steel' or 'muriate of iron'. The most important ferric salts are the alums, a type of which is the iron-ammonium alum ($Fe_2(SO_4)_3.(NH_4)_2SO_4.24H_2O$).

8. *Ferrous Sulphate*, $FeSO_4.7H_2O$. — 1 part of pure iron when dissolved in 1½ part of sulphuric acid diluted with 4 parts of water yields a liquid which, on evaporation, deposits bluish-green rhomboidal crystals of ferrous sulphate, containing 7 molecules of water. This salt may also be crystallized with 4, 3, or 2 molecules of water. The crystals effloresce in the air and become covered with a brown coating, which consists of a basic sulphate. Ferrous sulphate is soluble in about twice its weight of cold water; at 90° its solubility in water is greater than at 100°. The strong affinity which this salt possesses for oxygen renders it useful as a reducing agent; thus it is employed to precipitate gold and palladium in the metallic state from their solutions. At a red heat ferrous sulphate is decomposed with evolution of sulphur dioxide and trioxide, and formation of ferric oxide, thus—

$$2\,Fe\,SO_4 = Fe_2O_3 + SO_3 + SO_2.$$

If this decomposition be effected in a retort, the liquid which condenses in the receiver is known as 'Nordhausen sulphuric acid'. A noteworthy property of ferrous sulphate is the readiness with which it forms double salts of the type with the sulphates of the alkalies: $FeSO_4(R_1)_2SO_4.6H_2O$. These salts are less susceptible to oxidation on exposure than ferrous sulphate itself. For manufacturing purposes ferrous sulphate or 'green vitriol' is formed by exposing iron pyrites to the action of the air, whereby the sulphur is oxidized with the formation of sulphuric acid and ferrous sulphate. These products are removed by washing, scrap-iron is added to the liquid in order to neutralize the sulphuric acid, the whole is evaporated and crystallized.

9. *Ferrous Carbonate*, $FeCO_3$.—The occurrence of this salt as spathic iron ore, &c., has already been mentioned. By mixing an alkaline carbonate with a solution of a ferrous salt a pale-green voluminous precipitate of ferrous carbonate is produced, which rapidly absorbs oxygen, at the same time parting with its carbon dioxide, thus giving rise to hydrated ferric oxide. This salt, ferrous carbonate, occurs in certain ferruginous springs where it is held in solution by the carbon dioxide present.

The other salts of iron are of less interest than those whose properties we have briefly sketched.

IRON, MEDICINAL USES OF. Iron is employed by physicians in many forms, partly for its astringent action on the lining membrane of the throat, gullet, stomach, and bowels, and for its property of causing blood to contract and form a clot with albuminous bodies, but mainly because of its power of acting on the red corpuscles so as to improve the quality of the blood. When the purely local action is desired, iron preparations are sometimes given as injections, as in cases of bleeding from the nose, bleeding from the gums, leech-bites, &c. This astringent local action makes iron a valuable medicine in cases of relaxed bowel, diarrhœa, and similar affections, but in many cases the iron preparation requires to be associated with a laxative medicine, as in the iron-and-aloes pill. The astringent action is specially marked in the preparations known as *tincture of steel* and *sulphate of iron*. When the constitutional rather than the local action is desired, the least astringent preparations should be preferred, but the choice must be made in accordance with the condition of the patient's stomach as indicated by his tongue. The least astringent forms are *reduced iron* and *dialysed iron*; but other useful preparations for this purpose are *saccharated carbonate of iron*, the *phosphate*, the *tartrate*, and the *citrates* of iron, and also the *syrup of the hypophosphites*. It is a most valuable remedy in anæmia, in conditions of impaired nutrition, in cases of wasting due to loss of blood or chronic discharges, in the condition of weakness following fevers, in scrofula, malarial poisoning, blood-poisoning, diphtheria, erysipelas, &c. For the two last-named diseases it is given in large doses. In chronic kidney disease and nervous disease iron is also very useful, being used in the latter case along with strychnine. The mildest of iron preparations are the citrate of iron and ammonia and the citrate of iron and quinine. *Griffith's mixture* and *Blaud's pill* are valuable iron preparations. The hydrated oxide of iron is an antidote in cases of arsenic poisoning.

IRON-CLAD VESSELS. See WAR-VESSELS.

IRON CROWN, a golden crown, set with precious stones, with which anciently the kings of Italy, and afterwards the German emperors, were crowned when they assumed the character of kings of Lombardy. It has received the above name from an iron circle, forged, according to a tradition opposed by some and accepted by others, from a nail of the cross of Christ, and introduced into the interior of it. It was worn, we are told, by Agiluph, 591; and by Charlemagne as king of Italy; by Henry of Luxemburg, 1311; by Frederick IV., 1452; by Charles V., 1530; and by Napoleon I., 1805. Latterly it was taken by the Austrians to Vienna; but in 1866 it was given up to Victor Emmanuel on the conclusion of the peace with Austria. Napoleon I., after his coronation, established the order of the Iron Crown. When the Emperor of Austria in 1816 took possession of the Lombardo-Venetian Kingdom he admitted the order of the Iron Crown among the Austrian orders.

IRON MASK, THE MAN WITH THE, a famous personage who was kept a prisoner in two or three French prisons in the time of Louis XIV., and who has excited a curiosity corresponding to the care with which his identity was concealed. His first prison was the castle of Pignerol or Pinerolo (then belonging to France), of which Saint-Mars was governor, and it is said that he wore during the journey thither a black velvet mask, and that orders were given to kill him if he discovered himself. In 1686 he was carried by Saint-Mars to the isles of St. Marguerite (Alpes Maritimes); and the same precautions were observed as upon his first journey. Saint-Mars having been appointed governor of the Bastille in 1698, carried the prisoner with him there, but still masked. An apartment had been prepared for him more convenient, and furnished with more care than those of the other unfortunate beings who inhabited this sad abode. He was not permitted to cross the courts, and he could not take off his mask even before his physician. In other respects the greatest attention

was shown him, and nothing which he requested was refused him. He was fond of fine linen and lace, and was very attentive to his whole personal appearance. His education appeared to have been carefully attended to; and he amused his leisure by reading, and playing upon the guitar. The physician of the Bastille related that this unknown person was admirably formed, and that he had a very fine skin, although rather brown. He interested by the mere sound of his voice, never complaining of his situation, and never giving any hint of his character. Some of these statements are, however, not well authenticated, being due, it appears, to the somewhat romantic dressing given to the story by Voltaire. This unknown person died November 19, 1703, at ten o'clock in the evening, without having undergone any severe sickness. He was buried the next day at four o'clock in the afternoon in the cemetery of the church of St. Paul. These details were substantiated by the MS. Journal of Du Jonca, the lieutenant of the Bastille. He was, it was said, about sixty years of age, although the register of burials for the church of St. Paul, in which he is mentioned under the name of Marchiali, makes him only about forty-five. It is said that orders were given to burn everything which had been employed in his service; that the walls of the chamber which he had occupied were rubbed down and whitewashed; and that the precautions were carried so far, that the tiles of his room were removed, in the fear that he might have displaced some of them to conceal a letter behind them. But these details are doubtful, and latterly he was treated with no special consideration.

Conjecture has exhausted itself to discover who this mysterious personage might be. Laborde, first *valet de chambre* of Louis XV., and who had received from this prince many proofs of confidence, showed a desire to discover him. The king replied, we are told, 'I pity him, but his detention injured only himself, and has prevented great misfortunes; you cannot know him'. The king himself had not learned the history of the iron mask till his majority, and he never intrusted it to any one. The author of Mémoires Secrets pour servir à l'Histoire de Perse (Pecquet), was the first writer who attempted to raise the veil which covers the unknown prisoner. In this book, published in 1745, he maintains that it was the Count of Vermandois, a natural son of Louis XIV. and De la Vallière, who was arrested, it was said, for having given a blow to the dauphin; but it is known that the Count of Vermandois died in 1683, at the siege of Courtrai. Lagrange Chancel, in a letter to Fréron (1759), attempts to prove that the prisoner was the Duke of Beaufort, the *king of the markets*, as he was called, and that he was falsely reported to have been killed at the siege of Candia. Sainte-Aulaire, in his History of the Fronde has conclusively demolished this hypothesis. Saint Foix, in 1768, wished to prove, in his turn, that it was the Duke of Monmouth, who was said to have been beheaded at London, but who had been withdrawn from punishment. The Jesuit Griffet, who held the office of confessor to the prisoners of the Bastille from December 3, 1745, to 1764, has examined these different opinions in the Treatise upon the Proofs which serve to establish the Truth of History, ch. xiv. (Liège, 1769); and he adds that all the probabilities are in favour of the Count of Vermandois. Voltaire maintained (Philosoph. Dict. art. Ana, Anecdotes) that the unknown prisoner could be no one of the personages just mentioned, but did not venture to state who he was. 'The writer of this article', adds he, 'knows, perhaps, more of him than Father Griffet, and will not say more of him.' The name of the queen, Anne of Austria, mother of Louis XIV., has been mentioned in connection with the mysterious prisoner. He is said to have been her son by some favourite, of whom three are noted: 1, a young foreign nobleman, her chamberlain; 2, the Duke of Buckingham, as asserted by Linguet in the Bastille Dévoilée; and 3, Cardinal Mazarin, between whom and Queen Anne Saint-Michel more than hints that there was a secret marriage. Louis XIV. is supposed to have first learned of the existence of this elder brother when he reached his majority, and to have taken the precaution to imprison him to prevent unpleasant complications. Those about the king took every means to conceal the identity of the prisoner. The Abbé Soulavie, editor of the Memoirs of the Marshal de Richelieu, endeavours to prove, vol. iii. p. 75, that the Iron Mask was a twin brother of Louis XIV. Before the birth of this prince two herdsmen announced to Louis XIII. that the queen would give birth to two dauphins, who would occasion a civil war which would convulse the whole kingdom. To prevent these troubles he caused the last born of the twins to be brought up in secret. Till the revolution this was the prevalent opinion. At the time of the destruction of the Bastille, in July, 1789, there were not wanting curious persons, who sought, in the archives of this fortress, to discover some notices which might throw light upon this historical problem. But to no purpose. A widely-accepted conjecture was first thrown out in a letter written in 1770 by Baron D'Heiss to the Journal Encyclopédique. According to this view the Man with the Iron Mask was Count Girolamo Magni, or Mattioli, first minister of the Duke of Mantua, who had betrayed the interests of Louis XIV. by failing to secure for him, as he had pledged himself to do, in consideration of a large bribe, possession from his master of the fortress of Casale. For this offence he was lured to the French frontier, secretly arrested, and imprisoned in the fortress of Pignerol in 1679. Documentary evidence in confirmation of the conjectures of D'Heiss and Dutens was exhibited by M. Delort in his Histoire de l'Homme au Masque de Fer; so that this theory gained many adherents. The secret was preserved so carefully, on the supposition that Mattioli was the prisoner, because his seizure and detention were flagrant violations of international law. In a more recent investigation by M. Jung, La Vérité sur le Masque de Fer (1873), an attempt is made to identify the Mask with a gentleman of Lorraine, who was connected with an association for the assassination of Louis. Funck-Brentano in 1894 revived the view that Mattioli was the mysterious prisoner, and many now consider the controversy settled and this view established. Such is the position of Mr. Tighe Hopkins in his The Man in the Iron Mask (1901).

IRON-WOOD, a name popularly given to a number of different trees on account of the hardness and heaviness of their timber. Several trees to which the name is commonly applied belong to the genus *Sideroxylon*, and are natives of the tropics, New Zealand, the Cape, &c. *S. inerme*, the smooth iron-wood of the Cape, has long been grown in European greenhouses. Another tree bearing this name is the *Ostrya Virginica*, or hop hornbeam, a N. American tree of slender size, with foliage resembling that of the birch, while the fruit is like that of the hop.

IRONY, a term invented by the refined Athenians (*eirōneia*, dissimulation), and used primarily to denote ignorance purposely affected to provoke or confound an antagonist. By *irony* we understand, in modern usage, that figure of speech or rhetorical device in which the words of the speaker or writer convey a meaning exactly the reverse of their literal sense.

When skilfully employed it is one of the most effective figures of rhetoric. One mode of irony is, when a person pretends to hold the false opinion or maxim as true, while, by stronger and stronger illustration, he so contrasts it with the true, that it must inevitably appear absurd. Another mode is, when he assumes the mask of innocent *naïveté*, and excites ridicule by the unreservedness of his professions.

IROQUOIS, the name given by the French to the confederacy of North American Indians, called by the English the *Five*, and afterwards the *Six Nations*. The Mohawks, Oneidas, Onondagas, Cayugas, Senecas, and Tuscaroras, after they were driven from their hunting-grounds in North Carolina in 1712, were the members of this confederacy. They formerly resided on the Mohawk River and the lakes which still bear their names, and extended their conquests to the Mississippi and beyond the St. Lawrence. Their valour and successes had procured them the name of the *Romans of America*. Their territory abounded with lakes well stored with fish; their forests were filled with game, and they had the advantage of a fertile soil. The sachems owed their authority to public opinion; the general affairs of the confederacy were managed by a great council, composed of the chiefs, which assembled annually at Onondaga. They exterminated the Eries, drove out the Hurons and Ottawas, subdued the Illinois, Miamies, Algonquins, Lenni Lennapes, Shawanese, and the terror of their arms extended over a great part of Canada, and the northern and north-eastern parts of the United States. It is probable that, had America not been colonized by the whites, they would have absorbed all the nations from Canada to the Gulf of Mexico. In the long wars between the British and French, which continued with some interruptions for nearly a century, until 1763, they were generally in the British interest; and in the revolutionary war they were also mostly in favour of the British. According to the most recent statements there were over 38,000 Iroquois in the United States, nearly 30,000 being in the Indian Territory: in Canada there were about 9600.

IRRADIATION. The impression produced by the image of a bright object, which has a dark background, on the retina extends beyond the outline of the image, and causes the object to appear larger than it really is; a dark object on a bright background appears smaller for the same reason. The image of a star is really a point, and its apparent size is due to irradiation. Irradiation increases the apparent size of the bright portion of a new moon, so that it seems to grasp the faintly illuminated part. Irradiation differs very much in different people, and even in the same person on different days; it is allied to the phenomena of persistence of impressions, accidental images and haloes, &c.

IRRATIONAL QUANTITIES, or SURDS, are quantities which we cannot exactly determine, because they cannot be expressed in terms of a primary unit. Thus $\sqrt{2}$ is an irrational quantity, for if we perform the operation of extracting the square root of 2, we obtain 1·4142..., and though we may carry on the process to any extent, we cannot stop at any point and say that we have found the exact number which represents the square root of 2. The ratio of the circumference of a circle to its diameter is an irrational quantity, 3·14159...

IRRAWADI, IRAWADI, or IRRAWADY, one of the great rivers of Southern Asia, traversing Burmah in a southerly course. One branch of it is believed to rise near lat. 28° N.; lon. 97° 30′ E., contiguous to the eastern extremity of Assam and the sources of the Lohit, one of the tributaries of the Brahmaputra; another branch rises some days' journey farther east; and, in the absence of more complete information, we may assume that its origin is in East Tibet, somewhere in the neighbourhood of the above locality, the two branches uniting about lat. 26°. It has generally a south course, being deflected west, however, both near Bhamo and at Ava, and its total length has been estimated at 1200 miles. Below Bhamo, Amarapura and Mandalay, both former Burmese royal residences, Ava, Pagan, Prome, and, on branches of its delta, Bassein and Rangoon, are the chief places along its banks. At Yandabo, about 90 miles below Ava, it receives its principal tributary, the Kyen-dwen or Chindwin River, from the north; its other large affluents are mostly from the east. There are three rocky defiles in which its channel is suddenly contracted, the lowest near Mandalay; but from that point downwards to its delta it has generally a breadth of from 1 to 4 miles. About 140 miles from the Indian Ocean, which it enters by numerous mouths, the delta of the Irrawadi commences, a wide interlacement of branches occupying the greater part of Pegu, and on the west and east arms of which the towns of Bassein and Rangoon are respectively situated. The current of the Irrawadi is commonly gentle—even in its upper part being no more than at the rate of 2 miles an hour; except during the inundations, when it flows so rapidly that no sailing vessels could navigate it but for the assistance of the south-west monsoon. It is navigable from the sea upwards for steamers of 5 feet draught as far as Bhamo near the Chinese frontier, 900 miles from the sea. The Irrawadi Flotilla Co. has a large number of steamers specially constructed for its navigation. Like the Nile, the Irrawadi is the main artery of the country through which it flows: the principal population of Burmah being established along its banks.

IRRIGATION is the art of increasing the fertility of soils by spreading water over them artificially, or by inundating them at stated periods, as contrasted with watering by manual labour. The practice is coeval with human civilization, and must have been resorted to originally in countries where otherwise barrenness must have resulted from excessive drought. Among the first historical references to the use of machinery are those to the contrivances for raising the waters of the Nile, Tigris, and Euphrates to irrigate the land on their banks; and in India, China, and other parts of the East, vast works for the irrigation of extensive districts existed in times of remote antiquity. Wherever these works have been allowed to fall into disuse the ancient fertility of the country has disappeared. In Italy and Spain, and in the south of France, irrigation is indispensable to the proper cultivation of the land, not for grass alone, but for the potato crop, madder, wheat, maize, beans, and generally every kind of crop sown with the drill. In warm latitudes water is as indispensable to the agriculturist as manure is in more temperate regions, and hence the British government has found it not only expedient but necessary to promote the formation of vast works for irrigation in its Indian possessions, the inhabitants of which depend mainly for support on the rice crop, which requires a very abundant supply of water. In some parts of the United States irrigation is now carried on to a great extent, as in Utah, Colorado, Southern California, Kansas, and Arizona, large tracts being thus rendered productive that for want of rain would otherwise lie almost barren. It is probable that the Romans introduced irrigation into Britain, although it was little practised till the beginning of the nineteenth century. As models of works of this kind, the irrigation works of the Moors in Spain may still be studied with advantage. Although the benefit derived from water in irrigation is incontestable, the mode in which it acts has not been quite satisfac-

torily explained. The difficulty arises from the striking results produced by clear and limpid spring-water, not holding in suspension the fine soil of more elevated land, or receiving in its course the rich drainage of populous districts. Unquestionably sewage-water is the best for irrigation, from the amount of putrefying animal and vegetable matter it contains either in a state of solution or in suspension. But it is clearly established that beneficial results are due to the inorganic substances contained in water, as well as to the organic matter it deposits on the soil over which it passes. Such mineral constituents as salts of potash and soda, sulphate of lime, and soluble silica, act favourably on vegetation. Where large quantities of water have been made to pass over a field an absolute amount of phosphate of lime or bone-earth is imparted to it equivalent to a good dressing of bones. Streams or springs having their origin in the lower strata of limestone rocks are particularly characterized by fertilizing qualities. The mere abundance of the water itself is an important element in irrigation, for not only is a copious supply of nutriment brought to the roots of valuable plants, but it proves destructive to several which merely encumber the ground, and thus poor and unproductive heath-lands have been converted into luxuriant meadows. The application of the sewage-water of towns to increase the productiveness of land has been attended in some instances with results so beneficial as almost to transcend belief, as in the case of the Edinburgh meadows between Portobello and Leith, an acre of which has sometimes yielded £40 of rent, and from one of five annual cuttings 10 tons of grass have been obtained from the acre. The extreme luxuriance of water-meadows may not, however, be all gain, as the grass from excessive succulence tends to produce diarrhœa in animals feeding on it. Hence the quality of the grass should be carefully studied. There are several systems of laying out and forming water-meadows. *Ridge-and-furrow irrigation* is practised in Hampshire, Wiltshire, Berkshire, and Gloucestershire. The water of the rivers is diverted by means of hatch-work into small gutters along the tops of the ridges, into which the land is shaped, and after being made to pass over the entire surface, it falls into another series of gutters, which either convey it to the river whence it came, or send it on to irrigate meadows farther down the stream. *Catch-meadows*, so called from each trench catching the water from its neighbour above it, are more cheaply formed than ridge-and-furrow meadows, and the water falling from tier to tier of gutters suffices to irrigate a larger surface. In the valleys of Somersetshire and Devonshire, where abundant streams have a rapid descent over stones, the water has been led off in tiers of channels, each receiving in a level trough the overflow from above, until the lowest channel is reached, which delivers the water back to the bed of the river. In this way a hill-side can be irrigated as easily as a level field, and the system, from its cheapness and efficacy, is gradually extending. In *subterraneous irrigation*, which can be applied only to fields that are perfectly level, drains are drawn across the field in parallel lines at right angles to ditches formed round the sides. The side-ditches are below the level of the cross drains. The water is introduced into them till the cross drains are filled and the surface overflown. The water is let off when necessary by opening sluices connected with the side ditches, which serve both as conductor and main drain. Much care and skill are required for the proper management of water-meadows. There must be neither too much nor too little water; too rapid a flow must be guarded against, &c. See EGYPT, NILE, INDIA, SEWAGE.

IRTISH, a river of Asia, which rises in the Chinese dominions, on the south-west side of the Altai Mountains, and after expanding into Lake Zaisan, flows through the Russian territory of Semipalatinsk N.N.W. into the government of Tobolsk, passes the town of that name, and finally, after a course of about 1800 miles, joins the left bank of the Obi a little below Samarova. Its chief affluents are, on the right, the Om, Tara, Shish, Tui, and Demianka; and on the left the Tunduk, Osha, Ishim, Vagai, Tobol, and Konda. Much of its course is through low plains and steppes, and its navigation is much impeded by shifting sands. Its fisheries, particularly of sturgeon, are very productive.

IRVINE, a royal and parliamentary burgh, seaport, and market-town, in the county of Ayr, Scotland, on a rising ground on the right bank of the Irvine, an affluent of the Frith of Clyde, about ¼ mile from the estuary formed by its junction with the Garnock, 24 miles south-west of Glasgow, on the railway to Ayr. It consists of two broad and spacious streets, from which branch off smaller but well-paved cross streets. On the left bank of the river lies a part of the burgh called Fullarton, which is joined to the old royal burgh by a handsome stone bridge, and has well-built and commodious houses. There is a large and elegant parish church, and various other churches. Irvine Academy, occupying re-constructed and enlarged buildings, is a flourishing educational institution. A very handsome town-house, several banks, and numerous costly private residences, are notable architectural features. There is a Social and Literary Institute, comprising a lecture-hall, reading-room, library, and recreation-rooms. Manufacturing industry is now represented by chemical, engineering, foundry, ship-building, and other works. The harbour admits vessels of 450 tons, and has a good quay, which has lately been greatly extended and improved. The chief exports are coal, fire-clay goods, iron, chemicals; imports—timber, slates, salt, ore, grain, and butter. There are good golf-links near Irvine, which is one of the Ayr district of burghs. James Montgomery, the poet, and John Galt, the novelist, were born in Irvine. Pop. of the parl. burgh in 1891, 9037; in 1901, 9603.

IRVING, EDWARD, a celebrated preacher, founder of the sect which bears his name, was born at Annan, Dumfriesshire, on the 4th of August, 1792. After receiving a good education in his native place, he was sent in 1805 to the University of Edinburgh, where he attracted the special attention of Professors Leslie and Christison. He subsequently taught for several years, first at Haddington and then at Kirkcaldy (where he gained the friendship of Carlyle); and in 1815 he became a licentiate of the Church of Scotland. Having removed to Edinburgh in 1819, he made the acquaintance of Dr. Chalmers, and was subsequently appointed his assistant and colleague in St. John's Church, Glasgow. In 1822 he became minister of the Caledonian Asylum Chapel, a Presbyterian place of worship in Cross Street, Hatton Garden, London. Here he soon attracted very large congregations by the force and eloquence of his discourses, and the singularity of his appearance and gesticulation. The greatest orators and statesmen of the day hurried to hear him, and the seats of the chapel were crowded with the wealthy and the fashionable. The appearance of the preacher—tall, athletic, and sallow—displaying a profusion of jet-black glossy hair reaching to his shoulders, with a singular obliquity in one of his eyes, and a stern calm solemnity of aspect, enhanced the interest and excitement produced by his discourses. His strong northern accent added to his singularity, which was

still further increased by his violent and ungraceful, but impressive gesticulation. His phraseology was one of the peculiarities which gave him *éclat* with the public, for he expressed his ideas in the language of Milton, Hooker, and Jeremy Taylor. In 1823 he published an octavo volume of 600 pages, under the singular title of For the Oracles of God, Four Orations—for Judgment to Come, an Argument, in Nine Parts. Such was the demand for this publication, that a third edition was called for in less than six months. Two years afterwards another work appeared under the title of For Missionaries after the Apostolic School, a Series of Orations in Four Parts. 1, The Doctrine; 2, The Experiment; 3, The Argument; 4, The Duty. By the Rev. Edward Irving, A.M. The volume was dedicated to Coleridge the poet, with whom Irving had recently formed an intimate acquaintance. In 1825 Irving preached the anniversary sermon for the Continental Society, the substance of which he afterwards published in a treatise on the prophecies of Daniel and the Apocalypse, entitled Babylon and Infidelity foredoomed of God. About the same time he drew up his Introductory Essay to Bishop Horne's Commentary on the Book of Psalms, published in Glasgow, and which is generally considered as one of the choicest products of his pen. Sermons, Lectures, and Occasional Discourses, in three closely-printed volumes in octavo, in which his theological peculiarities were first distinctly enunciated, were published at London in 1828. These for some time back attracted considerable attention, but it was not till 1830 that they were formally taken up by the presbytery of the Scotch church in London, which in that year instituted proceedings against him, in which he was charged with holding Christ guilty of original and actual sin, and denying the doctrines of atonement, satisfaction, imputation, and substitution. In the beginning of 1832 his aberrations had become so marked and extraordinary that his hearers, who in 1829 had erected for him a large church in Regent Square, now found it necessary, in conjunction with the trustees, to prefer charges against their minister, with a view of either reclaiming him from error, or deposing him from his official station as a minister of the Scottish Church in London. On the 2d of May, 1832, the London presbytery unanimously found him guilty. The consequence was that he became dispossessed of his cure as minister of the National Scotch Church meeting in Regent Square. In 1833 the presbytery of Annan, which had licensed him, deposed him from the ministry, on which occasion his defence of himself was a sublime effort of oratory. In the autumn of 1834 he went to Scotland for the benefit of his health, and in December of that year expired at Glasgow of consumption, induced by his incessant cares and labours. An excellent biography of Irving has been written by Mrs. Oliphant. See IRVINGITES.

IRVING, WASHINGTON, a distinguished American writer, was born on 3d April, 1783, in New York, where his father, who had emigrated from Scotland before the Revolution, was a merchant of some standing. He was originally educated for the legal profession, and in 1806 was called to the New York bar, but his tastes were all in the direction of literature, in whose fields he made his first appearance by the publication, in 1802, of the Letters of Jonathan Oldstyle, in the New York Morning Chronicle, a journal edited by his brother, Dr. Peter Irving. Shortly after the issue of these he was threatened with an attack of pulmonary disease, and was recommended to try the effects of a journey to Europe. He accordingly sailed for Bordeaux, visited the south of France and Italy, and then returned across Mount St. Gothard, through Switzerland to Paris. After visiting Holland and England he returned in March, 1806, to America, and, as already mentioned, was admitted a barrister in the autumn of that year. Throughout 1807 he acted as principal contributor to the periodical of Salmagundi, which terminated in January, 1808, and in December, 1809, appeared his celebrated History of New York, by Diedrich Knickerbocker, in which the manners of the descendants of the original Dutch settlers, then a considerable element in the population of New York, were sketched in a spirit of the quaintest and most genial humour. About this time he joined two of his brothers as a partner in the mercantile firm of Irving Brothers, of New York and Liverpool, but this included merely a share in the business, without his being required to take any active part in its management. During the war with Great Britain, in 1813–14, he edited the Analectic Magazine in Philadelphia, and acted also for a time as aide-de-camp and military secretary to the governor of the state of New York. In May, 1815, he embarked for England, with the intention of making a second tour of Europe, but this was frustrated by the embarrassments of his brothers' house, occasioned by the conclusion of peace with Great Britain. The result of these was a bankruptcy in 1817, and Mr. Irving, who had actively but vainly exerted himself to avert this catastrophe, now resolved to follow literature as a profession. Having taken up his abode in London, he commenced in 1818 the series of papers entitled The Sketch-book, which were transmitted for publication to New York. The success of these was considerable, and an enlarged edition was published in 1820 in England, by Mr. Murray. Up to 1832, a period of seventeen years, Mr. Irving continued to reside in Europe, spending his time partly in England and partly on the Continent, more especially France and Spain. During this period were composed some of his most famed literary works, comprising Bracebridge Hall, sold to Murray for 1000 guineas, and published in 1822; The Tales of a Traveller, for which he obtained 1500 guineas, published in 1824; The Life of Columbus, sold for 3000 guineas, and published in 1828; Chronicles of the Conquest of Granada, in 1829; Voyages of the Companions of Columbus, in 1831; and Tales of the Alhambra, in 1832. He also acted for a time as secretary of legation to the American embassy in England, and in 1831 received the degree of D.C.L. from the University of Oxford. In the spring of 1832 he returned to New York, where he was received with general enthusiasm. The same year he accompanied on an expedition to the far west Mr. Ellsworth, one of the commissioners for the removal of the Indian tribes beyond the Mississippi. The results of this journey appeared in his Tour on the Prairies, published in 1835. The same year he published Abbotsford and Newstead Abbey, and Legends of the Conquest of Spain. Astoria, or Anecdotes of an Enterprise beyond the Rocky Mountains, appeared in 1836, the Adventures of Captain Bonneville in 1837, and the Biography and Poetical Remains of Margaret Miller Davidson in 1841. In 1842 he quitted America for Spain, having received, unsolicited, the honourable appointment of United States ambassador at Madrid, and continued in this office till 1846, when he returned to his native country. He now retired to his country seat of Sunnyside, the prototype of his own 'Sleepy Hollow,' on the banks of the Hudson, 25 miles from New York, and there spent the remainder of his days. His last literary works were Oliver Goldsmith—a Biography (1849), Mahomet and his Successors (1849–50), and the Life of George Washington (1855–56). To the last he enjoyed a green old age, and on the evening before his death was

apparently in perfect health. He was found dead on the morning of 28th November, 1859. Washington Irving never was married, but in early life was engaged to a beautiful girl, who prematurely died. In personal character he was a most amiable and genial-hearted man; and, in his younger days at least, was strikingly handsome. No American author has been more popular, and deservedly so, in England than he, having succeeded perhaps more thoroughly than any other in commending himself to the sympathies both of Old and New World readers; while in point of interest of narrative and elegance of style he will bear comparison with the first names among British classics.

IRVINGITES, a name derived from the Rev. Edward Irving, and commonly applied to the sect of Christians calling themselves the Catholic Apostolic Church. Irving, in the winter of 1829–30, had delivered a series of lectures in London on Spiritual Gifts, in which their restriction to the primitive church was denied, and their continuance to the close of the Christian dispensation maintained. In the spring of 1830 some remarkable phenomena occurred at Port-Glasgow, consisting in apparently supernatural utterances, partly in the vernacular and partly in unknown tongues. Irving's associates in the study of prophecy, after a careful investigation, were satisfied that there was here a revival of the spiritual gifts of the first ages of the church. The same phenomena appeared in his own congregation and in several others, and in the same year Irving furnished an account of them to Fraser's Magazine. These gifts were of two kinds, speaking in tongues and prophesying, and as the former were unintelligible they were believed to be 'unknown,' the Holy Ghost 'using the tongue of man in a manner which neither his own intellect could dictate nor that of any other man comprehend.' Prophesying consisted of 'exhortations to holiness, interpretations of Scripture, openings of prophecy, and explanations of symbols.' Expulsion from his London chapel and deposition from the ministry by the Presbytery of Annan (see IRVING, EDWARD) resulted from his maintenance of these views, and that portion of the congregation that adhered to him were forced into a position of isolation, and of necessity became a distinct community. In this way arose the Catholic Apostolic Church, at first Presbyterian in its order of worship and constitution of membership. The result of modifications through the agency of the abounding prophetical utterances may be briefly stated as follows:—As its constitution claims to be the development of that established in the primitive church, there is the fourfold ministry of 'apostles, prophets, evangelists, and pastors and teachers' (Eph. iv. 11). The three orders of the church catholic, bishops, priests, and deacons, are comprehended within this fourfold classification. The apostles possess spiritual prerogatives, and convey the Holy Ghost by the laying on of hands. They interpret authoritatively the prophetic utterances, and these must be brought by the pastors under their cognizance. The names of the other three ranks of this fourfold ministry sufficiently explain their functions. The church has no sectarian aims, and does not seek to proselytize, recognizing all who have been baptized as members of the one church, and all Christian communities in proportion to the measure of truth they hold. Their ritual embodies portions of those in use in different sections of the church, Greek, Roman Catholic, and Protestant. Material emblems and signs are employed to signify spiritual truths, and the propriety of magnificence in worship, where circumstances admit of it, is fully recognized. The ministry is supported by the tithes of the members, who give offerings besides for other purposes. The second coming of Christ is a subject of deep and abiding interest and sanguine hope to all the members, congregations of whom, though not numerous, are established in Britain, Canada, the United States, Prussia, France, and Switzerland. It was two years after Irving's death before the number of the apostles had been completed to twelve. After his deposition by the Presbytery of Annan he ceased to administer the sacraments and perform priestly functions, acting merely as a deacon, till he should receive a new ordination from the Spirit. This he believed was conferred on him on April 5, 1833, and by the imposition of the hands of the apostle he was constituted 'angel' or chief pastor of the church. The Catholic Apostolic Church holds essentially the same doctrines as the other Christian bodies.

ISAAC, the son of Abraham, remarkable for his birth, which was long promised to his parents, and took place when they were far advanced in age, and for his having been actually bound and placed as a victim on the altar. (See ABRAHAM.) He escaped death by a miracle, and resembled his father in faith and steadfastness in the worship of the true God in the midst of heathens, but not in activity and magnanimity. In him the patriarchal character shone milder and softer than in Abraham, but purer and nobler than in his son Jacob. By his marriage with Rebecca the intermixture of races, which would have taken place if he had chosen a woman of Canaan for his wife, was prevented, and the purity of descent from Abraham's family remained unimpaired. One of the most remarkable incidents in his life was the deception which was practised upon him when his son Jacob, at the instigation of Rebecca, obtained from him the blessing of Esau, the first-born. He died at Hebron, aged 180 years. Very different interpretations have been put on his character. The Arabian traditions in the Koran represent him as a model of religion. The Midrash ascribes to him the institution of the afternoon prayer.

ISABELLA, wife of Edward II. of England. See EDWARD II.

ISABELLA OF CASTILE, the celebrated Queen of Spain, daughter of John II., king of Castile and Leon, was born 23d April, 1451, and married, 19th October, 1469, Ferdinand V., king of Arragon, surnamed 'The Catholic.' After the death of her brother, Henry IV., in 1474, she ascended the throne of Castile, to the exclusion of her elder sister, Joanna, who had the rightful claim to the crown. During the lifetime of her brother Isabella had gained the favour of the estates of the kingdom to such a degree that the majority, on his death, declared for her. From the others the victorious arms of her husband extorted acquiescence in the battle of Toro, in 1476. After the kingdoms of Arragon and Castile were thus united Ferdinand and Isabella assumed the royal titles of Spain. To the graces and charms of her sex Isabella united the courage of a heroine, and the sagacity of a politician and legislatrix. She was always present at the transaction of state affairs, and she insisted that her name should be placed beside that of her husband in public ordinances. The conquest of Granada, after which the Moors were entirely expelled from Spain, was in a great degree her work; and the encouragement she gave Columbus assisted him to the discovery of America. In all her undertakings the wise Cardinal Ximenes was her assistant. She has been accused of severity, pride, and unbounded ambition, and it cannot be denied that she was deficient in womanly gentleness. But a spirit like hers was necessary to humble the haughtiness of the nobles without exciting their hostility, to conquer Granada without letting loose

the hordes of Africa on Europe, and to restrain the vices of her subjects, who had become corrupt by reason of the bad administration of the laws. By the introduction of a strict ceremonial, which subsisted till a recent day at the Spanish court, she succeeded in checking the haughtiness of the numerous nobles about the person of the king, and in depriving them of their pernicious influence over him. She checked private warfare, which had formerly prevailed to the destruction of public tranquillity, and introduced a vigorous administration of justice. In 1492 Pope Alexander VI. confirmed to the royal pair the title of *Most Catholic*, already conferred on them by Innocent VIII. The zeal for the Roman Catholic religion, which procured them this title, gave rise to the Inquisition (see INQUISITION), which was constituted in Spain in 1480, at the suggestion of their confessor, Torquemada. Isabella died in 1504, having extorted from her husband (of whom she was very jealous) an oath that he would never marry again. See FERDINAND V., XIMENEZ, and COLUMBUS.

ISÆUS, an Athenian orator, son of Diagoras, was born at Chalcis in Eubœa, and flourished during the period between the Peloponnesian war and the accession of Philip of Macedonia. He lived, therefore, between 420 and 348 B.C. Lysias and Isocrates were his teachers. Wholly unconnected with public affairs, he devoted himself to instruction in eloquence, and wrote judicial orations for others. Of his fifty orations eleven are extant, which are recommended by their pure, clear, concise, and often forcible style, and are generally on cases of disputed succession. An important edition is that of Schömann, with commentary (1831). Sir W. Jones translated ten orations of Isæus, with prefatory discourse, notes critical and historical, and a commentary (London, 1779). The eleventh, now known, has been discovered since.

ISAIAH (Heb. *Yeshayahu*, Salvation of Jehovah), the first of the four great Hebrew prophets, was the son of one Amoz, of whom nothing whatever is known, and who must not be confounded with the prophet Amos, as was done by Clemens Alexandrinus and some of the fathers. Isaiah prophesied concerning Judah and Jerusalem in the days of Uzziah, Jotham, Ahaz, and Hezekiah, kings of Judah. Of the circumstances of his life almost nothing is known, further than that he had an important influence over the kings and people. As his ministry commenced before the death of Uzziah, he must have been at the least eighty or ninety at the accession of Manasseh, who 'filled Jerusalem with innocent blood,' and of whose persecution Isaiah, according to tradition, was the first victim. His usual residence seems to have been at Jerusalem, and he lived about 740–700 B.C. He had three sons, given to him 'for signs and for wonders in Israel.' As there is a manifest want of a continuous unity of design in the prophecies of Isaiah a subordinate controversy has arisen as to who was the compiler of the book. The obvious answer, that it was Isaiah himself, assisted by a scribe, has been accepted by many, whose opinion is fortified by 2 Chr. xxxii. 32, from which it appears that Isaiah was otherwise an author. It is admitted that the 'visions,' which were seen at different times, are not arranged in exactly chronological or material order; but an attempt has been made to account for this on the hypothesis of an original work with subsequent modifications. The dispute, however, with regard to the arrangement of the prophecies sinks into insignificance in comparison with that concerning their authorship. As the last twenty-seven chapters seem to have been written in the time of the Babylonian captivity, they have been ascribed to a 'later Isaiah,' and coherence of structure and unity of authorship have not been denied to them. The German scholar Koppe in his remarks on ch. l. of his translation of Lowth's Isaiah (1779–81), was the first who intimated his suspicion of a later authorship, and his view has been adopted by Döderlein, Eichhorn, and Justi, and in its essentials by Paulus, Gesenius, Hitzig, Ewald, and others, and is that now virtually held by various English critics. The integrity of the book has found defenders in Jahn, Möller, Kleinert, Hengstenberg, Hävernick, Stier, Keil, Henderson, Alexander, and others. The impugners of the Isaiah-authorship rely mainly for argument on the author having taken his stand-point at the close of the Babylonish captivity, and on his knowledge of the name and career of Cyrus, who lived more than a century after the death of Isaiah. A difference of style and sentiment is also urged as militating against the commonly accepted authorship. The principal argument on the other side is drawn from the predictive character of prophecy, and from the nature of 'vision', in which the prophet sees the future as if it were the present. The style of Isaiah is peculiarly appropriate to the subjects of which he treats, uniting simplicity and clearness with the highest dignity and majesty. In fulness and power his poetry far surpasses that of all the other prophets. His writings are chiefly denunciations and complaints of the sins of the people, menaces of approaching ruin, and animating anticipations of a more glorious future. The whole bears the stamp of genius and true inspiration, and is marked throughout by nobleness of thought and feeling. Recent commentaries are those of Dillmann and Kittel (1898), Marti (1900), and Skinner (Cambridge Bible, 1896-98). See also Driver's Isaiah, his Life and Times; Cheyne's Introduction; G. A. Smith's article in Hastings' Dictionary of the Bible (1899); and Cheyne's articles in the Encyclopædia Biblica (1901.)

ISAR, a river of Germany, which rises in the Tyrol, about 6 miles N.E. Innsbruck, enters Bavaria, flows N.N.W., past Munich to Freising, where it turns abruptly E.N.E., passes the towns of Landshut and Landau; and joins the right bank of the Danube a little below Deggendorf; course above 190 miles. Its principal affluents are, on the right, the Dorfen and Sempt; on the left, the Loisach and Ammer. The current is extremely rapid, and is much used for floating timber.

ISAURIA, in ancient geography, a country in Asia Minor, bordering in the east on Lycaonia, in the north on Phrygia, in the west on Pisidia, and in the south on Cilicia and Pamphylia. The inhabitants were shepherds and herdsmen, and formidable as robbers. Their capital, Isaura, was a mere haunt of bandits. The consul Publius Servilius destroyed it; but another Isaura was built not far from it. Hence Strabo mentions two. No ruins of old Isaura appear to exist; but the remains of a triumphal arch of the Emperor Hadrian, of the city walls, which can be traced all round the city, and a gateway on a hill near the village of Olou Bounar, still mark the site of New Isaura. Outside the walls are many tombs, some of which are excavated in the rock.

ISCHIA (Latin, *Inarime* or *Pithecusa*), an island in the Mediterranean, 17 miles W. Naples. It is of oblong shape, 7 miles long and 4 miles broad; area, 26 square miles. Near its centre is Mount San Nicolo or Epomeo, an extinct volcano, of irregular conoidal shape, rising about 2600 feet, from which the surface gradually slopes, in all directions, towards the sea. The volcanic origin of the whole island is clearly indicated by the shape of its mountains, the fissures and chasms in the mountain-sides, the deep ravines across the plains, the lava heaped upon lava, tracts covered with tufa and lapilli, gray ashes and

sulphur, as well as by the smoke, steam, and hot mineral waters that gush out in almost every direction. Much of the surface is fit for cultivation, and exhibits the highest degree of fertility. Extensive vineyards, producing an excellent white wine, plantations of olives, and gardens abounding with oranges, citrons, melons, and groves of chestnut and ilex variegate the surface. Iron and sulphur are found in the island, and bricks, tiles, and earthenware are manufactured. But the great sources of the island's prosperity are its numerous thermal mineral springs, its exquisite climate and lovely situation, which attract thousands of summer visitors from all parts of the European continent. In May, 1881, Ischia was visited by an earthquake, which destroyed many lives and much property, but this sinks into insignificance compared with the catastrophe of the same nature in July, 1883, by which whole towns and villages were overthrown, and about 2000 people perished. Previous to this calamity the island had a pop. of nearly 30,000. The principal towns are Ischia on the east coast (pop. 6500), Forio on the west (6000), and Casamicciola on the north (4000); the two last-named places were completely destroyed by the earthquake of 1883. Pop. (1901), 26,891.

ISCHL, a market town and watering-place of Upper Austria, on both sides of the river Traun, 50 miles south-west of Linz, in the Salzkammergut. It has a handsome parish church, a small castle, an hospital and vapour and mud baths, the materials for which are derived from a salt-mine about 3 miles S.E. of the town, which has been worked to a large extent by adits leading into the heart of the mountain. Salt-baths were established here in 1822, and Ischl has become a fashionable watering-place. The emperor and many of the nobility have built villas in the neighbourhood. Pop. (1900), 9646.

ISEO, LAKE (*Lacus Sevinus*), in Northern Italy, between the provinces of Brescia and Bergamo, has a length of 15 miles from north to south, and is traversed by the Oglio, a tributary of the Po. It has an average breadth of 6 miles; and its greatest depth is 984 feet. The shores, which are abrupt and picturesque, are clothed with vineyards and olive gardens, and studded with towers, castles, and villas.

ISÈRE (anciently *Isara*), a river of south-eastern France, which rises on the west side of Mount Iseran near the Italian frontier, crosses Savoy in an irregular west course, passing St. Maurice and L'Hôpital, enters the department of Isère, to which it gives its name, and which it crosses in an irregular W.S.W. course, passing Grenoble; after which, traversing the north part of department Drôme, it joins the Rhone on the left, 5 miles above Valence. Its chief affluents are the Arly, Arc, Ozeins, Drac, and Bourne. Whole course, about 190 miles, of which nearly half is of some use for navigation; but the river is very subject to inundations. In general its channel is narrow and interrupted by shoals and islands.

ISÈRE, a department of France, bounded N. and W. by the Rhone, which separates it, in the former direction, from the department of Ain, and in the latter from the departments of Rhone and Loire; S. by the departments of Drôme and Hautes-Alpes, and E. and N.E. by Savoy; area, 3185 square miles. The surface is generally mountainous. At least twenty well-defined mountains are 6700 feet high. The culminating point, Le Grand Pelvoux, is 13,158 feet. There are no proper plains, except in the N. and near the centre. The whole department belongs to the basin of the Rhone, which drains great part of it directly. The only other important river is the Isère, which traverses it circuitously in a W.S.W. direction, and is augmented within it by numerous small tributaries. The soil, where available, is generally of great fertility, and the corn raised more than meets the home consumption. All the cereal and leguminous crops, together with maize and potatoes, are abundant. Medicinal plants are extensively grown; and fruit of various sorts is excellent in quality, and in quantity almost unlimited. None of the wines are first-rate. The mulberry is cultivated to a great extent, more especially in the large and beautiful valley of Gresivaudan, in the vicinity of Grenoble, and large quantities of the finest silk are obtained. The minerals are of considerable importance, including a little gold and silver, once worked in mines, now abandoned; lead, copper, and iron. A coal-field is worked to some extent; and there are some valuable quarries of marble, slate, granite, and porphyry. The manufactures are sail-cloth, coarse woollens, ordinary and table linen, gloves, tanned leather, cotton goods, and chemical products. The iron-mines employ a number of blast-furnaces, and the iron is extensively manufactured, and used as castings. There are also numerous paper, silk, and cotton mills. The trade is chiefly in corn, wine, liqueurs, turpentine, wool, hemp, cheese, nut-oil, metals, skins, leather, silk, &c. For administrative purposes the department is divided into four arrondissements—Grenoble, the capital; St. Marcellin, La-Tour-du-Pin, and Vienne; subdivided into 45 cantons and 560 communes. Pop. (1901), 563,813.

ISERLOHN, a town of Prussia, in the province of Westphalia, in the government and 15 miles west of the town of Arnsberg, is situated in a picturesque hilly district on the small river Baar. It has a new town-house, a real-gymnasium, and a school of practical metal-working with workshops attached, besides other schools. In the market-place is a war memorial with a colossal statue of the Emperor William I. Metal wares are largely made, including articles in iron, steel, brass, bronze, tin, &c., and in particular needles are manufactured to a great extent. Zinc is obtained here. Pop. (1900), 27,265.

ISERNIA (Latin, *Æsernia*), a town of South Italy (Naples), on a spur of the Apennines, in the province and 23 miles W. Campobasso. It is one of the most ancient towns in the kingdom; the see of a bishop; has a court of justice, a fine cathedral, in a great measure destroyed by the earthquake of 1805; many remains of antiquity, particularly a splendid aqueduct, which is led across a hill, and supplies several fountains and public works. The modern town, which is surrounded by a wall, consists chiefly of one long narrow street. The chief manufactures are blotting-paper and hydraulic machinery. Near it the first battle took place between the Sardinian and Neapolitan troops, Oct. 17, 1860. Pop. in 1901, 9322.

ISHMAEL (Hebrew *Yishmael*, whom God hears), the son of Abraham, by his concubine Hagar, the Egyptian, the handmaid of Sarah, was born when his father was fourscore and six years old. At first Abraham regarded him as the heir of the promise, but Isaac, the true heir, was afterwards born to him by Sarah. At the feast in celebration of the weaning of Isaac, Sarah saw Ishmael, then probably about sixteen years of age, 'mocking,' in consequence of which she urged the patriarch to cast out Hagar and her son. His character had been predicted to Hagar by the angel of the Lord previous to his birth. He was to be 'a wild man; his hand against every man, and every man's hand against him; and he shall dwell in the presence of all his brethren.' Abraham had been assured that of Ishmael would be made a great nation, a promise renewed to Hagar in the wilderness of Beersheba, when she and the lad, about to perish by thirst, were miraculously saved by the revelation of 'a well of water.' In the wilderness he grew to

manhood, and became a skilful and famous archer. His mother 'took him a wife out of the land of Egypt,' and thus there was a double infusion of Hamitic blood into the veins of the progenitors of the 'great nation' that was to spring from Ishmael, generally and justly believed to be the Arabian. Few incidents of his later life are recorded, beyond his having had twelve sons and a daughter, the connection of his family and that of Esau by marriage, and his death at the age of a hundred and thirty-seven, 'in the presence of all his brethren.' The meaning of this expression, which occurs also in the prophecy of the angel to Hagar after her conception, is confessedly obscure. But from Ishmael's having been present at his father's burial, it probably signifies nothing more than that he dwelt in the neighbourhood of Abraham and Isaac, as in the East burial follows death at an interval of only a few hours.

ISHMAELITES, in ancient geography and history, the descendants of Ishmael, the son of Abraham by Hagar. These are to be found among the Arabians, as the testimony of the Bible and of native tradition, and the corroborating accessories of physical characteristics and language, prove beyond a doubt. The Joktanite and Cushite monarchies in Southern Arabia give no indication in character and habits of having had Ishmaelites as founders, but the Bedouins of the north who roam over the deserts lying between the Peninsula of Sinai and the Persian Gulf, are unquestionably of Ishmaelitic origin. They maintain a primitive and patriarchal form of life, and are full of Ishmaelitic traditions. Mohammed claimed descent from Ishmael, but his descent is totally lost till the twenty-first generation preceding his birth.

The name of *Ishmaelites*, or *Ismaelians*, is also given to a Mohammedan sect which originally belonged to the Shiites, the adherents of Ali and the opponents of the Sunnites. In the first century of the Hegira the Iman Jafar Assadik, a descendant of Ali, on the death of his eldest son, Ismael, having transferred the succession to his younger son, Mousa, to the prejudice of the children of Ismael, a party refused to acknowledge Mousa, and considered Ismael's posterity as the legitimate Imans. By the oriental historians they are reckoned with the Nassarians among the Bathenins or Batenites, that is, adherents of the mystical, allegorical doctrines of Islamism. From the 8th to the 12th century they were powerful in the East. Under the name of *Carmatians* (as they were called, from Carmati, near Cufa, the birthplace of their chief Karfeh, in the 8th century) they devastated Irak and Syria. In Persia, which they likewise overran about this time, they were called *Meladehs*, that is, *impious*, or *Talimites*, because they professed Talim's doctrine, that man can learn truth only by instruction. One dynasty of the Ismaelians, founded by Mohammed Abu-Obkid-Allah, conquered Egypt about 910, and was overthrown by Saladin, the caliph of Bagdad, about 1177, when the dynasty became extinct with Adhed-Udin-Allah. The other (still existing) Ishmaelite branch founded a kingdom in Syria in 1090, under the Iman Hassan Ben-Sabbah, which became formidable in the East by its military power. Hassan, with his seven successors, is known in the East under the name of the *Old Man of the Mountain*, because his residence was in the mountain fastness of Mesiade in Syria. Thence he despatched his warriors—who were called *Hashishim*, from their immoderate use of a powder prepared from the leaves of the hemlock (Arab. *hashisheh*), which produces an excitement amounting to fury—on expeditions of robbery and murder. These Ismaelians, therefore, acquired in the West the name of *Assassins* (corruption of *Hashishim*), which thence became, in the western languages of Europe, a common name for *murderer*. At the close of the twelfth century the Mongols put an end to the dominion of the Old Man of the Mountain, who, according to Von Hammer's researches, was not a prince, but merely the head of a sect. From this time only a feeble residue of the Ismaelians, from whom proceeded the Druses, about A.D. 1020, has survived in Persia and Syria. The Syrian Ismaelians dwell chiefly around Massiad, south-west of Hamah, in the Jebel Ansarieh, a northern continuation of Lebanon. They are under Turkish dominion, with a sheik of their own, who, in consideration of a yearly tribute to the Porte, enjoys the revenues of the territory. These people are commended by modern travellers for their hospitality, frugality, gentleness, and piety. Early in the nineteenth century they suffered severely in a war with the Nossarians, a rival sect, who took their chief stronghold, Massiad, in 1809, and desolated the country. The village of Kadmus, on the western slope of Jebel Ansarieh, at no great distance from Massiad, is now their headquarters. The Ismaelians, with other Shiites, adore the prophet Ali as the incarnate God, and Mohammed as an ambassador of God, and the author of the Koran. All Ismaelians term themselves *Seid*, that is, descendants of the family of Mohammed, and wear the green turban, in token of their pretended nobility. In accordance with their exposition of the Koran they believe in supernatural communications of the Diety by the prophets (Imans), and in the transmigration of souls, deny a paradise and hell, do not observe the purifications and fasts of the orthodox Mohammedans, and perform their pilgrimages, not to Mecca, but to Meschid, the place of Ali's interment, four days' journey from Bagdad. They have no public temples, and their simple rites display more of pure theism than those of the Mohammedans. They were systematic proselytizers, and attempted to win over not merely Sunnites and Shiites, and all the different Mohammedan sects, but also Jews and Christians. The neophyte had to pass through nine several degrees, in the concluding one of which he was freed from all restraints with regard to his belief. The object of Abdallah Ibn Maimum, who first gave importance to the sect, is admitted to have been the abrogation of Islamism, and the replacing of it by materialism. But many changes have been made of the Ismaelite creed at different times. It was probably intended to gain political power by purifying and allegorizing Mohammedanism.

ISIAC TABLE, or BEMBINE TABLE (*Mensa Isiaca* and *Tabula Bembina*), an ancient Egyptian monument on which is represented the worship of the goddess Isis, with her ceremonies and mysteries. It is a square table of copper, divided into five compartments, covered with silver mosaic skilfully inlaid. The principal figure of the central group is Isis. After the capture of Rome (1525) this table came into the possession of Cardinal Bembo, from whom the Duke of Mantua obtained it for his cabinet. After the sack of Mantua in 1630 Cardinal Pavia obtained it, and presented it to the Duke of Savoy. It is at present in the royal gallery at Turin. Several engravings of it have been made; the first by Æneas Vicus (Venice, 1559), in figures the size of the original. Caylus has engraved and described it in his Recueil d'Antiquités Égyptiennes, Etrusques, Grecques et Romaines, vii. p. 34. It is filled with all sorts of hieroglyphics; and Champollion judged it to be the work of an uninitiated artist, little acquainted with the worship of Isis, and probably of the age of Hadrian.

ISIDORE. Three Spanish ecclesiastics bore this name, of whom the most famous was Isidore of Seville,

who flourished at the beginning of the seventh century, and is favourably known in ecclesiastical history as ISIDORUS HISPALENSIS. He was the most profound scholar, the most eloquent orator, and the ablest prelate of his age and country. He exercised a powerful influence over the development of Latin Christianity. Two of his brothers were bishops, one of Cartagena and the other of Seville, and in the palace of the latter he devoted his youth to study and religious exercises. Elevated to the episcopate of Seville in 600 or 601 he established a college for the education of youth; he presided over the second Council of Seville in 619; over the great Council of Toledo in December, 633; and died at Seville, 4th April, 636. He was an eager advocate of orthodoxy, a strict disciplinarian of the clergy, and was held in the highest estimation by his contemporaries and successors. The fruits of his industrious exertions in literature are not without value at the present day, and the canons of the two councils held under his presidency furnished materials for the basis of Spanish constitutional law, civil as well as ecclesiastical, down to the fifteenth century. There is a notorious collection of decretals falsely attributed to him. The most complete edition of the works of Isidore is that of F. Arevalo, seven vols. 4to (Rome, 1797–1803). Several of his works were translated into English as early as the middle of the sixteenth century.

ISIDORIAN DECRETALS. See DECRETAL.

ISINGLASS. This substance is almost wholly gelatine, 100 grains of good dry isinglass containing rather more than 98 of matter soluble in water. It is brought principally from Russia, but considerable quantities are also brought from Brazil, North America, and the East Indies. The Russian isinglass is chiefly obtained from the sounds or swimming-bladders of the sturgeon, which is very plentiful in the Caspian and rivers flowing into it; the American is obtained from the cod, sturgeon, hake, &c.; and the sounds of a great many fish produce it. It is the basis of the Russian glue, which is preferred to all other kinds for strength. Isinglass receives its different shapes in the following manner. The sounds are taken from the fish while sweet and fresh, slit open, washed from their slimy matter, divested of a very thin membrane which envelopes the sound, and then exposed to stiffen a little in the air. In this state they are formed into rolls about the thickness of a finger, and in length according to the intended size of the staple; a thin membrane is generally selected for the centre of the roll, round which the rest are folded alternately, and about half an inch of each extremity of the roll is turned inwards. Isinglass is best made in the summer, as frost gives it a disagreeable colour, deprives it of its weight, and impairs its gelatinous principles. Isinglass boiled in milk forms a mild, nutritious jelly, and is thus sometimes employed medicinally. A solution of isinglass in water, with a very small proportion of some balsam, spread on black silk, is the court plaster of the shops. Isinglass is also used in fining liquors of the fermented kind, and in making mock-pearls, stiffening linens, silks, gauzes, &c. With brandy it forms a cement for broken porcelain and glass. It is also used to stick together the parts of musical instruments. See JELLY.

ISIS, the principal goddess of the Egyptians, the symbol of nature or pantheistic divinity, the mother and nurse of all things. According to Diodorus, Osiris, Isis, Typhon, Apollo, and Aphrodite (Venus) were the children of Zeus and Hera (Jupiter and Juno), Osiris, the Dionysos (Bacchus) of the Greeks, married Isis (sun and moon), and they both made the improvement of society their especial care. Isis discovered the valuable qualities of wheat and barley, which had till then grown wild, unknown to mankind, and Osiris taught how to prepare them. In gratitude for these benefits the inhabitants always presented the first ears gathered as an offering to Isis. Isis thus corresponded to the Greek Demeter (Ceres). According to Plutarch's learned treatise (On Isis and Osiris) Osiris and Isis were the illegitimate offspring of Saturn and Rhea. Osiris was born the first, and at his birth a voice cried, 'The lord of the world is born.' On the second day Rhea was delivered of Aroueris, or the elder Horus (Apollo), on the third of Typhon, on the fourth of Isis, and on the fifth of Nephthys, who was called *Teleutē*, the Consummation, though others give her the name of *Aphroditē* and *Nikē* (Victory). Of these five children there were three fathers—Helios, Saturn, and Hermes. Typhon married Nephthys; Osiris and Isis loved each other even in their mother's womb. Osiris, the good spirit, was persecuted by Typhon, the bad spirit, who, by stratagem, shut him up in a chest, and threw him into the sea. When Isis learned this she cut off one of her locks, put on mourning garments, and wandered about disconsolate in search of the chest. Meanwhile she learned that Osiris, on a certain occasion, deceived by Nephthys, who was enamoured of him, had mistaken Nephthys for herself, and that the child which was the fruit of this union had been exposed by its mother. Isis therefore sought the child, and bred him up under the name of *Anubis*. The chest in which Osiris was shut up was, meanwhile, driven ashore at Byblos, and thrown on a bush, which, having suddenly grown into a beautiful tree, had entirely inclosed it. This tree was afterwards cut down by the king of the country as a curiosity, and used as a pillar in his palace. The chest was finally obtained by an artifice of Isis, but the body, being afterwards discovered by Typhon, was torn by him into twenty-eight or twenty-six pieces, which he scattered over the country. On discovering this Isis proceeded to collect the fragments, and Osiris having returned to life, Isis bore to him Harpocrates, the god of silence, who was lame in his lower limbs. As the goddess of fecundity, and the universal benefactress, she superintended the cure of human maladies, and even in Galen's time several medicines bore her name. After her death she was reverenced as the chief of the divinities. According to Herodotus the Egyptians represented Isis under the form of a woman, with the horns of a cow, as the cow was sacred to her. Another tradition also related that Isis, in the shape of a young cow, became the mother of Apis, by a ray from heaven (Osiris); that is, the sun and moon sustain the earth. She is also known by the attributes of the *lotus* on her head, and the *sistrum* in her hand, a musical instrument which the Egyptians used in the worship of the gods. The dress of Isis consists of a close under garment, and a mantle drawn together and fastened in a knot on her breast. Her head is covered with the Egyptian hood. Sometimes, like the Diana of Ephesus, the universal mother, she is represented with a great number of breasts. Among the Romans Isis afterwards received, in countenance, figure, and dress, somewhat of the character of Juno. A foreign character is to be recognized only in the mantle and fringed veil, and other attributes. She was particularly worshipped in Memphis, but at a later period throughout all Egypt. A festival of eight days (the festival of Isis) was annually solemnized in her honour, consisting of a general purification. From Egypt the worship of this goddess passed over to Greece and Rome. Pausanias describes the manner in which her worship was celebrated in Greece. The priests of Isis were bound to observe perpetual chastity, but when her worship passed into foreign countries it became

a cloak for the grossest licentiousness. The abuses which it occasioned at Rome caused its frequent prohibition there. It was, however, repeatedly revived. The Romans never considered the worship, which was introduced among them by Sulla (B.C. 86), altogether reputable, and its attendant immorality was vigorously lashed in the satire of Juvenal.

ISIS, the technical name of the *Mare's-tail* coral (*Isis hippuris*), which consists of a central axis of coral-structure covered and invested in the living state, by a soft outer tissue in which the numerous little coral polypes are imbedded. The characteristic composition of the coral of Isis has given to it the popular name above-mentioned, from its general likeness to the plant known as the 'mare's-tail.' The coral consists of a branching stem of alternating joints of horn and lime; the branches springing from the limy joints. In *Mopsea*, an allied coral to Isis, the branches take origin from the horny joints. The Isis belongs to that kind of coral-structure to which the term *sclerobasic* is applied. The distinctive peculiarity of this kind of coral consists in the coral axis being internal, and the living flesh external. The coral, however, is really *outside* the living flesh, because the living substance is inverted, the internal surface being turned to the outside. And to the *Isis*, and all other sclerobasic corals, Dana has applied the term 'foot-secretion.' The familiar red coral of commerce belongs to the same type of coral structure as the Isis. The order in which the Isis is included is that of the Alcyonaria, the distinguishing feature of which is the possession by the little polypes—or separate individuals of the colony—of *eight* tentacles or feelers surrounding the mouth, these organs being pinnate or fringed in a feather-like manner. The internal soft parts of the body are present in multiples of four. The Isis is found chiefly in the Indian Seas, in the Pacific Ocean, and on the coasts of America. It is classified in the family Gorgonidæ, one of the divisions of the order Alcyonaria mentioned above.

ISKENDEROON, or ISKANDEROON. See ALEXANDRETTA.

ISLA, JOSÉ FRANCISCO DE, a Spanish satirist, born at Segovia in 1714, entered the order of Jesuits, and distinguished himself in several monasteries as a teacher and preacher. On the expulsion of the Jesuits from Spain he retired to Bologna, where he died in 1783. His greatest work, which has procured him a European name and given him an enduring place in Spanish literature, is Historia del famoso predicador Fray Gerundio de Campazas, alias Zotes (Madrid, 1758), in which, taking Cervantes for his model, he, in a style of the finest irony, describes the preaching monk of his time. This book had the honour of falling under the ban of the Inquisition, and has been translated into French, English, and several other foreign languages. It has been frequently reprinted in Spain. The best edition is that published at Leipzig in two volumes in 1885 under the editorship of Lidforss. Isla also wrote other works.

ISLAM, or as it is pronounced in Syria, *Eslam*, the name applied by its votaries to the Mohammedan religion, signifies an entire submission or devotion to the will of another, and especially of God, and thence the attaining of security, peace, and salvation. This act is performed and these blessings are obtained, according to the doctrine of the Koran, by acknowledging the unity of God and the apostleship of Mohammed. Every man who makes this profession (*aslama*) is a Moslem, that is, has entirely given himself up to the will of God, and is, on that account, in a state of salvation (*salam*). It is held that Islam was once the universal religion, and that every child born in the true faith would abide in it, without defection, were it not for parental wickedness.

As Islam comprehends the practical as well as the doctrinal tenets of the Mohammedan religion—everything which Moslems must believe and practise—it embraces the whole of their civil and religious polity; for the system of Mohammed relates more to this world than the next, and was designed, like the law of Moses, for the secular as well as the spiritual direction of his followers. But, taken in its more common and direct sense, it signifies the profession of the five fundamental doctrines on which, according to a traditional declaration of the prophet, the whole edifice of the faith is built. Those five points are—1, the acknowledgment of the Divine Unity and of the prophetic mission of Mohammed; 2, observance of prayer; 3, giving of alms; 4, keeping the fast of Ramadan; and 5, the performance, if possible, of the pilgrimage to Mecca. They are often also subdivided and enlarged, in order to arrange them more conveniently into the two classes of belief (*iman*) and practice (*din*). The former relates to—1, God; 2, the angels; 3, the Sacred Book; 4, the prophets; 5, the last day; and 6, the divine decrees: the latter to —1, purification; 2, prayer; 3, alms; 4, fasting; and 5, the pilgrimage. To the first article of this creed the Persians and other adherents of Ali add, 'Ali is the vicar of God;' and that is the only essential point in which they differ from the Sunnites, or orthodox Mussulmans, who acknowledge the authority of the four first khalifs. The disputes concerning the succession to the khalifate, or supremacy of the prophet, spiritual and civil, which arose immediately after his death, split his followers, as is well known, into two distinct sects, the Sunnites and the Shiites, who have never since ceased to hate each other with a bitter animosity; but they differ more in the degree of veneration paid to Ali than in any other point; and professing the same creed, with the exception of one article, they derive their doctrines from the same sources. In their respective rituals, and their interpretation of particular texts, there are many minor differences; but both agree in superadding a traditional to the written law of Mohammed, and both have sanctioned that departure from the original simplicity of his doctrine, the re-establishment of which was the professed object of the Wahabees. See MOHAMMED.

ISLAND, a portion of land entirely surrounded by water. Islands are of very different extent, surface, &c. There are some so large that authors have doubted whether they should be called *continents*, as Australia; this, however, is a mere matter of definition. The great masses of land forming the Eastern and Western Continents are in reality islands. Excluding Greenland, the largest islands of the world are, in order of size: New Guinea, Borneo, Madagascar, Sumatra, Great Britain, Hondo, Celebes, South Island (N.Z.), Java, North Island (N.Z.), Cuba, Newfoundland, Luzon, Iceland, Mindanao, Ireland, Saghalien, Yezo, Hayti. A cluster of several islands is called an *archipelago*. The principal clusters in the Atlantic are the West Indies, the Azores, the Canaries, the Hebrides, Orkneys, Shetlands, &c. But the great world of islands is in the Pacific, and some modern writers consider them as forming a fifth division of the world, including the Eastern Archipelago, Polynesia, and Australia, to which they have given the name of *Oceanica*. A large island is a continent in miniature, with its chains of mountains, its rivers, lakes, and is often surrounded by a train of islets. The rivers of islands are in general little more than streams or torrents, and the smaller islands are often uninhabitable from want of water; but they serve as haunts and breeding-places of innumerable sea-birds. There are islands in rivers and lakes, as well as in the sea. In rivers they are often formed

by the division of the stream into various branches, and often by accumulations of earth brought down and deposited around a rocky base. Examples are not wanting of floating islands, which are formed by the roots of plants and trees interlacing with each other, and thus constituting a support for deposits of successive layers of earth. Islands have been grouped into the two distinct classes of continental and pelagic or oceanic islands. Continental islands follow each other in succession along the margin of the continents, and are generally of the same geological structure. Pelagic islands are mostly of volcanic or coral formation. Considerable islands have been known to be suddenly raised up from the sea-bottom by volcanic action, and soon after to have as suddenly disappeared in the ocean. The Pacific contains a great number of low islands having their basis formed of coral reefs, these reefs being produced by the labours of innumerable coral-animals or zoophytes. (See CORAL.) Submarine islands, as they have been sometimes called, or immense banks of sand above which there is no great depth of water, are not unfrequent. A portion of country nearly included between several rivers is sometimes called an island, as the ancient province of the *Isle de France*.

ISLANDS OF THE BLESSED, or FORTUNATE ISLANDS (*Insulæ Beatorum, Fortunatæ Insulæ*, in Greek *Nēsoi Makarōn*), according to the Grecian mythology certain islands, which were supposed to lie westward in the ocean, where the favourites of Zeus, snatched from death, lived in perpetual happiness. According to Hesiod they were the residence of the fourth race of heroes. In the earliest mythology the Islands of the Blessed, the Elysian Fields, and the lower world, were in general confounded with each other. Homer's Elysium is on the west border of the earth, near to Ocean; Hesiod's Elysium is the *Nēsoi Makarōn*.

ISLAY, an island of Scotland, belonging to the county of Argyle, on the west coast, one of the larger of the Inner Hebrides, immediately S.W. of the island of Jura, from which it is separated by a narrow channel, called the Sound of Islay, and 11 miles W. of the peninsula of Kintyre. It is 25 miles long by 17 miles broad; area, 154,000 acres. It has somewhat the form of an inverted heart—the broad end being largely excavated by the arm of the sea called Loch Indaal, 12 miles long by 8 miles broad; but, with this exception, and those of Loch Gruinart, on the north-west coast, and Loudon's Bay on the south-east, its sea-line is not marked by any very deep indentations, although small bays are sufficiently numerous. Many parts of the coast are bold and rocky, and some portions are lined with high perpendicular cliffs. The island is generally hilly, particularly in the north and east, although it nowhere presents any great elevations; the highest summits only reaching 1400 feet to 1600 feet above sea-level. There is, however, a very considerable extent of level ground, for the most part fertile and well cultivated. The island is chiefly composed of clay slate, chlorite slate, and some mica slate; quartz, various admixtures of felspar and hornblende, &c., with some limestone. Lead, iron and copper ore, manganese, and cobalt, occur, but none of them are wrought. The climate is mild, but humid. Agriculture has greatly improved of late years, and abundant crops of wheat, barley, oats, pease, flax, and potatoes are raised. Cattle and horses, both of which are considered to be of a superior description, much attention being paid to their improvement, are bred in large numbers; but whisky is the staple production, immense quantities being distilled and exported to Glasgow, England, and America. The other exports are cattle, oats, and limestone. The coasts abound with fish of various kinds. Islay was anciently the principal residence of the Lords of the Isles, whose pomp and power is attested by numerous ruins of castles, forts, and chapels. Pop. in 1891, 7375; in 1901, 6857.

ISLAY, YSLAY, or ILAY, a seaport town of Peru, adjacent to the port of Mollendo, and 50 miles S.S.W. of Arequipa, to which there is a railway. The town is said to contain 1500 inhabitants. The houses, mostly constructed of planks, are arranged into two or three streets having a wretched appearance. The port, of which the anchorage is good, is formed chiefly by a few straggling islets. Islay is the healthiest place on the coast, and people resort to it for sea-bathing. Most of the shipping trade now centres in Mollendo

ISLE OF FRANCE. See FRANCE (ISLE OF).

ISLINGTON, a northern suburb of London, in the county of Middlesex, now a metropolitan mun. and parl. bor. (four members). Not very long since a rural retreat, it is now almost entirely covered with many fine ranges of houses and pleasant villas. The most noteworthy edifice is the Agricultural Hall, in which the Smithfield cattle shows are held. The population in 1901 was 334,906. Communication with the City and other parts of the metropolis is maintained by several lines of tramway cars and omnibuses, and by the Great Northern, North London, and Midland Railways.

ISMAIL, a town of Russia in Europe, on the north arm of the Danube, 35 miles E. Galatz, and about 40 miles from the mouth of the river. Before it was stormed and laid in ruins by Suwarow, in 1790, it contained 30,000 inhabitants, and was one of the handsomest towns on the Danube, having numerous mosques, bazaars, and spacious dwelling-houses. Being ceded to Russia by the Peace of Bucharest in 1812, it began gradually to rise from its ruins, and had acquired importance as a fortress, a naval station, and a centre of trade, when it returned to Turkey by the Peace of Paris in 1856, being included in that portion of Bessarabia which was withdrawn from Russia. It was again given back to Russia by the Treaty of Berlin in 1878 as one of the results of the Russo-Turkish war. It has important manufactures of leather, and carries on a very extensive trade in corn, wool, tallow, and hides. Along with the modern portion Tutchkow, immediately to the east of it, it contains (1897) 31,293 inhabitants.

ISMAILIA, a town in Egypt, on the salt lake Timseh, near the Suez Canal, 46 miles south of Port Said. It came into existence through the making of the Suez Canal, being the centre of the engineering works, and is quite a European place, with hotels, an assembly-room, &c. It stands at the outlet of a branch of the fresh-water canal. Pop. 3000.

ISOBARIC LINE, a line drawn on a map through all places where the barometer is at the same height at a certain time. Telegraph communication enables these lines to be drawn with some accuracy. Winds generally blow from places where the barometer is high, to places where it is low. Storm warnings (first sent by Admiral Fitzroy) are based partly on information afforded by isobaric lines and partly on information sent by telegraph from distant localities where the storm has commenced.

ISOCHRONISM OF VIBRATIONS. The pendulum of a clock may swing through a large arc or through a small arc, but the time of a vibration is always sensibly the same; when an elastic rod is firmly fixed at one end in a vice, and the other end is caused to vibrate, whether its vibrations are great or small they are executed in sensibly equal times; when sound is conveyed by air, the vibrations of a particle of air are executed in sensibly the same time

when the sound is loud, as when it is dying away; this property of vibrations is called isochronism. After an elastic body has been slightly distorted, if it is allowed to return to its former shape the forces of restitution are known (Hooke's law) to be proportional to the amount of distortion; from this it may be proved by mathematics that the body will return to its original shape in the same time whether the distortion has been small or comparatively great. With the ear we can judge of the isochronism of sound vibrations, and we know that the pitch of a note from a tuning-fork continues the same until the sound dies away.

ISOCRATES, one of the most distinguished Greek orators, born at Athens 436 B.C. His principal teachers were Tisias, Gorgias, Prodicus, and Protagoras. On account of his weak voice and natural timidity he was reluctant to speak in public, or take any direct part in political affairs; but he employed himself most diligently in giving lessons in the art of eloquence, and preparing orations for others. He derived a considerable profit from this occupation, as is evident from the fact recorded by Plutarch, that he received a present of twenty talents (£2375 sterling) for a speech that he wrote for Nicocles, king of Cyprus. He was the first who saw the value of oratory in its practical application to public life. By basing it on sound moral principles he rescued it from the abuses of the Sophists, of whom he was the avowed enemy. Though from his constitutional timidity he never attained to the offices to which in Athens public eloquence afforded the only passport, eloquence nevertheless owed much to his services. He was particularly distinguished for a polished style and a harmonious construction of his sentences. The composition, revision, and repeated polishing of his speeches occupied so much time that he published little. His celebrated panegyric on Athens (Panathenaicus) employed him ten, or according to others, fifteen years. The critics of his time objected to him that his style was often prolix and overloaded with ornament, that he aimed rather at pleasing the ear than moving the heart; that he made the sense subservient to the sound, and often used unmeaning expressions and unappropriate figures to round off his periods. As all his speeches were modelled after the same pattern, their sameness excited weariness. His subjects were the most important points of morals and politics. His patriotism was sincere, and his desire for the freedom of Greece so intense, that he starved himself to death in his ninety-eighth year from grief at the unhappy battle of Cheronæa. In Plutarch's time sixty orations went under his name, not half of which were, however, deemed genuine. Twenty-one now remain, of which the principal are the Panegyricus (an oration in which he exhorts the Greeks to concord, and to war against the Persians) and the Panathenaicus (in which he dilates on the services rendered by Athens to Greece). Ten letters are also extant, but their genuineness is not without question. There are several complete editions of his orations, that by Benseler and Blass being among the best. There is an English translation by J. H. Freese in Bohn's Classical Library.

ISOGONIC LINE, a line drawn on a map through all places where the declination (which see) of the magnetic needle is the same. *Isoclinic lines* are drawn through places where the inclination (which see) or dip of a magnetic needle is the same; the zero isoclinic line (drawn through places where there is no dip) is called the magnetic equator. *Isodynamic lines* are drawn through places where the total magnetic force is the same; they coincide neither with the isoclinic lines nor with the parallels of latitude. See MAGNETISM (TERRESTRIAL).

ISOMERISM. This word, which is derived from the Greek *isos*, equal, and *meros*, a part, is used in chemistry as a general expression to denote the fact that bodies having the same ultimate composition may yet differ in their chemical and physical properties. There are three ways in which substances may exhibit isomerism:—

1. Two chemical compounds may be composed of the same elements and have the same percentage composition, while their vapour densities (see CHEMISTRY) are different. Thus *aldehyde* (C_2H_4O) exhibits the same ultimate composition as *paraldehyde* ($C_6H_{12}O_3$), both of these substances containing 54·55 per cent. of carbon, 9·09 per cent. of hydrogen, and 36·36 per cent. of oxygen; nevertheless 44 parts of aldehyde vapour occupy the same volume as 132 parts of paraldehyde vapour. These substances afford an instance of that kind of isomerism which is distinguished by the name *polymerism*.

2. Two chemical substances may be of the same ultimate composition, and also have the same vapour density, while they differ in physical properties, and also in their behaviour towards the same reagents. Thus the formula of propionic aldehyde and that of acetone is the same, namely, C_3H_6O; these substances differ, however, in physical properties, and also in their behaviour towards oxidizing agents, the former yielding propionic acid, the latter being resolved into formic and acetic acids. Such substances are said to exhibit *metamerism*.

3. Two chemical substances may be of the same composition, have the same vapour density, and by their behaviour towards reagents yield the same compound, or at any rate show that they are members of the same series, and nevertheless differ in physical properties. Thus four butylic alcohols are known, all of which have the formula $C_4H_{10}O$; these yield four corresponding chlorides, bromides, and iodides. That they are not, however, essentially the same substance is shown by the fact that their boiling-points, specific gravities, &c., differ. Such substances are said to exhibit true isomerism. The two latter cases, namely, metamerism and isomerism, probably exhibit differences of degree only.

The explanation of the facts of isomerism is based upon the assumption that chemical substances consist of atoms (see ATOMIC THEORY), and that these atoms are grouped together to form the molecule of a compound body. It is therefore possible that the same atoms may be differently arranged in the molecule; hence the properties of the molecule will depend not only on the kind or number of atoms it contains, but also on their arrangement. To exhibit this supposed difference in the arrangement of the atoms the rational formulæ of isomeric bodies are written differently. (See FORMULA.) Another way of looking at the facts of isomerism is to regard isomeric bodies of the same series as all formed from one parent substance, but that the amount of energy employed in the formation of each has been different, and that consequently isomeric bodies differ essentially in the possession of varying amounts of energy.

ISOMETRICAL, that is, 'equal measuring,' is the name given to that form of projection which employs three planes perpendicularly to each other, which are designated *isometrical chief planes*, while their lines of intersection are called *isometrical axes*. This projection takes the name of isometrical because the dimensions parallel to the *axes* appear in their true size. In this, and in the distinct idea which it gives of the form of the object, lie its peculiar advantages, which were first accurately ascertained in very recent times.

ISOMORPHISM. When two chemical bodies have the same atomic composition, and crystallize in

the same form, they are said to be isomorphous. It was formerly supposed that every substance had its own peculiar crystalline form. Mitscherlich, however, showed that certain elements or groups of elements may replace one another without altering the crystalline form of the compound. It is to be understood that by crystalline form is meant the primary form to which the crystals are reducible. Two substances may be really isomorphous, and yet have their crystals very differently modified. By taking advantage of the general statement of isomorphism chemists are sometimes enabled to fix upon the correct formula for a compound substance. It may not be possible to obtain the compound as a gas, and so to determine its vapour density; but another substance, which exhibits the same crystalline form and the same chemical relationships, may have its formula thus determined, and by reasoning from this the formula of the original substance may be deduced. Isomorphism seems to point to an atomic structure—a structure part of which may be taken down and replaced by other parts, the whole remaining in outward form the same. That this is so, is further borne out by the fact that two bodies are not truly isomorphous unless the atomic volumes of their constituent elements are equal. By atomic volume is meant the volume or space occupied by the atoms; this of course—on the assumption that atoms really exist—is proportional to the density of the body, and is found by dividing the atomic weight by the specific gravity of the substance.

ISOPERIMETRICAL, a term applied to figures which have an equal circuit or perimeter. The first *isoperimetrical problem* was proposed and solved by James Bernouilli; it is:—given the length of a curve, find what its shape must be when its area is the greatest possible (*Ans.* The Circle). There are many other isoperimetrical problems known to mathematicians.

ISOPODA, an order of the great Crustacean class, which includes a variety of different forms of varying degrees of organization. The Isopoda (Greek, *isos*, equal; *pous*, *podos*, foot) include the familiar Woodlice (*Oniscus*), and other kinds of so-called 'slaters,' together with several other forms, some of which are parasitic in their habits. The Isopods are placed in the subdivision *Malacostraca*, which includes Crustaceans in which the body is composed of a definite number of segments, the chest or thorax being formed of seven segments, and the abdominal joints also numbering seven. This characteristic is valuable as serving to distinguish these forms from the lower Crustacea. The eyes are '*sessile*,' that is, unsupported upon stalks, and hence the Isopods, with other forms, are classified among the *Edriophthalmate* or 'sessile-eyed' Crustacea. The body is generally elongated, having a convex upper and a concave lower surface. The head can be readily recognized and separated from the first joint of the thorax or chest, and bears a pair of antennæ or feelers, which are frequently of elongated form. Well-developed jaws exist, and the eyes, which may be simple or compound, are borne on the dorsal or back aspect of the head. The seven succeeding thoracic joints bear each a pair of limbs, which, from their equality in size, have given to Isopoda their technical name. The thoracic feet in these forms are never provided with breathing organs as in many other and allied Crustacea; but in the female Isopods the limbs may bear plates at their fixed extremities to which the eggs are attached whilst undergoing part of their development. The seven joints comprising the abdomen are generally more or less completely united; and to the abdominal limbs or appendages we find the gills (*branchiæ*) or breathing-organs attached. These organs exist in the form of vascular plates attached to the inner aspect of the limbs, and one of the posterior pairs of limbs is generally developed to form a protective covering, which may be folded over the other limbs and their respiratory organs. The Isopoda vary widely in habits; some, like the Woodlice, are terrestrial, and inhabit damp situations, such as under stones, and moss, and under the bark of trees; others live as parasites on fishes, and in the gill-chambers or on the outer surface of shrimps, crayfish, and other higher Crustaceans; and whilst some forms are exclusively marine, others inhabit fresh water. The order Isopoda has been divided by Milne Edwards into the *Cursorial*, or Running Isopods, the *Natatorial*, or Swimming forms, and the *Sedentary*, or those which are parasitic in their habits. The former group includes the most highly-organized members of the division, the *Sedentary* forms being those which exhibit the lowest grade of Isopod structure. The *Cursorial* forms are known by the absence of limbs or appendages adapted for swimming, and particularly by the absence of any fin-like tail. The familiar 'slaters' belong to this group. The *Oniscidæ* or Woodlice; the *Idotheidæ* or Box-slaters, which inhabit the sea; and the *Asellidæ* or Water-slaters, are the three families included within its limits. The Woodlice possess the power of rolling themselves up into a little ball when touched or irritated. The *Asellidæ* include the little boring form known as *Limnoria terebrans*, which, although only averaging about one-sixth of an inch in length, commits great ravages and destruction in wooden piles and other erections placed in the sea by boring into and disintegrating them. The *Natatorial Isopoda* possess a swimming tail, formed by the last pair of abdominal limbs, together with the elongated extremity of the body. The *Cymothoidæ*, or Fish Lice, are parasites upon fishes, and appear to attach themselves chiefly to the tails of their bearers. The legs are provided with hooked claws. The *Sphæromidæ* are not parasitic, but are also marine, and possess the power of coiling themselves into a ball-like form when alarmed or disturbed. The *Sedentary Isopoda* are represented by a single family, that of the *Bopyridæ*, the members of which live within the gill-cavities of shrimps, &c. The feet in this section are short, and are furnished with hooked processes, fitting them for retaining hold of the surface to which they attach themselves. These latter forms appear to undergo a peculiar development. The females are destitute of eyes, possess fourteen feet, and have only rudimentary feelers or antennæ. The males are much smaller than the females, and do not exhibit any segmentation of the body such as other Isopods, or even their own females possess. And in other Isopods we find the early embryonic state of these forms appears to be of a much higher order than their subsequent and adult state; since, when young and undergoing development, they are active and free swimming, whilst, when fully grown, they become more or less fixed, and incapable of active movement. These phenomena, seen in many other Crustaceans, are included under the term of 'retrograde development.'

ISOTHERMAL LINES, lines drawn on a map through places which have the same mean annual temperature. The mean temperature of a place depends not only on its latitude but the nature of the prevailing winds and the neighbourhood of mountains, seas, deserts, &c.; so that isothermals do not at all correspond with the parallels of latitude. *Isotheral* lines are drawn through places having the same mean temperature during the hottest month of the year. *Isochetaenal* lines are drawn through places having the same mean temperature during the coldest month

in the year. *Isogeothermal* lines are drawn through places where the soil has the same mean annual temperature. An isothermal zone is the space inclosed by two isothermals. Isothermals are more regular and (except in the polar regions) have a greater tendency to coincide with parallels of latitude than isotherals, and more especially than isocheimenals. In July and January, in the northern hemisphere, places on the continents are warmer and colder than places which have the same latitude on islands or on the oceans. The isocheimenals for the British Isles run nearly north and south, the temperature rising towards the west. The mean winter temperature of Kerry is much warmer than that of Constantinople or even Cabul.

ISPAHAN, or ISFAHAN, an important city of Persia, in the province of Irak-Ajemi, formerly the capital of the whole country, on the Zendarood, 210 miles south of Teheran, in the midst of an extensive plain watered by a broad river. In the time of Chardin the walls were 24 miles in circuit, and contained 162 mosques, 48 colleges, 1802 caravansaries, and 273 public baths, and the population was then estimated at 600,000. A great part of the city is at present a mass of ruins, with here and there an inhabited house. Under the caliphs of Bagdad it became the capital of the province of Irak. Being situated in the centre of the empire, and surrounded by the most fertile territories, it soon became a place of great population, wealth, and trade. In 1387 it was taken by Timûr Beg, and the citizens were given up to indiscriminate massacre, and 70,000 are said to have perished. Shah Abbas made it the seat of his empire, and spared no cost in embellishing it with the most splendid edifices. In 1722 it was taken by the Afghans; but in 1727 it was retaken by Nadir Shah, since which it has not been a royal residence. The great palace built by Shah Abbas is said to have been 5 miles in circuit, a great part of which space, however, was laid out in ten gardens, adorned with summer-houses and other elegant structures. The walls and buildings of this palace remain nearly entire, but it has been stripped of nearly all its costly furniture and everything valuable that could be removed. The square called Maidan Shah was one-third of a mile in length, and was formerly encircled by a canal bordered with plane-trees; but all vestiges of both are now obliterated. Another remarkable object, the Chahar Bagh (four gardens), an avenue more than 1 mile long, composed of four rows of large and beautiful plane-trees, with canals and basins to receive the waters of the Zendarood, according to the British consul's statament in 1899, 'is now practically a wilderness'. There are several handsome bridges in the city, one of which has thirty-three arches, and instead of a parapet a gallery extends from end to end, composed of arcades, between which is the pathway. The mosques display great magnificence. The private buildings have a mean appearance, being built of bricks dried in the sun, but within they are handsome and convenient. The streets are narrow, winding, irregular, unpaved, and very dusty. When Ispahan was in its prosperity its suburbs were distinguished for their extent and beauty. The manufactures of the city are still extensive, including trinkets, fire-arms, sword-blades, glass, and earthenware. The textile fabrics range from the most expensive velvet and satin to the coarsest nankeen and calico. Ispahan is an important emporium of the inland commerce of Persia. British goods are brought chiefly from Bushire and Ahwaz (on the Karun), being carried by pack animals. The present population is about 80,000.

ISRAEL and ISRAELITES. See JEWS.

ISSOIRE (ancient *Iciodurum*), a town of France, in the department of Puy-de-Dôme, on the Couse, near its mouth in the Allier, 19 miles S.S.E. of Clermont. It consists in general of well-built houses and clean regular streets; has a court of first resort, a communal college, an ancient church in the Romanesque style; and manufactures of agricultural machines, woollens, &c., and a considerable trade in cattle, wine, and fruit. The mineral springs of Leins are in the vicinity. Pop. (1901), 6791.

ISSOUDUN (ancient *Auxellodunum*), a town of France, in the department of Indre, on the Théols, here crossed by three bridges, 17 miles north-east of Châteauroux. Part of it having been burned in 1651, and rebuilt, has wide and regular streets lined with handsome houses and well supplied with water; but the other parts, especially those named Château and Bas-Château, have narrow, tortuous dirty streets. It possesses a court of first resort, a chamber of commerce and manufactures, four churches, an elegant town-hall, hospital, barracks, communal college, prison, and theatre; with well-formed walks outside the town; manufactures of steam-engines, agricultural implements, woollen cloths, cottons, lace, hosiery, and leather; and a trade in wool, wine, corn, and cattle. The White Tower, dating from the twelfth century, is an interesting relic. Pop. (1901), 10,784.

ISSUE, in *law*, the point in dispute which is submitted to the decision of the court or jury. An issue may be either of law or of fact. When a defendant denies the sufficiency of a plaintiff's allegation as matter of law to support the plaintiff's action, he is said to tender an issue at law, and the plaintiff is bound to accept it; but should the defendant traverse the plaintiff's fact, and propose to refer the matter disputed to some mode of trial, he is said to tender an issue of fact. The legislation both in England and the United States has for some time been in the direction of requiring the specific fact in controversy to be put plainly in issue by the pleadings. In England the law on this subject has been greatly modified by the Judicature Act of 1875. It is provided by the present rules of pleading, that, subject to the rule that each party must deal specifically with each allegation of fact in any claim made by his opponent of which he does not admit the truth, the plaintiff by his reply may join issue on the defence, and each party in his pleading, if any, subsequent to reply, may join issue upon the previous pleading, and such joinder of issue shall operate as a denial of every material allegation, not specifically admitted in the pleading on which issue is joined. When one party denies an allegation of fact in the previous pleading of an opponent, he must not do it evasively; thus, should it be alleged that he received a certain sum of money, his denial of receiving that particular sum will not be sufficient; he must deny that he received that sum or a part thereof, or declare how much he did receive; or, to put a further case, when a matter of fact is alleged with divers circumstances, it shall not be considered sufficient to deny it, as alleged along with such circumstances, but a fair and substantial answer must be given. See PLEADING.

ISSUS, anciently a town of Cilicia, in Asia Minor, on the Gulf of Issus. Much discussion has taken place with regard to its probable site. Xenophon describes it as 'the uttermost city of Cilicia, on the sea'; and the Anabasis would give us the best means of fixing the site were we able to ascertain the precise spot where the 10,000 crossed the Pyramus, and could we rely on the accuracy of the numbers in the Greek text. Here Alexander of Macedon gained a complete victory over Darius (B.C. 333), by which

the camp and family of the Persian king fell into his hands. See ALEXANDER THE GREAT.

ISTAMBOL. See CONSTANTINOPLE.

ISTHMIAN GAMES, so called because they were celebrated on the Isthmus of Corinth, which joins the Peloponnesus to the continent. On it was a famous temple consecrated to Poseidōn, near which the Isthmian games were celebrated. On one side of the temple were the statues of the victors in these games, and on the other was a grove of pines. In the temple stood four horses, gilded all over, with the exception of their ivory hoofs: by the side of the horses were two Tritons, the upper parts of which were gilt, and the rest of ivory. Behind the horses was a car, with the statues of Poseidōn and Amphitritē, of gold and ivory. Not far from the temple were a considerable theatre, and the stadium, of white stone, in which the games were celebrated. The whole isthmus was sacred to Poseidōn, who was thence called *Isthmius*. According to the common opinion the Isthmian games were founded in honour of Palæmon or Melicertes, by Sisyphus, king of Corinth. (See INO.) Others relate that Theseus established them in honour of Poseidōn. They were originally held in the night, and had perhaps fallen into disuse, when Theseus restored them, and ordered them to be celebrated in the day. As Theseus was either the founder or the restorer of these games some honourable distinctions were reserved for the Athenians, but the right of conducting the solemnities belonged to the Corinthians. All Greece took part in them, excepting the Eleans, whose absence was thus explained:—As the sons of Actor were riding to these games they were killed, near Elea, by Heraclēs. Their mother, Melionē, discovered the murderer, who then resided in the territory of Argos. She therefore demanded satisfaction of the Argives, and on their refusal to grant it requested the Corinthians not to admit them to the games, as disturbers of the public tranquillity. As they would not yield to her solicitations Melionē pronounced direful curses on all the Eleans if they should ever participate in these games. When there was war between the states of Corinth and Athens a sacred truce was concluded, and the Athenians were solemnly invited to attend the celebration of the games. They were celebrated with the same splendour as the Olympian and other public games, in the first and third years of each Olympiad, probably in autumn; the athletic exercises were the same. The victors were at first adorned with wreaths of pine-leaves, but afterwards with wreaths of dry and faded ivy. The pine wreaths were afterwards resumed. Victory shed a lustre not only over the individual, but over his family and the community to which he belonged.

ISTHMUS, a term used in geography to denote a narrow neck of land between two seas connecting two larger portions of land, as two continents, or a peninsula and the mainland. The ancients often applied this name, without any limiting addition, to the Isthmus of Corinth, which unites the Peloponnesus to the mainland of Greece.

ISTRIA, or HISTRIA, the name given by the Greeks and Romans to the country which still bears the same appellation. It is a peninsula of triangular form, projecting into the north-east corner of the Adriatic Sea. It is now an Austrian margravate, and along with Görz, Gradisca, and the town and territory of Trieste, forms the Coastland province. The surface is mountainous, particularly in the north, where it is traversed by ramifications of the Julian Alps. Its only river of any consequence is the Isonzo. The soil is generally thin and gravelly, and the grain produced falls far short of the consumption; but the forests, which are extensive, yield excellent timber, and the vine, olive, and mulberry are successfully cultivated, furnishing, with their products, the chief sources of wealth. Area, 1800 square miles. Pop. (1890), 318,209; (1900), 344,173.

ITALY. GEOGRAPHICAL AND STATISTICAL INFORMATION. *Situation.*—Italy is a kingdom in Southern Europe, consisting in the main of a large peninsula stretching southwards between the Adriatic Sea and the western part of the Mediterranean, but also including a considerable portion of the mainland and some of the adjacent islands. It is bounded on the N. by the Alps, which separate it from Austria and Switzerland, except at the district lying to the north of Lake Garda, where its frontier does not follow the line of the Alps; on the W. by France, from which it is separated along the larger part of the frontier line by the Graian, Cottian, and part of the Maritime Alps, and by the Mediterranean; on the S. by the Gulf of Taranto and the Mediterranean; and on the E. by the Adriatic and a portion of the Austro-Hungarian Empire. It is comprised between 36° 40′ and 46° 40′ N. lat., and between 6° 35′ and 18° 35′ E. lon. The principal islands belonging to it are Sicily and Sardinia; the others include the Lipari Islands, Capri, Ischia, Giglio, Monte Cristo, Elba, &c. Rome is the capital.

Political Divisions.—For administrative purposes the Kingdom of Italy is divided into sixty-nine provinces, which are grouped under sixteen departments (*compartimenti territoriali*), some of which consist of only a single province. The provinces are subdivided into circles (in Venetia and the province of Mantua called districts). The following table furnishes a list of the provinces and departments, with the area of each, and the population at the census of Feb. 10, 1901:—

Provinces and Departments.	Area in sq. m.	Pop. on Feb. 10, 1901.
Alessandria	1950	811,833
Cuneo	2882	638,235
Novara	2553	743,115
Torino (Turin)	3955	1,124,218
PIEMONTE (Piedmont)	11,340	3,317,401
Genova (Genoa)	1582	934,627
Porto Maurizio	455	142,846
LIGURIA	2,037	1,077,473
Cagliari	5204	483,548
Sassari	4090	308,206
SARDINIA (Island)	9,294	791,754
Bergamo	1098	459,594
Brescia	1845	538,427
Como	1091	580,214
Cremona	695	327,838
Mantova (Mantua)	912	311,942
Milano (Milan)	1223	1,442,179
Pavia	1290	496,969
Sondrio	1232	125,565
LOMBARDIA (Lombardy)	9,386	4,282,728
Belluno	1293	192,800
Padova (Padua)	823	443,227
Rovigo	685	221,904
Treviso	960	412,267
Udine	2541	592,592
Venezia (Venice)	934	401,241
Verona	1188	422,437
Vicenza	1052	447,999
VENETIA	9,476	3,134,467
Bologna	1448	527,367
Ferrara	1012	271,776
Forlì	725	280,823
Modena	987	315,804
Parma	1250	294,159
Piacenza	954	245,126
Ravenna	715	235,485
Reggio nell'Emilia	876	274,495
EMILIA	7,967	2,445,035
Ancona	762	302,172
Ascoli Piceno	796	245,172
Macerata	1087	259,429
Pesaro e Urbino	1118	253,982
MARCA (The Marches)	3,763	1,060,755

Provinces and Departments.	Area in sq. m.	Pop. on Feb. 10, 1901
Perugia	3748	667,210
UMBRIA	— 3,748	— 667,210
Arezzo	1273	271,676
Firenze (Florence)	2265	939,054
Grosseto	1738	144,722
Livorno (Leghorn)	133	123,877
Lucca	558	319,523
Massa e Carrara	687	195,631
Pisa	1179	320,829
Siena	1471	233,830
TOSCANA (Tuscany)	— 9,304	—2,549,142
Roma (Rome)	4663	1,196,909
LATIUM	— 4,663	—1,196,909
Chieti (Abruzzo Citeriore)	1138	370,907
Teramo (Abruzzo Ulteriore I.)	1067	307,444
Aquila (Abruzzo Ulteriore II.)	2484	396,629
Campobasso (Molise)	1691	366,571
ABRUZZI E MOLISE	— 6,380	—1,441,551
Benevento	818	256,504
Napoli (Naples)	350	1,151,834
Salerno (Principato Citeriore)	1916	564,328
Avellino (Principato Ulteriore)	1172	402,425
Caserta (Terra di Lavoro)	2033	785,357
CAMPANIA	— 6,289	—3,160,448
Foggia (Capitanata)	2688	425,450
Bari	2065	827,698
Lecce (Terra d'Otranto)	2623	706,520
APULIA	— 7,376	—1,959,668
Potenza	3845	490,705
BASILICATA	— 3,845	— 490,705
Cosenza (Calabria Citra)	2568	465,267
Reggio di Calabria (Calabria Ultra I.)	1221	428,714
Catanzaro (Calabria Ultra II.)	2030	476,227
CALABRIA	— 5,819	—1,370,208
Caltanisetta	1263	327,977
Catania	1917	705,412
Girgenti	1172	371,638
Messina	1246	543,809
Palermo	1948	785,357
Siracusa (Syracuse)	1442	427,507
Trapani	948	368,099
SICILIA (Sicily)	— 9,936	—3,529,799
KINGDOM OF ITALY	110,646	32,475,253

Italy also possesses the colony of Eritrea on the African shore of the Red Sea, and some territory in Somaliland. The total area of these possessions is about 188,000 square miles, with a population of about 850,000.

Physical Features.—The length of the coast of the mainland of Italy has been estimated at about 1450 miles, that of the islands of Sicily and Sardinia at about 850 miles; so that the whole coast-line, inclusive of the smaller islands, must amount to about 2400 miles. It is not much broken. The whole shore of the Adriatic presents a comparatively smooth and continuous line, interrupted only by the spur of Gargano, which, by its south side, contributes to form the Gulf of Manfredonia. The largest gulf of all is that of Taranto, in the south. The west coast, though much more indented than the east, is more remarkable for the number, and occasionally for the beauty, of its bays, than for their magnitude. Commencing at the south extremity and proceeding north, the most important which present themselves, in succession, are those of St. Eufemia, Policastro, Salerno, Naples, Gaeta, and Genoa. The eastern shore is generally flat and uninteresting, presenting, particularly along its northern part, a long series of sandy islands and lagoons, which retard the progress of the rivers, dam up their mouths, and, depriving them of a proper outlet, occasion the formation of pestilential marshes. On the west coast the same thing is occasionally seen, but occurs on a large scale only in the Roman territory, where the Pontine Marshes, notwithstanding the proved practicability of draining them, are permitted to spread their poisonous malaria, and convert extensive tracts, of great natural fertility, into almost uninhabitable deserts. But with this very prominent exception, the west coast is considerably elevated, the ramifications of the mountains often stretching down and terminating in lofty cliffs, with a magnificent background of alpine heights. Few countries can boast of possessing scenery of this description equal to that which is exhibited by the Gulfs of Genoa and Naples.

The interior of Italy is finely diversified. The loftiest mountains of the Alps stand on its northern and north-western frontiers, and shelter it from the rigours of the north, giving here a climate which, though not free from the disadvantage of an oppressive summer heat in the lower valleys and plains, is unrivalled for the general mildness of its temperature and the brightness of its sky. In immediate connection with the branch of the Alps called the Maritime Alps is the chain of the Apennines, which, first proceeding east till the Adriatic is approached, then turn south, and run down the middle of the peninsula through its whole length to the Straits of Messina; while numerous branches are thrown off laterally, and form an endless succession either of loftier hills clothed with forests, or gentler slopes covered with olives and vines. In the spaces between the mountains and hills lie valleys remarkable either for their wild romantic beauties or the fertility of their soil. In the north, inclosed between the ranges of the Alps and Apennines, is a plain of vast extent, stretching from the western frontiers of Piedmont, across Lombardy, to the shores of the Adriatic, and perhaps the most fertile in Europe. Other plains, still more attractive by their beauty, occur in various parts of the Italian peninsula.

The general fertility of Italy is intimately connected with its geological structure. Except in the ranges of the Alps in the north, and the terminating branches of the Apennines in the south, granite and the metamorphic strata, which generally form soils of little natural fertility, are not of frequent occurrence, and occupy a very limited extent of surface. On the other hand, volcanic rocks, as might be expected in a country whose volcanic agency is still active, occupy considerable tracts, particularly on the west coasts of Naples and of the Roman territory, where, by their decomposing lavas, soils of almost exhaustless fertility have been formed. The sedimentary rocks of the Italian continent, with exception of the metamorphic strata already referred to, are comparatively recent. At the bottom of the series is the Jura lime stone, which is largely developed in the Apennines. The main body of it, commencing on the eastern frontiers of Tuscany, is continued in a broad zone far south into the old kingdom of Naples, where, after a partial interruption, it reappears in the south-west, chiefly in the province of Salerno, and partly in that of Potenza, and in the south-east in the province of Bari. It also occupies a considerable space on the north side of the Gulf of Gaeta, and on the western slope of Mount Gargano. It is likewise the prevailing rock in the north of Lombardy, where it stretches east from the shore of Lake Maggiore to the Austrian province of Illyria. Above the Jurassic limestone, and occupying almost an equal extent of surface, is the chalk, with its accompanying rocks. The main body of it stretches east along the Gulf of Genoa, and north into Emilia, then turns southward through Tuscany, forms a long narrow belt along the eastern side of the main body of the Jurassic limestone, and, though partially interrupted, finally reaches the extremity of the peninsula, where, in Cape St. Maria di Leuca, its white cliffs form the eastern entrance of the Gulf of Taranto. In the north of Naples a large tract, of a somewhat oval form, lies completely inclosed by the

Jura limestone. The next strata in the ascending series belong to the tertiary period, and consist of sandstones, travertin, and marl. These rocks occupy a considerable portion of Tuscany, and of the central part of Piedmont between Turin and Alessandria, but receive their chief development on the east coast, where, without attaining much width, they stretch without interruption from the neighbourhood of Rimini to the north-west extremity of the spur. Here the main body, spreading out, is continued S.S.E., and forms the greater part of the shore of the Gulf of Taranto. Another branch, still skirting the east coast, reaches its extremity in the Gulf of Taranto. Above all the ancient strata now mentioned are immense diluvial and alluvial deposits, still in course of gradual augmentation. Of these partial tracts are found both on the coast of Tuscany and the maritime provinces on the west near Rome, particularly the Pontine Marshes; but they are insignificant in comparison with the space which they occupy in the luxuriant plains of Lombardy, not only forming extensive flats along the northern shores of the Adriatic, from the Gulf of Trieste to the Gulf of Venice, but filling the greater part of the basin of the Po.

The river now mentioned is the only one of magnitude of which Italy can boast. It has the advantage of pursuing its course between the Alps and the Apennines, and deriving its supplies from both of them, conveyed from the Alps by the Dora Riparia, Dora Baltea, Sesia, Ticino, Adda, Oglio, and other tributaries on the left bank of the river, and by the Stura on its right bank; and from the Apennines by the Trebbia, Secchia, Panaro, &c., all on its right bank. Another river of some importance, which has its mouth at no great distance from the former, and is partly fed in the same way, is the Adige (*Etsch* in Germany); and the Bacchiglione, Brenta, Piave, Livenza, and Tagliamento, which are of much less importance, have their basins in Venetia or the north-eastern part of Italy, and all fall, like the Po and the Adige, into the Gulf of Venice. In the southern part of Italy, the peninsula of which it consists is not only narrow in itself, but is divided by the central chain of the Apennines into two watersheds, each of which lies so near the shore as to leave no room for the formation of large rivers. If the streams descend directly from the mountains to the shore, their course is necessarily so short as to give the character of mere torrents, often rising suddenly in their beds, and again as suddenly retiring within them. It sometimes happens, however, that the mountains, in ramifying, form parallel ridges, and thus give rise to longitudinal valleys, by pursuing which the course of the rivers is greatly lengthened, and their volume of course augmented. In this way the Italian peninsula, notwithstanding its narrowness, has obtained the Arno, Tiber, Garigliano, and Volturno. Numerous lakes are scattered over the surface. Many of them, independent of their natural beauties, derive much adventitious interest from classical associations; the most important are Lakes Maggiore, Como, and Garda.

Climate.—The peninsula in its southern part resembles Africa more than Europe. It has the dry and burning climate of Africa, as well as the sirocco which blows on its coasts, and resembles the simoom of that continent. In the continental part of the country the neighbourhood of the Alps, the abundance of water-courses, and the direction of the fine valley which opens on the Adriatic are all circumstances which serve to maintain a delightful temperature. Yet this region is at times extremely cold. The climate of Italy is generally salubrious, but there are numerous exceptions to this character. In the north the lagoons and the rice-plantations of the basin of the Po give rise to exhalations which engender fevers. In Central Italy the Maremma of Tuscany, the Campagna of Rome, the Pontine Marshes, and the environs of Volturno, like districts elsewhere, have been notorious for malaria, which is now successfully combated. See MALARIA.

Zoology.—The fauna of Italy differs little from that of the other countries of Europe situated in the same latitude. Its mountains afford a retreat to the lynx, chamois, brown bear, and wolf, while among those of Sardinia is found the mouflon or wild sheep. The porcupine is very generally found in the Apennines. The pale-red fox (different from the common species) and the blind mole are also found. The birds, which are very numerous, comprise most of the species of Central Europe, a large number of those belonging to the eastern part of Europe, and some African birds, especially the Egyptian vulture. Among the reptiles are the common viper and the asp; other noxious creatures are the scorpion and the tarantula. The marine fauna of Italy is also very comprehensive, including all the varieties of fish which are found in the Mediterranean. The fisheries embrace anchovies, sardines, tunnies, sword-fish, &c. The coral polyp (among other species the madrepore) is also of economic importance, there being a large number of persons employed in the coral fishery.

Vegetation.—The natural productions of the soil of Italy are as various as its climate. In the Alpine regions all the plants belonging to cold climates flourish, while the southern regions possess a real tropical flora. Among trees are pines and firs, especially the stone-pine, with edible seeds; the evergreen and other oaks, the chestnut, the poplar, &c. The olive, mulberry, fig, orange, citron, pomegranate, pistachio, jujube, and date grow in the south and in suitable places in the north. In the extreme south the cotton-plant, sugar-cane, Indian fig, agave, and other tropical plants are cultivated. Everywhere is seen the vine. The other vegetable products are common to Italy and the rest of Europe.

Agriculture.—This forms the chief support of the population, and the land is very productive in almost all parts of the kingdom, although it is not everywhere equally well cultivated. The best cultivation, aided by an excellent system of irrigation, is found in Lombardy, Venetia, Piedmont, Tuscany, and the parts of Emilia adjoining the Po. The most neglected parts of the country in point of cultivation are the islands of Sicily and Sardinia. About 85 per cent. of the surface of Italy is productive, and 15 per cent. unproductive. Of the productive land again about 41 per cent. consists of arable land and vineyards, 21 per cent. of meadows and pastures, 5 per cent. of olive and chestnut plantations, and 18 per cent. of forests. Italy may be divided into four agricultural zones or regions:—1, the olive, orange, and citron region, embracing Sicily and Sardinia, the Neapolitan provinces except the Abruzzi, and the part of the coast of Liguria called Riviera di Ponente; 2, the region of olives and pines, embracing the Abruzzi, Umbria, Tuscany, and the part of the Ligurian coast called Riviera di Levante; 3, the vine and oak region, embracing Lombardy, Venetia except the province of Udine, the provinces of Parma, Piacenza, Modena, Novara, Alessandria, and Lomellina, now part of the province of Pavia; 4, the vine and chestnut region, comprising the two large Piedmontese provinces of Turin and Cuneo, and the province of Udine in Venetia. All kinds of cereals are cultivated. The wheat is of fine quality, and is chiefly used as a breadstuff by the wealthier classes, while maize and rye are principally used by the poor, who also consume great quantities of pulse

and chestnuts. Hemp and flax are crops of considerable importance, and quantities of both are exported; cotton is grown in small quantities, chiefly in the warm and level districts of the province of Salerno, and of Calabria and Sicily; and the sugar-cane is grown also to a small extent in Sicily and Sardinia. The commoner fruit-trees of Europe are the objects of attention everywhere, and the cultivation of southern fruits is carried on particularly in the Neapolitan and Sicilian provinces, and furnishes large quantities of oranges, lemons, almonds, figs, &c., for export. The mulberry is largely grown for the nourishment of the silkworm. Tobacco is grown in many parts. In the cultivation of the olive Italy surpasses all other European states; so that, although the home consumption of olive-oil is very large, much is exported. There is also a very large production of wine. The average annual production of some of the above-mentioned objects of cultivation may be estimated as follows:—

Wheat,	17,800,000 qrs.	Potatoes,	2,420,000 qrs.
Maize,	10,700,000 ,,	Hemp,	111,000,000 lbs.
Oats,	2,420,000 ,,	Flax,	30,000,000 ,,
Rye & Barley,	2,300,000 ,,	Cotton,	22,000,000 ,,
Rice,	3,350,000 ,,	Tobacco,	7,250,000 ,,
Other Cereals,	2,250,000 ,,	Olive-oil,	74,500,000 galls.
Total Cereals,	39,100,000 ,,	Wine,	666,000,000 ,,

On account of the celebrity which the wines of Italy anciently enjoyed, and which secured for that country the appellation of Œnotria (wine country), as well as on account of the large quantity still produced there, this department of Italian agriculture deserves a somewhat more detailed notice. In ancient times the best wines were obtained from the vineyards on the two slopes of the Apennines. From the north to the south this favoured country produced wines of the first quality. Among the most celebrated were those of Liguria (which extended a good way further inland than the modern territory of the same name); those of Albanum (now Albano), near Rome, which became very agreeable by age, and received the warmest praises from ancient writers; those of Nomentum (Mentana), about 15 miles to the east of Rome, which are compared by Strabo to the best wines of Greece; those of Setia (Sezze), about 35 miles to the south-east of Rome, which were much prized by Augustus and all the wealthy Romans of his age; the Cæcuban wine, which grew in Campania, the province to the south of Latium, and which from the earliest times held the first place among the wines of Italy, and was particularly esteemed for the exquisite delicacy of its flavour; the Falernian and Massic wines, which also grew in Campania, and likewise had a very high reputation; those of Cales and Surrentum, also grown in Campania, but reckoned inferior to those previously mentioned as grown in the same province. Besides these there were the Mamertine wine from the neighbourhood of Messana in Sicily; the Sabine, Signine, &c., which were of indifferent quality; and the Vatican, and those of Veii, Caere, and other places, which were considered the worst. The south-west of Sicily, which now produces excellent wines, is nowhere mentioned for its wine-growing qualities in the writings of the ancients. At the present day the wines of Italy are admittedly inferior to their ancient reputation. Upon this a French writer remarks that 'while the inhabitants of less favoured countries employ their industry in selecting the best shoots and protecting them from the intemperance of all seasons, the Italians, accustomed to see the vine grow almost spontaneously and everywhere bear fruit which attains complete maturity, do not seek to improve the advantages of their situation, and sure of a sufficient vintage neglect this plant even in those districts where the quality of its products invites some care. The vines yield many wines, among which the liqueur wines are distinguished for their good quality; but those which serve for daily use cannot enter into competition with those of France. The most of them are at once sweet and harsh, often coarse, and although they appear to combine much body and strength they do not easily bear transport, and deteriorate in little time, even without being removed to a distance. Their bad quality proceeds not only from the want of care shown in the cultivation of the vines, but also from the bad processes employed in the manufacture.' Among the liqueur wines which are so abundant in Italy may be mentioned the lacryma-Christi, nasco, giro, tinto, Malmsey, aleatico, and muscat. The most famous of the Italian red wines are those of Carmignano in Tuscany, and those of the Isle of Elba, Bari, and Ischia. The white wines of Marsala and Castel-Veterano are compared to Madeiras of the second class.

The rearing of live-stock is an important industry in Italy, which exports cattle, sheep, goats, and swine. Horses are imported, and also sheep's wool. The cultivation of green crops as food for cattle is scarcely known. During the summer the animals are led to the pastures, and in winter they are furnished with straw and a little hay in their stalls. The farmers do not give much attention to the improvement of their domestic animals, which have lost much of their original excellence. The cattle are estimated to number about 5,000,000 (including 15,000 buffaloes), many of them team oxen. Sheep number 6,900,000. Some camels are perfectly acclimated near Pisa in the low-lying tracts of San Rossore. The cheese of Italy is famous, especially the Parmesan. The timber obtained from the woods is not sufficient to meet the home demand.

Manufactures.—Since the consolidation of the kingdom manufactures have made great advances, especially in Tuscany and the northern provinces. They now afford support to 18 per cent of the population. The development of industry has been particularly remarkable in recent years; the consumption of coal for industrial purposes has greatly increased; and the adoption of electricity as a motive power (partly through the utilization of water-power) is rapidly increasing. Engineering is thus a progressive industry. In ship-building Italy takes a respectable place among the maritime countries of Europe; it is most largely carried on in Liguria. Musical instruments are made in all the capitals. Especially famous are the bow instruments of Cremona, and nowhere are violin strings made so well as in the Abruzzi. In the iron industry the department of Lombardy stands at the head; and in that department more particularly the provinces of Brescia, Como, and Milan. The town of Brescia is the chief seat of the cutlery manufactures in Italy. The manufacture of gold and silver wares is very flourishing in Rome, Milan, Naples, Genoa, Venice, and Catania, and like that of articles in bronze has long been an important branch of Italian manufacturing industry. Italy is very rich in marble of the most beautiful and various colours and markings. The department most celebrated in this respect is Tuscany, especially the province of Massa e Carrara, and the district of Serravezza in the province of Lucca. The district of Volterra in the province of Pisa is noted for its alabaster quarries and the making of articles in alabaster. The cities of Rome, Naples, and Florence enjoy a world-wide reputation for their cameos and mosaics, as also (along with Leghorn and Genoa) for articles of coral. Earthenware manu-

factures have long been carried on in Italy with the best success. The articles in terra cotta especially are remarkable for the beauty of their forms. Venice and the neighbouring island of Murano are celebrated for the manufacture of glass beads, but the other glass manufactures of Italy do not nearly suffice for the home consumption. In the department of chemical industries the production of boracic acid (obtained from the lagoons of Tuscany) and of tartaric and citric acids, the manufacture of soap (of great consequence in Venice), and the preparation of alizarine or madder-red at the mouth of the Sarno, may be particularly mentioned. Among articles used for meat or drink, pickled meat and sausages (which are exported to a considerable extent), and liqueurs and rosolios, are the most important which are made in Italy. The beet sugar industry is not as yet very important, but has recently much increased. The manufacture of tobacco is a state monopoly, and employs about 15,000 hands. The spinning and weaving industries in Italy are in some branches very highly developed. The most important of these are the silk manufactures, which form one of the chief sources of the national wealth. With the exception of Abruzzi, Basilicata, and the island of Sardinia, all the provinces of the kingdom take part in the preparation of the raw silk which is used in the manufacture, but this is more especially the case in Lombardy, Piedmont, and Venetia. The rearing of silk-worms is more largely carried on in Italy than in any other country in Europe. Over 2,000,000 spindles are employed in spinning the silk, and the weaving is a very extensive branch of manufacture in Como, Genoa, Caserta, Milan, Turin, Florence, and Naples. Silk industries employ over 170,000 hands. The cotton manufacture is, as a textile industry, next to that of silk, and has greatly increased in recent years, the factories being chiefly in Lombardy, Piedmont, Lucca, and the Genoese district. About 1,900,000 spindles are now employed, the number of hands being 80,000. Woollen manufactures are chiefly carried on in Upper Italy, in Piedmont and Venetia, in the provinces of Novara, Vicenza, and Turin. The number of spindles at work is about 345,000, the looms about 9000 (half being power-looms), the hands employed about 28,000. The import of woollen yarns, and still more so of woollen fabrics, is large. Flax, hemp, and jute support industries of some importance. Hand-spinning is general where the raw material is grown. Good fabrics are woven, although they are not able to compete with those made in England, France, Germany, and Austria. Hempen fabrics, which are chiefly produced in the provinces of Bologna and Ferrara, where rope-making also plays an important part, are articles of export. Tanning is carried on in almost every part of the peninsula. There are in several places, but chiefly Genoa and Naples, factories for the making of gloves, boots, and shoes, which are of excellent quality, and exported to various countries, and even to America. The paper manufacture is very flourishing, and great advances have been made in the processes employed. In the making of straw hats and other articles in plaited straw Italy maintains the first place among the countries of Europe. The chief seat of this industry is in Tuscany (especially Florence and its environs), where it supports a great number of persons. The products of this manufacture are known all over the world. The making of furniture, and of articles of turnery, and articles used for personal adornment, as well as the manufacture of felt and silk hats, may be mentioned among the other manufacturing industries carried on in Italy.

Commerce, Shipping, and Banks.—The foreign trade of Italy is not on the whole large in proportion to the size and population of the country, and is not making much progress. In 1882, '89, and 1900 the imports and exports reached the following figures:—

	1882.	1889.	1900
Imports.....	£53,816,000..	£55,646,000 .	£68,259,185
Exports.....	46,232,000..	38,026,000..	54,195,984

Among the chief imports are coal, grain, cotton, silk, wool, sugar, coffee; by far the largest export is silk, raw and thrown, others being wine, olive-oil, oranges and lemons, hemp and flax, sulphur. In 1900 the import of coal reached the value of £8,311,262; of raw cotton, £6,036,323; cotton goods, £584,422; of silk, raw, twisted, &c., £6,451;738; of machinery, £3,101,811. In the same year the exports of silk and silk goods were valued at £18,033,647 (as against £20,810,735 in 1899); of animals and animal products at £6,838,558; of wine at £2,519,296; olive-oil, £1,138,120; fruit, £2,190,338. The trade of Italy is chiefly with France, the United Kingdom, Germany, Austria, Switzerland, Russia, and the United States. In 1899 the imports from France amounted to fully £6,000,000; from the United Kingdom, to nearly £12,000,000; and from Germany, to nearly £8,000,000; in the same year the exports to France amounted to fully £8,000,000; to the United Kingdom, to nearly £6,000,000; and to Germany, to £9,400,000. The chief exports from Italy to the United Kingdom include olive-oil, hemp, and fruits, and the principal imports from the United Kingdom are coal, machinery, metals, wool, and woollens.

The following table will show the chief imports from and exports to Britain by sea in 1903:—

Imports.		Exports.	
Chemicals, Dyes, &c.....	£554,669	Brimstone.....	£95,267
Coals.....	3,655,122	Chemicals.....	131,126
Cottons.....	240,306	Fruit.....	608,137
Fish	155,647	Hemp.....	271,176
Machinery.....	775,574	Hides, raw.....	291,271
Metals..	628,255	Metals and ores....	236,168
Wool.....	354,170	Olive and other oil..	177,100
Woollens.....	285,747	Sumach.....	110,815
		Stones.....	228,786

In the year 1899 the merchant marine of Italy consisted of 6148 sailing and steam vessels, of 815,162 tons burden, the steamers being of 277,520 tons burden, these figures including vessels engaged in the coasting trade and in fishing from 1 ton burden upwards. The total tonnage entered at Italian ports in 1899 amounted to 30,307,515 tons; cleared, 30,162,879 tons. The principal ports are Genoa, Leghorn, Messina, Naples, Palermo, Venice, and Catania, Genoa standing first and Naples second.

There are now only three banks of issue in Italy. The chief of these is the Bank of Italy, formed by the union of the National Bank of the Kingdom of Italy, founded in 1850, with a share capital of £8,000,000, and having its chief seats in Florence, Genoa, Milan, Naples, Palermo, Rome, Turin, and Venice; with the National Bank of Tuscany, founded in 1857, share capital £2,000,000; and the Tuscan Credit Bank, founded in 1860, share capital £2,400,000. The other two banks of issue are the Bank of Naples, founded in the sixteenth century; and the Bank of Sicily, founded in 1843: chief seats, Palermo and Messina.

Railways, Telegraphs, and Post-office.—The length of the railways in operation, including Sicily and Sardinia, is now about 10,000 miles, of which considerably more than half belong to the state. The first line of railway was opened in 1839, but the process of construction was for a long time slow. In recent years the state has engaged in constructing

railways, and has also obtained possession of others by purchase, but all are now worked by private companies. It is expected that when all the lines undertaken by the government have been completed, the total cost of construction will have amounted to 5,000,000,000 lire, or £200,000,000. The receipts of the Italian railways in 1875 were £5,792,771; in 1880, £7,204,280; in 1901, about £12,800,000.

The total length of the telegraph lines in operation in the kingdom is over 25,000 miles, most of which belong to the state. The total number of inland despatches amounts to between seven and eight millions annually. The post-office in the course of the year now transmits considerably more than 250,000,000 letters and post-cards. The number of post-offices in the kingdom, including collecting-boxes, is stated to be over 7700.

Constitution and Government.—The constitution of the kingdom of Italy is a limited monarchy. It is based upon the fundamental statute of March 4, 1848, fixing that of the Kingdom of Sardinia. The throne is hereditary in the male line of the royal house of Savoy. The king attains his majority on completing his eighteenth year. He exercises the power of legislation only in conjunction with a national parliament, consisting of two chambers. The first chamber is called the senate, and is composed of the princes of the blood, and an indefinite number of members appointed for life by the king. These last must be above forty years of age, and must be distinguished either by holding or having held some high office either in church or state, or by eminent services in literature, science, art, or any other pursuit tending to the benefit of the nation, or they must have paid for at least three years a sum not less than 3000 lire (£120) in direct taxes. At present the senate numbers somewhere about 334 members. The second chamber is called the chamber of deputies, and consists of 508 members, who are elected by a majority of all the citizens above twenty-one years of age who are in the enjoyment of civil and political rights, can read and write, and who pay direct taxes to the state or the provincial administration to the amount of 20 lire (=16*s.* 8*d.* English money) yearly. Certain persons enjoy the franchise independently of the taxation test, such as members of learned academies and of chambers of commerce, professors, state officials, members of knightly orders, doctors, advocates, &c. For the election of the members of the chamber of deputies the whole country is divided into electoral colleges or districts. Any one who has the right of voting and has completed his thirtieth year may be elected, unless he be a clergyman or an officer of state. Some officers of state, however, may be elected. The king calls the chambers together every year. The sittings are public. The president of the senate is appointed by the king, that of the chamber of deputies is elected by the chamber itself. The chamber of deputies has the right of impeaching ministers of the crown, in which case the senate is the court before which the impeachment is tried. The constitution of the provinces and communes is based upon the law of March 20, 1865. Each province has the right of independent administration, and the executive power is intrusted to a provincial council, the members of which are elected by the communal electors for five years, and to a provincial deputation or commission elected by the council from its own members, and managing the business of the province when the council is not sitting. The provincial councils elect their own presidents and other officials. In each commune there is a communal council elected like that of the provinces for five years, and a municipal giunta elected by the council. The head of the communal administration is the *sindaco*, who in all the chief communes is elected by the council from among its own members, and in other cases is nominated by the king from the members of the communal council.

The executive power of the state is exercised by the king through responsible ministers forming a council of ministers. In addition to this there is a state council possessing consultative powers, and authorized to decide on questions of competence arising between the administrative departments and the law-courts, as well as in cases of dispute between the state and its creditors. There are eleven departments in the government: 1, the ministry of foreign affairs, to which is attached the diplomatic council; 2, the ministry of the interior, with the supreme sanitary council, and the command of the national guard; 3, the ministry of justice and ecclesiastical affairs; 4, the ministry of finance, with the permanent council of finance; 5, the ministry of the treasury; 6, the ministry of war; 7, the ministry of marine, with the supreme council for naval affairs; 8, the ministry of public instruction, with the supreme council of instruction; 9, the ministry of public works, with the supreme council for public works; 10, the ministry of agriculture, manufactures, and commerce, with the councils for trade and manufactures, agriculture, mines, and woods and forests; and 11, the ministry of posts and telegraphs. The court of accounts of the Kingdom of Italy occupies an independent position. For the administration of the law there are, besides numerous courts of first instance, 161 civil tribunals and the tribunals of correction, 92 assize courts, 24 courts of appeal, and 4 courts of cassation (at Turin, Florence, Naples, and Rome).

Finances.—The finances of Italy are not in a satisfactory condition, this being due partly to the expensive wars which were necessary in order to establish and consolidate the unity of the kingdom, partly to the increase of the public debt in consequence of the successive annexations of different portions of the Italian territory, since the present Kingdom of Italy has naturally inherited the debt of each of the separate states of which it was formed, partly to the large sums expended on railways and on the army and navy. At the end of 1874 the nominal capital of the whole Italian debt was valued at a sum equal to £395,343,569. In the year 1902 the total debt was estimated to have increased to about £506,540,000. The difficulty experienced by the government in raising money to meet all its obligations has impelled it to resort to means which are, in some cases, extremely oppressive and unpopular (such as the grist tax), and in other cases scarcely creditable (state lotteries). The Italian budget divides the revenue and expenditure into ordinary and extraordinary. According to the budget of 1900–1901 the total revenue estimated for that year was £69,056,870, and the total expenditure £69,212,500. For a number of years following the establishment of the kingdom (1861) the expenditure generally exceeded the revenue, the deficit rising in one year (1866) to £24,680,000. From that date the deficit decreased steadily, and 1884–85 showed a surplus of £1,400,000. Such a surplus, however, is rare, that for 1898–99 being £399,918. The progressive increase of the receipts to balance the expenditure is mainly due to two causes, the establishment of new taxes and the more careful collection of the old ones. Besides the general budget there is one for communes and another for provinces, both of which exhibit, if not an altogether satisfactory condition, at least an improving one.

Army and Navy.—By the law of 7th June, 1875, supplemented by subsequent enactments, all men

capable of bearing arms are under obligation of military service from the end of their twentieth to the end of their thirty-ninth year. The forces are divided into three main branches: the standing army, the mobile militia, and the territorial militia. The regular time of service for the infantry is two or three years with the flag, six or five years in the reserve, three or four years in the mobile militia, and seven years in the territorial militia. The cavalry serve three years with the flag, six years in the reserve, and ten in the territorial militia. A certain number of the annual recruits (decided by the ballot) are only called on to serve under the flag from two to six months, which may be spread over several years. A third category have to engage in military exercises for only thirty days during the nineteen years. The whole kingdom is formed into twelve military districts, each with an army corps. In 1900 the permanent standing army numbered in all 851,164, of whom 257,615 were actually serving with the flag. Of the latter 170,127 were infantry, 25,106 cavalry, and 29,365 artillery. The mobile militia numbered 304,497, the territorial militia 2,106,233. The total army strength was 3,261,894.

Great efforts have been made to strengthen the fleet in recent years, and it now possesses some powerful vessels. There are thirteen battleships of the first class, two of which, the *Duilio* and *Dandolo*, have their citadel armour 22 inches in thickness. These are reputed to be among the most powerful war-ships yet constructed, each carrying four 100-ton Armstrong guns. Three others carry 105-ton guns.

Ecclesiastical Affairs.—According to the provisions of the fundamental statute the Roman Catholic is the state religion, but all other creeds are tolerated, and adherents of all religions have equal municipal and political rights. The spiritual head of the Roman Catholic Church, the pope, has his seat at Rome. His prerogatives are regulated by the law of the 13th May, 1871, which also determines the relation between church and state. By this law the person of the pope is pronounced sacred and inviolable. The Italian government pays sovereign honours to the pope, and guarantees him a yearly dotation of 3,225,000 lire (£129,000). The pope also enjoys the possession of the palaces of the Vatican and the Lateran, and the villa of Castel Gandolfo, without being subject to taxes on their account, and these places are not put under the jurisdiction of the state. Temporary residences of the pope, as well as places where a conclave or a council is held, are protected by similar immunities. The pope is perfectly free in the exercise of his spiritual functions; and free intercourse is also guaranteed between the head of the church and the episcopate, as well as the whole Catholic world. The ambassadors of the pope, and those accredited to the holy see by foreign powers, enjoy all the privileges granted to such functionaries by international usage. The church has the entire right of nominating to all ecclesiastical offices and benefices. The royal *exequatur* and *placet* are abolished. This guarantee-law, as it is called, which really determines the relations between church and state at the present day, has never been acknowledged by the popes, who have hitherto declined to accept the dotation. In the Kingdom of Italy there are 51 archbishoprics and 223 bishoprics, beside 6 cardinal-bishops with sees in Italy. The number of parish priests is about 76,500. The monasteries and convents have been abolished by a royal decree dated July 7, 1866, and extended to the former Papal States, and to Rome itself, by another decree dated June 25, 1873. Among the Waldenses, who follow the religious observances of the reformed church, the highest spiritual authority is confided to a synod.

Education.—Compulsory education is enforced by the law of 15th July, 1877, for all children who have completed their sixth year, and do not receive adequate instruction either at their homes or in private schools. Attendance is obligatory at the rudimentary schools in the commune for such children up to their ninth year, and in case of failure to pass the requisite examination they may be detained a year longer. The elementary communal schools are entirely supported by the municipalities, which nominate and pay the teachers, and carry out the educational laws under the supervision of the state school-inspectors. The subjects of compulsory instruction are reading, writing, arithmetic, the metric system, the rudiments of Latin, and the first duties of a man and a citizen. Religious instruction is not obligatory. There are many schools supported by the church, as well as private schools, but all must adopt the government code, and are open to government inspection, while all teachers must hold the government certificate. The urgency of the need for all practicable measures being used to advance the cause of popular education in Italy may be gathered from a return issued by the Italian government in March, 1870, which gives information regarding the amount of education received by the military conscripts born in 1847, and called up for active service in 1868, and shows that throughout the Kingdom of Italy the average percentage, reckoned over the different provinces of the kingdom, of these conscripts who were totally unable to read or write was 64·27. In the province of Girgenti it was 85·82, and in the southern provinces generally it was above 80. The average percentage by 1897 had decreased to little more than 37. It is now comparatively rare to meet a boy or girl who cannot at least read. Education is practically free up to the university. Besides the regular day schools there are evening schools, in which elementary education may be carried further. The principal institutions for secondary education are the gymnasiums and lyceums, the former having a course of five years, the branches taught being Greek, Latin, Italian, history, geography, and arithmetic; the latter, having a course of three years, add to these subjects philosophy, mathematics, physics, chemistry, and natural history. No fees are charged either in gymnasium or lyceum. In addition to these there are a number of technical schools, in which fees are charged. There are also schools of agriculture, mining, commercial education, &c. For the higher education there are no less than twenty-one universities, many of them of ancient foundation, and at one time of considerable renown. The oldest are those of Bologna (founded in 1119), Padua (1222), Naples (1224), Rome (1244), Perugia (1320), Pisa (1329), Siena (1349), Pavia (1390), Turin (1412), and Parma (1422). The other universities are Cagliari, Camerino, Catania, Ferrara, Genoa, Macerata, Messina, Modena, Palermo, Sassari, and Urbino. The number of students at all the universities was returned in 1897-98 at 22,540, of whom Naples had 5465, Turin 2551, and Rome 2300. In all universities the theological faculty has been abolished. Co-operating with these institutions for the education of the people there are about 150 training schools for teachers, with an attendance of about 18,000 students. There are government art schools at Bologna, Carrara, Florence, Lucca, Milan, Modena, Parma, Ravenna, Rome, Turin, Venice, &c., with a total of 3300 pupils; and in addition the academies of Genoa, Bergamo, Verona, Siena, Pisa, and Perugia. Musical conservatories are supported by the government at Florence, Milan, Naples, Palermo, and Parma.

Money, Weights, and Measures.—The present monetary system of Italy is the same as that of France, the lira being equal to the franc, and divided

into 100 centesimi, as the franc is into 100 centimes. The lira is accordingly equal to about 9½*d*. The weights and measures of Italy have also been adopted from France, and in their case the names also have been adopted, with only such modifications as are necessary to give them an Italian form. Thus the Italian gramma = the French gramme, the chilogramma = the kilogramme, the litro = the litre, the ettolitro = the hectolitre, and so on; the metro = the mètre, the ettometro = the hectomètre, the chilometro = the kilomètre, &c.; the aro = the are, the ettaro = the hectare; and the stero = the stère, and the decastero = the decastère. The quintale metrico is the same as the quintal metrique, and the tonnelata the same as the tonneau metrique. See DECIMAL SYSTEM.

HISTORY.—Italia did not become the general name of this country until the age of Augustus. It was known to the Greeks under the name of Hesperia, and also, either in whole or part, by those of Ausonia, Saturnia, and Œnotria. The name of Italia was at first merely a partial name for the southern extremity. From the earliest times Italy was inhabited by many tribes of different origin. The region on both sides of the Po (Padus) in Upper Italy was inhabited by a Gallic race, divided into numerous tribes and states possessing a number of towns on the coast as well as on the fruitful plain in the interior. Adjoining them on the north-east were the Venetians, and on the west coast the Ligurians. Central Italy was the seat of several races which had partly been settled in the land from time immemorial, and were thence regarded as aborigines, and had partly immigrated from foreign countries. Among the former were the Sabellians, a powerful, warlike, freedom-loving people, subdivided into various tribes, the chief of whom were the Sabines, Samnites, and Æquians; the Umbrians, who dwelt to the north of the Sabellians, and are considered by scholars to be the most ancient of all the races inhabiting Italy; the Latin tribes, living to the west of the Samnites in the region called, from them, Latium; and the Oscans, Opicans, or Ausonians, living further south than the Latins, being the earliest inhabitants of Campania. Among the latter races who came into Italy from foreign countries, the most remarkable were the Etruscans, who dwelt between the Gauls in the north, the Umbrians, the Latins, and the sea. Lower Italy was occupied by Apulians in the south-east, supposed to be a member of the Oscan race; and by Lucanians, a Sabellian tribe; and the Brutii in the south-west, the former occupying the district to the south of Campania and Samnium, and extending as far as the root of the small peninsula in the extreme south-west, which was the habitation of the latter. The coasts of Lower Italy as far north as Latium were studded many hundred years before Christ with Greek colonies, from whom the neighbouring tribes derived some of the elements of Greek culture and an acquaintance with Greek mythology. Evidence of this is found in the Latin legend to the effect that after the destruction of Troy the hero Æneas, with a number of Trojan followers, came to Italy and formed a settlement in Latium, where he married the daughter of the Latin king. At an early period in Italian history Rome, the chief town of Latium (founded, according to the received date, B.C. 753), became predominant among the cities and tribes of Central Italy, and it gradually extended its influence over the whole country until, by the end of the third century B.C., it had brought into allegiance or subjection all the tribes of Italy from north to south, including those of the islands of Sicily, Corsica, and Sardinia. The history of ancient Italy thus merges to a great extent in that of Rome, to which article, as well as those treating of the more important races of Italy, the reader is referred for further information concerning ancient Italy, while we here take up the thread again with the overthrow of the empire in the west, A.D. 476.

First Period. From Odoacer to Alboin (476–568).—This period comprises the time of the dominion of the Herulians and Rugians, and of the Ostrogothic Kingdom. Shortly after the beginning of the reign of the Emperor Romulus Augustulus the Germanic troops, Herulians and others, in the Roman pay, demanded for themselves a third part of the territory of Italy, and when the demand was refused Odoacer, their leader, dethroned the powerless emperor, and assumed the title of King of Italy. For twelve years this valiant barbarian ruled, not without fame, when Theodoric, king of the Ostrogoths, instigated by Zeno, emperor of the East, marched at the head of 200,000 men bearing arms, accompanied by their wives and families and all their movable possessions, from their seats on the Danube into Italy (488). After defeating Odoacer at Verona (489), and shutting him up in Ravenna, he obliged him to surrender after a brave defence which lasted for three years, and not long after he was slain by the Goths at a tumultuous banquet (493). Thenceforward Theodoric ruled over Italy with Ravenna as his capital. His Goths spread from the Alps to Sicily. In the lagoons of the Adriatic alone some fugitives who had fled from the devastations of Attila, and obtained a subsistence as sailors and by the manufacture of salt, maintained their freedom. Theodoric, who combined the vigour of the north with the cultivation of the south, is justly termed the *Great*, and, under the name of Dietrich of Bern (Verona), has become one of the principal heroes of old German story. But the energy of his people soon yielded to Roman corruption. Totilas for ten years in vain endeavoured to maintain the almost completed conquest against the military skill of Belisarius and Narses, the generals of the Byzantine emperor Justinian. He fell in battle in 552, and Teias, his successor, in 553, after which Italy was annexed to the Eastern Empire, under an exarch who resided at Ravenna. But not many years after the country was invaded by the Lombards (Langobardi, Longobardi), a German people which had emigrated from the Elbe to Pannonia. Under King Alboin they conquered the Po basin, which received from them the name of Lombardy, almost without a blow (568), and founded a kingdom which had its capital at Pavia. Their government was less favourable to the arts and sciences than that of the Goths.

Second Period. From Alboin to Charlemagne (774), *or Period of the Lombard Empire.*—The kingdom of the Lombards included Upper Italy, Tuscany, and Umbria. Alboin also created the Duchy of Benevento, in Lower Italy, with which he invested Zotto. The whole of Lombardian Italy was divided into thirty great fiefs, under dukes, counts, &c., which soon became hereditary. Together with the new kingdom, the confederation of the fugitives in the lagoons still subsisted in undisturbed freedom. The islanders, by the election of their first doge, Anafesto, in 697, established a central government, and the Republic of Venice was founded. (See VENICE.) Ravenna, the seat of the exarch, with Romagna, the Pentapolis, or the five maritime cities (Rimini, Pisaro, Fano, Sinigaglia, and Ancona), and almost all the coasts of Lower Italy, where Amalfi and Gaeta had dukes of their own, of the Greek nation, remained unconquered, together with Sicily and the capital, Rome, which was governed by a patrician in the name of the emperor. The slight dependence on the court of Byzantium disappeared almost entirely

in the beginning of the eighth century, when Leo the Isaurian exasperated the orthodox Italians by his attack on images. (See ICONOCLASTS.) The cities expelled his officers, and chose consuls and a senate, as in ancient times. Rome acknowledged, not indeed the power, but a certain paternal authority of its bishops, even in secular affairs, in consequence of the respect which their holiness procured them. The popes, in their efforts to defend the freedom of Rome against the Lombards, forsaken by the court of Byzantium, generally had recourse to the Frankish kings. In consideration of the aid expected against King Astolphus, Pope Stephen III. (754) not only anointed Pepin, who, with the approbation of Pope Zacharias, had been made king of the Franks in 752, but, with the assent of the municipality of Rome, appointed him patrician, as the imperial governor had hitherto been denominated. In 756 Pepin presented the exarchate of Ravenna, with the five cities, to the pope, thus laying the foundation of the temporal power of the holy see. At the invitation of Pope Hadrian I. Charlemagne made war upon Desiderius, the king of the Lombards, took him prisoner in his capital, Pavia, united his empire with the Frankish monarchy (774), and eventually gave Italy a king in his son Pepin.

Third Period. From Charlemagne to Otho the Great (961), or *Period of the Carlovingians and Interregnum.*—The attempts of Charlemagne against the Duchy of Benevento, the independence of which was maintained by Duke Arichis, and against the republics in Lower Italy, where Naples, Amalfi, and Gaeta in particular, had become rich by navigation and commerce, were unsuccessful. Leo III. bestowed on the king of the Franks, on Christmas-day, A.D. 800, the imperial crown of the West, which needed a Charlemagne to raise it from nothing. But dislike to the Franks, whose conquest was looked upon as a new invasion of barbarians, united the free cities, Rome excepted, more closely to the Eastern Empire. Even during the lifetime of Charlemagne Frankish Italy was given to his grandson Bernard (810). But Bernard having attempted to become independent of his uncle, Louis the Debonnaire, he was deprived of the crown, and his eyes were torn out. Italy now remained a constituent part of the Frankish monarchy, till the partition of Verdun (843), when it was allotted, with the imperial dignity, and what was afterwards called Lorraine, to Lothaire I., eldest son of Louis. Lothaire left the government (850) to his son Louis II., the most estimable of the Italian princes of the Carlovingian line. After his death (875) Italy became the apple of discord to the whole family. Charles the Bald of France first took possession of it, and after his death (877) Carloman, who was succeeded, in 884, by his brother Charles the Fat, who united the whole Frankish monarchy for the last time. His dethronement (887) was the epoch of anarchy and civil war in Italy. Berengarius, duke of Friuli, and Guido, duke of Spoleto (besides the Marquis of Ivrea, the only ones remaining of the thirty great vassals), disputed the crown between them. Guido was crowned king and emperor, and after his death (894) his son Lambert, although Berengarius got himself crowned king in the same year. Arnulf, the Carlovingian king of the Germans, enforced his claims to the royal and imperial crown of Italy (896), but, like most of his successors, was able to maintain them only during his residence in the country. After the death of Lambert (898) and Arnulf (899) the struggle for supremacy in Italy still continued, the competitors now being Berengarius, of Friuli, and Louis, king of Lower Burgundy (Arles), but at last the former succeeded in restoring quiet by driving out his rival. In 915 he was crowned emperor, with which title he reigned till 924, when he was assassinated. At the time that this happened Rudolph II., king of Upper Burgundy, was engaged, on the invitation of the Lombards, in an expedition into Italy for the purpose of dethroning Berengarius, but soon after (926) he was induced to relinquish his claims to Italy in favour of Hugh of Provence, who seems to have agreed to cede in return to Rudolph his kingdom of Arles. Hugh sought to strengthen the insecure throne of Italy by a bloody tyranny. His nephew, Berengarius, marquis of Ivrea, fled from his snares to Otho the Great of Germany, assembled an army of fugitives, returned, and overthrew Hugh (945), who was succeeded by his son Lothaire. Berengarius became his first counsellor, but was more bent on gratifying his ambition than on securing the welfare of the country. After the death of Lothaire, in 950 (poisoned, it was said, by Berengarius), the latter wished to compel his widow—the beautiful Adelaide—contrary to her inclination, to marry his son. Escaping from his cruelty she took refuge in the castle of Canossa, where she was besieged by Berengarius II. She now applied for aid to Otho I., king of Germany, who passed the Alps, liberated her, conquered Pavia, became king of the Franks and Lombards (in 951), and married Adelaide. To a prompt submission, and the cession of Friuli, the key of Italy, which Otho gave to his brother Henry, Berengarius was indebted for permission to reign as the vassal of Otho. But, the nobles of Italy preferring new complaints against him, ten years after, Otho returned (961), deposed him, and led him prisoner to Bamberg, and after having been himself crowned king of Italy with the iron crown, in 961, united this kingdom with the German. Early in the following year (962) he was crowned emperor by Pope John XII., and from this event dates the foundation of what is known in history as the Holy Roman Empire.

Otho gave the great imperial fiefs to Germans, and granted to the Italian cities privileges that were the foundation of a free constitution, for which they soon became ripe. The growing wealth of the Papal court, owing to the munificence of the French kings, which had promoted their influence on the government, so beneficial under Leo IV. and popes of a similar character, became, through the corruption of the Roman court in the tenth century, the first cause of its decline. The clergy and the people elected the popes according to the will of the consuls and a few patricians. In the first half of the tenth century two women disposed of the holy chair. Theodora elevated (913 or 914) her lover John X., and Marozia, the daughter of Theodora, in 931, elevated her son, John XI., to the Papal dignity. The brother of the latter, Alberic of Camerino, and his son Octavian, were absolute masters of Rome, and the last was pope, under the name of John XII., when twenty years of age (956). Otho the Great, whom he had crowned emperor, deposed him, and chose Leo VIII. in his stead; but the people, jealous of its right of election, chose Benedict V. From this time the popes, instead of ruling the people of Rome, became dependent on them. In Lower Italy the Republics of Naples, Gaeta, and Amalfi still defended their independence against the Lombard duchy of Benevento, with the more ease, since the duchy had been divided (839) between Siconolphus of Salerno and Radelghisius of Benevento, and subsequently among a greater number, and since with the dukes they had had a common enemy in the Saracens, who had been previously invited over from Sicily by both parties (about 830), as auxiliaries against each other, but who had settled and main-

tained themselves in Apulia. But about forty years later the Greeks in Lower Italy, who had hitherto adhered to the Byzantine Empire, succeeded, with the aid of Louis II. of Germany, in recovering the territory that had been wrested from them by the Saracens, and out of the recovered region formed a separate province, called the Thema of Lombardy, which continued under their dominion upwards of a hundred years, being governed by a catapan (governor-general) at Bari. Otho the Great himself did not succeed in driving them altogether from Italy. The marriage of his son, Otho II., with the Greek princess Theophania, put an end to his exertions for this purpose.

Fourth Period. From Otho the Great to Gregory VII. (1073). *The Dominion of the German Kings.*—In opposition to the designs of the Count of Tusculum, who wished to supplant the absent emperor at Rome, a noble Roman, the consul Crescentius, attempted to govern Rome under the semblance of her ancient liberty (980). Otho II., king since 973, occupied with his projects of conquest in Lower Italy, did not interfere with this administration, which became formidable to the vicious popes Boniface VII. (antipope) and John XV. But when Otho III., who had reigned in Germany since 983, raised his kinsman Gregory V. to the popedom, Crescentius caused the latter to be expelled, and John XVI., a Greek, to be elected by the people. He also endeavoured to place Rome again under the nominal supremacy of the Byzantine Empire. Otho, however, reinstated Gregory, besieged Crescentius in the castle of St. Angelo, took him prisoner, and caused him to be beheaded with twelve other noble Romans (998). But the Romans again threw off their allegiance to the emperor, and yielded only to force. On the death of Otho III. (1002) the Italians considered their connection with the German Empire as dissolved. Harduin, marquis of Ivrea, was elected king, and crowned at Pavia. This was a sufficient motive for Milan, the enemy of Pavia, to declare for Henry II. (in Italy, I.) of Germany. A civil war ensued, in which every city, relying on its walls, took a greater or less part. Henry was chosen King of Italy by the nobles assembled in Pavia; but disturbances arose, in which a part of the city was destroyed by fire (A.D. 1004). Not till after Harduin's death (1015) was Henry recognized as king by all Lombardy. He was succeeded by Conrad II. (in Italy, I.) At a diet held at Roncaglia, near Piacenza, in 1037, Conrad made the fiefs hereditary by a fundamental law of the empire, and endeavoured to give stability and tranquillity to the state, but without success. The cities (which were daily becoming more powerful) and the bishops were engaged in continual quarrels with the nobility, and the nobility with their vassals, which could not be repressed. Republican Rome, under the influence of the family of Crescentius, could be reduced to obedience neither by Henry II. and Conrad II., nor by the popes. When Henry III. (in Italy, II.), the son of Conrad, whom he succeeded in 1039, entered Italy (1046), he found three popes in Rome, all of whom he deposed, appointing in their stead Clement II., and ever after filled the Papal chair, by his own authority, with virtuous German ecclesiastics. This reform gave the popes new consequence—a consequence which was severely felt by the successor of the emperor to whom the reform was due. Henry died in 1056. During the long minority of his son Henry IV. (in Italy, III.) the policy of the popes, directed by the monk Hildebrand (afterwards Gregory VII.), succeeded in creating an opposition which soon became formidable to the secular power. (See POPES.) The Normans also contributed to this result. As early as 1016 warriors from Normandy had established themselves in Calabria and Apulia. Allies sometimes of the Lombards, sometimes of the republics, sometimes of the Greeks against each other and against the Saracens, they constantly became more powerful by petty wars. The great preparations of Leo IX. for their expulsion terminated in his defeat and capture (1053). On the other hand, Nicholas II. united with the Norman princes, and, in 1059, invested Robert Guiscard with all the territories conquered by him in Lower Italy. From that time the pope, in his conflicts with the imperial power, relied on the support of his faithful vassal, the duke of Apulia and Calabria, to which Sicily was soon added. While the small states of the south were thus united into one large one, the kingdom in the north was dissolving into smaller states. The Lombard cities were laying the foundation of their future importance. Venice, Genoa, and Pisa were already powerful. The Pisanese, who, in 980, had given to Otho II. efficient aid against the Greeks in Lower Italy, and in 1005 boldly attacked the Saracens there, ventured, in connection with the Genoese (no less warlike and skilled in navigation), to assail the infidels in their own territory, and twice conquered Sardinia (1017 and 1050), which they divided into several large fiefs, and distributed them among their principal citizens.

Fifth Period. From Gregory VII. to the Fall of the Hohenstaufen (1268). *Struggles of the Popes and Republics with the Emperors.*—Gregory VII. humbled Henry VII. in 1077. Urban II. instigated the emperor's own sons against their father. Conrad, the eldest, was crowned King of Italy in 1093, after whose death (1101) Henry, the second son, succeeded in deposing his father from the imperial throne. Henry V., the creature of the pope, soon became his opponent; but after a severe conflict concluded with Calixtus II. the concordat of Worms (1122). A main point which remained unsettled gave rise to new difficulties in the twelfth and thirteenth centuries —the estate of Matilda, countess of Tuscany, who died in 1115, and by a will, the validity of which was disputed by the emperor, bequeathed all her property to the Papal see. Meanwhile, in the south, the Norman state, under Roger II., was formed into a kingdom, from the ruins of republican liberty and of the Greek and Lombard dominion (1130). In the small republics of the north of Italy the government was in most cases divided between the consuls, the lesser council (*credenza*), the great council, and the popular assembly (*parlamento*). Petty feuds developed their youthful energies. Such were those that terminated with the destruction of Lodi by Milan (1111), and the ten years' siege of Como by the forces of the same city, allied with those of nearly all the Lombard cities (1118–27). The subjugation of this city rendered Milan the first power in Lombardy, and most of the neighbouring cities maintained an alliance with her. Others formed a counter-alliance with her antagonist, Pavia. In Rome the love of liberty, restrained by Gregory VII., rose in proportion as his successors ruled with less energy. The schisms between Gelasius II. and the antipope Gregory VIII., Innocent II. and the antipope Anacletus II., renewed the hopes of the Romans. Arnold of Brescia, formerly proscribed (1139) for his violent attacks against the luxury of the clergy in that country, was their leader (1146). After eight years Adrian IV. succeeded in effecting his execution. Frederick I. of Hohenstaufen (called *Barbarossa*) crossed the Alps six times, in order to defend his possessions in Italy against the republicanism of the Lombard cities. Embracing the cause of the Pavian union as the weaker, he devastated (1154) the territory of Milan, destroyed Tortona, and was crowned in Pavia and Rome. In 1158 he reduced

Milan, demolished the fortifications of Piacenza, and held a diet at Roncaglia, where he extended the imperial prerogatives conformably with the Justinian code, gave the cities chief magistrates (*podestà*), and proclaimed a general peace. His rigour having excited a new rebellion, he reduced Crema to ashes (1160), compelled Milan to submission, and having driven out all the inhabitants, demolished the fortifications (1162). Nothing, however, but the terror of his arms upheld his power. When the emperor entered Italy (1163) without an army, the cities concluded a union for maintaining their freedom, which in 1167 was converted into the Lombard Confederacy. The confederates restored Milan, and, to hold in check the Ghibelline (imperial) city of Pavia, built a new city, called, in honour of the pope, *Alessandria*. Neither Frederick's governor, Christian, archbishop of Mainz, nor he himself, could effect anything against the confederacy; the former failed before Ancona (1174), with all the power of Ghibelline Tuscany; and the latter, with the Germans, before Alessandria (1175). In the next year, also (1176), he suffered a severe defeat at Legnano, in consequence of which he saw himself obliged to conclude a concordat with Alexander III., and a truce with the cities at Venice. Some years afterwards a peace, which secured their independence, was signed at Constance (1183). The republics retained the *podestà* (foreign noblemen, now elected by themselves) as judges and generals. As formerly, all were to take the oath of fealty and allegiance to the emperor. But, instead of strengthening their league into a permanent confederacy (the only safety for Italy), they were soon split into new factions, when the designs of the Hohenstaufen on the throne of Sicily drew Frederick and Henry VI. (V.) from Lombardy. During the minority of Frederick II., and the disputes for the succession to the German throne, Innocent III. (Frederick's guardian) succeeded in re-establishing the secular authority of the holy see in Rome and the surrounding country, and in enforcing its claims to the donations of Charlemagne and Matilda. In 1197 he also brought over almost all Tuscany, except Pisa, to the party of the Guelfs, the party opposed to foreign domination, and hence as a rule inclined to the popes. A blind hereditary hatred, rather than a zeal for the cause, inspired the parties; for when a Guelf (Otho IV.) ascended the imperial throne, the Guelfs became his party, and the Ghibellines the pope's; but the reversion of the imperial crown to the house of Hohenstaufen, in the person of Frederick II., who at the same time inherited from his mother, the Princess Constance, the Kingdom of the Two Sicilies, soon restored the ancient relations (1212). In Florence this party spirit gave pretence and aliment (1215) to the disputes of the Buondelmonti and Donati with the Uberti and Amidei, originating in private causes; and most cities were thus internally divided into Guelfs and Ghibellines. The Guelf cities of Lombardy renewed the Lombard confederacy in 1226. After the emperor had returned from his crusade (1229), for undertaking which contrary to the will of the pope he was excommunicated, he waged war, with varying success, against the cities, and against Gregory IX., heedless of the excommunication, while Ezzelino da Romano, under the pretence of favouring the Ghibellines, established, by every kind of violence, his own power in Padua, Verona, Vicenza, and the neighbourhood. The Papal court succeeded in seducing the Pisanese family of the Visconti of Gallura in Sardinia, from the republic, and rendering them its vassals, notwithstanding the resistance of the republic, and especially of the counts of Gherardesca. Thence Pisa, too, was divided into Ghibellines (Conti) and Guelfs (Visconti). Frederick, however, married his natural son, Enzio, to a Visconti, and gave him the title of *King of Sardinia*. The plan of Gregory IX., to depose Frederick, was followed by Innocent IV., in the Council of Lyons (1245), whither the pope had fled to be out of the power of Frederick. This greatly weakened the Ghibelline party, which was already nearly undermined by the intrigues of the mendicant orders. The hitherto faithful Parma revolted; and the war between Guelfs and Ghibellines raged with greater fury than ever. The Bolognese united all the cities of Italy in a Guelf league, and in the battle of Fossalta (1249) took Enzio prisoner, whom they never released. In the following year (1250) Frederick died, his death being hastened, no doubt, by the disasters of the last few years, and by grief caused by the fate of his favourite son Enzio. His sons, Conrad IV. and Manfred, endeavoured to maintain themselves in the possession of their hereditary dominions in Lower Italy; but Innocent IV., who now joyfully returned to Italy, excommunicated them, and his successor, Urban IV., offered the crown of Naples to Charles of Anjou, brother of Louis IX. of France, who accepted the offer and landed at the mouth of the Tiber in 1265. Conrad had died long before (1254), but Manfred offered an energetic resistance to the invader, until he was killed at the battle of Benevento in 1266. After this battle the power of the Ghibellines in Italy was completely broken. In the Trevisan Mark, in Upper Italy, they had maintained the supremacy under Ezzelino till 1259, when Ezzelino was taken prisoner by the Guelfs at the battle of Cassano. For two years after the battle of Benevento Conradin, the son of Conrad IV., contested Naples with Charles of Anjou, but in 1268 fell by treachery into his hands and was executed. These contests were fatal to liberty; the house Della Scala followed that of Romano in Verona, and Milan itself, with a great part of Lombardy, found masters in the house Della Torre. Tyrants everywhere arose; the maritime republics and the Republic of Tuscany alone remained free.

Sixth Period. From the Fall of the Hohenstaufen to the Formation of the Modern States.—In this period different princes attempted to usurp the sovereignty of Italy.—1. *The Princes of Anjou.* After Charles I. of Anjou had become, by the favour of the pope, king of Naples, senator of Rome, Papal vicar in Tuscany, and had directed his ambition to the throne of Italy (a policy in which his successors persevered), the names of Guelfs and Ghibellines acquired a new signification. The former denoted the friends, the latter the enemies, of the French. Although with the fall of the Hohenstaufen the power of the German emperors in Italy was practically at an end for the time, yet in Lombardy, and to some extent also in Tuscany, their supremacy was still at least nominally recognized; many Ghibellines still looked forward to a restoration of the Holy Roman Empire in Italy as the only means of re-establishing order, and others wishing to gratify their own schemes of ambition, often sought to obtain a legal authority for their usurpations by purchasing from the empire the title of imperial vicars. In Sicily, by the so-called Sicilian Vespers (1282), the French were driven out, and the crown of the island was bestowed upon Peter of Arragon, the son-in-law of Manfred, with whose help the inhabitants successfully resisted all the attempts of Charles of Anjou to recover the island, which remained separate from Naples for nearly 150 years. Thus the house of Arragon came to be the natural allies of the Ghibellines, as the house of Anjou were the allies of the Guelfs. To the factions of Guelfs and Ghibellines were added in the republics the parties of the nobility and the people. Everywhere in Middle and Upper Italy there was anarchy and civil war. The free republics experi-

exceed constant revolutions, and were engaged constantly either in party strife, or war with towns or dynasties. The old confederacies were dissolved, and their place taken by new and transitory alliances. The honest exertions of the noble Gregory X. (who died 1276) to establish peace were of no avail; those of Nicholas III. (1277–81), who feared the preponderance of Charles, were more efficacious; but Martin IV. (1281–85), servilely devoted to Charles, destroyed everything which had been effected, and persecuted the Ghibellines with new animosity. A different interest—that of trade and navigation—impelled the maritime republics to mutual wars. The Genoese assisted Michael Palæologus (1261) to recover Constantinople from the Venetians, and received in requital Chios; at Meloria, they annihilated (1284) the navy of the Pisans, and completed their dominion of the sea by a victory over the Venetians at Curzola (1298). In Tuscany the party of the Guelfs formed themselves under the leadership of Florence and the influence of the church into a league for the maintenance of the national freedom against the imperial power. Only Pisa and Arezzo remained attached to the Ghibelline cause. In Lombardy it was different. Many towns, indeed, such as Novara, Lodi, Vercelli, Asti, Cremona, and above all Milan, formed themselves into a Guelf confederacy; but there was on the one hand an equally strong Ghibelline confederacy, consisting of the cities of Verona, Mantua, Treviso, Parma, Piacenza, Reggio, Modena, and Brescia, opposed to this, and, on the other hand, those who, with the title of capitani, ruled in name of the people, had generally no hesitation in increasing their authority by attaching themselves to the empire. Freedom seemed to have expired, when the people, weary of the everlasting feuds of their tyrants, rose in most of the cities, and expelled them (1302–6), including the Visconti, who had supplanted the Della Torre (1277) in the government of Milan.—2. *The Germans and the Della Scala.* Henry VII., the first emperor who had appeared in Italy for sixty years (1310), restored the princes to their cities, and found general submission to his requisitions, peace among the parties, and homage to the empire. Florence alone undertook the glorious part which she so nobly sustained for two centuries, as the guardian of Italian freedom, chose Robert of Naples, the enemy of Henry, her protector for five years (1313), and remained free while Italy swarmed with tyrants. Robert also held the dignity of Papal vicar in the States of the Church during the pontificates of John XXII. and Benedict XII., the popes then residing at Avignon under the influence of France in what is known as the second Babylonian captivity; but the authority of Robert in this capacity was merely nominal. He had no power to allay the violent discussions of the nobles, especially the Colonna and Orsini, or to check the general license and anarchy which prevailed. The Ghibelline Pisa received a master after the death of Henry (1313), in Uguccione della Faggiuola (1314), who also ruled over Lucca. After his expulsion Lucca received another lord in Castruccio Castracani (1316); Padua fell to the house of Carrara (1318); Alessandria, Tortona, and Cremona, to the Visconti of Milan; Mantua devolved, by inheritance, to the Gonzagas (1328); in Ferrara, the long-contested dominion of the Este was established (1317); and Ravenna was governed from about the beginning of the fourteenth century by the Polenta. In the other cities the same tyranny existed, but frequently changing from family to family, and therefore more oppressive. These petty princes, especially Della Scala, Matteo Visconti, and Castruccio, were a counterpoise to the ambitious views of Robert of Naples, son of Charles II. of Naples. Robert, however, acquired for his son, Charles of Calabria, the government of Florence and Siena, which he retained till his death. Louis of Bavaria, who came to Italy (1327) to reduce the Anjous and the Guelfs, became himself at variance with the Ghibellines, whom he alienated by his caprice and perfidy; and the character of John XXII. so cooled the zeal of the Guelfs, that both parties, recognizing the common interest of liberty, became somewhat more friendly. The amiable adventurer John, king of Bohemia, suddenly entered Italy (1330). Invited by the inhabitants of Brescia, favoured by the pope, elected Lord of Lucca, everywhere acting the part of a mediator and peacemaker, he would have succeeded in establishing the power at which he aimed, had he not been opposed by the Florentines. On his second expedition to Italy (1333) Azzo Visconti, Mastino della Scala, and Robert of Naples, united against him and his ally, the Papal legate Bertrand of Poggetto, who aspired to the dominion of Bologna. After the downfall of both (1334), when the Pepoli began to rule in Bologna, Mastino della Scala, master of half Lombardy and of Lucca, began to menace the freedom of Lombardy. Florence led the opposition against him, and excited a war of the league, in which it gained nothing but the security of its liberty. After the baffled Mastino had sold Lucca to the Florentines the Pisans arose and conquered it for themselves (1342). In Rome, still torn by the feuds of the nobles, Cola di Rienzi (1347) sought to restore order and tranquillity; he was appointed tribune of the people, but was forced, after seven months, to yield to the nobility. Having returned, after seven years of banishment, with the legate Cardinal Albornoz (1354), he ruled again a short time, when he was murdered in an insurrection. About this time Italy suffered by a terrible famine (1347) and a still more terrible pestilence (1348), which swept away two-thirds of the population. No less terrible was the scourge of the *bande* (banditti), or large companies of soldiers, who, after every peace, continued the war on their own account, ravaging the whole country with fire and sword; such as the bands of the Count of Werner and of Montreal. About this time the emperor Charles IV. made that expedition into Italy from which may be dated the gradual extinction of the political parties of Guelfs and Ghibellines. Charles had himself crowned King of Lombardy at Milan, and emperor at Rome, but he saw that neither of the Italian parties really desired foreign domination, and that the Ghibellines merely gave the empire their support for their own party purposes, and he therefore did not seek to strengthen himself by attaching himself to either party, but was content to add to his resources for the government of the empire in Germany by selling to the towns and princes the imperial rights in Italy. From this time forth, then, instead of the constant feuds between Guelfs and Ghibellines, we find princes and free towns contending with one another for the extension of their territories, and instead of the citizen armies of former times, bands of mercenaries whose enterprising leaders (condottieri) not seldom held the fate of states in their hands and acquired dominions of their own. In the middle of the fourteenth century the most aggressive family in Italy was that of the Visconti of Milan. In 1353 the republic of Geneva submitted to Giovanni Visconti, Archbishop and Lord of Milan, who in 1350 had purchased Bologna from the Pepoli; but his enterprise against Tuscany failed through the resistance of the confederated Tuscan republics. Another league against him was concluded by the Venetians (1354) with the petty tyrants of Lombardy, but in the end the former became not only opponents but rivals of the Milanese in their plans of aggrandize-

ment. In 1395 Giangaleazzo Visconti obtained from the Emperor Wenzel (Wenceslaus) Milan, as a duchy in fief, and within the next seven years brought under his power in succession Siena, Perugia, and Bologna, so that Florence alone still stood up for the cause of freedom, and it also was threatened. After the death in 1403 of this member of the Visconti family a great part of their possessions was lost during the minority of his sons, but their power was soon again in the ascendant. Duke Filippo Maria Visconti between 1416 and 1420 reconquered all his states in Lombardy, and in 1421 Genoa also submitted to him. In 1425 the Venetians in alliance with the Florentines conquered all the territory of North-eastern Italy as far as the Adda, which they retained in the Peace of Ferrara in 1428. After this humiliation of Milan there was for many years to come no state in Italy so much stronger than the rest as to endanger the balance of power; for although Naples and Sicily, the latter attached since 1409 to the Arragonese crown, were again brought under one ruler in 1435 by the succession of Alfonso V. of Arragon to the Kingdom of Naples, that monarch had his attention too fully occupied by the intrigues and disturbances of the Anjou party to be able to interfere in the affairs of the other states. Yet mutual jealousy still excited frequent wars, in which two parties among the Italian mercenary soldiers, the Bracheschi (from Braccio da Montone) and the Sforzeschi (so called from Sforza Attendolo), continued always hostile to each other, contrary to the custom of those mercenary bands. After the extinction of the male line of the Visconti (1447), Francis Sforza succeeded in gaining possession of the Milanese state (1450). On the death of Alfonso V. of Arragon Naples was again separated from Sicily, which remained attached to the crown of Arragon, and fell to John II. the brother of Alfonso, while Naples was inherited by Ferdinand the natural son of Alfonso. The Venetians having formed a union with some princes against him, found an ally in Florence, which, with a change of circumstances, wisely altered her policy. About this time the family of the Medici attained to power in that city by their wealth and talent. Milan, Venice (which possessed half of Lombardy), Florence (wisely managed by Lorenzo Medici), the States of the Church (for the most part restored to the holy see), and Naples (which was incapable of employing its forces in direct attacks on other states), constituted, in the fifteenth century, the political balance of Italy, which, during the manifold feuds of these states, permitted no one to become dangerous to the independence of the rest, till 1494, when Charles VIII. of France, at the suggestion of Lodovico Sforza (called il Moro), entered Italy to conquer Naples as the inheritance of the house of Anjou. After an unresisted march through Italy Charles took possession of Naples; but while he wasted his time in festivities at the capital a league was formed against him by the leading Italian states, who were joined by Ferdinand of Arragon, and he was compelled hastily to retreat, leaving only a small body of troops to protect his new conquest. In 1496 the whole of Naples was reconquered from the French by Gonsalvo of Cordova, the general of Ferdinand, and the Arragonese dynasty restored. Louis XII., the successor of Charles VIII., resumed the plans of the latter, and on this occasion Ferdinand of Spain was the ally of the French king. The two monarchs having conquered Naples fell to disputing among themselves as to the division of their conquest, war was declared between them, the result of which was that Ferdinand managed to retain the whole conquest for himself, which was thus reunited to Sicily and Arragon (1501–4). Louis was more successful against Milan, which, supported by hereditary claims derived through his grandmother Valentina Visconti, wife of Louis of Valois, Duke of Orleans, brother of Charles VI. of France, he subjected to himself in 1500. The attempts of Cesare Borgia, the son of Pope Alexander VI., to acquire the sovereignty of Italy were frustrated by the death of his father (1503), when the warlike pope Julius II. completed the subjugation of the States of the Church, not indeed for a son or nephew, but in the name of the holy see. He concluded with Maximilian I., Ferdinand the Catholic, and Louis XII. the league of Cambray (1508) against the ambitious policy of the Venetians, who artfully succeeded in dissolving the league, which threatened them with destruction. The pope then formed the so-called Holy League with the Venetians themselves, Spain and the Swiss, for the purpose of driving the French from Italy, but the object of the league was not carried out till later. Max. Sforza, who had reacquired Milan (1512), relinquished it without reserve to Francis I. (1515) after the battle of Marignano, but the Emperor Charles V. assumed it as a reverted fief of the empire, and conferred it on Francesco Sforza, brother of Maximilian (1520). This was the cause of violent wars, in which the efforts of Francis were always unsuccessful. He was taken prisoner at Pavia (1525), and, with his other claims, was compelled to renounce those on Milan, which remained to Francesco Sforza, and, after his death (1540), was granted by Charles V. to Filippo, the son of Francesco. The Medicean popes, Leo X. (1513–21) and Clement VII. (1523–34), were bent, for the most part, on the aggrandizement of their family. Charles V., to whom all Italy submitted after the battle of Pavia, frustrated indeed the attempts of Clement VII. to weaken his power, and conquered and pillaged Rome (1527); but becoming reconciled with the pope, he raised the Medici to the rank of princes. Florence, which through inner demoralization had lost its ancient love of freedom, and had already for a considerable time been in fact though not in name ruled by the Medici, was now converted into a regular principality under Alessandro de Medici, who was imposed on the Florentines by the arms of Charles V. (1530).

Seventh Period. Mutations of the Italian States down to the French Revolution.—After the extinction of the male branch of the marquises of Montferrat, Charles V. gave this state to the Gonzagas of Mantua (1536). Parma and Piacenza, which Julius II. had conquered for the Papal see, Paul III. erected into a duchy (1545), which he gave to his natural son Peter Alois Farnese, whose son Ottavio obtained imperial investiture in 1556. Genoa, subject to the French since 1499, found a deliverer in Andrea Doria (1528). He founded the aristocracy, and the conspiracy of Fiesco (1547) failed to subvert him. In 1553, besides Milan, Charles V. conferred Naples also on his son Philip II., and for a century and a half from this time the Austro-Spanish influence, unfortunately for the intellectual and political life of the peninsula, was predominant in Italy. In the second half of the sixteenth century the prosperity of Italy was increased by a long peace, as much as the loss of its commerce allowed. The tranquillity continued till the contest for the succession of Mantua and Montferrat after the extinction of the Gonzaga family (1627). Misfortunes in Germany compelled Ferdinand II. to confer both countries as a fief on Charles of Nevers, the *protégé* of France, whose family remained in possession till the war of the Spanish succession. The peace of Italy was not interrupted during the second half of the seventeenth century, except by the attempts of Louis XIV. on

Savoy and Piedmont, and appeared to be secured for a long time by the treaty of neutrality at Turin (1696), when the war of the Spanish Succession broke out. Austria conquered Milan, Mantua, and Montferrat (1706), retained the two first (Mantua was forfeited by the felony of the duke), and gave the last to Savoy. In the Peace of Rastadt (1714) Austria obtained, moreover, Sardinia and Naples; Savoy obtained Sicily, which it exchanged with Austria for Sardinia, from which it assumed the royal title. The house of Farnese becoming extinct in 1731, the Spanish Infant Charles, son of Elizabeth Farnese, daughter of the eldest brother of Antonio, the last duke of the Farnese family, obtained Parma and Piacenza. In the war for the Polish throne, of 1733, Charles Emmanuel of Savoy, in alliance with France and Spain, conquered the Milanese territory, and received therefrom, in the Peace of Vienna (1738), Novara and Tortona. Charles, infant of Spain, became king of the Two Sicilies, and ceded Parma and Piacenza to Austria. The Medici of Florence, entitled, since 1575, Grand-dukes of Tuscany, became extinct in 1737; and Francis Stephan, duke of Lorraine, then received Tuscany by the preliminaries of Vienna, and, becoming emperor in 1745, made it the appanage of the younger line of the Austro-Lorraine house. In the war of the Austrian Succession the Spaniards conquered Milan (1745), but were expelled thence by Charles Emmanuel, to whom Maria Theresa ceded in reward some Milanese districts. Massa and Carrara fell to Modena in 1743 by right of inheritance. The Spanish Infant, Don Philip, conquered Parma and Piacenza in his own name, lost them, and obtained them again as a hereditary duchy by the Peace of Aix-la-Chapelle (1748). Thus in the eighteenth century the houses of Lorraine, Bourbon, and Savoy possessed all Italy with the exception of the ecclesiastical territories, Modena, and the republics, which beheld with apathy operations in which they had no share. A quiet of forty years ushered in their downfall.

Eighth Period. From the French Revolution to the Peace of 1815.—The French revolution had a great influence on the history of Italy. In September, 1792, the French troops first penetrated into Savoy, even before the King of Sardinia had openly joined the Austrians in entering the first coalition. Though expelled for some time in 1793 by the Piedmontese and Austrians, they held it at the end of the year. The National Convention had already declared war against Naples in February, 1793. In April, 1794, the French advanced into the Piedmontese and Genoese territories, but were expelled from Italy in July, 1795, by the Austrians, Sardinians, and Neapolitans. It was different, however, when, in 1796, Napoleon Bonaparte received the chief command of the French army in Italy. He forced the King of Sardinia to conclude a treaty of peace, by which the latter was obliged to cede Nizza (Nice) and Savoy to France; conquered Austrian Lombardy, with the exception of Mantua; and exacted large sums of money from Parma, Modena, Tuscany, and other states.

In January of the following year (1797) Mantua also surrendered, and the rapid successes of the conqueror so alarmed the pope as to induce him to purchase peace by the cession of Bologna, Ferrara, and Romagna in Italy, and Avignon in France; the payment of a money indemnity, and the surrender of art treasures (Peace of Tolentino, 1797). Bonaparte then advanced into Austrian Germany, and a rising having taken place among the Venetians in his rear, he made this a pretext for overthrowing the Venetian state. In October, 1797, the Peace of Campo Formio was concluded, by which the Cisalpine Republic was formed out of the Italian territories which had been surrendered by Austria and the pope, together with some sections taken from other powers. Austria received in compensation Venetia and Dalmatia. (See CISALPINE REPUBLIC.) A few days later Sardinia concluded a treaty of alliance with France. The French then advanced towards Rome, overthrew the ecclesiastical government, and erected a Roman republic (1798). In Genoa, in the same year, Bonaparte occasioned a revolution by which a democratic republic was formed after the model of the French, under the name of the Ligurian Republic; and Lucca also was obliged to accept a republican form of government. In 1798 the second coalition against France was formed, and the King of Naples, instigated by his wife, a daughter of Maria Theresa, took the opportunity of sending a Neapolitan army to attack the French at Rome. The French were at first driven out, but under Championnet they soon returned, and repulsed the Neapolitan army, forcing it to retreat into its own territory, where they followed it. The court then fled from Naples to Sicily, and Championnet having taken the capital after an obstinate resistance, erected Naples into the Parthenopean Republic. The French directory likewise thought the formation of the second coalition a good opportunity for compelling the King of Sardinia to surrender his territories on the continent, and Piedmont received a military administration. The same fate befell Tuscany, which had formed an alliance with Naples and Britain. In consequence of the victories of the coalition, the French were again driven out of Rome, Naples, and the rest of Italy except Genoa, and the King of Sardinia and the pope returned to their capitals; but in the brilliant campaign of 1800 Napoleon destroyed all the advantages gained by the allies in Upper Italy, the most of which he reconquered. By the Peace of Lunéville (Feb. 9, 1801) the possession of Venice was confirmed to Austria. The Duke of Parma received Tuscany, and afterwards from Bonaparte the title of King of Etruria. Parma was united with France. The Cisalpine and Ligurian Republics were guaranteed by Austria and France, and with the Ligurian territories were united the imperial fiefs included within their limits. The King of Naples, who had occupied the States of the Church, was obliged to conclude peace at Florence (28th of March). By Russian mediation he escaped with the cession of Piombino, the Stato degli Presidj, and his half of the Island of Elba, together with the promise of closing his harbours against the British. The other half of Elba Tuscany had already relinquished to France; but the whole island was obstinately defended by the British and Corsicans, with the armed inhabitants, and not evacuated till autumn. The Stato degli Presidj France ceded to Etruria, September 19. To the republics of Genoa and Lucca the first consul gave new constitutions in 1801. In January, 1802, the Cisalpine Republic was transformed into an Italian republic, formed on the model of the new French constitution, and Bonaparte became president. He appointed the citizen Melzi d'Erile vice-president. Genoa also received a new constitution, and Girolamo Durazzo for doge. Piedmont, however, was united with France. After Bonaparte had become emperor in 1804 he attached (March 17, 1805) the royal crown of Italy to the new imperial crown; he promised, however, never to unite the new monarchy with France, and even to give it a king of its own. The new constitution was similar to that of the French Empire. Napoleon founded the order of the Iron Crown, and having placed the crown on his own head at Milan, May 26, he appointed his stepson Eugène Beauharnais

viceroy of Italy, who laboured with great zeal for the improvement of all branches of the government, of industry, and the arts. Circumstances, however, rendered this new government oppressive, as the public expenses during peace amounted to 100,000,000 francs (£4,000,000), which were all to be contributed by less than 4,000,000 people. No European power recognized expressly the Italian kingdom of Napoleon. The emperor continued to strengthen his power against the active enemies of the new order of things. He seized Dalmatia, and annexed it to the Kingdom of Italy, while he gave to his sister Elise Bacciocchi, wife of Pasquale Bacciocchi, Piombino and Lucca as French dependencies. On the 24th of May, 1806, Guastalla, on the 25th the Ligurian Republic, and on the 21st of July Parma and Piacenza were made French provinces. The pope was obliged to sanction the imperial coronation by his presence. In 1806 Naples also was occupied by the French, and on the 31st of March Napoleon gave it as a kingdom to his brother Joseph; and afterwards, in 1808, when Joseph was nominated to the throne of Spain, to Joachim Murat, grand-duke of Berg; while the English secured the rightful king Ferdinand in the possession of Sicily. In 1808 Etruria was annexed to France, and in 1809 Tuscany was given to Napoleon's sister Elise as a grand-duchy. In the same year (1809) the States of the Church were entirely united to France. After the Peace of Venice Istria and Dalmatia were separated from the Kingdom of Italy, and incorporated with the newly-created Kingdom of Illyria. Bavaria was obliged to cede to Italy the circle of the Etsch (Adige) in the Tyrol, a part of the circle of Eisack, and the district of Clausen.

The power of the French emperor was now, to all appearance, as firmly established in Italy as in all Europe. While the Italian people were supporting French armies, sacrificing their own troops in the ambitious wars of Napoleon in remote regions, and were obliged to pay heavy taxes in the midst of the total ruin of their commerce, all the periodicals were full of praises of the institutions for the encouragement of science, arts, and industry in Italy. After the fatal retreat from Russia, Murat, whom Napoleon had personally offended, deserted the cause of France, and joined Austria, Jan. 11, 1814, whose army penetrated into Italy under Bellegarde. The viceroy, Eugène, continued true to Napoleon and his own character, and offered to the enemies of his dynasty the boldest resistance, which was frustrated by the fall of Napoleon in France. After the truce of April 21, 1814, the French troops evacuated all Italy, and most of the provinces were restored to their legitimate sovereigns. The wife of Napoleon, however, the Empress Maria Louisa, obtained the duchies of Parma, Piacenza, and Guastalla, with reversion to her son; and Napoleon himself became sovereign of Elba, of which he took possession, May 4. But before the Congress of Vienna had organized the political relations of Europe, he effected his return to France, March 1, 1815. At the same time the King of Naples, Murat (see MURAT), abandoned his former ambiguous attitude, and took up arms, as he pretended, for the independence of Italy. But his appeal to the Italians, March 30, was answered by a declaration of war by Austria, April 12. Driven from Bologna by the Austrian forces, April 15, and totally defeated by Bianchi at Tolentino, May 2 and 3, he lost the Kingdom of Naples, into which the Austrian general Nugent had penetrated from Rome, and Bianchi from Aquila, seven weeks after the opening of the campaign. He embarked from Naples with a view of escaping to France, May 19. Ferdinand IV. returned from Palermo, and Murat's family found an asylum in Austria. Murat himself made a descent in Calabria from Corsica, in order to recover his lost kingdom, but was taken prisoner at Pizzo, brought before a court-martial, and shot, Oct. 14, 1815.

Meanwhile the Congress of Vienna, by the act of June 9, 1815, had arranged the affairs of Italy.—1. The King of Sardinia was reinstated in his territories, according to the boundaries of 1792, with some alterations on the side of Geneva; for the portion of Savoy left in possession of France by the Peace of Paris of May 30, 1814, was restored by the Treaty of Paris of November 20, 1815. To his states was united Genoa, as a duchy, according to the boundaries of that republic in 1792, and contrary to the promises made to Genoa.—2. The Emperor of Austria united with his hereditary states the new Lombardo-Venetian provinces formerly belonging to Austria—the Valteline, Bormio, and Chiavenna, separated from the Grisons, besides Mantua and Milan. Istria, however, was united with the Germanic-Austrian kingdom of Illyria; Dalmatia, with Ragusa and Cattaro, constituting a distinct Austrian kingdom.—3. The valley of the Po was adopted as the boundary between the States of the Church and Parma, otherwise the boundaries of January 1, 1792, were retained. The Austrian house of Este again received Modena, Reggio, Mirandola, Massa, and Carrara.—4. The Empress Maria Louisa received the state of Parma as a sovereign duchess, but by the Treaty of Paris of June 10, 1817, only for life, it being agreed that the Duchess of Lucca and her descendants should inherit it. Lucca in that case fell to the Tuscan dynasty, which in return resigned its districts in Bohemia to the Duke of Reichstadt.—5. The Archduke Ferdinand of Austria became again Grand-duke of Tuscany, to which were joined the Stato degli Presidj, the former Neapolitan part of the island of Elba, the principality of Piombino, and some small included districts, formerly fiefs of the German Empire. The Prince Buoncompagni Ludovisi retained all his rights of property in Elba and Piombino.—6. The Infanta Maria Louisa received Lucca, of which she took possession as a sovereign duchy 1817, with an annuity of 500,000 francs, till the reversion of Parma.—7. The territories of the church were all restored, with the exception of the strip of land on the left bank of the Po; and Austria retained the right of maintaining garrisons in Ferrara and Commacchio.—8. Ferdinand IV. was again recognized as King of the Two Sicilies. Britain retained Malta. The knights of Malta, who had recovered their possessions in the States of the Church and in the Kingdom of the Two Sicilies (in Spain, 1815), for a time made Catania, and after 1826 Ferrara their residence. The Republic of San Marino, and the Prince of Monaco, whose mountain fortress the Sardinians, and before them the French occupied, alone remained unharmed amid the fifteen political revolutions which Italy had undergone in the course of twenty-five years. The Austrian predominance was thus more firmly established than ever in Italy.

Ninth Period. From the Peace of 1815 to the Present Time.—Although the final result of all the commotions and changes that had taken place in the political situation of Italy and its component states since the outbreak of the French revolution was to leave the country in the same divided and dependent condition in which it had existed before, yet there was a strong desire of union and independence among the people. Traces of a struggle for a united and liberal government were almost everywhere visible; and several of the governments, Naples, Rome, and Turin in particular, in vain endeavoured to protect

themselves against secret political societies (Unitarians, Carbonari) and freemasonry by inquisitory tribunals, Jesuits, and secret police. While the spirit of Carbonarism (see CARBONARI), having for its object the union of Italy under one government, and its independence of foreign powers, particularly of Austria, excited by the Spanish revolution of 1820, threatened to subvert the political institutions of the peninsula in general, as well as of the single states; and in some places actually shook them, especially in Naples and Sicily, where in 1820 Ferdinand I. (IV.) was compelled to promise a constitution similar to that granted to Spain in 1812; and likewise in Sardinia, where Victor Emmanuel abdicated in 1821 in favour of his brother Charles Felix. The cabinets of the great European powers in the meantime supported the principle of conservatism by a prompt suppression of every tendency to revolution. Austria, as the power most nearly concerned in the insurrections in Italy, and which already in 1815 had acceded to the institution of a representative government, now undertook, with the approbation of the other powers assembled at the Congress of Laibach, to restore despotism in Naples and Sicily as well as in Sardinia, which actually took place in March and April, 1821. In accordance with the political maxims laid down at the Congress of Laibach and another subsequently held at Verona, the system of repression was, subsequently to these events, carried out with the utmost rigour. But whilst, on the one hand, a despotic reaction was systematically organized in various states by means of the Jesuits and similar agencies, a revival of the secret political societies took place, and diffused itself with equal vigour on the other. Against these the strongest measures were employed by government. Great cruelties were practised in Naples and Sicily, even on those who were only the objects of political suspicion; and this took place more especially in Modena, where in 1821 Duke Francis IV. had placed himself at the head of a system of secret police. In the Lombardo-Venetian Kingdom, in Parma and Lucca, as also in Tuscany and the Papal States, less stringent measures were adopted. The judicious policy of Pope Pius VII. and his secretary of state, Cardinal Consalvi, contributed much to soothe the popular mind and establish internal tranquillity—a system carried out by his successors, Leo XII. and Pius VIII., who contented themselves with merely excommunicating the Carbonari and other secret societies without calling to account the participators in earlier political unions. Their example was followed in Parma and Lucca, and likewise in Tuscany, when Leopold II. succeeded his father Ferdinand III.

The causes which had produced the Italian revolutions of 1820 and 1821 continued in the meanwhile to operate with unabated force; and by the arbitrary proscriptions and imprisonments of so many distinguished and popular individuals a still deeper hatred of government was roused. When in 1830, in consequence of the French revolution of July, a general spirit of revolt spread itself throughout Europe, the Italians likewise considered the state of events a favourable conjuncture for striking a blow for national and political freedom. But the hopes of the patriots were soon quenched. The risings in Modena, Parma, and Bologna were suppressed by Austrian troops, and the reigning princes who had been driven out of the first two states returned to their dominions. In the States of the Church the Papal troops, recruited from banditti and criminals, were employed to put down the uprisen provinces, and they behaved with so much violence that Austrian forces were necessary to defend the government and country from their own soldiers. In order not to allow all the power in Italy to fall into the hands of the Austrians the French suddenly occupied Ancona in February, 1832, and they retained it for several years. An invasion of Savoy from Switzerland by a band of Italian and Polish exiles under the Genoese Ramorino, undertaken with the purpose of overthrowing the Sardinian throne, and then in conjunction with the Italian patriots, headed by Mazzini, who gave themselves the name of 'Young Italy,' bringing about a revolution throughout the whole country, ended in a miserable failure (February, 1834).

On the failure and bloody suppression of these attempts at revolution an apparent tranquillity prevailed throughout Italy; but it was only the tranquillity of exhaustion. The unwearied activity of the secret societies, more especially of Mazzini's 'Young Italy,' with its republican tendencies, diffused itself over a great part of the peninsula. In 1838 Ancona was evacuated by the French; and at the same time the Austrian troops quitted the Papal States, while the amnesty, proclaimed a short time previously in Venice and Lombardy, appeared to produce a lasting conciliatory effect on the minds of the people. Yet the feeling of discontent secretly remained, and received support from the alertness and industry of the exiles and emigrants. Isolated attempts at revolt in the Romagna in 1843 and 1844 and the insurrection at Rimini in 1845 might at least be regarded as important symptoms, while the method adopted by the Papal government in dealing with these occurrences only served to widen the breach. Along with these revolutionary tendencies a definite wish for procuring a moderate amount of reform was gradually taking possession of the minds of the educated part of the community. This had already been discussed since 1839 in the assemblies of the *literati*, who, entertaining the idea of a national confederacy, supported the project of an Italian Customs Union or Zollverein, and rested their hopes partly on the milder and better administered government of Tuscany, partly on a peaceful revolution taking place in Sardinia. Governments such as those of Naples and Rome had lost all popular sympathy; and the rule of Austria in the north, notwithstanding the introduction of numerous improvements, had failed in conciliating the minds of the liberal and national party. A general languor and inaction had also, as afterwards appeared, crept by this time into the Austrian government, which neglected to secure the means of energetically withstanding a violent outbreak. At this conjuncture Pope Gregory XVI. died, in June, 1846, and the election of Cardinal Mastai Ferretti to the Papacy under the name of Pius IX. seemed to mark an epoch in the history of Italy, for the spirit of reform which he introduced into the government of the Papal States soon spread to Tuscany and Sardinia. Whilst thus in Rome, Florence, and Turin the new political system carried the day, and the inhabitants hailed with enthusiasm the altered times and the commencement of a new era, complaints resounded in corresponding proportion over the rest of Italy of oppression and neglect of public obligations. Naples and Austria stood forth more especially in opposition to the new system of politics. Naples had succeeded in suppressing the violent attempts made in the summer of 1847 without putting a stop, however, to the increasing ferment. In Lombardy Austria still maintained the old system, and by the investment of Ferrara in August, 1847, made a tolerably unmistakable declaration against the Papal policy. Among the small states, Modena, where in 1846 Duke Francis V. had succeeded his father, rejected all proposals of reform, in reliance on the Austrian bayonets. By

virtue of a treaty Lucca passed over in October, 1847, from a branch of the Bourbon family to Tuscany, whilst to these same Bourbons Parma, Piacenza, and Guastalla passed in December of the same year by the death of Maria Louisa. Here, as in Modena, the ruling powers sought to prop themselves by the assistance of Austria, which meantime found occupation for itself in an attack within its own territory. The opposition of the Lombardic population, nursed by political and national aversion, became more manifest every day, and from subdued murmurs of discontent proceeded to unconcealed expressions of hostility. Throughout the whole of Italy a hatred of the Austrian sway was systematically cherished, and to the whole movement a hostile direction gradually given against Austria. The old Austrian policy, now in its last agonies, found itself wholly incapable to meet in any way the threatened storm. The commotion was as great in other parts of Italy. In January, 1848, the inhabitants of the island of Sicily were in rebellion, demanding a constitution and ultimately the complete severance of the island from the continental government.

At this season of political ferment the revolution of February 1848 broke out in France, and produced an electric effect throughout Europe. Owing to the bitter hatred with which the inhabitants of the Lombardo-Venetian kingdom regarded the Austrian rule, sanguinary disturbances had already taken place in the previous month of January, and the violent proceedings instituted by the government against the principal actors in them, had only served to augment the general detestation of its sway. The proclamation of martial law in February could scarcely, in the visible decline of the Austrian power, produce the desired effect on the popular mind by inspiring terror. On the arrival of the news of the Paris revolution, the reserve, which had hitherto prevailed in upper Italy, was thrown aside, and the overwhelming intelligence of the insurrection in Vienna soon completed the universal eruption. Without the upright intention of accommodating matters by a comprehensive system of reform, or the power to crush opposition by military force, the Austrian government adopted a policy, characterized partly by timidity, partly by violence. The insurrection at Milan, on 22d March, followed by similar commotions throughout almost the whole of North Italy, compelled the Austrian army, under Field-marshal Radetzky, to evacuate the capital and retreat to Verona; whilst, at the same time, Venice, by the hasty capitulation of the authorities, recovered its independence, and the reign of despotism came to an end in Parma and Modena. These events inspired Charles Albert, king of Sardinia, with the hope of making himself master of the Lombardo-Venetian Kingdom, and carrying out his idea of a national Italian confederacy. He therefore declared war with Austria, and supported by numerous Italian free companies during the first period of enthusiasm and surprise, drove back the enemy's troops to the northern frontier of Italy. The position of affairs soon changed however. On the 6th of May Radetzky (then in his 82d year) successfully withstood the attacks of the Italians at Santa Lucia, not far from Verona, and on the 25th of July gained at Custozza a second bloody victory, which resulted in the reconquest of Milan and the whole of Lombardy. The King of Sardinia made his escape by night into his own territories, and then concluded an armistice with the victors. Pushed on by the democrats Charles Albert renewed his attempts in the following year (1849), but in a campaign of five days (March 20–24) the old field-marshal put a speedy termination to the enterprise, and frustrated the hopes of the Italian patriots. Charles Albert, despairing of his fortunes, abdicated in favour of his son Victor Emmanuel, and fled by secret roads from his dominions. The young king then concluded a disadvantageous peace with Austria. Since that date the Sardinian government has gone steadily onwards in the direction of liberal reform and development of its internal resources. Venice, favoured by its position, resisted for some months longer the besieging army of the Austrians, but was at last obliged to surrender (Aug. 25, 1849). In other parts of Italy events had meanwhile taken a similar course. In Rome, where Pope Pius IX., alarmed at the sudden outburst of revolutionary projects, checked himself in his career of reform, the excitement soon grew to such a pitch that he lost all control of his subjects. In vain he promised a constitution and summoned an assembly of the states to the capital. His minister Rossi was assassinated in November, 1848, whereupon the democrats took all the power into their own hands. The pope fled in terror to Gaeta, leaving his capital in the hands of the populace and the insurgent volunteers, who erected a Roman Republic, and even laid hands on the church property (Feb. 1849). Mazzini, the active head of 'Young Italy,' and Garibaldi, the leader of the volunteers, ruled in Rome. The pope now appealed to the protecting states for help, and was so far successful that a French army under General Oudinot marched up to the walls of Rome and demanded the restoration of the old order of things. When this was refused the French proceeded to lay siege to the city, but met with so determined an opposition, that it was only after frequent bloody contests, extending over several weeks, that the city fell into their hands (July, 1849). The republicans sought safety in flight, a French garrison was permanently posted in Rome, and under the protection of French bayonets the old condition of affairs was gradually restored. The insurgent Sicilians had no better success than the Lombards, Venetians, and Romans, being gradually subdued by the Neapolitan arms. In Tuscany, as in Rome, the democrats for a short period obtained the upper hand and compelled the grand-duke to flee, but the republican form of government lasted only a few weeks. Sardinia, therefore, remained the only state which preserved the constitutional benefits resulting from 1848, and strenuously withstood all requisitions to act otherwise. The Lombardo-Venetian Kingdom entered the states of the Austrian union, whilst, notwithstanding some isolated conciliatory measures, such as the re-establishment of a free port at Venice, the system of military dictatorship was still maintained. In Rome, which the pope again entered in April, 1850, the new organization of the state restored the spiritual rule, with a silent abrogation of the constitution of 1848. In Naples the last miserable shadow of freedom was abolished, and against the originators and promoters of the insurrection of 1848 there was opened an array of legal proceedings, the tyrannies of which engaged deeply the attention of foreign countries. In Tuscany, which was occupied by Austrian troops, and wholly bound to Austria by a military convention, despotism and priestly power returned in all their force. In Modena and Parma the returned princes, relying on the protection of Austria, pursued a policy of revenge and repression against the adherents of a free political life. In such circumstances the condition of Italy, harassed and unsettled, presented a most melancholy picture; nor could some important non-political improvements, including the formation of railways, the accession to the Austrian postal union, and the freedom of the navigation of the Po, effect any satisfactory amelioration. The extraordinary increase of robberies, especially in Central Italy, the almost unintermitted

exercise of martial law, the continued existence of secret societies, and the scantily veiled expressions of hatred to the ruling powers, in spite of all the military severity of governments, showed, as at Milan, in February, 1853, how unsatisfactory was the state of the political and social relations of the country. The same system prevailed with little amendment up to the year 1859. In Naples the cruelties exercised on political prisoners, which led to a cessation of intercourse between that state and Great Britain, were still continued with unabated severity, and a complete reign of terror prevailed throughout Southern Italy. Though in a milder form, the system of repression was likewise rigorously maintained in the central and northern states of the peninsula. Sardinia alone, true to constitutional principles, exhibited the happy results of free institutions in the midst of the surrounding despotism and intolerance, religious and political.

Austrian oppression in Lombardo-Venetia, the tyranny of the kings of Naples, and the misgovernment of the Papal States and of the duchies, abetted by Austria, led to the war of 1859, when France, siding with Sardinia, defeated the Austrians at Magenta (June 4) and Solferino (June 24), and drove them out of Lombardy, after which Francis Joseph, emperor of Austria, in a personal interview with Napoleon III., emperor of the French, at Villafranca, agreed to the preliminaries of a peace, stipulating for the surrender of Lombardy, as far as the line of Peschiera and Mantua, by Austria to France, the formation of a confederacy of Italian states under the presidency of the pope, and the return of the princes who had been expelled in the course of the war from their dominions by their subjects, provided that their return was not effected by foreign intervention but only by the will of their subjects. Of these three preliminaries only the first was ultimately ratified by the Treaty of Zürich (Nov. 10, 1859). Lombardy was ceded to France, who gave it up to the King of Sardinia, in return for which the latter ceded to France some time later Savoy, the ancestral domain of his family, and Nice. The other two stipulations of the preliminaries of Villafranca were not carried out. So far from inviting back their banished rulers, the inhabitants of the duchies hastened to summon assemblies to pronounce their deposition, and to annex themselves to Sardinia. Even Bologna withdrew from the Papal rule, and put itself under the protection of Victor Emmanuel. In March, 1860, popular votes were taken in Savoy, Nice, Tuscany, Parma, Modena, and the four northern Papal legations, constituting Romagna, in virtue of which the cession of the first two to France was carried into effect, and the remainder were incorporated in the Kingdom of Sardinia. Neither the protests of Switzerland against the surrender of the districts on the south of the Lake of Geneva, nor the ban of excommunication pronounced by the pope on the chief actors in these events, could prevent them from taking their course. Meanwhile the victorious career of Garibaldi in Sicily and Lower Italy had led to the dethronement of the King of Naples, and the detachment of the provinces of Umbria, Urbino, and the Marshes, with Benevento and Pontecorvo, inclosed by the Kingdom of Naples, from the States of the Church; and Sardinia intervening to complete the revolution, the whole of Italy and Sicily, except Rome and its vicinity and Venetia, was combined in a united realm, which, in 1861, was proclaimed as the Kingdom of Italy, with Victor Emmanuel as its sovereign, the temporal power of the pope being secured by French troops stationed in Rome. In the war which broke out in the spring of 1866 between Prussia and Italy combined on the one side, and Austria on the other, the Italian invasion of Venetia was repulsed in the battle of Custozza (June 24); but the Austrians, suffering heavy reverses from the Prussians, ceded Venetia to the Emperor of France, by whom its destiny was put to the vote of its inhabitants. Their vote being in favour of union with Italy, the province was accordingly joined to it. There was still one part of the Italian territory not included in the Kingdom of Italy, namely, the Papal States, where the pope continued to maintain his temporal authority under the protection of French troops. According to a convention concluded between France and Italy, Sept. 15, 1864, these troops were to be withdrawn in the course of the year 1866. This was, indeed, actually done, but their place was taken by a corps (the Antibes legion) levied in France and commanded by the French general Dumont, whom Napoleon sent in July, 1867, for the purpose. The protestations of the Italian government against this infringement of the spirit of the convention of 1864 were of no avail, and the convention was still further violated by a renewed direct intervention of Napoleon in the Papal States. On the outbreak of the Franco-German war, however, the French troops were withdrawn, and after the fall of the empire in consequence of the defeat at Sedan, the Italian government could no longer resist the demands of the press and of popular feeling, and occupied the Papal States (Sept. 1870), soon after which they were annexed to the Kingdom of Italy. While the pope was thus deprived of his temporal dominions, his spiritual independence was guaranteed. In 1871 the seat of government was removed to Rome from Florence (having until 1865 been at Turin). In 1878 Victor Emmanuel, the first king of united Italy, died, and was succeeded by his son Humbert, who, being assassinated in 1900, was succeeded by his son, Victor Emmanuel III. Latterly Italy has been in alliance with Germany and Austria-Hungary, the three powers having in view the preservation of the peace of Europe. The acquisition of territory in Africa has recently been pursued.

LANGUAGE AND LITERATURE. *Language.*—The origin of this beautiful and most harmonious tongue is lost in obscurity. The opinion that the Italian originated from a mixture of the classical Latin with the languages of the barbarians who overran Italy is erroneous. The Roman literary language, which the scholar learns from Horace and Cicero, was not the dialect of the common people. That the former could not have been corrupted by the mixture of the barbarous languages is proved by the fact that Latin was written in the beginning of the middle ages, long before the revival of learning, with surprising purity. After the language of common life had been entirely changed by the invasion of the northern tribes, in its whole spirit, rather than by the mere admixture of foreign words (a consequence of the change of the spirit of the people), then a new language of literature was formed, though the classical Roman still continued to be used. The new language was opposed to the variety of dialects which had grown out of common life; the formation of it, however, was slow, because the learned and the poets, from whom it was necessary to receive its stamp and development, despised it as an intruder on the Latin, which was venerable as well by its age, and the treasures handed down in it, as on account of the recollections of former greatness with which the suffering Italians were fond of flattering themselves. Even down to the present day literary Italian, the melody of which carries us away in the most unimportant author, is not to be found as the common idiom of the people in any part of Italy. It is a mistake to suppose that Boccaccio's language is to be heard from the lips of Tuscan peasant girls or

Florentine porters. Even the Tuscan and Florentine dialect differs from the pure language of literature, which, during the first centuries of Italian literature, is found purer in the poets of Sicily and Naples than in the contemporary writers of Tuscany. Dante, the creator, as it were, of Italian prose and poetry, and whose works are full of peculiarities of different dialects, distinctly maintains in a treatise, De vulgari Eloquio, that it is inadmissible to attempt to raise a dialect to a literary language. Dante, indeed, distinguishes in the *lingua volgare* (so the language was called which originated after the invasion of the barbarians) a *volgare illustre, cardinale, aulicum, curiale;* but this sufficiently proves that he held the opinion above stated. The dialects of Italy have undergone many changes since Dante's time, but they still retain the main characteristics ascribed to them by the poet. The broadest differences are those between the northern and southern dialects. In the former consonants predominate even in the terminations of words, and the corruptions of the original Roman vocables are very considerable; in the latter, on the other hand, vowels predominate, and especially the obscure sounds of *u* and *o*. In Central Italy, Tuscany, and the Papal States, upon which foreign influences have been comparatively slight, the language has maintained the greatest resemblance to the ancient Roman, and hence it is not to be wondered at that the higher classes in Tuscany and the Papal States unquestionably speak the purest Italian. In the north of Italy three distinct and well-marked dialects are spoken. The middle one is chiefly characterized by Teutonic hardness and Teutonic corruptions. In the east a quite peculiar dialect has been developed, bearing the stamp of effeminacy, and even, one may say, of childishness, and it is this dialect which has received more literary cultivation than all other dialects of Italy, as distinguished from the common literary language of the educated classes. In the west the influence of the French language is clearly discernible, although less in the Genoese than in the Piedmontese dialect, in the latter of which the peculiarities are so great that one might hesitate whether to reckon it among the dialects of Italian, or to consider it as a separate language.

The higher literary language of Italy, which grew up alongside of these dialects as early as the twelfth century, as Dante correctly observes, and which, through the fact that it most nearly approaches the ancient Latin, has been found capable of a higher development than any of the dialects properly so called, was first spoken in Sicily at the court of Frederick II., and then came to be used by the majority of poets in all districts of Italy. About the fourteenth century all traces of dialectical peculiarities, as well as of French and Provençal forms and idioms, which are very common in the older writers, disappear from the literary language of Italy, at any rate from the language of poetry. The poetical dialect of Italy, now a purely conventional one but one sanctioned by the use of centuries, was consciously formed chiefly by Dante, and afterwards by Petrarch, and appears to be fixed for all time coming. With regard to it there is no dispute; it has remained to the present day essentially the same as it was in the time of Dante. Italian prose has naturally not proved so stationary. The most ancient authors in this department were, like Dante, Tuscans or Florentines; and among them Boccaccio holds the first place, although his study of the ancient classics led him to give an excess of fulness to his language, and to affect a clumsy structure of sentence, which long continued to be defects of Italian prose, and which have found imitators even down to the most recent times.

As Italy, till very recently, possessed no centre of national culture, and as no prose writer succeeded in attaining so commanding a position as to be generally taken as a model by other writers, it constantly happened that on the appearance of a new work of any consequence violent disputes arose regarding its style. During the seventeenth and until after the middle of the eighteenth century the French language had a pernicious influence on the development of the Italian, since many Italians, from a partiality for the French nation and a love of the French philosophical culture of that period, went the length of repudiating the peculiarities of their own language, and in effect writing French with Italian words. It was only about the end of the eighteenth and the beginning of the nineteenth century that such writers as Monti, Perticari, &c., as patriotic as they were highly cultivated, put an end to this evil practice by their exhortations and their example. Italian prose, therefore, has not enjoyed a constant and uniformly progressive development, but has experienced several vicissitudes of growth and decline; and hence the time of Dante and Petrarch, the fourteenth century, is still justly regarded by the Italians as the golden era of their language, and called *il gran secolo*, or sometimes *il trecento*. After being neglected for a short period during the fifteenth century, on account of the extreme attention then bestowed by the educated classes on the ancient classical languages, it revived during the sixteenth in Ariosto, Guarini, and Tasso, in whom it reached the highest point of its development as to its form; sank during the seventeenth and eighteenth under the mischievous influence of Gallicism, and then in recent times experienced a new regeneration. At the present day efforts are being made to bring back the literary language of the new Kingdom of Italy to its ancient unity during the classic era of its history by taking the Florentine dialect as the basis. This movement was headed, during his lifetime, by the poet Manzoni, who in March, 1868, then eighty-four years of age, edited a report on the subject in conjunction with the journalist Bonghi.

The Italian language, as we find it at present, is essentially a Latin dialect, though changed in its grammar and construction by the infusion of the modern spirit into the antique, as the character of the people underwent the same change. A number of Latin forms of words, which, even in the language of the Romans, existed in common language (as, for instance, *o*, instead of *um*, at the end of a word), have been, by the course of time and revolutions in literature, elevated to a grammatical rank; and the same is very probably true of forms of phraseology. In many instances the Italian exhibits changes in the Latin forms which have evidently taken place in the same way, in which common people, in our days, corrupt the correct modes of speech by a rapid, or slurred, or mistaken pronunciation. This is partly the reason why the Italian has changed so considerably the proportion of the consonants to the vowels in Latin (from 1·2 : 1, the Latin proportion, to 1·1 : 1, the Italian proportion); and this is one of the chief reasons of the great and uniform harmony in the Italian language. A careful investigation will show that, in fact, little admixture of Teutonic words took place, but that it is much more the Teutonic, or modern spirit, which changed the language so considerably. The study of Italian has been carried on, in modern times, with great zeal, and a recurrence to the old writers has much diminished the influence of the French models, so general after the time of Algarotti. The principles according to which purity is now judged have been clearly laid down by Count Julius Perticari, son-in-law to Monti, in the work Amor Patrio di Dante (Milan, 1820), which powerfully opposes the

presumption of the Tuscans in claiming to be in possession of the only good Italian. This work was considered for a long time the production of Monti, who, by his Proposta di alcuni Correzioni ed Aggiunte al Vocabolario della Crusca, gave sufficient reason for such conjecture. To render the nobler language also the common property of the provinces, to which it had hitherto remained foreign, was the aim of Gherardini's Introduzione (Milan, 1815). So far, it must be confessed, the Italians cannot boast of having studied the grammar of their language with scientific thoroughness. The first work of any importance on this subject was that of Cardinal Bembo, which, begun perhaps about 1500, appeared for the first time in 1525, under the title of Prose. It was preceded only by some small treatises of no moment, by Fortunio, Liburnio, and Mercantonio Flaminio. The Prose, which is composed in the form of a dialogue, is neither scientific in its method nor complete in its matter, being based exclusively on Boccaccio and Petrarch. The endeavours of Count Giangiorgio Trissino to regulate the orthography of the language and to fix it by new characters had, after a long struggle, no other result than to introduce the consonants *v* and *j*. The following may be mentioned among the other grammatical works which had a considerable success in their own day, and have exercised some permanent influence:—the Ercolano of Varchi (Florence, 1570), the object of which was to vindicate the claim of the Florentine dialect to be regarded as the sole standard of literary correctness; Salviati's Avvertimenti della lingua (Venice and Florence, two vols. 1584–86), in which only the letters, the noun, and the article are treated of at length; Buommatei's Della lingua toscana (Florence, 1648), the first tolerably complete work of the kind, and adopted by the Accademia della Crusca. It has been several times republished. A rich store of observations and examples is to be found in the Osservazioni della lingua of Cinonio (Part I. Forlì, 1685; Part II. Ferrara, 1644, Milan, four vols. 1809). The first systematic and complete grammar, well furnished with good examples, is the Regole ed osservazioni of Corticelli (Bologna, 1785, and often subsequently), which is the source from which all modern grammarians have borrowed. Useful works on separate sections of the Italian grammar have since been published by Mastrosini (1814), Mannucci, Gherardini, Antolini, and others. Probably the best Italian grammar published in recent years is the Grammatica Italiana dell'Uso Moderno (Florence, 1881) by R. Fornaciari. Blanc's Italienische Grammatik (Halle, 1844) and Bockeradt's Lehrbuch der Italienischen Sprache (Berlin, 1878) are the most valuable works on the Italian language from a historical point of view.

Italian lexicography likewise dates from the sixteenth century, in the first half of which the meagre works of Minerbi (1535), Fabricio de Luna (1536), and Accaritio (1543) were published. Somewhat richer are Le Ricchezze della Lingua Volgare (1543) and Della Fabbrica del Mondo (1546) of Alunno. The first more complete Lexicon is the Memoriali della Lingua of Pergamini (1568). At last, in 1612, there appeared at Venice the Vocabolario degli Academici della Crusca, which confined itself with pedantic strictness almost exclusively to the authors of the Trecento and to Florentine speech; and while it carefully collected all the corruptions and mean expressions of the vulgar of Florence, left entirely out of account the language of social intercourse, and of the arts and sciences. Several revised editions have been published at various times, the most recent being that begun in 1863 and still in progress. That of Manuzzi (1831–44) should also be mentioned. The first non-Florentine but truly Italian dictionary is the Dizionario Enciclopedico of Francesco Alberti (Lucca, six vols. 1797–1805). Among the larger Italian dictionaries more recently published the principal are: Dizionario della Lingua Italiana (Bologna, seven vols. 1819–26); the large Dizionario Universale della Lingua Italiana, by Mortara, Bellini, Codagni, and Mainardi (eight vols. 1845–56); the dictionaries of Tommaseo and Bellini (1864); Carena (1851–53); Fanfani (1855; new edition, 1890); and Petrocchi (Novo Dizionario Universale della Lingua Italiana, two vols. Milan 1887–91). Dictionaries of synonyms have been published by Tommaseo (fifth edition, Naples, two vols. 1886) and Zecchini (new edition, Turin, 1892). The best Italian and English dictionaries are those of Petronj (Italian, French, and English); James and Grassi (1854; new edition, 1884); Millhouse (1850; new edition, 1889), and Jäschke (1894; English-Italian). Among dictionaries of the German and Italian languages may be mentioned that of Grünwald and Gatti (1893 onwards).

Literature.—One consequence of the irruption of the barbarians into Italy was a period of darkness and ignorance, as well as of disorder and distraction, from whose chaotic confusion the germs of a new civilization could only be developed slowly and laboriously. Out of this confusion the Italian language and Italian literature arose about the second half of the twelfth century. From its origin about that epoch to the present day Italian literature may be divided into five periods:—1, the period of the origin of Italian poetry under the influence of the Provençal poets down to the close of the era in which the first great Italian poets and prose-writers flourished (about the end of the fourteenth century); 2, the period of the predominance of classical studies (fifteenth century); 3, the period of the fusion of a genuine Italian culture with the spirit of the antique (sixteenth century); 4, the period of decline under French influence (seventeenth and eighteenth centuries); 5, modern literature (close of eighteenth century, with the nineteenth).

First Period. During the flourishing period of Provençal poetry many of the poets, wandering about in the exercise of their muse, were welcomed by the nobles of the various small states of Italy, especially in the north, and their example stirred up many Italians (the most famous of whom is Sordello of Mantua) to write poems in imitation of the Provençal poets, and even in the Provençal tongue. But about the close of the thirteenth century native poets arose, who indeed imitated the Provençals as to the form of their compositions, but wrote in their own language. At that date the court of Frederick II. at Palermo, where he resided till his elevation to the imperial throne, was the chief seat of Italian culture, and the centre of literary activity. Frederick II. and his sons Enzio and Manfred were themselves poets, and Pietro or Piero delle Vigne (or in the Latin form of his name, *Petrus de Vineis* or *Vinea*), the minister and friend of Frederick, was the author of numerous Italian songs, as well as of a sonnet, which has been preserved, showing that that form of poem is at least as old as the thirteenth century. At the same court there flourished Guido and Odo Colonna, Jacopo da Lentino, Ranieri, and Ruggicio da Palermo, and many others; whilst in other parts of Italy there lived during the same century the Bolognese poets Guido Guinicelli, Ghislieri, Fabricio, and Onesto, and the Tuscan poets Guittone d'Arezzo, Bonagiunta da Lucca, Gallo Pisano, Brunetto Fiorentino, Brunetto Latini, and Guido Cavalcanti, also called Benvenuto da Imola (died 1300), the last of whom, a friend of Dante, rises far above all the others. Contemporary

with these were the prose-writers Matteo Spinello, author of a chronicle of events from 1247 to 1268, the first work written in prose in the Italian language; Ricordano Malespini, also an historian, and Crescenzi da Bologna, a writer on agriculture. But the great luminary of this period is Dante (1265–1321), the creator, to a certain extent, of the Italian poetical language, and the author of the magnificent poem called La Divina Commedia, which contains in its melodious verses the whole wisdom and learning of the middle ages. He was a Florentine by birth, but lived during the last and greatest years of his life (1302–21) in compulsory exile, having been banished from the city by the party of the Bianchi as one of the leading members of the hostile party of the Neri. Of the minor works of Dante besides the De vulgari Eloquio, giving an account of the various dialects of Italian, which has already been mentioned in the section on the Italian Language, the Convito (Banquet), consisting of fourteen canzoni on philosophical subjects, the first three of which are accompanied by a prose commentary, deserves to be mentioned not merely on account of its intrinsic value, but also as presenting the first model of Italian prose. On the same occasion as that on which Dante was banished the same fate befell one Petracco, who, removing to Arezzo, became the father of Petrarch (Francesco Petrarca, 1304–74), another of the great lights of the golden era of Italian literature. His name is best known, perhaps, in connection with the sonnets in which he breathes out his quenchless love for Laura de Sade, a married woman whom he had seen at Avignon; but he was an extremely versatile writer, who wrote in prose as well as verse, and in Latin as well as Italian, and he exhibits in his various works not only the warmth of feeling which is so remarkable in his sonnets, but also a vast extent of erudition and great power of philosophical and moral reflection. The only other great writer of this era is Boccaccio da Certaldo (1313–75), author of the Decamerone (Ten Days), a work consisting of a series of 100 tales, which are represented as related in ten days, during a plague which raged at Florence, by a company of Florentine ladies and gentlemen. In imitation of these tales, many similar series appeared soon after, the most celebrated of which are the Cento novelle antiche, most of which are written from those of Boccaccio, but are not stained by the indelicacy which marks most of the latter; the Novelle of Franco Sacchetti, and the Pecorone of Ser Giovanni. Among the other writers of this period are Francesco Stabili or Cecco d'Ascoli (burned as a heretic in 1327), author of a poem called Acerba, directed against Dante, the only redeeming quality of which is its wit; Barberino, a popular poet; Cino da Pistoja (died 1336), praised by Dante for having improved the Italian language, author of a legal work called Il comento, of great value in its day; the chroniclers Dino Compagni, author of a fragment of Florentine history, Giorgio Villani (died 1348) and his brother Matteo (died 1363); and the earliest Italian writer of burlesque, Pucci. To the same period belong a number of romances of chivalry (Reali di Francia, relating the earliest achievements of Charlemagne; Guerino il meschino, Lancelot, Tristan, &c.), composed in imitation of those by French and Provençal writers. The travels of the renowned Venetian Marco Polo also fall to be mentioned during this period, although they were originally written in French, in order that they might obtain a wider circulation.

Second Period. This period, extending over the fifteenth century, is remarkable for the great interest taken throughout Italy in the study of the ancient classical languages, an interest so general and absorbing as to check the growth of the native literature. 'The Italians,' says Gibbon, 'were oppressed by the strength and number of their ancient auxiliaries: the century after the deaths of Petrarch and Boccace was filled with a crowd of Latin imitators, who decently repose on our shelves; but in that æra of learning it will not be easy to discern a real discovery of science, a work of invention or eloquence, in the popular language of the country.' Several causes may be assigned for this extraordinary devotion to classical studies. An impulse had been given to such studies by the example of Petrarch and Boccaccio in the previous century, and this impulse was strengthened by the arrival from Constantinople, even before the capture of that city by the Turks (1453), but especially after that event, of numerous Greek scholars, who brought with them the Greek language and manuscripts of the ancient Greek writers. At this time it happened that Italy enjoyed comparative peace, and that several of the states of which it was composed had at their head enlightened men, who were liberal patrons of literature, and eagerly welcomed at their courts the Greek refugees, whom they encouraged and supported in their own labours upon ancient authors and in diffusing a knowledge of Greek language and literature among the Italians, while they advanced such studies by their own example, and by devoting their wealth to obtaining manuscripts of the ancient classics from all accessible libraries in Asia as well as in Europe. The most celebrated of these patrons of scholarship and literature were the popes Nicholas V. (1447–55) and Pius II. (Æneas Sylvius: 1458–64); Cosmo de' Medici at Florence (1428–64), and his grandson, Lorenzo the Magnificent (1472–92); Alfonso, king of Naples (1435–58); the families of Visconti and Sforza in Milan; that of Gonzaga in Mantua, and Este in Ferrara. During his reign of eight years Nicholas V. amassed a library of 5000 volumes at Rome. Cosmo de' Medici, 'the father of a line of princes whose name and age are almost synonymous with the restoration of learning,' founded one library at Venice and three at Florence, where he also instituted an academy for the study of the Platonic philosophy; and his grandson Lorenzo, by means of his emissary Janus Lascaris, brought into Europe from the East 200 manuscripts, fourscore of which were as yet unknown in Europe. The efforts of scholars and patrons were greatly aided by the invention of printing, which took place about the middle of the same century. Printing-presses were set up at Venice, Bologna, and Rome, which rapidly multiplied the copies of the works of ancient authors, which were thus much more speedily disseminated than could have been the case if manuscript copying had continued to be the sole method of reproduction. The literatures which were thus, as it were, generally revealed were at once so novel in their character and so rich in their contents that it is not surprising that they should have both stimulated curiosity and excited enthusiastic admiration to such a degree as to lead to the almost total neglect of the native language and literature. The scholars of this period are so numerous that we can mention the names of only a few of them. One of the earliest of them was Francesco Filelfo, who lived under the patronage of Nicholas V., and translated the Iliad and Odyssey into Latin verse. The most noted of the other native Italian scholars are Poggio Bracciolini, Lorenzo Valla, Leonardi Bruni, Ambrogio Traversari, Pico della Mirandola, Cristoforo Landino, Marsilio Ficino, and Angelo Poliziano. Of the scholars just mentioned, Mirandola (1463–94) and Landino (died 1504) are those to whom most credit is due for implanting and propagating a love of knowledge among the Florentine youth. Before leaving the depart-

ment of scholarship it is right to mention the Greeks Chrysoloras, Bessarion, Constantine Lascaris, and Chalcondylas as among the most noted of those who during this age, although not natives of Italy, carried on their researches in Italy and under Italian patronage, and who contributed to produce that enthusiasm for the classical languages of antiquity which is characteristic of the period.

It was only towards the close of the century now under review that Italian literature, in the strict sense of the term, revived. Angelo Poliziano (1454–94), one of the ornaments of the court of Lorenzo the Magnificent, and already mentioned among the scholars of the period, was also one of the most celebrated of those who again employed Italian as a literary language, as in his Stanze and in the Favola d'Orfeo, the first original Italian drama. There was one class of poems in which the Italian language had never been disused, namely, the chivalrous epics belonging to the cycle of which Charlemagne forms the central figure, and his paladins the principal heroes. Such are the Buovo d'Antono, Innamoramento di Rè Carlo, and numerous others, but these are merely popular poems of small literary excellence. The earliest poem of this class which rose so high above the others as to take a permanent place in Italian literature was the Morgante Maggiore of Luigi Pulci (died 1487), the first canto of which has been translated into English by Lord Byron. In it the author, while imitating in part the heroic style common to all the writers of such poems, gratifies his own satire and scoffing humour by making a vein of burlesque run through the whole. The brothers of Luigi Pulci, Bernardo and Luca, were of little note. After the Morgante Maggiore the next romantic epic which appeared was the Orlando Innamorato of Boiardo (died 1494), a work exhibiting much greater elevation of sentiment than the former, and greater richness of invention, but harsh and antiquated in style, so much so as to be now read chiefly in the modernized form of Berni. The Mambriano of Cieco da Ferrara may also be mentioned as belonging to the same class. In a different kind of poetry the chief writers of this date are Matteo Palmieri (died 1475), author of Città di Vita, in a certain sense the last echo of Dante; Serafino Aquilano, an imitator of Petrarch, and Bernardo Accolti, who earned the surname of l'Unico from his renown as an improvvisatore. The Italian prose writers of this period include a few writers of tales (such as Masuccio Salernitano), one or two historians (as Pandolfo Collenuccio, historian of Naples, and Bernardino Corio, of Milan), some authors of travels, as the Genoese Giorgio Interiano, the Venetian Cadamosto, and the Florentine Amerigo Vespucci; besides two artists, Leon Battista Alberti, who wrote a dialogue, Della Famiglia, and Leonardo da Vinci, author of Trattato della Pittura. A considerable number of historical works were written in Latin, for example, the valuable history of that age by Æneas Sylvius, as well as the history of the Council of Basel, by the same author, and the first important history of Venice, written by Mercantonius Sabellicus.

Third Period. The sixteenth century in Italy includes both the most flourishing epoch of Italian literature and the beginning of its decline. In the early part of the century there were still many warm patrons of literature at the head of the different states, the most munificent of whom was Pope Leo X. (1513–21), the son of Lorenzo the Magnificent of Florence, and even farther on in the century the family of Este, in Ferrara, added lustre to its name by the support it gave to Tasso. Still, the general enthusiasm for literature and the honourable rivalry of the princes of Italy in its support disappear during this century. The ancient republican freedom had now, too, generally given place to the absolute power of sovereign princes, and the church had set itself to repress the reforming tendencies of the age; both of which circumstances had the effect of putting a check to the liberal classical culture and the eager spirit of inquiry which characterized the previous century. In the beginning of this century, however, classical studies still continued to flourish, and many of the best poets of the period still disdained to use any language but the Latin as a literary medium. Among these the most noted are Sadoletus, Vida, Navagerus, and in part also Sannazaro, although he also used Italian. These are known as authors only of short Latin poems; but a longer work, an epic called Syrias, by Angelio da Barga, appeared almost simultaneously with the Gerusalemme Liberata of Tasso, late in the century. Among the poems written in Italian in the early part of the century are Girone il Cortese, the subject of which belongs to the Arthurian cycle, and the Amadigi of Bernardo Tasso, a poet who would certainly have been more famous had his own renown not been eclipsed by that of his son Torquato. But far above all the poets of his time rises Lodovico Ariosto (1474–1533), author of Orlando Furioso, a romantic epic, written in continuation of the Orlando Innamorato of Boiardo, and the first which truly answered to the national taste. This continuation by Ariosto resembles its model in the gorgeous colouring which is given to all the accessories of the narrative, in the free play which is given to the imagination, in the stories of knightly prowess and deeds of magnanimous and often pompous daring, of love and of chivalrous courtesy, of the marvels of enchantment and the like; but it differs from the work of Boiardo in being relieved by a vein of humorous satire more delicate than that which runs through the Morgante Maggiore of Pulci, and far excels the Orlando Innamorato in picturesqueness of narration and beauty of language. The heroes of the poem belong, of course, like those of the Orlando of Boiardo, to the time of Charlemagne; still, it need not excite any wonder that the tales of such heroes were found so pleasing to the Italians of that day, for it must be remembered that Italy was then the battle-field of the neighbouring nations, France, Austria, and Spain, and the acts of courtesy and wonders of daring related in these romantic epics were paralleled by those ascribed by popular fame to the Chevalier Bayard, Diego de Paredes, Gaston de Foix, and other heroes in the wars between those countries. There is one other great poet belonging to this century, Torquato Tasso (1544–95), who still remains the favourite of his nation. His great work is the Gerusalemme Liberata, which is unsurpassed in beauty and sweetness of language, although wanting in many of the qualities which are necessary to constitute a good epic. He was born a lyric poet, and in vain endeavoured to attain by study to those powers which nature had denied him. Both Ariosto and Tasso were followed by trains of feeble imitators, none of whom are of sufficient note to deserve mention. In contrast to the serious and even solemn tone of Tasso, a large number of the poets of the sixteenth century are characterized by a spirit of frivolity and indifference which was much more in accordance with the taste of the educated classes of that time. This was pre-eminently the age of burlesque poetry. The chief poets in this department are Folengo, better known as Merlino Coccajo (died 1544), if not the inventor, at any rate the great improver of maccaronic poetry, and Francesco Berni (celebrated in another department as the renovator of Boiardo), originator of a

humorous kind of poetry which was called from him *bernesca;* but nearly all the learned men and statesmen of the period have furnished something in this style. The form which that kind of poetry generally took was that of short poems, called *capitoli*, in terza rima. In the more legitimate kind of satire the chief name is that of Ercole Bentivoglio (died 1573), a satirist of the true ancient Roman type. Pietro Aretino, who is credited with being the most indelicate of all Italian writers, shone in all departments of poetry. Lyric poetry was very abundant during this period. Nearly every author has left behind him at least one or two poems of the lyric kind; but the most celebrated among those who are at least chiefly, if not exclusively, lyric poets, are Pietro Bembo (died 1547), Giovanni dalla Casa, Angelo di Costanza, Annibale Caro (1507–66), renowned for his exquisite translations of ancient classics, and the poetess Vittoria Colonna (died 1547). Many didactic poets also belong to this period. The most noted is Rucellai, author of Le api. The tragedies of the period (such as the Tullia of Martelli, the Canace of Sperone Speroni, the Torrismondo of Tasso, &c.) are chiefly cold imitations of the ancients. The comedy, too, which found favour with the educated classes, was the ancient Latin comedy in an Italian dress. The chief authors in this department are Ariosto (who seems to be the best entitled to be considered the father of Italian comedy), Bibiena (Calandra), and Macchiavelli (Clizia and Mandragola). But alongside of this Latin comedy in Italian there grew up among the people a native product known as Commedia dell' arte, in which the author of the play merely sketched the plan and indicated the nature of the action in each of the scenes, but left the dialogue itself to the actors. Out of this was developed the Italian masque. The pastoral drama attained its highest development during this period. The first traces of this species of poetry are met with in the Ameto of Boccaccio, and the Arcadia of Sannazaro, the faithful adherent of Frederick III. of Naples; but it is found in a truly dramatic form first in the Favola di Cefalo, or the Aurora of Correggio Visconti (died 1506). The most celebrated work of this kind (at the best rather uninteresting) is the Pastor Fido of Giambattista Guarini (died 1612). The choruses in these pastoral dramas were usually sung, and this suggested the idea of setting whole pieces to music, whence arose the modern opera. The first attempts of this nature were made before the end of the sixteenth century by Ottavio Rinuccini of Florence (died 1621), and the musician Jacopo Peri in conjunction.

The prose writers of this period are scarcely less famous than the poets. They are chiefly political writers and historians. By far the most famous of the first class is Niccolò Macchiavelli (1469–1527), author of Discorsi sopra la prima deca di T. Livia, and of the notorious and much-debated treatise called Il Principe. In the department of history the Storia Fiorentina by the same author is also a master-piece. The only other political writer of eminence is Paruta (1540–98), author of Discorsi politici and Della perfezione della vita civile. Many of the historians of this period still continued to write in Latin, among whom are Paolo Giovio (died 1552), Rucellai, Galeazzo Capra, &c. The most famous of those who wrote in Italian are Francesco Guicciardini (1482–1540), author of the general history of his time; Nardi, Varchi, Nerli, Segni, &c., historians of Florence; Bembo, Paruta, and Contarini, historians of Venice; Giustiniani, Bonfadio, and Foglietta of Genoa; Cinzio and Falletti of Ferrara; Costanzo, Porzio, and Summonte of Naples; and Davanzati, author of a history of the Reformation in England.

There were also, as is natural in an age so renowned for its excellence in art, many writers upon painting, sculpture, and architecture. The most noted of these are Vasari (1512–74), author of the valuable lives of painters, sculptors, and architects; Palladio and Scamozzi, writers on architecture, and Raphaello Borghini, author of Il repose, a treatise on painting and sculpture written in the form of a dialogue, a favourite form with the prose writers of that period. With these may be reckoned the extremely interesting life of Benvenuto Cellini, the celebrated artist in metals. Matteo Bandello is the most celebrated author of Novelle during this period, but the works of this nature produced during the sixteenth century come far behind those of an earlier age. In philosophy the greatest names are those of Girolamo Cardano, Giordano Bruno, and Giulio Cesare; their works are, however, mostly written in Latin.

Fourth Period. In the early part of this period pure literature is entirely thrown into the shade by science, which then made gigantic strides in Italy. The Italian universities now reached their most flourishing condition under the fostering care of several patrons, the principal of whom was Ferdinand II., duke of Tuscany. Numerous scientific academies were founded, such as the Accademia dei Lincei, and the Accademia del Cimento, the latter of which, however, flourished during only a short period before it became extinct. By far the most eminent of the men of science of this period is Galileo Galilei (1564–1642), who deserves to be mentioned in a history of literature, not only on account of his scientific fame, but also for the literary elegance displayed in his Dialoghi and other works. After Galilei the most celebrated names in science are those of his pupils Viviani, Torricelli, and Castelli, besides those of Borelli, Malpighi, the three Cassini (father, son, and grandson), Bellini, and the famous physician and poet Francesco Redi. The most celebrated writer and lecturer on law of his day was Vincenzo Gravnia, author of L'origine del diritto civile. In philosophy Tommaso Campanella (died 1639), who may be regarded as the successor of Bruno, composed his interesting Poesie filosofiche, and Giambattista Vico (died 1744), wrote the Principj di scienza nuova, the earliest work on the philosophy of history. The only historians of importance are Sarpi, who wrote the history of the Council of Trent; Davila, historian of the civil wars in France, where he resided sixteen years; Bentivoglio, historian of the Flemish wars; and later Pietro Giannone (died 1748), author of a history of Naples. The rest are merely at the best industrious compilers; but the name of Muratori (died 1750), the celebrated annalist and collector of ancient historians, cannot be passed over, although his numerous works are written chiefly in Latin. Works on the history of Italian literature are particularly abundant during this period. The principal authors of such histories were Cinelli, Boccalini, Rossi, Fontanini, Gimma, Crescimbeni, Mazzucchelli, and above all Tiraboschi (1731–94). The most celebrated writers on the fine arts were Baldinucci, the continuator of Vasari, Dati, and Baglione, author of numerous biographies of artists. Bianchi was a writer of some note on various problems connected with politics and social life.

The decline which marks the fourth period into which we have divided the history of Italian literature is much more striking in the poetry than in the prose of the period. The corrupted taste already manifested in the Pastor Fido of Guarini, which during the seventeenth century was universally regarded as a masterpiece, became still more corrupt. The most esteemed poet of the period was Giambattista Marini of Naples (died 1625), whose two

chief works are La strage degli innocenti and Adone. The latter of these especially illustrates all the prevailing defects of the age, being full of plays upon words, balanced antitheses, fantastic metaphors and similes, in short, as far as possible from what is natural. His lyrics are mostly of the venal class of panegyrics, epithalamia, elegies, and the like. The majority of the contemporary and immediately subsequent poets were imitators of Marini, possessing all his faults, while they wanted his rich fancy and power of melodious expression. These were the most lightly thought of in their own day, yet almost the only poets of that period whose works still hold a place in Italian literature are those who kept themselves more or less aloof from the prevailing taste of the time. Such was Alessandro Tassoni (died 1635), whose mock heroic poem called La secchia rapita (The Stolen Bucket) is unquestionably the most important poetical production in Italian of the seventeenth century. There are two other works in the mock heroic style which may be mentioned, namely, Lo scherno degli Dei, by Francesco Bracciolini (died about 1645), and Il malmantile racquistato by Lorenzo Lippi (died 1664). The greatest satirists of the period were Trajano Boccalini (died 1613); the great landscape-painter, Salvator Rosa (died 1673), whose severe moral satires appear to have arisen from improvisations; and Benedetto Menzini (died 1704). Most of the lyrists of the period, especially in the earlier part, were imitators of Marini, but Gabriello Chiabrera of Savona (died 1637) must be mentioned as one who struck out an independent path, going back for a model to the ancient Greek lyric poet Pindar. His influence can scarcely be said to have improved the taste of the period. It was rather the source of another stream of corruption; for while he avoided the faults of the Marini school he fell into the opposite faults of bombastic magniloquence and high-flown pathos. The number of lyrists was largely multiplied in the last quarter of the seventeenth century. The leaders of the band were the physician already mentioned, Francesco Redi (died 1698), Francesco Filicaja of Florence (died 1707), both of whom attempted a revival of the classical lyric of Italy, for which Petrarch was the model; and Alessandro Guidi of Pavia (died 1712), cultivator of the Pindaric lyric introduced by Chiabrera. About this time a new direction was given to the efforts of the lyrists of the period, by an influence proceeding from the court of Queen Christina of Sweden, who then lived at Rome and gathered round her a nucleus of literary aspirants. The endeavour of the new school was to avoid as well the degenerate artificiality of the Marinists as the empty pathos of the Pindarists, and to impart to the lyric poetry of the time more simplicity and naturalness; but all that they succeeded in doing was to create a new conventional kind of lyric in a pastoral dress, as much open to the objection of mannerism and affectation as either of the styles it was set up to supplant. This new style received support from the Academy of Arcadians, founded about 1690. For more than half a century it was predominant in every department of pure literature in Italy except the drama, and its influence even extended to France and Germany. Among the more notable names of this part of the period are those of Innocenzo Frugoni of Genoa, Eustachio Manfredi, Giambattista Zappi, and Francesco Lemene of Lodi. Paolo Rolli (died 1767) may be specially mentioned for his endeavours to make the Italians acquainted with English literature (especially Milton), and for his agreeable imitations of Horace, the ancient Roman elegiac poets, and Anacreon. The only epic of this period that deserves mention (besides those of Marini and the mock-heroic poems given above) is the Conquisto di Granata of Girolamo Graziani (died 1675). The short tales called Novelle, which in previous centuries were so favourite a form of composition with the Italians, are now no longer produced. The drama during this period is almost choked by the increased devotion of the Italians to the opera, for which the libretti of Apostolo Zeno (died 1750), and the still more excellent ones of Pietro Trepassi called Metastasio (died 1782) were composed. The most celebrated dramatist of his time was Pier Jacopo Martelli (died 1727), who wrote in Alexandrine verse, which from him took the name of Martellian, but which was soon given up altogether, at least in tragedy. The Merope of Scipione Maffei is regarded as the best tragedy of the early part of the eighteenth century. Although the regular drama was thus in a very low state, the Commedia dell' arte still continued to flourish among the people, and the plays composed in this style by Tiberio Fiorillo (died 1694), as well as those by the landscape-painter already mentioned among the satirists, Salvator Rosa, were received in their day with great applause.

Fifth Period. About the middle of the eighteenth century a complete revolution took place in Italian literature, which was preceded and accompanied by a general elevation of public life. The study of the ancient classics and classical antiquities was revived; an enthusiasm for Dante took the place of the preference for Petrarch formerly prevailing; the influence of English and German literature began more distinctly to be felt; and all these circumstances contributed to communicate a more healthy tone to the national literature. Gasparo Gozzi (died 1786) and Giuseppe Baretti (died 1789) are perhaps more than any others entitled to the honour of being considered the leaders in bringing about this improvement. Both of these made an excellent use of the new art of journalism in propagating their own views and raising the national taste, the former in his Osservatore periodico (founded in 1761), and the latter in the Sferza letteraria (Literary Knout), which appeared between 1763 and 1765. About the same time appeared two works which exercised a wide and beneficial influence on the Italian mind. These were a translation of Ossian by Cesarotti, and Giorno, a satire of Giuseppe Parini (1729–99), a poem not less remarkable for the natural elegance with which it is composed than for the severity of the castigation which it bestows upon the Milanese nobles for the effeminacy of their life. The odes of Parini introduced a new era for lyric poetry, which, however, no longer occupies the prominent place in the literature of the country which it did during the prevalence of the Arcadian taste. The principal lyrists were Ippolito Pindemonte (died 1828), Giov. Fantoni, called Labindo (died 1807), and above all Ugo Foscolo (died 1827). Satirical and didactic poetry, on the other hand, became more common. The former is represented by the Sermoni of Gozzi, the Cicerone of Carlo Passeroni, Gli animali parlanti of Casti, the poems of Giusti (died 1850); besides the Giorno of Parini; and the latter by the Stato rustico of Vincenzo Imperiali, the Coltivazione de' monti of Bartolo Lorenzo (died 1820), the Bacchi di seta of Betti, and the poems of Arici (died 1836).

But it was in the drama, and more particularly the tragic drama, that the revival of Italian literature was most clearly discernible. Vittorio Alfieri (1749–1803) may be said to have been the creator of the national Italian tragedy, and next after Parini was the most remarkable poet of his time in Italy. He was succeeded by Vincenzo Monti (died 1828), who, both as dramatist and as lyric poet, was the Coryphæus of Italian literature during the period of the

French revolution and the first French Empire. The influence of Dante is very marked in his productions. Monti again was succeeded by Alessandro Manzoni (1784–1873), whose two historical tragedies Il conte di Carmagnola and Adelchi opened up a new path for Italian tragedians, a path in which he has been followed chiefly by Giov. Batt. Niccolini (died 1861), author of Giovanni da Procida, Arnoldo da Brescia, &c., and Silvio Pellico (died 1854), the most successful of whose tragedies was Francesca da Rimini. Since 1850 an increased activity has been produced on the Italian stage, partly by the more general introduction of English and German pieces, and partly in consequence of prizes being offered for the best native performances in this department. Giuseppe Revere, Dall' Ongaro, and (in Naples) Tommaso Arabia are the principal dramatists whose activity has been called forth by this means. As Alfieri was the creator of Italian tragedy, Carlo Goldoni (died 1793) was the great reformer of Italian comedy, on which he impressed a truly national stamp, although he cannot be said, in all respects, to reach the ideal of a writer of comedies. His principal rival was Carlo Gozzi (died 1806), who invented a peculiar species of comedy, the subjects of which he found in popular tales of fairies and the like. The most celebrated writer of comedies, subsequent to these two, was Alberto Nota (died 1847). Besides the writers of tragedy and comedy, in the proper sense, Giacinto Battaglia, Giacometti (died 1882), Gualtieri, and Fortis may be mentioned as the chief cultivators of what may be called the drama of common life during this period. Here also may be given the name of Romani, whose libretti greatly contributed to the success of Bellini and Donizetti as operatic composers.

One of the ways in which the effect of English and German literature showed itself in Italy was in the creation of a school of romanticists who looked back for inspiration to the middle ages, the literary and artistic treasures of which, belonging to Italy, they zealously brought to light. In the second decade of the present century a contest arose between classicism and romanticism, which in course of time resulted in favour of the latter. The most characteristic traits of the romantic school are to be seen in the lyric and epic poetry of the period, composed after German and English models (ballads, romantic epics, &c.); but the creations of the romantic school of Italian poetry in these departments are not so important as those in the region of tragedy, where Manzoni and his followers were its chief representatives. The romantic school has also the honour of adding an entirely new kind of literary production to the literature of the country. This is the patriotic historical novel of the kind invented by Sir Walter Scott, of which the earliest, as it is still the best, specimen produced in Italy was Manzoni's I promessi Sposi. Manzoni has been imitated in this kind of novel by Massimo d'Azeglio (died 1866), author of Ettore Fieramosca; Cesare Cantù, Tommaso Grossi, and numerous others. The Ultime lettere di Jacopo Ortis, a novel by Ugo Foscolo, though not of the historical kind introduced by Manzoni, having indeed preceded that kind of novel by many years, is yet due to foreign influence, its conception being derived from Goethe's Werther. The Italian novelists of the present day (such as Carcano, Ruffini, Bersezio, Dall' Ongaro, &c.) have forsaken the path of Manzoni. In poetry as well as in tragedy and romance Manzoni was the leader of the romantic school. In this department his chief followers are Giov. Berchet, Tommaso Grossi, Nicolò Tommaseo, and Prati. In poetry the leader of the classicists is Count Giacomo Leopardi (died 1887), and among his followers may be mentioned Marchetti, Alessandro Poerio, Terencio Mamiani, and the poetess Ferrucci. The most recent school of Italian poetry (comprehending Romani, Carrer, Aricì, Torti, Dall' Ongaro, Rossetti, &c.) cannot be said to belong to either of the two schools.

Among the prose writers of this period the historians take a prominent place. The principal are Denina (died 1813); Carlo Botta (died 1837); Pietro Colletta (died 1831), author of a history of Naples during its later period; Coppi, the continuator of Muratori's Annals; Cesare Cantù, author of a history of the world and other historical works—the last survivor of what is denominated the Guelph school of historians, which regards the Papacy as the keystone of Italian unity and the central point of modern civilization; and Ranieri, a Neapolitan historian, the chief modern representative of the historical school hostile to the Papacy. In addition to those who are, strictly speaking, historians, Massimo d'Azeglio, Balbo, Gioberti (died 1852), and Mazzini (died 1872) may be mentioned as having exerted, by their historico-political works, a powerful influence on the public opinion of Italy, and contributed accordingly to shape the course of recent events. In 1842 the Archivio storico Italiano was founded at Florence for the encouragement of historical studies. In the various departments of science the principal among the older names of the present period are those of Volta, Galvani, Scarpa, and Spallanzani; and among those of a more recent date, Marmocchi (in geography); Schiapparelli, Donati, Capocci, and Gasparis (in astronomy); Simonda and Filippi (in natural history); Piria (in chemistry); Melloni, Marianini, and Secchi (in medicine). At the close of the eighteenth century appeared two celebrated writers on the science of legislation—Gaetano Filangieri and the Marquis of Beccaria. In the early part of the nineteenth century philosophy was chiefly represented by Romagnosi; at a later date by Rosmini (1787–1855), Tommaseo Gioberti, &c. Rationalism has been represented by Ausonio Franchi, Greek philosophy by Centofanti (died 1880), and scepticism by Giuseppe Ferrari. Pasquale Galuppi (died 1846) was the first to make his countrymen acquainted with German philosophy, the chief recent adherent of which is the Hegelian Vera (died 1885). Linguistic and archæological studies have received a large share of attention; but none of the modern classical scholars rival the great Latin lexicographers of the eighteenth century, Facciolati and Forcellini. Among archæologists are Inghirami, Borghesi, Bossi, Visconti, Count Rossi; among Egyptologists, Rosellini and Peyron; among orientalists, Ascoli and Gubernatis. The principal Italian review is the Nuova Antologia, which is published at Florence.

The following are the principal works on the history of Italian literature:—Tiraboschi, Storia della Letteratura Italiana (Modena, 1772–83, and frequently republished), continued by Lombardi in his Storia della Letteratura Italiana nel Secolo XVIII. (Modena, 1827–30), and Levati in his Saggio sulla Storia della Letteratura Italiana ne' primi 25 anni del Secolo XIX. (Milan, 1831); Ambrosoli, Manuale della Letteratura Italiana (2nd edition, Florence, four vols. 1864; continued by Mestica, 1886 onwards); De Sanctis, Storia della Letteratura Italiana (1870–71); D'Ancona, Origini del Teatro Italiano (2nd edition, 1891); Storia Letteraria d'Italia Scritta da una Società di Amici sotto la Direzione di Pasquale Villari (6 vols., Milan, 1870 onwards); Bartoli, Storia della Letteratura Italiana (7 vols., Florence, 1878–89); and the Manuale by D'Ancona and Bacci (4 vols., 1892–93). Tiraboschi's is the basis of all subsequent works on the subject.

ART. *Architecture.* See ARCHITECTURE.

Painting and Engraving.—The art of painting was early introduced both into Italy and Germany by Greek masters; but the diversities of national character, climate, and religion produced different results in the two countries. A glowing imagination, an easy life, an innate sense of the beautiful, enthusiastic piety, the constant sight of nature in her fairest forms, and the contemplation of the master-pieces of ancient art, occasioned painting in Italy to unfold with great magnificence; while in Germany the ancient painters loved rather to dwell on the inward life and character. They were poets and philosophers who selected colours instead of words. The Italians have therefore remained inimitable in the ideal of this art, as the Greeks in statuary. The twelfth century is generally taken as the period of the beginning of the history of painting in Italy, but even before that time it had been the scene of the labours of Greek and Byzantine artists. During the pontificate of Leo the Great (440–461) a large picture in mosaic was executed in the Basilica of St. Paul, on the road to Ostia, and the portraits of the first forty-two bishops, which are seen in the same church, date their origin from the same time. Mosaic and encaustic painting was then the prevalent mode. Painting in distemper was afterwards introduced. About the end of the sixth century there were many paintings which were not believed to be the work of mortal hands, but were attributed to angels or blessed spirits. To this class, called *Acheiropoiëta* (not made with hands) belongs one of the most famous representations of the Saviour, in wood, at Rome, of which a sight can be obtained only with difficulty, in the *sanctum sanctorum*. In the eighth century painting on glass, mosaic on a ground of gold, and painting in enamel, were zealously prosecuted in Italy. There were already many native artists. One of the oldest monuments of art is the celebrated Christ on the Cross, in the Trinity church at Florence, which existed there as early as 1003. About 1200 a Greek artist, Theophanes, founded a school of painting in Venice. The genuine Italian style first bloomed, however, in Florence, and may be treated under three leading periods: 1, from Cimabue to Raphael; 2, from Raphael to the Carracci; 3, from the Carracci to the present time.

First Period. The art was first pursued with zeal in Pisa. The only artist of distinguished eminence who preceded Cimabue, who was born at Florence in 1240, was Guido of Siena, whose most celebrated work is a madonna, executed in 1221 for the church of San Domenico in his native place, where it is still to be seen. Cimabue, who was regarded as a prodigy by his contemporaries, first introduced more correct proportions, and gave his figures more life and expression. His scholar Giotto (died 1336) excelled him even in these respects, and exhibited a grace hitherto unknown. He was the friend of Dante and Petrarch, and practised with equal success historical painting, mosaic, sculpture, architecture, and portrait and miniature painting. He first attempted foreshortening and a natural disposition of drapery, but his style nevertheless remained dry and stiff. Bonifacio VIII. invited him to Rome, where he painted the still celebrated Navicella. He was followed by Gaddi, Stefano, Maso, and Simone Martini (Memmi). But Masaccio (properly Tommaso Guidi, born 1402) first dispelled the darkness of the middle ages, and a brighter dawn illumined the art. The Florentine Republic in the beginning of the fifteenth century had attained the summit of its splendour. Cosmo de' Medici patronized all the arts and sciences; Brunelleschi then built the dome of the cathedral; Lorenzo Ghiberti cast the famous doors of the baptistery in bronze; and Donatello was to statuary what Masaccio was to painting. Paolo Uccelli laid the foundation for the study of perspective. Luca Signorelli, who first studied anatomy, and Domenico Ghirlandaio, who combined noble forms and expression with a knowledge of perspective, and abolished the excessive use of gilding, were distinguished in their profession. Leonardo da Vinci (1452–1519), who was a master in all the arts and sciences, infused so much philosophy and feeling into the art that, by his instrumentality, it quickly reached maturity. From him the Florentine school acquired that grave, contemplative, and almost melancholy character to which it originally leaned, and which it afterwards united with the boldness and gigantic energy of Michael Angelo. The Roman school already enumerated among its founders the miniature painter Oderigi, who died in 1300. He embellished manuscripts with small figures. Guido Palmerucci, Pietro Cavallini, and Gentile da Fabriano were his most distinguished successors. Almost all the painters of this time were accustomed to annex inscriptions to their pictures: the annunciation to the Virgin Mary was their favourite subject. Perugia was the principal seat of the Roman school. As early as the thirteenth century there was a society of painters there. Pietro Vanucci, called *Perugino* (1446–1524), first introduced more grace and nobler forms into this school, whose character acquired from him something intellectual, noble, simply pious, and natural, which always remained peculiar to the Roman school. Perugino's great scholar Raphael soon surpassed all former masters, and banished their poverty, stiffness, and dryness of style. Taste came into Venice from the East. Andr. Murano and Vittore Carpaccio are among the earliest artists of that city. Giovanni and Gentile Bellino are the most distinguished painters of the earlier Venetian school. The latter laboured some time in Constantinople under the reign of Mohammed II. They introduced the glowing colours of the East; their style was simple and pure, without rising to the ideal. Andr. Mantegna (died 1506) was the first to study the ancient models. Padua was the principal seat of the Venetian school. Mantegna afterwards transferred it to Mantua, and his style formed the transition to the Lombard school. Schools of painting flourished in Verona, Bassano, and Brescia. Giovanni da Udine (who was so distinguished by his faithful imitation of nature in secondary things that he painted for Raphael the garlands around his pictures in the Farnesina), Pellegrino, and Pordenone were the most able predecessors of the two great masters of the Venetian school, Giorgione and Titian. No capital city served as the central point of the Lombard school. Bologna subsequently became the centre. Imola, Conto, Ferrara, Modena, Reggio, Parma, Mantua, and Milan were afterwards considered the seats of this school. Galasio (who lived about 1220), Alighieri, Alghisi, Cosimo Tura, Ercole Grandi, and especially Dosso Dossi (died 1560), were the principal painters of Ferrara. The last, a friend of Ariosto, possesses a remarkable grandeur of style, united with a richness of colouring which may bear comparison with that of Titian. Bramante (died 1514), who was likewise a great architect; Lippo Dalmasi; and especially Francesco Raibolini (died 1517), called *Francesco Francia*, were highly distinguished among the Bolognese masters. The latter, who was marked by a tender religious expression and uncommon industry, had the greatest veneration for Raphael. It is asserted that at the sight of the St. Cecilia of his master he was so struck with the impossibility of attaining the same perfection that he fell into a deep melancholy, and soon after died. Here also belongs the charming Innocenzo da Imola.

Second Period. We now come to the greatest masters of any age, who, almost at the same time, as heads of the four schools, carried every branch of the art to the highest perfection. In Italy they and their scholars are called *Cinquecentisti*, from the century in which they flourished. This period of perfection passed away rapidly, and soon required the violent restoration with which the third period commences. After Leonardo da Vinci, in the Florentine school, had settled the proportions of figures, and the rules of perspective and of light and shade, and his scholars, Luini (who united Raphael's style with that of his master), Salaino, and Melzo, besides the admirable Baccio della Porta, who is famous under the name of *Fra Bartolommeo* (died 1517), and whose works are distinguished for elevated conception, warmth of devotion, and glowing colours, had done much for the art, and after the gentle and feeling Andrea del Sarto (died 1530), the gifted Baldassare Peruzzi and the gay Razzi had made this school distinguished, arose the most extraordinary of all masters, Michael Angelo Buonarotti (1474–1564). His gigantic mind grasped, with equal power, statuary, architecture, and painting. His fire of composition, his knowledge of anatomy, the boldness of his attitudes and foreshortenings, leave him without a rival; but, as a model, he was detrimental to the art, because his imitators necessarily fell into exaggeration and contempt of a simple style. In grandeur his fresco painting the Last Judgment, in the Sistine chapel at Rome, is inimitable. Beauty was never so much his object as power and sublimity, especially since, in the former, he could never equal Raphael, but in the latter stood alone. Dante was his favourite poet. In his later years the erection of St. Peter's church almost entirely engrossed his thoughts. Rosso de' Rossi, Daniele da Volterra, Salviati, Angelo Bronzino, Alessandro Allori, and many others, were his scholars and imitators. If we turn our attention to the Roman school we find at its head the first of artists—Raphael Sanzio da Urbino (1483–1520). His genius showed itself as elevated in his fresco paintings, in the *stanze* and *loggie* of the Vatican (the former of which contain the School of Athens, the Parnassus, and the Conflagration of the Borgo, while the latter contain scriptural scenes from the creation through the whole Old Testament), as it appears lovely, spiritual, and original in the frescoes of the Farnesina (representing the life of Psyche). No less superior are his oil paintings, of which we shall only mention his madonnas, celebrated throughout the world, especially the Madonna del Sisto (in the Dresden gallery), the Madonna della Sedia (in Florence), Madonna della Pesce (in Madrid), Maria Giardiniera (in Paris), Madonna di Foligno (in Rome), his St. Cecilia (in Bologna), and his last work, the Transfiguration of Christ. His scholars and successors—the bold Giulio Romano (died 1546), the more gloomy Gianfrancesco Penni, called il Fattore (died 1528), the lofty Bartolommeo Ramenghi, surnamed *Bagnacavallo*, Pierino del Vaga (properly Buonaccorsi), Polidoro da Caravaggio, Gemigniani, Benvenuto Tisio da Garofalo, and many others—were skilful masters; but they forsook the path of their great pattern, and degenerated into mannerism. Federico Baroccio (died 1612) endeavoured to counteract this tendency. In spirit he belonged to the Lombard school, as he aimed at, and in part attained, the grace of Correggio. With his scholars Francesco Vanni and the brothers Zucchero he infused a new life into the Roman school, though the latter produced pleasing rather than great works, and fell into mannerism. Muziano was distinguished in landscape-painting, and Nogari and Facchetti in portrait-painting. At the head of the Venetian school we find the two excellent colourists Giorgione Barbarelli di Castelfranco (died 1511) and Tiziano Vecelli (died 1576). The portraits of the former are celebrated for their warmth and truth. The latter was great in all the departments of art, inimitable in his carnation, or painting of flesh tints, excellent as an historical and portrait painter, and the first great landscape-painter. Even in extreme old age his powers were unimpaired. Ariosto and Aretino were friends of the gay, happy Titian. He executed many works for the Spanish kings. Some of his most famous works are the altar-piece of St. Pietro Martire, his pictures of Venus, his Bacchanal, and his Children Playing, in Madrid, his Cristo della Moneta, &c. He first understood the art of painting with transparent colours. In groups, he selected the form of a bunch of grapes for a model. His successors—Sebastiano del Piombo, Palma Vecchio, Lorenzo Lotto, Paris Bordone, Pordenone—are distinguished, especially in colouring. Schiavone, whose *chiaroscuro* and richness of colour are truly remarkable; Giacomo da Ponto, called *Bassano*, who imitated reality, even in common things, to deception, and who was the head of a whole family of painters; the ardent, inspired Robusti, called *Il Tintoretto* (died 1594), and the fantastic, splendid Paul Veronese, properly Paolo Cagliari (died 1588), who painted boldly and brilliantly with a free pencil, but neglected all propriety of costume, and frequently mingled masks in historical paintings, were ornaments of the Venetian school. It likewise degenerated, and its mannerists were worse than those of the other schools, because they did not study the antiques and the ideal. At the head of the Lombard school we find the charming Antonio Allegri da Correggio (died 1534), whose works are distinguished for harmony of colours as well as for expression and grace. His successors and scholars were Francesco Rondani, Gatti, Lelio Orsi, and especially Francesco Mazzola, called *Il Parmegianino* (died 1540). This artist possessed much ease, fire, and a peculiar grace, which frequently borders on mannerism. Gaudenzio Ferrari and many others are the ornaments of the Milanese school. In Bologna we find Bagnacavallo (died 1542), a distinguished artist of this period, whom we have already mentioned as one of Raphael's scholars. Francesco Primaticcio (died 1570), Niccolò dell' Abbate, Pellegrino Tibaldi, Passarotti, and Fontana were also celebrated Bolognese artists.

Third Period. This period begins with the age of the three Carracci. These excellent artists endeavoured to restore a pure style, and, by the combined study of the ancient masters of nature and science, to give a new splendour to the degraded art. Their influence was powerful. The division into the four principal schools now ceases, and we find but two principal divisions—the followers of the Carracci, who are called eclectics, and the followers of Michael Angelo da Caravaggio, who are called naturalists. Lodovico Carracci (born 1555, died 1619) was, according to some accounts, the uncle, according to others the cousin of the two brothers Agostino (born 1558 or 1559, died 1601) and Annibale (born 1560, died 1609). In 1589 all three united in establishing at Bologna an academy for painting, which was called Accademia degli Incamminati, and soon became so famous that all other schools for painting in the city were closed from want of attendance. The scholars of the Carracci are numberless. The most famous endeavoured to unite the grace of Correggio with the grandeur of the Roman masters. Cesare Aretusi was distinguished for the most faithful copies of Correggio and Guido Reni (died 1642), especially for the ideal beauty of his heads, the loveliness of his infant figures and the uncommon facility of his

pencil. The Bolognese Francesco Albani (died 1660) lived in constant rivalry with Guido. He produced many large church paintings, but was most celebrated for the indescribable charm with which he represented, on a smaller scale, lovely subjects from mythology, and especially groups of Cupids. His paintings in the Verospi gallery, and his Four Elements, which he painted for the Borghese family, gained him universal reputation. The back-ground of his landscapes is excellent. All his works breathe serenity, pleasure, and grace. The third great contemporary of those already mentioned, Domenico Zampieri, called *Domenichino* (died 1641), was at first little esteemed by them, on account of his great modesty and timidity. Thrice were prizes awarded by Lodovico to drawings, the author of which no one could discover. At last Agostino made inquiries, and the young Domenichino timidly confessed that the drawings were his. His industry and perseverance rendered him the favourite of his master. His works evince the most thorough knowledge, and are rich in expression of character, in force, and truth. His Communion of St. Jerome, his Martyrdom of St. Agnes, and his fresco in the Grotta Ferrata, are immortal master-pieces. Giovanni Lanfranco (died 1647) was especially distinguished for the effect of his light. Bartol. Schidone is one of the best colourists of this school. The Bibienas, the Molas, Al. Tierini, Pietro da Cortona, Ciro Ferri, also deserve mention. At the head of the naturalists, who, with a bold and often rash pencil, imitated nature, without selection, stands Michael Angelo Merigi, or Amerigi da Caravaggio (died 1609). The chief of those who in a later age took him as a model was Salvator Rosa (died 1673), to whose name may be added those of Preti (*il Calabrese*) and Giuseppe Crespi, called *Spagnuolo*. His chief opponent in Rome was D'Arpino, who stood at the head of the idealists, or rather of the mannerists. Caravaggio and his successors, Manfredi, Leonello Spada, Guercino da Cento, &c., often took common nature for a model, which they servilely imitated, thus profaning the genuine dignity of the art, though they cannot be denied strength and genius. About this time, the beginning of the seventeenth century, the *bambocciate* were introduced. (See Laar, Peter.) Many artists, especially Michael Ang. Cerquozzi, surnamed *delle battaglie* and *delle bambocciate*, followed this degenerate taste. Andrea Sacchi made great efforts to oppose him. His drawing was correct and grand; Raphael was his model.

Italian art, already in the seventeenth century very far sunk below the purity of style and the nobility of composition which distinguished it in the time of Raphael, during the eighteenth century fell into a complete decay. Three or four names of this epoch, those of the Neapolitan Solimena, the Venetians Tiepolo and Canaletto, and the Luccese Pompeo Battoni, alone deserve to be saved from oblivion. During the first half of the nineteenth century the artists of Italy still confined themselves to dull imitations of the ancient masters and to academical commonplaces. The Milanese Andrea Appiani is the only one that need be separately distinguished among the crowd. The other more tolerable painters of this period are Francesco Hayez, Vincenzo Camuccini, Pietro Benvenuti, and Giuseppe Bezzuoli. At the present day an improvement is discernible in the position of Italian art, and serious efforts are being made to rise above the standard of academic conventionality. Among the chief artists are Ussi of Florence, Andrea Gastaldi of Turin, Federigo Faruffini of Sesto, Domenico Morelli, Francesco Castiglione, Camillo Miola, and others belonging to Naples, Pompeo Molmenti of Venice, &c.

The chief authorities on the history of Italian art are, besides Vasari, Ranalli in his Storia delle belle arti in Italia (Flor. 1856), Lanzi in his Storia pittorica della Italia (2d. ed. Pisa, 1848–52), and Crowe and Cavalcaselle in their History of Painting in Italy (Lond. vols. i.–iii. 1864–67).

In the art of engraving the Italians have acquired great eminence. Tommaso Finiguerra, who flourished 1460, was the first celebrated master of this art, which he taught to Baccio Bandini. They were succeeded by Mantegna; but Marco Antonio Raimondi, of Bologna, who lived in 1500, was the first to introduce greater freedom into his engravings. His copies of Raphael have always been highly valued, on account of their correctness. His manner was imitated by Bonasone, Marco da Ravenna, Ghisi, and others. Agostino Carracci, Parmegiano, Carlo Maratti, and Pietro Testa etched some excellent works. Stefano della Bella was distinguished for his small, spirited, and elegant pieces. Among the moderns, Bartolozzi deserves mention in stippled engraving. Cunego, Volpato, and Bettelini are also distinguished; but, above all, Giuseppe Longhi (died 1831) and the Florentine Raphael Morghen (died 1833), who carried the art of engraving to a degree of perfection never before anticipated. Among the most celebrated Italian engravers subsequent to these two are Faustino, Pietro Anderloni, Domenico Marchetti, L. Calamatta, Giuseppe Bianchi, Pietro Fontane, Cremonesi, Michele Bisi, Filippo Caporali, Locatelli, and Faruffini.

Sculpture.—Although Italy has possessed some eminent sculptors, this branch of art (apart from some great works of Michael Angelo) never attained so high a position in that country as painting. Nothing need be said of the sculptures which decorate the monuments erected during the Romano-Byzantine period of Italian art. For the most part they merely reproduce conventional types, and they are uniformly very roughly executed. To Niccolò da Pisa in the thirteenth century belongs the honour of having first broken loose from the barbarous manner of the early carvers in stone, and to have taken as models the master-pieces of ancient art. His numerous works (among others the pulpit in the baptistery of Pisa and the tomb of Saint Dominic at Bologna) clearly reveal the new source of inspiration. Niccolò had a worthy successor in his son (according to other accounts brother), Giovanni da Pisa, who in his turn trained up a school of sculptors in the true principles of the art. The most famous of these are the brothers Agnolo and Agostino da Siena and Andrea da Pisa. The influence of Giovanni da Pisa may also be traced in the magnificent works of Masuccio, Pietro, Stefanoni, and others, all of whom were distinguished in architecture as well as in sculpture, for it must not be forgotten that at that time, and even as late as the fifteenth century, sculpture and even painting were rather regarded as handmaids of architecture, than as separate arts regulated by laws of their own. Hence it was necessary for the architect to possess a thorough knowledge of all the three arts, and thus we find that several masters, such as Giotto, Andrea, Orcagna, Leonardo da Vinci, Michael Angelo, and Raphael were at once architects, painters, and sculptors, that others were architects and painters, and still more architects and sculptors. During the fifteenth century the sculptors of Florence, then the metropolis of the arts, excelled all their rivals, as much as her painters and architects did theirs. At their head stand Lorenzo Ghiberti (died 1455), and Donatello (died 1466), both of whom instead of contenting themselves with a mere imitation of the works of antiquity, only looked to them for lessons as to the manner in which nature was to be understood and

interpreted, while in other respects they followed an independent path. Among the other great artists of the period were Filippo Brunelleschi, Giacomo della Quercia, and Niccolò d'Arezzo, all of whom besides Donatello were competitors with Ghiberti in the case of the famous bronze doors of the baptistery of the church of San Giovanni at Florence. (See GHIBERTI.) Giacomo della Quercia afterwards rendered himself celebrated by executing the central door of the cathedral of Bologna. Brunelleschi was so much devoted to architecture that he has left behind him but a small number of sculptures. Luca della Robbia was also eminent among the masters of that time, but his works are chiefly in enamelled earthenware, the secret of making which he discovered himself. The best pupils of Donatello were Desiderio da Settignano (died 1485), and Andrea Verrochio, a jeweller, sculptor, engraver, painter, and musician, celebrated as the sculptor of one of the most admirable equestrian statues in bronze anywhere to be seen, that of Colleone at Venice, and no less so as the teacher of Leonardo da Vinci and Michael Angelo. The other chief sculptors of the fifteenth century are Matteo Civitali, Benedetto da Rovezzano, and Lorenzo di Pietro (called *Il Vecchietta*), the last also celebrated as a painter and an architect. In Michael Angelo the Italian renaissance in statuary reached its highest point. That great artist gave to the human form a character of force and majesty, and in action a fulness and vehemence which he did not always keep within the limits of reality, but which constitute the sublime and truly original aspect of his works. His great misfortune was to be followed by a crowd of imitators, who exaggerated the majesty of his style to a ridiculous extreme. The two most illustrious of his pupils were Montorsoli and Baccio da Montelupo. Sansovino (died 1570) was able to preserve himself from a servile imitation, and became the founder of a school at Venice, from which proceeded Cattaneo, Pietro da Salo, Jacopo Colonna, and others. Besides these the sixteenth century numbers among its celebrated masters of the chisel Benvenuto Cellini, more famous as a designer in metal than as a sculptor in marble; Tribolo, Vincenzio Danti, Giovanni Merliano da Nola, called the Michael Angelo of Naples, &c. With Bernini in the seventeenth century statuary underwent a complete decline similar to that which befell the other arts as well as literature during the same period, from which condition it did not rise again till about the end of the eighteenth and the beginning of the nineteenth century, when a renewed lustre was shed on the Italian school of sculpture by Antonio Canova (died 1822), who acquired an immense reputation, partly justified by the grace of his figures and the delicacy of the execution. After him Lorenzo Bartolini (died 1850) acquired distinction by the excellence of his works. The chief defects of this artist and of the Italian sculptors of the present age generally is the want of originality of conception and breadth of execution.

MUSIC.—It was in Italy that the imperfect forms of ancient music were first lost in the modern. Here we first find the proper choral song, the foundation of modern church music, which was at first sung in unison, chiefly in melodies derived from the old Græco-Roman music, and adapted to Christian hymns and psalms. (See MUSIC.) It seems to have had its origin when Bishop Ambrosius, in the fourth century, introduced into the Western Church songs and hymns adapted to the four authentic modes of the Greeks, and appointed psalmists or precentors. Gregory the Great, in the sixth century, enlarged the choral song by the plagal modes. From this time singing-schools were multiplied, and much was written upon music. The most important inventions for the improvement of music generally we owe to the eleventh century, and particularly to the Benedictine Guido of Arezzo, who, if he did not invent the mode of writing musical notes and the use of the clef, improved and developed them, determined the exact relations of the tones, named six of the tones of the scale, and divided the scale into hexachords. In the thirteenth century the invention of music in measure was spread in Italy, dependent upon which was that of counterpoint and figured music. Instruments were multiplied and improved in the fourteenth and fifteenth centuries. Many popes favoured music, particularly vocal, and consecrated it by their briefs; yet the ecclesiastical ordinances restrained the independent development of music. Much instruction was given in singing in the fifteenth century, and not entirely by monks. Music acquired the rank of a science, and vocal music in counterpoint was developed. In the sixteenth century we discover distinguished composers and musicians—Palestrina (chapel-master to Pope Julius III.), whose works possess great dignity and scientific modulation; his successor, Felice Anerio; the celebrated contrapuntist and singer, Gregorio Allegri; and the writer upon harmony, Giuseppe Zarlino, chapel-master at Venice. Music was cultivated at Rome and Venice with the greatest zeal. Hence it spread to Naples and Genoa; and all Italy, Schubert says, was soon a loud-sounding concert-hall, to which all Europe resorted to hear genuine music, particularly beautiful singing. About the end of the sixteenth century we first meet with the profane music in the form of the opera. The first operatic composer was Jacopo Peri. The taste for this new kind of composition spread so quickly, that composers were soon unable to supply the demands of the people, and from forty to fifty new operas appeared yearly in Italy. This caused great competition among the Italian musicians. Thus the peculiar character of the Italian music, not to be changed by foreign influence, was developed the more quickly, because this species was cultivated independently, and unrestrained by the church. Already, in the middle of the seventeenth century, when the music of the theatre was continually advancing, simplicity began to give place to pomp and luxuriance, and the church style to decline. Music (says Schubert) united the profane air of the drama with the fervour of the church style, and this was the first cause of the decline of the latter. Let us now consider the principal periods of the former. Vocal music must have been first; it was regulated by the discovery and improvement of instruments; thence arose the simple, grand church music of the fifteenth and sixteenth centuries; with it various forms of national song were developed. On the stage the higher style of music flourished independently. Here the Italian, without much attention to the poetical part of the performance, which was, as a rule, only the hasty work of a moment, though an exception must be made in favour of the operatic texts of Metastasio, followed his inclination for melody and sweet sounds, which appears even in his language. All the southern nations show a great sensibility, and melody is to them as necessary as harmony to the inhabitants of the north; but to no nation so much as to the Italians, whose beautiful climate and happy organization for song (Italy produces the most beautiful alto and tenor voices—few bass) made melody their chief aim in their music. On the other hand, the simplicity of melody degenerated into effeminacy and luxuriance, from the time when vocal music developed itself independently, and the voice, but little supported by the instrumental music, began to be cultivated like an instrument; when, instead of poetical expression and truth, mere gratification of the ears, not deep emotion, but a

momentary excitement, and a rapid change of tones, with the avoidance of all dissonance, were principally desired; when music began to predominate over poetry, which first took place on the stage, and thus the musical part of the performance obstructed the improvement of the dramatic and poetic. This taste spread over other countries so much the more easily as Italian music had advanced by rapid strides far before that of the rest of Europe, as appears even from the predominance of Italian terms in the language of music. Among the best composers of the seventeenth century are Girolamo Frescobaldi, Francesco Foggia, Bapt. Lully, and the celebrated violinist and composer Arcangelo Corelii. To the singers, of whom the most were also composers, belong Antimo Liberati, Matteo Simonelli, both singers in the chapel of the pope. In the beginning of the eighteenth century Ant. Caldara was distinguished. He increased the effect of the singing by the addition of instruments, but his style partook much of the theatrical. In the middle of this century Italian music, especially theatrical, flourished, particularly at Naples, Lisbon, and also in Berlin. This has been declared by some the most brilliant period of Italian music. There were some distinguished instrumentalists in Italy, as the organists Scarlatti and Martinelli, the violinist Tartini, Domenico Ferrari, Geminiani, Ant. Lolli, Nardini, and Clementi. Among the composers of the eighteenth century may be mentioned Traelta, who, through his refinements, injured the simplicity of composition; Galuppi, distinguished by simple and pleasing song, rich invention, and good harmony; Niccolo Jomelli, who gave greater importance to instrumental music; Nic. Porpora, distinguished for his *solfeggios* in church music; Pergolesi, whose music is always delightful from its simple beauty (for example, his Stabat Mater); Pater Martini, at Bologna; the sweet Piccini, rival of Gluck; the agreeable Sacchini Sarti. Of a later date are Paesiello, Cimarosa, the ornament of the *opera buffa*, and Zingarelli (Romeo and Juliet), Nasolini, Paganini, Niccolini, Cherubini, Rossini, Bellini, Donizetti, Verdi, and Mascagni.

ITCH (*Scabies*), a cutaneous disease due to the irritation of an insect known as the itch insect (*Acarus scabiei*). The male is just large enough to be seen with the naked eye, and has eight legs and a number of spines projecting from its under-surface. The female is slightly larger, and on the ends of the four front legs it has suckers, while the hind-legs end in long hairs. When the female is placed on the skin it bores its way into the epidermis, and after lying embedded for a little, lays an egg. It then bores a little farther along and lays another egg. Daily a fresh egg is laid, the insect meanwhile advancing and penetrating into the skin till it has bored a tunnel, which passes more deeply into the skin the farther it is carried. With the growth of the skin, and the shedding of the cast-off cells of the epidermis, the tunnel is brought nearer to the surface, till the first egg is exposed about the time it is hatched. The disease usually attacks the webs between the fingers, the front of the wrists and elbows, and the lower part of the belly, the nipple in the female, the buttocks, and the genitals. The feet and legs are attacked in children. There is intense itching, worse at night, or whenever the person becomes warm. The scratching induced, and the irritation, lead to a scattered inflammation of the skin; swollen lines, pimples capped with crusts of dried blood, blisters and pustules, are formed. The chief thing to be looked for is the burrow, which is like an old pin-scratch. It is irregular in shape, from half a line to 3 inches long, with a whitish dotted appearance—the dots being the eggs—and a little mound at the deep end, where the adult acarus lies. The affected person should take a hot bath, and should thoroughly scrub the whole body, except the head, with soap and water. After the bath the whole body, and especially the part where the eruption is, should be well anointed with sulphur ointment, which must be well rubbed in. In the morning, after the use of the ointment, a warm bath should be taken.

ITHACA, sometimes (popularly) called *Thiakē*, one of the seven Ionian Islands, lying in the Gulf of Patras, forming (with some smaller islands) an eparchy of the nomos of Cephalonia in Greece, is 18 miles long, and not above 5 broad. The whole island is rugged and uneven, and is divided by the deep and wide Gulf of Molo into two nearly equal parts connected by a narrow hilly isthmus. It consists of a mass of limestone rock rising into hills of considerable height; and though sterile on the whole, is not devoid of verdant lawns and hollows, while it is also in part clad with woods of olive-, orange-, and almond-trees, or with vineyards, and copses of myrtle, cypress, arbutus, oleander, and other shrubs. The climate is very healthy. The inhabitants cultivate industriously their light and scanty soil, but are dependent on commerce for a good part of their grain supply. Currants are the chief product of the island. According to Homer, Ithaca was the royal seat of Ulysses, and it is minutely described in the Odyssey. Of the places mentioned by Homer several can be traced with great appearance of probability, such as the mountain called Neritos, the grotto of the nymphs, the 'raven's rock', the fountain of Arethusa, &c. There are ruins of Cyclopean walls similar to those of Argos, Tiryns, and Mycenæ. Pateras, vases, bracelets, mirrors, lamps, coins, &c., have been dug up in an ancient burying-ground here. Vathi, the modern capital, trades largely in oil, wine, raisins, and currants. It has a cathedral and about 5000 inhabitants. There are several villages besides. Schliemann carried on excavations here in 1869 and 1878. The people are said to be of very pure Greek blood, and the women are noted for beauty. Pop. (1896), 11,409; of eparchy, 13,286.

ITHACA, an American town, capital of Tompkins county, in the state of New York, situated about 1½ mile s. of the head of Cayuga Lake, being 142 miles w. of Albany. Iron-founding and tobacco and paper manufacture are carried on, and there are several flour and oil mills in the place. There is a large trade in coal. Cornell University is in the city. Pop. (1890), 11,079; (1900), 13,136.

ITINERARY, a name given to a list of the stations and halting-places on a road between two important localities, together with a statement of the different distances between them. Some of the itineraries which have been preserved to us among the records of antiquity are important for ancient geography. Of these may be mentioned—1. Itineraria Antonini, including the Itinerarium Provinciarum, or a list of the routes through the Roman provinces of Europe, Asia, and Africa; and the Itinerarium Maritimum, exhibiting the most frequented tracks along the coasts and at sea. Both consist of a bare list of the places to be passed, with a statement of their respective distances, for the most part according to milestones. Originally confined to the use of the civil and military services, they at a later period became somewhat like our tourist and postal guides. They appear to have been revised, and to have assumed the form in which we now possess them, in the time of Diocletian. 2. The Itinerarium Hierosolymitanum, made by a Christian in 333 for the use of travellers from Burdigala

(Bordeaux) to Jerusalem. The edition of these itineraries by Pinder and Parthey (Berlin, 1848) has, at least for critical purposes, superseded all others.

ITTNERITE, a mineral closely allied to HAUYNE (which see). It is a hydrated double silicate of aluminium and sodium and calcium, but it contains also iron, potash, chlorine, sulphuric acid, and a sulphide, as upon treatment with an acid it evolves sulphuretted hydrogen. It was found at the Kaiserstuhl, near Freiberg, by Von Ittner (hence its name). The mineral has since been found at other localities.

ITURBIDE, AUGUSTIN DE, Emperor of Mexico, was born at Valladolid de Michoacan (now Morelia), in New Spain, on Sept. 27, 1783. Until 1810 he held no higher rank than that of a lieutenant in the provincial regiment of his native city. On the breaking out of the troubles in Mexico he joined the royalist party, and in this cause displayed such valour and ability that in 1816 he rose to the command of what was called the *northern army*, which occupied the provinces of Guanaxuato and Valladolid. In 1820 we find Iturbide again in the field, under circumstances which gave him unexpected importance. At that period the imprudent acts of the Spanish cortes produced so much exasperation among the clergy and the partisans of absolutism in Mexico, that these persons united to effect the independence of their country. They selected Iturbide as their agent, appointing him commander of the army in the south. He quickly bore down all opposition, and became so popular that he ventured upon the audacious step of having himself proclaimed Emperor of Mexico, in July, 1822, under the name of Augustin I. The Congress declared the throne hereditary in his family, and voted him a yearly allowance of 1,500,000 dollars. His reign was full of trouble, and came to an end in less than a year, by his abdication in March, 1823. Congress granted him on his abdication a yearly pension of 25,000 dollars on condition of his leaving the country, making sufficient provision for his family in case of his death. He resided in Leghorn for about a year, when he was induced to make an attempt to recover his lost crown. He landed with but a single attendant at Soto la Marina, where he was arrested and shot, 19th July, 1824. His son was adopted by the Emperor Maximilian as his heir, Maximilian himself being childless. The collapse of the second empire, however, destroyed his chances of a throne.

ITYS, son of Tereus and Procne. See PHILOMELA.

ITZEHOE, a town of Prussia, in Holstein, in a beautiful valley inclosed by wooded hills, on the right bank of the Stör, which is here navigable, 32 miles north-west of Hamburg. It consists of an old and a new town, connected by a long bridge, has a parish church, with several interesting monuments; a chapel, built in 1240, and now attached to St. George's Hospital; an old convent, and a stateshouse, for the provincial assemblies of Holstein; manufactures of tobacco, cement, chicory, &c., and a large sugar-refinery. Itzehoe is the oldest town in the Duchy, being founded by Charlemagne in 809. Pop. (1900), 15,649.

IVAN, or IWAN, the name of several sovereigns distinguished in Russian history. The most celebrated are Ivan III. and Ivan IV., who laid the foundations of the Russian Empire, the latter being commonly known as Ivan the Terrible. (See RUSSIA.) Ivan VI. was son of the Grand-princess Anna and of Antony Ulrich, duke of Brunswick-Wolfenbüttel. The Empress Anna took him, in 1740, out of the hands of her niece, declared him her son, and gave him an apartment near her own. She soon after declared the child her successor, and her favourite Biron was to be his guardian and regent. Biron caused the oath of allegiance to be taken to the prince, and when he was banished the parents of the child assumed the reins of government until the daughter of Peter I., Elizabeth, ascended the throne. The young Ivan was taken from his cradle by soldiers, and shared the fate of his banished and imprisoned parents. In 1756 he was carried to the fortress of Schlusselburg. In 1763 Mirovitch, a nobleman who was lieutenant in the garrison of the above fortress, induced several soldiers to assist him in freeing the prince, and by means of a forged order from Catharine, attempted to obtain admission to Ivan; but two officers, who guarded him, when they saw that resistance was fruitless, stabbed the unfortunate prisoner in accordance with an order that he should be put to death in case of an attempt to deliver him by force.

IVES, ST., a municipal and formerly a parl. borough and seaport of England, in Cornwall, on the western shore of the bay of same name, 18 miles W.N.W. from Falmouth. It has a very antiquated and picturesque appearance. It has a handsome and interesting church, of the time of Henry V., with an elegant tower 90 feet high; several other places of worship, several schools, a town-hall and meat-market, reading-room, &c. Boat-building, ship-repairing, cask, rope, and seine making, are all carried on here; but the principal business of the place is the pilchard fishery, which is extensively prosecuted. The pilchards are principally exported to the Italian and Spanish markets. Some of the inhabitants are employed in the neighbouring mines. A pier was erected here in 1770; but the new pier and breakwater, 615 feet long, recently constructed, is a great and valuable improvement. A number of vessels are engaged in the coasting and foreign trade of the port. Copper, tin, and slates are exported from the vicinity. The borough lost its separate parl. representation in 1885, but it gives name to one of the six parliamentary divisions of Cornwall. Pop. in 1891, 6094; in 1901, 6697.

IVES, ST., a market town of England, in Huntingdonshire, 5 miles east by south of Huntingdon, on a slope on the left bank of the Ouse, here crossed by a substantial stone bridge of six arches. It has wide and well-kept principal streets; but the lower part of the town is liable to be inundated by the river. It has a light handsome church with a lofty spire, dating from the fifteenth century; a fine Congregational and several other dissenting places of worship; a corn exchange, court-house, and markets, &c. There are no manufactures, and very little trade, but the markets for cattle and sheep are among the largest in the kingdom. The town was almost entirely destroyed by fire in 1689, and in 1823 it was inundated by the overflowing of the Ouse. Pop. in 1891, 3037; in 1901, 2910.

IVIÇA, IVIZA, or IBIZA (anciently *Ebusus*), an island of the Mediterranean, belonging to Spain, chief of the group called the *Pithyusæ*, 52 miles from Majorca. Area, 190 square miles; pop. 24,273. The soil is fertile, producing corn, wine, oil, fruit, flax, and hemp, with little labour. Salt, obtained by evaporation, forms, with fish and wood, the chief article of export. The capital is of the same name, and has a good harbour. Pop. (1897), 5545.

IVORY, properly the substance of which the tusks of the elephant consist, though the similar substance constituting the tusks of the hippopotamus and the horn of the narwhal is also so called. There is also a wholly different substance known as vegetable ivory (which see). Ivory is prized for its beautiful colour, the fineness of its grain, and the high polish it is capable of receiving. That of the

African elephant is most esteemed by the manufacturer for its density and whiteness. It is used as a material for knife-handles, pianoforte keys, combs, the backs of brushes, billiard balls, chess-men, carved figures, and ornamental articles of various kinds. Thin plates of ivory are used as panels for miniature paintings, and etchings are sometimes executed on such plates. The ivory of the hippopotamus is preferred by the dentist. The shavings and sawdust of ivory, by burning in a crucible, are converted into a black powder, from which is prepared a pigment known as *ivory black*. Ivory may be stained or dyed. The use of ivory was well known in very early ages. We find it employed for useful or ornamental purposes, in connection with arms, girdles, sceptres, &c. The ancients were also acquainted with the art of sculpturing in ivory, of dyeing and inlaying it, and they often employed it in statuary. Some of the most famous Grecian statues were *chryselephantine*, that is, were overlaid with plates of gold and ivory in conjunction. In 1903 the imports of ivory (including sea-cow and sea-horse teeth) into Great Britain was 9241 cwts.; and the estimated value £339,855. To provide this quantity of ivory it is estimated that 9000 to 12,000 elephants must have lost their lives. The medium weight of a tusk is about 60 lbs., but some are found weighing as much as 170 lbs

IVORY-BLACK. See BONE-BLACK, and above article.

IVORY COAST, part of the coast of Guinea, between Cape Apollonia and Cape Palmas. See GUINEA.

IVREA, a town of North Italy, in the province of Turin, picturesquely situated on the Dora Baltea, 32 miles N.N.E. of Turin. The most remarkable objects are the cathedral, said to have been founded in the fifth century on the site of a heathen temple; several other churches, remarkable chiefly for their antiquity; a provincial college, episcopal seminary, town-house, court-house, &c. Pop. 6000.

IVRY-LA-BATAILLE, a village of France, in the department of Eure, on the river Eure, 20 miles south-east of Evreux. It is chiefly known as the scene of a battle fought on Mar. 14, 1590, in which Henry IV. defeated the forces of the League. Pop. (1901), 1034.

IVRY-SUR-SEINE, a town of France, in the department of the Seine, agreeably situated on a gentle eminence above the left bank of the Seine, 3 miles S.S.E. from Paris. It has a parish church, finely situated on a height overlooking the town; the remains of an old castle, and manufactures of glue, gelatine, chemical products, &c. At La Gare, in the vicinity, are extensive glass and porcelain works. There is a large hospital for incurables. Pop. (1896), 22,228; (1901), 28,585.

IVY (*Hedera helix*), a shrubby climbing plant of the natural order *Araliaceæ*, celebrated from remote antiquity, and held sacred in some countries, as in Greece and Egypt. The leaves are smooth and shining, varying much in form, from oval entire to three or five lobed, and their perpetual verdure gives the plant a beautiful appearance. The flowers, which are produced in autumn, are yellowish-green and inconspicuous, disposed in globose umbels, and are succeeded by deep green or almost blackish five- or ten-celled berries, which are emetic and purgative. The calyx is five-toothed, the petals and stamens are five in number, and the single style has five obscure stigmas. It ascends to the summits of the tallest trees, and also clings to the sides of old walls, rocks, &c., by means of the large number of aërial rootlets which it sends out. The ovate entire leaves of ivy are found only on the non-climbing flowering branches. Ivy occurs throughout almost the whole of Europe, and in many parts of Asia and Africa, but, like the holly, it is a scarce plant in America. The smooth shining leaves of the ivy are admirably adapted for throwing off rain, and thus tend to prevent dampness in walls when carefully trained. In other respects, too, the effect of ivy on walls and trees is altogether beneficial under proper conditions. Various substances have been got from different parts of this plant, and preparations of it used to be employed in pharmacy. From the stem is obtained, naturally or by incision, a sticky gum resin, of a yellowish-brown or sometimes greenish colour, which when powdered is orange-yellow. In masses or layers it is translucent, it has a balsamic odour and slightly pungent taste. *Hederic* and *hederotannic* acids are obtained from the seeds, which also contain a fat, sugar, a nitrogenized body, and inorganic salts. Hederic acid has the formula $C_{32}H_{54}O_{11}$. Ivy leaves and ivy berries were formerly administered for various medical purposes, but they are long out of use. The common ivy is the only British species of the order Araliaceæ, which is very closely related to Umbelliferæ. The African or Irish ivy (*H. canariensis*) has larger leaves with a more distinctly five-lobed form, and in this species the leaves of the flowering branches are also usually lobed. The Asiatic Ivy (*H. colchica*) has the leaves almost or quite unlobed. A species found in Ceylon (*H. terebinthacea*) produces a substance very similar to turpentine, and the wood of another species found in the Dutch East Indies (*H. umbellifera*) is aromatic. The South European Ivy (*H. poetarum*) is a tenderer species than the common one, and requires protection from frost in the more northerly parts of Europe. The name American Ivy is sometimes given to the Virginian Creeper (*Ampelopsis hederacea*), a well-known climbing wall plant introduced from the United States. It was called by Linnæus *Hedera quinquefolia*. The leaf and habit of the common ivy are so characteristic that reference is often made to them in the specific names of other plants, 'ivy-leaved' being common as a designation. The ivy has long been an object of cultivation on account of its beautiful evergreen leaves, and many varieties, striking alike in form, colour, and variegation, are now common. The cultivation of the tree forms of ivy is not, however, commonly attended to in Britain.

IXION, in Greek mythology, king of the Lapithæ in Thessaly, son of Phlegyas. He married Dia, daughter of Deioneus, and promised his father-in-law a valuable present for the choice he had made of him to be his daughter's husband. His unwillingness to fulfil his promises induced Deioneus to have recourse to violence; and he stole away some of Ixion's horses. Ixion concealed his resentment, invited his father-in-law to a feast at Larissa, the capital of his kingdom, and murdered him by casting him into a fiery pit. This treachery so irritated the neighbouring princes that all of them refused to perform the usual ceremony by which a man was then purified of murder, and Ixion was shunned by all mankind. Zeus had compassion upon him, and placed him at the table of the gods. Ixion became enamoured of Hera, and attempted to seduce her. Hera was willing to gratify the passion of Ixion, or, according to some, she informed Zeus of the attempts which had been made upon her virtue. Zeus made a cloud in the shape of Hera, and carried it to the place where Ixion had appointed to meet her. Ixion was caught in the snare, and from his embrace with the cloud were born the Centaurs. (See CENTAURS.) Zeus banished him from heaven; but, hearing that Ixion had boasted that he had seduced Hera, the god struck him with his thunder, and ordered

Hermes to tie him to a winged or fiery wheel in Hades. He was also scourged, and compelled to repeat the words 'Benefactors should be honoured.'

IXODES. The *Ixodes* or '*Ticks*' form a family of the order Acarina or mites. These forms are included in the class Arachnida, of which group the spiders, scorpions, and mites form the typical examples. The Ticks possess the Acaridan characteristics in that they are parasitic animals, possessing oval or rounded bodies. The eyes, when present, are simple, two in number, and placed on the upper aspect of the head. The breathing organs exist in the form of tracheæ or air-tubes, which are essentially similar in character to those of insects. The mouth is pre-eminently fitted for suction, and its parts are disposed to form a proboscis, which is jointed, and can be retracted or protruded at will. Spines, adapted for wounding the skin of the animals upon which these forms reside, are also found associated with the proboscis. The Ixodes infest dogs, sheep, oxen, and other mammals, but birds and reptiles are also annoyed by the attacks of certain species. The well-known '*Harvest-bug*,' so annoying to the frequenters of fields in the autumn months, is a true Tick. The proboscis and spines of the Ticks form a structure known as the 'rostrum' or 'beak,' by means of which they retain a firm hold of the skin of their hosts. This 'rostrum' is provided with recurved hooks, which greatly increase its efficiency as a suctorial organ. The *Ixodes* subsist upon the blood of the creatures to which they attach themselves; and in the case of sheep, &c., they may produce great irritation and disease of the skin, as well as constitutional debility. It is important lastly to distinguish the Ticks (being Arachnidans) from insects, with which they have nothing in common; the Arachnida being a group of animals entirely different in most structural points from the Insecta.

IYNX, daughter of Pan and Echo, or of Peitho (the Suada of the Romans). She inveigled Zeus into his intrigue with Io. As a punishment, Hera changed her into a bird called the *wry-neck* (*Iynx torquilla*), which still possessed the power of exciting love. When it became desirable that Medea should be enamoured of Jason Aphroditē gave the hero the magic iynx, and instructed him how to use it in order to inspire Medea with a passion for him. From this time the iynx became a part of the love-spells among the Greeks. The enchantress tied the bird to a four-spoked wheel, which she turned while she muttered her incantations; or, according to some traditions, she only stretched upon the wheel the entrails of the wry-neck. Another method was to consume the bird over the coals on a wheel of wax. The magic wheel was also called *iynx*, because the bird or its entrails were extended upon it. It is sometimes used as a symbol of the art of exciting love in general, and more particularly of unchaste love. In the sequel the signification of the word iynx became different, and it was extended to every charm in poetry and music. In this sense the iynx went under the name of the nightingale, and it is thus represented on the monument of Sophocles and in the temple of the Pythian Apollo.

J.

J, the tenth letter and seventh consonant of the English alphabet. The character *j* designates very different sounds in the different languages. In English it has the same sound as *g* in *genius*. This sound is called a soft palatal sound, that of *ch* as in *charity* being the hard palatal. In French it is always sounded like the French *g* before *e* and *i;* in German it has the sound of the English *y* in *you;* in Italian it is always a vowel (long *i*), and the character *j* is now little used by Italian printers except at the end of words for *ii;* in Spanish it is guttural, a little softer than the German *ch* in *ach*. How nearly the sounds which are expressed by *j* are related has been shown in the article G; and in the article I it is mentioned that *i* before another vowel naturally becomes the German *j*. (For other observations also relating to *j* see the article I.) Jacques Pelletier of Mons is said to have first placed the *j* at the beginning of words which began with this consonant in his French Grammar (1550). Gille Beys, printer in Paris, imitated him in 1584; but the Dutch were for long the only people that used it systematically in printing. In regard to the separation of words beginning with the two letters in dictionaries, the editors of the French Encyclopédie, printed in 1765, did not dare to make it; and English dictionaries have hardly yet given up the practice of mixing together *i* and *j*, as well as *u* and *v*. The other nations adopted it from the French. The Romans, in inscriptions and legends of medals, wrote all words which we write with a *j*, as *Jupiter*, *Justinus*, with an *i*, as *Iupiter*, *Iustinus*. The French and English sounds of *j* were unknown to the Greeks and Romans.

JACAMAR (*Galbula*, Brisson). These brilliant birds are nearly connected with the kingfishers, from which, however, they differ by the form of their beak and feet. Their plumage has a metallic lustre, which it is almost impossible to imitate by art. They live in damp woods, and feed on insects. Most if not all the true jacamars are natives of Tropical America. There are several species of nearly allied birds found in India, having a shorter and stouter beak, to which Le Vaillant has given the generic name of *Jacamerops*.

JACANA, a wading bird of the family Palamedeidæ and sub-family Parrinæ, of which the chief genus is *Parra*, found in the warmer parts of Asia, Africa, and America. The bill is long, slender, straight at the base, and vaulted at the tip; at the base is a large, naked, dilated plate, standing up in front of the forehead, and descending in some species towards the neck; wings long, with the third quill the longest; tail very short, partly concealed by the coverts; tarsi long, naked, and slender, with transverse scales; the toes, four in number, are of great length, entirely separated, and all armed with long, straight, and sharp claws. The jacanas frequent marshes, river banks, and ponds, in pairs or in small flocks; they walk on the floating leaves of water plants in search of aquatic insects, buds, and seeds. The common Jacana (*Parra jacana*), illustrated at Ornithology, a native of South America, is of a black colour, with a red mantle; the primaries green; the Chinese Jacana (*P. Sinensis*) has the general colour brown, with the head, throat, and wing-coverts white; hind neck with golden silky plumes; the long tail-feathers black.

JACK, a name for various implements, appliances, and mechanical contrivances. The *lifting-jack* is used in raising heavy weights by means of force exerted from below. In the usual form of the apparatus the weight is raised by pressure from the upper end of a vertical screw which is caused to ascend by the turning of a handle, but in other simpler forms a vertical rack operated by a lever, or by a lever in conjunction with a screw, is used. Hydraulic pressure may also be used for lifting. A *jack-plane* is the plane used for giving wood a preliminary rough dressing. The old *roasting-jack* was a contrivance for turning the spit on which meat was roasted before an open fire. A pulley on the axis of the spit was driven by means of a belt passing round a larger pulley, which was caused to rotate by a dog inside. A later form of roasting-jack is that known as the *bottle-jack*. This is shaped somewhat like a bottle, and contains a clock-work mechanism which causes the meat suspended from it to rotate.

The *smoke-jack* is moved by a fan placed horizontally in the chimney, and being carried about perpetually by the draught of the fire, requires no machinery for winding it up. Spiral flyers, coiling about a vertical axle, are sometimes used, and occasionally a vertical wheel, with sails like the float-boards of a mill.

Jack, in sea language, is a sort of flag displayed from a mast erected at the outer end of a ship's bowsprit.

JACK, or JACA (*Artocarpus integrifolia*), a tree of the bread-fruit genus, a native of India and South-eastern Asia. The fruit grows to a larger size than the bread-fruit of the Society Islands, often weighing more than 30 lbs., and containing from 200 to 300 seeds, each of them four times as large as an almond. The seeds or nuts are eaten after being roasted or boiled, and the sweet fleshy pulp of the fruit is also eaten; but the strong peculiar smell offends some people. When the tree is young the fruit grows from the twigs, in middle age it grows from the trunk, and when the tree gets old, from the roots. It forms a great part of the food of the natives in some parts of India, Ceylon, &c. The timber, of a yellowish colour, is used for almost every purpose, being strong and ornamental, and is imported into Britain for making musical instruments, cabinet work, &c., for which it is well suited. The tree is abundant in Burma as well as in Ceylon, and grows to a great size, logs of from 3 to 5 feet in diameter being common. Several other species are also known as timber and fruit trees. The wood of the jack-fruit tree yields a yellow dye, which is used to some extent to dye clothes, though it is not very permanent.

JACKAL (*Canis aureus*, Linnæus), a member of the Canidæ or Dog family, possessing intimate relations with the dogs on the one hand, and the wolves on the other. The dog, as is well known, will, in fact, interbreed with the wolf and jackal, the hybrid offspring being prolific. The jackals possess a wide distribution throughout the warmer regions of the Old World, and are found in south-east Europe, and in Africa from Barbary southwards to the Cape of Good Hope; whilst in Asia they are distributed throughout Persia, Syria, and the southern regions of the continent generally. The common jackal is a dog-like animal, averaging about 2 or 2½ feet in length, and about 14 inches in height. The bushy tail extends to about 8 inches. The eyes are small, and the pupil of the eye is round. The general colour of the body is a dirty yellow or brown, interspersed with markings of lighter and darker colours. Thus, on the sides of and beneath the lower jaw, the coat is whitish, as also on the inner aspect of the limbs; whilst the muzzle and nails are black. The tail itself has black hairs interspersed with the yellow fur. The teeth are arranged similarly to those of the dog. The jackals appear to be thoroughly nocturnal in their habits, inhabiting holes and burrows, which they excavate in the ground, during the day; and coming forth in the evening and during the night to hunt in packs, described by travellers as being composed in some instances of immense numbers. In particular the cry of the jackal has been alluded to by travellers. Their voice is of a most peculiar kind, the cry consisting of a series of prolonged howls, followed by shorter yelps. The jackal subsists chiefly upon carrion and decaying matter, often that which has been left after the repast of the fiercer and larger carnivora. The popular notion that the jackal was the 'lion's provider', in that he roused the prey for the king of beasts, and participated in the repast, is quite devoid of truth. The jackal, in reality, dances attendance upon the larger members of his class, and feeds upon the remains or fragments which the originators of the feast may leave. The cry of the jackal, independently of any attachment to the lion, &c., may arouse the prey, and thus start a chase in which he may latterly join, for the purpose of securing the remains of the feast. The jackal also kills prey for himself, and often joins with others for the purpose of hunting down antelopes, deer, or other animals. But without this source of fresh prey, these creatures, as already mentioned, act as natural scavengers by removing carrion of all kinds. They also eat certain kinds of vegetable food, especially the ber-fruit, the sugar-cane, and maize; and sometimes they do considerable damage to sugar and other plantations. The jackal is susceptible of being tamed, although the result of domestication is simply to give the animal a cowed and subdued aspect. Owing to its abominable smell it is by no means a desirable domestic animal. It is believed to be exceedingly cunning, and in many Eastern tales it plays exactly the same part as the fox does in those of Europe. The 300 animals mentioned in the Bible, as having been used by Samson in his vengeance upon the Philistines, are believed by biblical commentators to have been jackals. The foxes of Syria are scarce, and do not exist in large packs; and hence the jackal is the only likely animal which could have been caught in such numbers as mentioned in the narrative. The common jackal (*Canis aureus*) is the most widely distributed species; but another species, found mostly in Southern Africa, is known as the Black-backed Jackal (*C. mesomelas*). This latter form is found chiefly at the Cape of Good Hope. It has the back and end of the tail black, the other parts being mostly red or yellowish-red. Its food consists of various rodent mammals and small antelopes, and its fur is employed by the natives of South Africa for making their karosses. Another species of jackal found in South Africa is the Side-striped Jackal (*C. adustus*), so-called from a light stripe which is found on the sides of some specimens. The Senegal jackal (*C. anthus*) has a good deal of the appearance of a greyhound. (See illustration at CARNIVORA.)

JACK-BOOT, a sort of boot reaching above the knee which was invented in the seventeenth century partly to serve as defensive armour for the leg. It was one of the earliest forms of the top-boot, and was used, until a comparatively recent date, by cavalry officers and other military men; and indeed a somewhat modified form of it is still in use. Sometimes these boots were of very great weight. Similar boots worn by fishermen and others are known by the same name.

JACKDAW (*Corvus monedula*, Linnæus). This bird is included in the *Corvinæ*, or family of True Crows, which family is included in the order *Insessores* (which see) of the class of birds. The genus *Corvus*, of which the jackdaw is a species, includes all the most typical members of the crow family, among which the jackdaw is distinguished by its comparatively short bill, which is coloured black; by the white eyes; by the under part of the head and neck being of a grayish colour; by the glossy black upper plumage, and the dusky colour of the under plumage; and by the black legs. The average length is about 12 inches. The British jackdaws do not migrate, but those of the Continent belonging to the same species appear to leave their respective countries at stated periods. The nests are built in towers, spires, and like elevated situations, and even in towns and populous cities these birds are present and breed freely. The eggs are of a greenish colour, and from five to six are to be found in each nest. The female is exceedingly attentive to the young after they are hatched. The food of the jackdaw appears to consist of worms, insects, larvæ, and like matter; and it thus exhibits a difference from the ordinary crows, which subsist chiefly on carrion. Instances are on record where jackdaws have become expert fishers (Bingley): and where they thus exhibited a preference for a piscatorial diet. Like their neighbours the rooks, jackdaws are gregarious in habits. They are, of all the crows, most readily domesticated; and they may be taught to pronounce words with great distinctness. Jackdaws, like the magpies, have attained a somewhat unenviable notoriety for their thieving propensities, and appear to regard articles of jewelry, money, and other shining or bright substances, with especial favour. They secrete their plunder in the nest, and frequently a heterogeneous and sometimes valuable assortment of articles may be found deposited in their retreats. So bold indeed do these birds occasionally become, that they have been known to carry off spectacles from persons who were reading.

JACKET, Steam, a space filled with steam surrounding the cylinder of a steam-engine; from it heat passes into the cylinder and prevents the condensation of steam which would otherwise take place during expansion; there is no gain in economy in expanding steam more than two and a half times unless a steam-jacket is employed. It may be shown from the second law of thermodynamics that when saturated steam, in a cylinder well covered with non-conducting materials, expands doing work, part of it is condensed, the rest remaining in the form of saturated steam. When this occurs the condensed steam remains in the cylinder for some time; it absorbs heat from the steam which enters at the beginning of a new stroke, and gives out the heat at the end of the stroke; in this way heat passes from a body at a high temperature to a body at a low temperature without doing work. Even when the steam is slightly superheated before entering, condensation will occur before the end of the stroke, and a steam-jacket will be found to increase materially the efficiency of the engine. The advantage of the jacket is very apparent in compound engines, which are specially designed to employ a great amount of expansion; the economy effected is greater than in the best Cornish engines.

JACKSON, a flourishing town, capital of Jackson county, Michigan, United States; situated on the Grand River, near its source, on the Central Railroad, 76 miles west of Detroit. The river affords an extensive water power, which is employed in factories and mills of various kinds. Agricultural implements are extensively manufactured here, and there is a thriving general trade. Within the boundaries of the city is a bituminous coal-mine, and there are others in the neighbourhood. Pop. (1900), 25,180.

JACKSON, a town, Hinds county, capital of Mississippi, United States, on the right bank of Pearl River, 45 miles east of Vicksburg, with which it is connected by rail. It contains a handsome state-house and other government buildings, the state lunatic asylum, penitentiary, several churches, &c. Between 30,000 and 40,000 bales of cotton are annually shipped here. Pop. (1900), 7816.

JACKSON, Andrew, President of the United States of North America from 1829 to 1837, was born of Scoto-Irish parentage at Waxhaw, near Cambden, in South Carolina, in 1767. His father died a few days before the birth of his son, and the widow, though left in rather straitened circumstances, resolved to educate Andrew for the church. In his fourteenth year, however, while attending school, on the outbreak of the American revolution, he joined a regiment of volunteers to fight in the cause of independence. After losing two brothers in the struggle, and being shortly after deprived by death of his remaining parent, he retired from military service, devoted himself to law, and commenced practising in a part of North Carolina which was afterwards formed into the state of Tennessee. In this state he obtained the appointment of procurator from Washington, and was also repeatedly employed as commander of the militia in driving back the Indians from the frontiers. In 1796 he was one of the members of convention who drew up the constitution of Tennessee, was shortly after elected to represent it in Congress, and in 1797 became senator. The last situation he held only for one year, and having returned to Tennessee, was, in 1799, appointed a judge of its supreme court. Soon, however, he retired from all public functions, and devoted himself to the cultivation of his farm on the Cumberland River. He was thus engaged, when at the commencement of the war with Great Britain, in 1812, he was intrusted as major-general with the command of the Tennessee militia. In this capacity he first distinguished himself at the head of a body of 2500 in an expedition down the Mississippi for the protection of the low country of Louisiana, then defeated a body of Creek Indians who were wasting the country with fire and sword, and made himself master of Pensacola. Shortly after he obtained the command of the troops of the line destined for the defence of New Orleans, and established his military reputation by his repulse of the British there in 1815. His arbitrary proceedings, however, in the course of the war incurred general censure, and a sentence was passed condemning him to pay a very heavy fine. From 1817–18 he was employed against the Seminole Indians, but again sullied his reputation by the harshness and cruelty of his measures, more especially by putting two British subjects to death contrary to all law and justice, on the simple ground that as Great Britain and the United States were then at peace, he was entitled to treat them as outlaws and pirates. In 1824 he was first put forward for the office of president, but failed, because his majority, though decided over all his competitors, was not sufficient to carry the election without an appeal to the house of representatives, who decided in favour of his competitor Crawford. His next attempt was more successful, and he triumphantly carried the election both in 1828 and in 1832. The eight years during which he thus presided over the state were marked by the rapid extension of democratic tendencies. In 1837 he retired to his estate in Tennessee, but appears to have suffered much both from long sickness and trials of various kinds. These are said to have produced a favourable change on his temper and character, and his last days were spent in an assiduous discharge of the duties of religion, as a member of the Presbyterian Church. He

died at his seat called the Hermitage, near Nashville, in 1845.

JACKSON, THOMAS JONATHAN, better known as *Stonewall Jackson*, an American general, born 21st January, 1824, at Clarksburg, Virginia. In 1842 he entered the military academy at West Point as cadet. Four years later he received a second-lieutenant's commission, and was attached to Magruder's battery in the Mexican war. For his gallantry at Churubusco and Chapultepec he was breveted captain, and before the conclusion of the war was raised to the rank of major. In 1852 he resigned his commission and was appointed professor of mathematics and artillery tactics in the military institute at Lexington, Virginia. On the outbreak of the civil war in 1861 he entered the Southern army with the rank of brigadier-general. He commanded the reserve at the battle of Bull's Run (21st July), and acquired his cognomen by the firmness of his troops and his own coolness in the heat of the action. By the end of the year he had reached the rank of major-general. On 8th June, 1862, he was defeated by General Banks at Cross Keys, but made a masterly retreat. On the 28th–29th August he gained the second battle of Bull's Run, and captured Harper's Ferry on the 15th September. On the 17th he supported Lee at Antietam, and again at Fredericksburg on 13th December. On the 2d May, 1863, he took a prominent part in the battle of Chancellorsville. On the evening of that day, while he and his staff were returning to head-quarters, they were mistaken for a body of the enemy and fired upon by one of his own regiments. The general was wounded in the arm, amputation failed to save him, and he died 9th May, 1863. He is described as a man of the plainest habits, indomitable energy, and deep religious feeling, and his memory is held in respect by all parties as one of the best and bravest of American soldiers.

JACKSON, WILLIAM, a musical composer, was born in 1730, at Exeter, and received the rudiments of a classical education, with a view to his following one of the liberal professions. His taste for music displayed itself, however, so decidedly while he was yet a youth, that his friends were induced to place him under the organist of the cathedral belonging to his native city. Having passed two years in the metropolis, where he availed himself of the instructions of the celebrated Travers of the chapel-royal and of some of the best musicians of his day, he returned to Exeter in 1750, and, succeeding eventually to the situation of organist, there passed the remainder of his life. In 1782 he published two octavo volumes, containing Thirty Letters on Various Subjects, which went through three editions. He also printed, in 1791, some Observations on the Present State of Music in London. His musical compositions, especially his songs and duets, are still justly popular, and are distinguished by chasteness of conception, ingenuity, and truth of expression. He died in 1803.

JACKSONVILLE, a town, capital of Morgan county, Illinois, United States, on the Great Western Railroad, 32 miles west of Springfield, on an undulating and fertile prairie, near a small affluent of the Illinois River. The town is distinguished for the elegance of its public buildings, and for the number of its educational and charitable institutions, among which are the Illinois College, the state asylums for the blind, the insane, and the deaf and dumb. The college was founded in 1830, and has a library of 4000 volumes. Pop. in 1900, 15,078.

JACKSONVILLE, a rising and important town of the U. States, capital of Duval county, Florida, situated near the north-east corner of the state, on the St. John's River, about 25 miles from its mouth. It is the principal port on this river as well as a busy railway centre, and is also a favourite resort of invalids and visitors during the winter. It has wide and regular streets, planted with shade-trees, numerous fine hotels, gas and electric lighting, telephones, street-cars, &c. Its trade embraces lumber, naval stores, cotton, oranges, &c. Pop. (1900), 28,429.

JACOB, the son of Isaac, the last of the patriarchs, and the true ancestor of the Jews. His name means 'supplanter,' and several events of his early life rendered it highly appropriate. Having cheated his brother out of the parental blessing he had to flee; and, on his way to Laban, his uncle, he received the first intimation that the inheritance of the divine promise had devolved on him. He saw in a dream a ladder reaching from heaven to earth, and angels ascending and descending upon it, and was favoured with a special manifestation of the presence of God, who conferred on him the blessing of Abraham. After this vision he firmly believed that Jehovah had chosen him to be the father of a great people. This belief, and the love of Laban's daughter Rachel, were his consolation during the bitter years which he was obliged to devote to the flocks of his uncle, in order to obtain his mistress. After having served seven years he found in his veiled bride Leah (whom he did not love), the elder sister of Rachel, and in order to obtain Rachel he was obliged to serve seven years more. Besides these fourteen years he served six years for a herd, and, after having repaid the deceit of his father-in-law by an artifice which much increased his possessions (Gen. xxx. 27–43), he departed privately with his wives and children and property. Laban pursued him, and scarcely had Jacob appeased him, when, after twenty years' absence from home, he met the followers of his brother Esau. In this dilemma Jacob sought relief in prayer, and an angel wrestled with him all night until the morning dawned. Jacob came off victorious, though with a lame thigh, and he was in consequence honoured with a change of name, being henceforth called *Israel*, that is, the *hero of God*, in remembrance of the contest. This afterwards became the title of his house, and the Hebrews from him are called *Israelites*. Jacob now went forth with more confidence to the much-dreaded meeting with his brother, and appeased his rough but noble nature by his submission. His return to his father's tent made a great change in the character of Jacob. His cunning and avarice appeared to him, as it has since to his descendants, a necessary means of surmounting the many difficulties of his dependent situation. Now that he had become rich, and uncontrolled master of his possessions, he showed himself worthy of his father; and if he did not resemble Abraham in greatness and power, he did in piety and tender love for his children. Yet through them he was destined to suffer the greatest afflictions. As he had two lawful wives, and, according to the custom of the country, two concubines (Bilhah and Zilpah), with twelve sons and a daughter, he could not escape domestic troubles and dissensions. His beloved Rachel died soon after his return home. A prince of the Hivites violated his daughter Dinah, and his sons revenged the injury by plundering and murdering that people. He could neither prevent this nor the incest committed by Reuben with Bilhah. Humiliation and repentance for the sins of his youth seemed now his lot. But his greatest affliction was the loss of his favourite son Joseph, whose brothers, full of envy against him, had sold him to a caravan of Ishmaelite merchants, and brought his coat, stained with blood, to their father, as a proof that he had been devoured by wild beasts. Joseph subsequently became, in consequence of his wisdom, the highest officer at the court of Pharaoh, and in this capacity recognized his

brothers when they came to Egypt to purchase corn, pardoned them, and called the whole house of his father out of Canaan to dwell in a fruitful region of Egypt. The aged Jacob again embraced his favourite son, whom he had for many years supposed dead, and enjoyed under his protection a happy old age. A short time before his death Israel collected his sons around his bed, and pronounced over each of them a blessing full of prophetic anticipations of the characters and future fate of his descendants. He bestowed the privileges of the first-born on his fourth son, Judah, Reuben having forfeited them by the crime abovementioned, and Simeon and Levi by the murder of the Hivites. To his grandsons Manasseh and Ephraim, the sons of Joseph, he gave privileges equal to those of his sons. The descendants of Judah composed the most powerful tribe among the Hebrews, who were hence called *Jews*. In conformity with Jacob's last will Joseph buried him in the tomb of Abraham, before Mamre in Canaan.

JACOBI, FRIEDRICH HEINRICH, a distinguished German philosopher, born at Düsseldorf in 1743. His father intended him for a merchant. He early showed a religious turn, which, on his being sent to Frankfort as an apprentice, exposed him to ridicule. He therefore soon went to Geneva, where his mind was cultivated by intercourse with the most distinguished scholars, and by the study of the best productions of French literature. In consequence of the taste he had acquired for letters he returned home with reluctance, in order to take charge of his father's business. After having conducted the business for some time an appointment at court was conferred on him, which relieved him from any further mercantile engagements. His brother, Johann Georg, introduced him to an acquaintance with Wieland, and he soon appeared as an author. In 1779 he was called to Munich as privy-councillor, but soon fell into disgrace on account of his exposure of the abuses of the Bavarian system of customs. More of his writings appeared at this time, and his summers were spent at Pempelfort, in a charming country seat which he had built. But the death of his wife interrupted this tranquil and happy life. He now applied himself with renewed zeal and industry to his studies, encouraged by a journey to Weimar, where he saw Goethe again, and became acquainted with Herder. His letters on Spinoza appeared in 1785, from which time his mind was much occupied with metaphysical speculations on religious subjects. As the influence of the French revolution extended itself he went from Düsseldorf, in 1794, to Holstein, and lived part of the time at Wandsbeck and Hamburg, and partly at Eutin. In 1801 he went to Paris, and returned to Eutin, where he intended to end his days; but in 1804, having received an invitation to the new academy erected at Munich, he was induced to accept it on account of the loss of a considerable part of his fortune by the misfortunes of his brother-in-law. He was made president of the Bavarian Academy, and retired from office at the age of seventy years, retaining, however, his salary. His last days were occupied with the collection of his works. He died March 10, 1819.—Jacobi has been called the *German Plato*, on account of the religious glow in his metaphysical writings. But whatever opinions may be entertained respecting his philosophy, all admit that he was a most exemplary man, truly revered by all who were acquainted with him. His philosophy, among other traits, is characterized by an aversion to systems, all of which, he maintains, when consistently carried out, lead to fanaticism. His views were opposed to those of the dogmatic Mendelssohn, the critical Kant, the idealizing Fichte, and the pantheistic Schelling. Of his works we mention Eduard Allwill's Briefsammlung (Breslau, 1781); Woldemar, a philosophical novel (Flensborg, 1779); Ueber die Lehre des Spinoza, a series of letters to Mendelssohn (Breslau, second edition, 1789); David Hume über den Glauben, or Idealismus und Realismus (Breslau, 1787); Sendschreiben an Fichte (Hamburg, 1799); and Von den göttlichen Dingen und ihrer Offenbarung (Leipzig, 1811). His works were published by Fleischer (Leipzig, in six volumes), to which is to be added his Correspondence (published by Fr. Roth, in two volumes, 1825 and 1827). Schlegel's review of Jacobi's Woldemar (in vol. i. pages 1 to 46 of Charakteristiken und Kritiken) deserves the attention of the student of Jacobi. His dispute with Schelling was carried on with considerable animosity. It gave birth to Schelling's Denkmal der Schrift von den Göttlichen Dingen (Tübingen, 1812).

JACOBI, JOHANN GEORG, a German poet, was born at Düsseldorf, 1740, studied theology in 1758 at Göttingen, and later in Helmstedt, then became professor of philosophy and eloquence in Halle, where he published the Iris (1774 to 1776, three volumes), a periodical for ladies. Joseph II. appointed him professor of belles-lettres in the University of Freiburg in the Brisgau (1784). From 1795 to 1800 he published the Uberflüssiges Taschenbuch, and from 1803 to 1807 the Iris. An edition of all his works was published at Zürich, in seven volumes. He died January 4, 1814.

JACOBI, KARL GUSTAV JAKOB, an eminent German mathematician, born in 1804 at Potsdam, studied at the gymnasium there, and at the University of Berlin, and in 1829 was appointed to the chair of mathematics at Königsberg. This situation he held till 1842, when bad health obliged him to resign it, and he removed to Berlin, where he lived till his death on the 18th of February, 1851. The work on which his fame as a mathematician rests is entitled Fundamenta novæ theoriæ functionum ellipticarum (Königsberg, 1829). He also published a Canon Arithmeticus (Berlin, 1839), and contributed many valuable papers to Crelle's Journal of Pure and Mixed Mathematics, and to the Transactions of the Berlin Academy of Sciences, of which he was a member.

JACOBINE MONKS. See DOMINICANS.

JACOBINS, the members of a political club which played an important part in the first French revolution. Its origin is traced to a society established some days subsequent to the opening of the states-general at Versailles, in 1789, by several distinguished members of the first assembly, particularly from Brittany, called the *Club Bréton*. On the removal of the constituent assembly from Versailles to Paris this club established itself also in the capital, in the old convent of the Dominican friars or Jacobins in the Rue St. Honoré, admitted any citizen recommended by four of its members, and assumed the new name of *Société des Amis de la Constitution*, but was from its place of meeting called Jacobins, which shorter appellation prevailed, and was finally adopted by the members themselves. The society rapidly increased in numbers, not only deputies but all who aspired to political influence seeking admission. Every political question and motion was here debated before being laid before the National Assembly; the most popular orators, such as Mirabeau, Danton, Robespierre, Lafayette, &c., took part in the debates; the club became the controlling power of the revolution. Extreme opinions gaining the ascendency in it, most of its original founders abandoned it, and established another club, styled the Société des Feuillants, where more moderate counsels prevailed. It was considered by some, however, that the parent society was not thorough enough, and a number of its members

seceded and formed the Société des Cordéliers, which was characterized by its extravagant radicalism and the boisterousness of its proceedings; it had, however, but a short independent existence, being reunited to the original society in June, 1791. The Jacobins now extended their influence over the width and breadth of the nation; over 1200 branch societies were organized, and obeyed the orders from the head-quarters in Paris. The Journal de la Société des Amis de la Constitution had, in May, 1791, been added to the ordinary means of correspondence, and became a powerful instrument in spreading revolutionary opinions into every corner of the kingdom. The Jacobins took the lead in the insurrectionary movements of June 20 and August 10; they originated the revolutionary commune of Paris, which became a formidable power; and they changed their former name to a more expressive one, *Les Amis de la Liberté et de l'Égalité*. From this time they ruled supreme, and the Convention itself was for a while but a tool in their hands. Robespierre was indebted for his political supremacy to the popularity he had acquired among them. The revolution of the 9th Thermidor, which overthrew that dictator, was a fatal blow to the Jacobins; the terror which they had inspired gradually vanished. The reactionary party, styled the *Jeunesse dorée*, went in force to attack their head-quarters, 9th November, 1794, and the Convention ordered the suspension of their meetings and the closing of their hall. The scattered remains of the party attempted to regain their influence at the end of the Directory by establishing the *Club du Ménage*, and then the *Club de la Rue de Bac;* but the revolution of the 18th Brumaire (9th Nov. 1799), which established the consulate, put an end to all their hopes. Some writers have seen in the formation of this society the long concocted operations of a conspiracy against legitimate government and religion throughout Europe; and during and after the revolution the name of Jacobin has been applied indiscriminately to any one holding radical, or even liberal views, in matters of politics and religion.

JACOBITES, Monophysite Christians in the East, who, oppressed and dispersed amidst the religious contests of the sixth century, were united by a Syrian monk, Jacobus Bardai or Janzalos (578), during the reign of Justinian, into a distinct religious sect. Out of gratitude to their founder they called themselves by his name, and had in Syria, Egypt, and Mesopotamia numerous communities, with bishops and patriarchs. On account of their separation from the Catholic Church they were glad to obtain the protection of the Saracens, who possessed themselves of the East in the middle of the seventh century. The Egyptian Jacobites, having abused the indulgence granted them by the Saracens, suffered a persecution in 1352, after which, being much diminished in numbers and restrained in the exercise of their religion, and being gradually separated from their Asiatic brethren, they formed a distinct sect. Internal disputes and political causes occasioned a separation about the same time of the Abyssinian and Armenian Monophysites from the great body of the Jacobites; and after numerous attempts by the popes to bring them over to the Roman Catholic Church they still maintain themselves as an independent sect in Syria and Mesopotamia, and consist of about 30,000 or 40,000 families. These Jacobites are governed by two patriarchs, appointed by the Turkish governors, one of whom, with the title of the *Patriarch of Antioch*, has his seat at Diarbekir or Aleppo; the other, the Syrian, resides in the monastery of Saphran, near Mardin, and governs the Mesopotamian societies. Circumcision before baptism and the doctrine of the single nature of Christ (hence their name *Monophysites*) are common to them with the Copts and Abyssinians; but in other respects they deviate less than the other Monophysites from the discipline and liturgy of the orthodox Greek Church.

JACOBITES. In Great Britain this name was applied to the adherents of James II. (who abandoned the throne in 1688) and his posterity. In Scotland and Ireland, where the Revolution was not effected except with the assistance of arms, the Jacobite party formed one of the two great divisions of each country; and although soon crushed out in Ireland by conquest, they continued in Scotland to comprise a large proportion of the population until some time after the rebellion of 1745. In England, however, the Revolution was accomplished with the apparent consent of all parties; but in a year or two the Jacobite party gained considerable influence, and continued to disturb the government of William throughout his reign. The refusal of a portion of the bishops and clergy to take the oaths to the new government gave a certain consistency and tangible ground of opposition to the friends of the royal exile. Many of William's chief advisers and officers, too, carried on a secret correspondence with James at St. Germains, not so much from attachment to his cause as with a view to secure their own interest in case of his return. After the accession of Anne and the death of James the efforts of the Jacobites slackened for a time; but towards the close of her reign they revived. It is now placed beyond all question that Bolingbroke and Oxford, with others of the Tory ministers of Anne, were in treaty with the son of James II., and either really or pretendedly negotiating for a restoration. On the arrival of George I. in 1715 the first rebellion broke out in Scotland; its mismanagement and failure damped considerably the enthusiasm of the English Jacobites. In Scotland, however, the party maintained its influence until the unsuccessful rebellion of 1745 put an end to its political importance. Several country gentlemen of the ultra-conservative stamp maintained a correspondence with Charles Edward until his death in 1787, and on the death of his brother, the Cardinal of York, in 1807, the adhesion of the almost extinct party was transferred to the house of Brunswick. In Scotland the hopes and wishes of the Jacobite party found expression in many beautiful songs, which form an interesting portion of the national literature; see Hogg's Jacobite Relics (1819–21), the Culloden Papers (1815), Mrs. Thomson's Memoirs of the Jacobites (1845–46), &c.

JACOBS, Christian Friedrich Wilhelm, was born at Gotha in Saxony, 1764, studied theology in Jena in 1781, and in 1784 went to Göttingen, where he abandoned his theological studies in order to devote himself to philology. In 1785 he became a teacher in the gymnasium of his native city, where he undertook, in conjunction with several learned friends, the Charactere der Dichter aller Nationen (seven vols.) as a sequel to Sulzer's Theorie der Schönen Wissenschaften, the continuation of which was prevented by the death and separation of the contributors. Among his other works are the following:—Bion and Moschus in 1795; in 1796 and 1797 Exercitationes criticæ in Scriptores veteres (two vols.) His Emendationes in Anthol. Græc. (1798) was followed by a reprint of the part of the Analecta of Brunck which belongs to the Anthology, with indexes (Leipzig, 1794–1814, eight vols.) His Tempe (Leipzig, 1803, two vols.) was prepared contemporaneously with his commentary on the Anthology, which he finished in 1803. Of his Elementarbuch der Griechischen Sprache two volumes had appeared when he was appointed (1807) professor of ancient literature in the lyceum in Munich and

member of the new Bavarian Academy. In Munich he completed the third and fourth volumes of his Greek Elementarbuch, and in three years returned to Gotha, where he was appointed chief librarian and superintendent of the cabinet of coins. Here he made out a catalogue of the valuable library, and published the Greek Anthology, from the Vatican MS., under the title Anthologia ad Fidem Codicis Vaticani edita (Leipzig, 1813–17). He died in 1847. The number of his publications is very great.

JACQUARD, Joseph Marie, the inventor of a famous machine named after him, was born at Lyons in 1752. His parents, belonging to the humble silk weavers, early employed him in the same occupation, and so completely neglected his education that he could neither read nor write till self-taught. He soon began to show a very decided turn for mechanics, and amused his leisure by constructing models of buildings and other objects. In his twelfth year he was placed with a bookbinder, and then with a type-founder, but on his mother's death returned home and assisted his father. Some years after, when his father was dead, he endeavoured, by means of the little property which his parents had left him, to establish a small silk manufactory; and about the year 1777 he married. His enthusiasm for invention and his commercial inexperience were the ruin of his factory, and he was obliged to abandon it almost penniless. Left now without means, without ambition, and almost without thought for the future, he spent his time in brooding over inventions in weaving, typography, and cutlery, but arrived at no successful result, and saw himself compelled at last to enter the service of a lime-burner, while his wife employed herself in Lyons in making straw-bonnets. In 1790 he had conceived the idea of the weaving-machine, which has made his name famous over the manufacturing world; but the revolution suddenly broke out, and for a time absorbed all his thoughts. Having with his son assisted in defending Lyons against the army of the Convention in 1793 they were both denounced, and obliged to save themselves by flight. They joined the army of the Rhine, and fought together till the son was killed, when Jacquard returned to Lyons, and under more favourable circumstances resumed the consideration of his loom, which he succeeded in constructing, though in an imperfect form, so as to be able to present it in 1801 to the national exposition of the products of industry. He was rewarded with a bronze medal, and also obtained a patent for ten years. About this time his attention was attracted by a paragraph in an English newspaper offering a prize for the construction of a machine applicable to the weaving of fishing-nets and similar maritime purposes. He was again successful as an inventor, and was rewarded both with a gold medal and a situation in the Conservatoire des Arts et Metiers. In 1804 he returned to Lyons, and laboured to introduce his loom into general use. He found himself assailed by abuse and open violence from those whom his invention had temporarily thrown out of employment. He was denounced as the enemy of the people, and as the man who was reducing thousands to ruin and starvation. His house was entered by an infuriated mob, and one of his looms broken in pieces; and on several occasions he barely escaped from their fury with his life. Ultimately the invention was purchased for the use of the public; its value was universally acknowledged, and he was enabled to spend the latter years of his life in comfortable independence. He died in 1834, at the advanced age of eighty-two.

JACQUARD LOOM. See Weaving.

JACQUERIE, the name given to the rising of the French peasantry against their lords in the middle of the fourteenth century after the battle of Poitiers. They committed great devastations and outrages—burning castles, murdering men and violating women—particularly in the north-east of France. They were at length quelled by the Captal de Buch and Gaston Phébus, count of Foix, who slaughtered 7000 of them near Meaux. The term *Jacquerie* is derived from *Jacques Bonhomme*, a familiar epithet for a peasant.

JADE, an ornamental stone, also called Nephrite, a native silicate of calcium and magnesium, usually of a colour more or less green, of a resinous or oily aspect when polished, hard and very tenacious. It has been used by rude nations for their weapons and implements, and has been and is highly prized in many parts of the world, as in China, New Zealand, and among the native races of Mexico and Peru. Jade celts or axes are common among uncivilized races, and prehistoric specimens have been found in Europe, though the stone itself is not found there. A similar stone, more properly called *jadeite*, is frequently confounded with jade proper. It is a silicate of aluminium and sodium.

JADE, or Jahde, a small strip of territory belonging to the Prussian province of Hanover, but formerly to the Grand-duchy of Oldenburg, acquired by the Prussian government for the purpose of constructing a naval port. The port was formed on the western shore of Jade Bay, and was formally opened by King William in June, 1869. The principal harbour is 1200 feet long and 750 broad, and there are dry docks, government building-yard for the construction of iron-clads, &c. The town of Wilhelmshaven, which was founded at the same time, has rapidly increased in population, the inhabitants being 5970 in 1871, and 15,476 in 1890. The town and harbour are both surrounded by a line of fortifications.

JAEN, a town, Spain, Andalusia, capital of the province of the same name, finely situated on a terraced slope above a river of the same name, 122 miles E.N.E. of Seville. It consists of an old town, with some remains of a Moorish wall flanked with towers, and very irregular, narrow, and winding streets; and a new town, generally of respectable appearance. The principal edifices are the cathedral, in the Græco-Roman style, remarkable for its magnitude and solidity, flanked by two towers above 200 feet high; several other handsome churches, town-house, provincial government-house, and bull circus capable of seating 8000 spectators. Pop. (1897), 25,929.—The province has an area of 5184 sq. miles, is largely mountainous in character, and contains valuable lead-mines. Pop. (1900), 474,490.

JAFFA, or Yaffa (anciently *Joppa*), a maritime town in Palestine, 33 miles north-west of Jerusalem, with which it is now connected by a good road, while a railway was also opened in 1892. It is picturesquely situated upon an eminence, crowned by a castle, but is not now surrounded with walls. The narrow, ill-paved, and dirty streets rise above one another in tiers, and many of them are connected by flights of steps. The harbour is a shallow basin, inclosed by rocks, and the roadstead is unsafe; but notwithstanding this there is a considerable trade, the chief exports being oranges (an excellent variety cultivated here), sesame, soap (here manufactured), olive-oil, maize, and wheat. Jaffa or Joppa is a very ancient town, having been the seaport of Jerusalem from the time of David and Solomon, while there are traditions of its existence long prior to this period. In 1187 it was taken by Saladin, in 1191 by Richard I. In 1799 it was taken by Napoleon, who here put to death 1200 Turkish prisoners. Pop. 35,000, two-thirds being Mohammedans.

JÄGERNDORF, or KARNOW, a town of Austria, in Silesia, 13 miles north-west of Troppau, beautifully situated at the foot of the Burgberg, in the valley between the Gold Oppa and the Oppa. It has spacious well-paved streets, a handsome church with two towers 230 feet high, the loftiest in Silesia; a palace of the Liechtenstein family, town-house, high school, Minorite cloister and hospital, and manufactures of woollens, &c. Pop. (1890), 14,278; (1900), 14,675.

JAGGERY, a coarse brown sugar made in the East Indies by the evaporation of the juice of several species of palms, chemically the same as cane-sugar. The sap which yields jaggery becomes by fermentation palm-wine, and from it arrack is distilled.

JAGO, ST. See SANTIAGO.

JAGUAR (*Felis onca*, Linnæus). This animal represents, in the New World, the leopard and tiger of the eastern hemisphere. It inhabits South America, especially in its central and northern parts, and also the southern districts of North America, up to Northern Mexico. In colour and general appearance the jaguar is leopard-like. The upper part of the body is generally of a yellowish or fawn colour, which becomes continuous with the white colour of the throat, belly, and inner aspect of the legs. The head, limbs, and under surface are covered on this ground-colour with black spots or patches, whilst the trunk is encircled by patches having a black central point, or composed of smaller spots arranged in groups, dark rings being often conspicuous. But considerable variety of coloration occurs, and some specimens are completely black. The jaguar may attain a size equal to that of the tiger or leopard, although in its average proportions the animal is generally smaller than either of these. In strength, however, the jaguar appears to equal these creatures, as it has been known to carry off oxen and bullocks; whilst on one occasion a jaguar was observed to kill a horse, to bear his victim to a river some distance off, and to swim across the rapid flood with his prey, which he then dragged into the adjoining jungle. This creature, like the leopard, climbs trees with great ease and dexterity, and appears to swim quickly and well. The neighbourhood of large rivers, indeed, is a frequent haunt of the jaguar, which is attracted no doubt by visits of animals in quest of water, upon which it can prey. Whilst possessing a fair share of courage, and even when brought to bay or incited by hunger attacking man himself, the jaguar is by no means a fierce or combative animal. On the contrary, he appears to avoid man, and even in his forays to single out the last of a herd, or the least protected of a flock, as the object of attack. The jaguar's mode of attack consists in springing upon the back of the victim; and by placing one paw on the back of the head and the other on the muzzle, he is enabled to twist the head round with a sudden jerk, by which the spine is dislocated and the animal deprived of life. In captivity the jaguar may become subdued or even docile. See illustration at CARNIVORA.

JAHDE. See JADE.

JAIL. See PRISON.

JAIL FEVER, a dangerous disease once very prevalent in prisons, and which is now considered to be merely a severe form of typhus fever (which see).

JAINAS, or JAINS, a Hindu religious sect, which from the wealth and influence of its members forms an important division of the Indian population. They are most numerous in western and north-western India, more especially in the Bombay native states and Rajputana. The name signifies a follower of Jina, one of the denominations of their apotheosized saints. The sect was very numerous and important in the eighth and ninth centuries of the Christian era, and they have left many monuments of their skill and power in the fine temples built in different parts of the Deccan, as well as elsewhere. The founder of the sect was Rishabadeva, a Hindu, but the system itself was an offshoot or aftergrowth of Buddhism, with which it has many leading doctrines in common, but is distinguished from it by its recognition of a divine personal Ruler of all, and by its political leanings towards Brahmanism. The Jains deny the divine origin and infallible authority of the Vedas; they reverence certain holy mortals, now termed Tîrthankara or saints, who acquired by self-denial and mortification a station superior to that of the gods; and they manifest extreme and even ludicrous tenderness for animal life. They positively affirm that the world exists from all eternity, not being created by God or any other being, and that it will exist for ever. This world is divided into three parts—the upper, the middle, and the lower worlds. Below this world there is a world called Adhogati (abyss, the lowest hell), above which there are seven infernal worlds; above those again are ten Pavanalokas (purgatories), above which is this world of earth. Still ascending, we find the Jyotiloka (starry world, world of light). In our world there are two worlds included: the Vyantraloka (world of demons) and the Vidyadharaloka (world of demi-gods); again above those are sixteen different kinds of Devalokas (worlds of the gods), over which is the Ahamindraloka (world of Indra); and above that again is the Mokshaloka (world of bliss), where dwells the Supreme Being called the Anadi-chitta-para-meshti (Eternal-intellectual-heavenly-dweller). The Jainas believe that not to kill any sentient being is the highest virtue; and lying, covetousness, theft, are strongly condemned. Not to eat at night, and to drink water strained (for fear of its containing any insect), not to drink toddy or arrack, are important injunctions. Various fruits and vegetables they will not eat even under the pressure of starvation, and any kind of flesh meat they will not touch with the hand. They believe in a sort of nirvâna (like the Buddhists). Those who attain to this nirvâna, this extinction of action, this final liberation, do not return to a worldly state, and there is no interruption to their bliss; they have perfect vision and knowledge, and do not depend upon works. The Jainas are split up into two principal divisions, Digambaras and S'wetâmbaras; the points of difference between them are said to comprehend a list of 700 topics, eighty-four of which are considered of paramount importance. The Digambara (sky-clad, naked) now wears coloured garments, confining the disuse of clothes to meal hours; the S'wetâmbara wears, as the name signifies, white garments. Both the parties have the same Veda.

JALAP, the dried tubers of *Exogonium Purga* (natural order Convolvulaceæ), has received its name from being principally brought from the environs of Jalapa; though the plant which produces it is abundant in other parts of Mexico, including the immediate vicinity of Vera Cruz. It is a beautiful convolvulus-like plant, bearing delicate pink flowers; the stem is perennial but thin, and forms in the ground a tuber of an oval form, which attains the size of a small turnip, and from the end of which the roots and stem are given off; externally the tubers are of a dark umber-brown colour, and much wrinkled. It is much employed in medicine as a purgative, and has been known in Europe since 1610.

JALAPA, or XALAPA, a city of Mexico, capital of the state of, and 52 miles north-west of Vera Cruz, on the railway from that seaport to the interior, at the foot of a basaltic mountain 4335 feet above the

sea-level. It is irregularly built, and the houses have a picturesque appearance. It has a church said to have been founded by Cortez, a Franciscan convent, and several cotton factories. In the vicinity is found the plant from which jalap is obtained, a name derived from the town. In certain seasons the climate is moist and disagreeable, but it is at all times healthy. Pop. (1895), 18,173.

JAMAICA, the largest and most valuable of the British West India Islands, and the third in extent of the whole group, is 144 miles long, and from 21 to 49 miles broad, and has an area of 4207 square miles. It is about 90 miles S. of Cuba, 120 miles W. of Hayti, and 310 miles from the nearest point in Central America. As dependencies it has the Cayman Islands on the N.W., and the Turks and Caicos Islands N. of Hayti, the latter belonging geographically to the Bahamas group. The scenery of Jamaica is extremely beautiful. The central mountain chain rises close to the coast at the western and eastern ends, and with its spurs and outliers occupies the greater part of the area of the island. Except at the eastern end, where the Blue Mountains are situated, with their highest point, Blue Mountain Peak, 7420 feet above sea-level, the altitude nowhere exceeds 3000 feet. The whole chain is covered with luxuriant vegetation. West of Kingston cultivation extends to the summits, which are for the most part tolerably flat; east of Kingston the peaks and ridges are sharper, and are covered with virgin forest. There are numerous valleys, those belonging to the Blue Mountain range proper being very narrow, with precipitous sides, whilst elsewhere a fair proportion are of considerable extent and great fertility. Not more than a seventh of the area of the island, however, can be called really level, and of this a considerable part is marsh. The most important of the level tracts commences a little east of Kingston, in the neighbourhood of which it is called the plain of Liguanea, and extends westward for about 30 miles, with a breadth of about 5 miles. Here the rainfall is less than in any other part of the island, and cultivation on the large scale can only be carried on by means of irrigation, though the soil is naturally fertile. An extremely beautiful and fertile plain on the north side, near Falmouth, is known as 'the Queen of Spain's Valley'. The coast-line is over 500 miles in length, and possesses some good harbours, of which those at Kingston and Port Antonio are the best and most important. There are also roadsteads with good anchorage, as at Annotto Bay and Black River, which are much used by shipping in fair weather. There are numerous small rivers, rivulets, and springs (the name Jamaica is said to mean Land of Springs), but none of the rivers are navigable except the Black River, for small craft, for 20 or 30 miles from its mouth, and the Cabaritta and Salt Rivers for barges for a short distance from the coast. Many of the rivers and streams sink in the ground, and come to the surface again at a lower level nearer, and in some cases under, the sea. Slight, hardly noticeable shocks of earthquake are not infrequent, but severe shocks are very rare. The most serious on record occurred in 1692, when the greater part of the town of Port Royal, then by far the most important in the island, with its houses and other buildings and their inhabitants, subsided under the sea to a depth of from 20 to 50 feet.

The climate of Jamaica in the lower plains along the coast is hot, but not unhealthy. The average maximum day temperature is in winter about 85°, and in summer about 90°; at night the average minimum is in winter about 65°, and in summer about 75°. The day heat, especially in the summer, is moderated by the sea breeze, which blows from about 9 a.m. to 6 p.m. The pleasantness and salubrity of the climate increases with every additional foot of elevation above sea-level, and above 2000 feet it is one of the healthiest and most agreeable in the world. A great part of the parishes of Manchester and St. Elizabeth is between 2000 and 3000 feet above the sea, with a temperature never below 60°, nor above 80°, and would make an ideal health resort. At the Government Cinchona Plantations in the Blue Mountains, 5000 feet above the sea, the usual limits of temperature throughout the year are 50° and 70°; and the climate is a perpetual spring, with almost constant sunshine. The rainfall ranges from 33 in. in Kingston (the average for ten years) to from 200 to 300 in. in the north-east, where the moisture-laden trade-wind strikes the high mountains; for the whole island the average for ten years is 66 in. The heaviest fall occurs usually in May and October, when there are generally a few days of heavy and almost continuous rain, which are known as the May and October 'seasons' respectively. The three first months of the year are nearly always very dry. Jamaica lies somewhat out of the central track of West Indian cyclones, which are consequently not nearly so frequent as in the Lesser Antilles and Porto Rico. Yellow fever, which was such a scourge in the first half of the nineteenth century, has been practically unknown, except at rare intervals, for more than a generation. Although it gave rise to some anxiety in 1885 and 1897, the deaths due to it were in each case under 100, or less than 1 per cent of the total mortality. Intermittent fever is common, but rarely dangerous. When cholera has appeared in Europe and America, it has usually visited Jamaica also; in 1851-52 there was a terrible epidemic which carried off 40,000 people, or nearly three times the usual number of deaths in a year.

The soil of Jamaica is generally fertile, and the island depends for its prosperity entirely on its culture. Its chief exports are fruit, mostly bananas and oranges, the trade in which is of recent origin; sugar, rum, dyewoods (chiefly logwood), coffee, pimento, ginger, coco-nuts, cocoa, &c. The cultivation of tobacco and cocoa, for which the soil and climate are admirably adapted, has increased considerably of late years, and the quality of some of the tobacco recently grown has been declared by experts to be equal to that of the best grown in Cuba. Pine-apples of the most delicious flavour are readily grown, and some are exported. Large plantations of cinchona-trees, which grow luxuriantly, were established by the government between 1870 and 1880, and subsequently by many private individuals. The articles of food most largely consumed by the peasantry are yams, cocoes (a tuber similar to the yam), bread-fruit, plantains, &c.; peas of various descriptions; and salt fish, salt beef, and salt pork, all imported and used more as a relish than as a food. Rice is largely eaten by the coolies, and is nearly all imported, though some is grown in the island. Maize grows readily, but more is imported than is produced locally, and most of it is used as food for horses and mules. None of the products mentioned, except pimento, one minor species of yam, and possibly cocoes, are indigenous to the island; the rest are all imported. Other exotics are the now ubiquitous bamboo and mango, the lime, lemon, grape-fruit, nutmeg, kola-nut, &c. &c. The native timber trees, such as mahogany, yacca, mahoe, cedar, bully-tree, &c., are numerous and valuable, many being beautiful in colour and grain, and excellently adapted for cabinet work, and all being used for building. Ferns of all kinds abound, especially in the high mountains, where

tree-ferns and filmy ferns in many varieties are specially numerous.

Horses, asses, mules, and cattle are raised in large numbers, and good pasturage is plentiful, the best being the guinea-grass, which grows to a height of from 3 to 5 feet, and was accidentally introduced through the seed being imported as food for canaries. The draught work on the sugar estates is almost entirely performed by cattle; whilst on the public roads horses are mostly used for drawing carriages, and mules for carts. Horses and mules are about equally used for riding; and mules and donkeys for the conveyance of produce over the mountain paths. Goats and pigs are universally kept. Sheep are comparatively scarce, and mutton is a luxury, being about twice the price of beef or pork. Domestic fowls of all kinds are abundant. The markets are well supplied with the fish which abound on the coasts; but the fresh-water fish, though far more delicate in flavour, is seldom seen, and difficult to procure. Amongst the wild animals the agouti is the only indigenous quadruped, known locally as the cony, in appearance something between a rat and a rabbit, now very rarely seen, and only in two or three localities. Others are the wild pig, common in the Blue Mountain forests, and the mongoose, which was introduced to destroy the rats on the sugar estates, but has now, from its enormous increase in numbers and its fondness for poultry, become an even greater pest than the rats themselves. Amongst wild birds may be mentioned the 'John Crow', a species of buzzard peculiar to Jamaica, numerous species of pigeons, snipe, wild duck, and three species of humming-birds. Lizards, in colour brown, blue, or green, are numerous. There are only two species of snakes, both of them quite harmless and very rare. Scorpions are numerous, but the sting is rarely serious, less so usually than that of a wasp; centipedes, whose bite is much more to be dreaded, are rarely seen. Butterflies and moths are numerous, some of them very beautiful. The greatest insect pest is the tick, said to have been introduced in recent years on cattle from Central America. It infests cattle and horses, and takes every opportunity of settling on human beings, causing intense irritation. It hangs in clusters, each individual hardly larger than a pin's point, on guinea-grass and other low vegetation, and can be, to a great extent, avoided by keeping to the main roads and worn foot-tracks. Monkeys are unknown in Jamaica.

The government of Jamaica, for about 200 years up to 1865, had been administered by a governor, an executive, and a legislative council appointed by the crown, and a house of assembly elected by the freeholders of the island; but in consequence of the serious revolt which broke out in that year, the house of assembly was abolished and the government entirely altered. In 1884 an Order of Council was passed, under which half the members of the Legislative Council were to be elected, and three nominated members' seats left vacant, unless in case of emergency, so that ordinarily the elected members had a majority. No vote could in any case be passed if all the elected members were against it, and no financial vote could be carried if two-thirds of their whole number opposed it, unless the governor declared the matter to be one of 'paramount importance'. This arrangement not being considered to have worked satisfactorily, the governor was in 1899 instructed to appoint the full number of nominated members, so as to give the government a permanent majority. The island is divided into fourteen 'parishes', with a limited amount of local self-government. Kingston is the capital. There is an imperial garrison kept in the island, and a local volunteer force. The police force is semi-military in character. In 1898-99 the total public revenue was £672,768, and the expenditure £748,515; whilst the value of the exports was £1,662,543, and that of the imports £1,813,793. Two-thirds of the exports go to the United States, and only one-sixth to the United Kingdom, whilst the imports come about equally from each. The island has recently suffered from severe depression, due to unfavourable seasons and the unusually low price of all its products, a depression from which it is now happily recovering The English church is presided over by a bishop, assisted by a regular staff of parochial clergy. The Baptists, Methodists, Presbyterians, and other Protestant bodies are well represented, and there are considerable numbers of Roman Catholics and Jews. Education has since 1865 been greatly developed and extended. There are about 900 schools with 96,000 children in attendance. In 1899 the public debt was fully £2,000,000, but by far the greater part of it has been expended on railways, roads, harbours, and other public works. There are 187 miles of railway, connecting Kingston with Port Antonio and Montego Bay, in the N.E. and N.W. respectively. The population of the island was estimated on 31st March, 1903, at 785,434. According to the census of 1891 it was 639,491, of which 14,692 were returned as white, 121,955 as coloured, 488,624 as black, 10,116 as East Indian (coolies), 481 as Chinese, and 3628 not stated. Of the births two-thirds, about the same proportion as in the other West Indies, are illegitimate. All the efforts of the churches seem to make no impression on this blot on the character of the people. If we leave out of consideration thefts of growing produce, or 'prædial larceny', there is very little crime in the island: intemperance is also very rare.

Historical Sketch. — Jamaica was discovered by Columbus, May 3, 1494, in his second expedition to the New World. It was occupied by the Spaniards, and out of an estimated population of 60,000 at the discovery of Columbus not a single descendant was alive little more than a century and a half afterwards. In 1655 it was conquered by the English, under Admirals Penn and Venables, during the administration of Oliver Cromwell. The immigration of whites was now encouraged, and in the hands of Governor D'Oyley the government was administered with energy. In May, 1658, an unsuccessful attempt was made by the Spaniards to recover the island. About this time the settlement became the resort of the buccaneers, who spent their immense gains in characteristic extravagance, and enriched the inhabitants. After the Restoration of Charles II. Jamaica became a place of refuge for many English republicans. One of the first measures of the monarch was to continue D'Oyley in office, and authorize the election of a council and assembly of representatives by the people. This, which was the establishment of a regular civil government, the island having been previously governed by martial law, took place in 1661. Afterwards controversies arose between the assembly and the crown which unsettled the affairs of Jamaica for fifty years. At length, in 1728, a compromise was effected. On the conquest of the island from the Spaniards a number of African slaves fled to the mountains, and maintained themselves in these fastnesses in spite of all efforts to dislodge them. Their numbers were continually increased by the accession of deserting slaves, and a harassing conflict thus maintained with the white population. In 1738 a species of independence was guaranteed to these Maroons, as they were called; but at length, in 1795, hostili-

ties broke out again. The activity and skill of the Maroons rendered them an overmatch for the great force brought against them; and at last the British resorted to the use of blood-hounds. Thus, hunted down like wild beasts, and hemmed in by a force too powerful to be overcome, they had no alternative but submission. About 600 were transported to Nova Scotia, where many of them perished. In 1807 the slave-trade was abolished, and in May, 1833, an act was passed by the English government liberating all the slaves in the island, under the restriction of an apprenticeship for a certain number of years. The act was to take effect from the 1st of Aug. 1834, and to compensate the owners for the loss thereby occasioned a sum was awarded to Jamaica of £6,161,927, 5*s.* 10*d.* The results of this measure were not so satisfactory as might have been expected. The negroes were treated by many of the proprietors with great unfairness, and even tyranny, so that large numbers refused to work, with the result that many estates were left uncultivated and the owners ruined. In 1840 the government sanctioned the importation of coolies. This measure was looked upon by the blacks with great discontent, as interfering with the rate of wages of those who were willing to work, but matters proceeded in a peaceable course until October, 1865. On the 7th of that month a serious revolt broke out at Morant Bay. The court-house was burned down, the custos of the district, two justices of the peace, and a clergyman, with about twenty others, were killed. Martial law was proclaimed in the county of Surrey, except in Kingston, and the military proceeded to put down the insurrection with great severity. G. W. Gordon, a mulatto, a man of independent means, a member of the legislature and a Baptist preacher, was suspected of instigating the revolt. A warrant for his apprehension was issued, but before it was served he surrendered himself at Kingston. The governor (Mr. Eyre) had him sent to Morant Bay, where he was tried by court-martial, and hanged on the 23rd. A like fate awaited many of those captured by the military. The severity of the repression excited a strong feeling of dissatisfaction in England. Governor Eyre was removed, and the representative constitution suspended. Since that time there have been no signs of disaffection, and the prosperity of the colony seems to have been gradually advancing. New objects of cultivation are being introduced, as the pita plant or sisal hemp for its fibre; various vegetables, &c.

JAMES, St., called the *Greater*, the son of Zebedee. He was called to be an apostle, together with his brother St. John, as they were mending their nets with their father, who was a fisherman. They then followed Christ, were witnesses with St. Peter of the transfiguration, and accompanied our Lord in the garden of Gethsemane. In the lists of the apostles given in the synoptic Gospels and in the Acts the names of Peter, Andrew, James, and John stand first; and it is plain that these four were at the head of the twelve throughout. After the ascension St. James persevered in prayer with the other apostles and the women and the Lord's brethren. Nothing further is certainly known of him till the passover of 44, when, being in Jerusalem, the Jews stirred up Herod Agrippa I. against him, who put him to a cruel death. Thus St. James was the first of the apostles who suffered martyrdom. There is a legend that he went to Spain, and that his bones lent miraculous aid to the Spaniards against the Saracens.

JAMES, St., called the *Less*, an apostle, the brother or cousin of our Lord, who appeared to him in particular after his resurrection. He is called in Scripture the *Just*, and is probably the apostle described in Matt. x. 3 and elsewhere as the son of Alphæus. He was the head of the church in Jerusalem when the Scribes and Pharisees threw him down from the gable of the temple, and a fuller dashed out his brains with a club, about the year 62. This is the account of his death given by Hegesippus, a Christian of Jewish origin, who lived in the middle of the second century, and it differs somewhat from the narrative of Josephus. Some critics maintain that James, the son of Alphæus, was one person, and James, the brother of Jesus, another. Whether James was the author of the epistle which bears his name is considered doubtful.

JAMES I., King of Scotland, of the house of Stuart, born at Dunfermline in 1394, was the son of Robert III. by Annabella Drummond. In 1406 he sailed for France in accordance with the wish of his father, that he might escape the danger to which he was exposed by the ambition of his uncle the Duke of Albany, who had previously rendered his own accession to the throne more easy by the murder of the heir-apparent, the Duke of Rothesay; but the vessel in which he was being conveyed was taken by the English off Flamborough Head, and he and two companions were carried prisoners to the Tower of London. For the next eighteen years he remained a prisoner in England, being confined during part of his captivity in Nottingham Castle, Evesham, and Windsor Castle. He received an excellent education from Henry IV. of England, and, to relieve the tedium of captivity, he applied himself to those poetical and literary pursuits in which he so highly distinguished himself. Robert III. died very shortly after learning of his son's captivity, and James was proclaimed king; but during the remainder of the reign of Henry IV., and the whole of that of Henry V., he was ungenerously detained in England, with a view to prevent the alliance of Scotland with France. This did not, however, prevent the apprehended result. James was for some time in France with Henry V., and he witnessed the capitulation of Melun. At length, in 1424, under the regency of the Duke of Bedford, he was restored to his kingdom, at which time he was in his thirtieth year, and highly accomplished both mentally and in all manly exercises. But hostages for the payment of 60,000 marks, in instalments of 10,000 a year, had to be given before his captivity came to an end. A promise was secured that the Scottish troops would leave France, and it was requested that James should marry an English lady. Previous to his departure he married Jane or Joanna Beaufort, daughter of the Earl of Somerset, a lady of distinguished beauty, of the blood royal of England, who is the fair dame alluded to in his beautiful poem of the King's Quhair. James had become enamoured of her through seeing her in the royal gardens from the windows of his apartments while a captive in Windsor Castle. One year's payment of the ransom was remitted as her dowry. On his return to Scotland he in 1425 arrested the Duke of Albany, the late regent, and a large number of his relations and supporters, and after a summary trial had them executed as traitors. These and some other rather arbitrary and impolitic measures were atoned for by the enactment of many good laws; and as far as a lawless nobility would allow them to be put in practice, these much improved the state of society in Scotland. In 1428 he renewed the Scottish alliance with France, betrothing his daughter Margaret to the dauphin, afterwards Louis XI., and in 1436 she was sent to France. A fruitless endeavour of the English to prevent this marriage, by intercepting the Scottish fleet, so exasperated James that he declared war

against England. He was, however, on such bad terms with his nobility, in consequence of his endeavours to curb their ambition and improve his revenue, that, after besieging Roxburgh Castle, he was obliged to disband his army, under the apprehension of a conspiracy. He then retired to the Carthusian monastery of Perth, which he had himself founded, where he lived in a state of privacy which facilitated the success of a plot formed against his life. The chief actors in this tragedy were Robert Graham, uncle of the Earl of Strathearn, and Walter, earl of Athol, the king's uncle, the former of whom was actuated by revenge for the resumption of some lands improperly granted to his family, and the latter by the hopes of succeeding to the crown. By means of bribery the assassins, who had under their command 300 armed men, gained admission to the king's apartments, and an alarm being raised, the queen's ladies attempted to secure the chamber door. One of them, Catharine Douglas, thrust her arm through the staple, in which state she remained until it was broken by the assailants. The instant the assassins got into the apartment they dragged the king from his concealment in a recess under the floor, and in spite of the cries and remonstrances of the queen, who in vain threw herself between them and the object of their resentment, put him to death by multiplied wounds. He perished in the forty-fourth year of his age and thirteenth of his reign, Feb. 21, 1437, leaving one son and five daughters; and his murder was punished by the deaths of the conspirators in exquisite tortures. The king, who may be said to have fallen a martyr to his attempts to abolish the anarchy and disorder which prevailed throughout his kingdom, holds a deservedly high place in the catalogue of royal authors by his poem of the King's Quhair (that is, book). James is also said to have been a skilful musician, and some attribute to him the composition of several of the most admired of the Scottish melodies; but of this Dr. Burney is much inclined to doubt. Among the works ascribed to James I. are three admirable descriptive poems, respectively entitled, Christ's Kirk on the Green, Peblis to the Play, and the Gaberlunzie Man, the authorship of which is sometimes given to James I., and sometimes to James V. The balance of unprejudiced opinion inclines in favour of James I. as the author of the two former, and though probably not the author, James V., from his well-known roving propensities, was in all likelihood the hero of the last-mentioned piece.

JAMES II., King of Scotland, when his father was assassinated in February, 1437, was only seven years of age. A minority under such circumstances could not but be troubled, and the kingdom was distracted by contending factions, who strove for the possession of the king's person, as the surest means of obtaining the ascendency. The chancellor, Crichton, and Sir Alexander Livingston, wielded conjointly the royal authority until James had reached his fourteenth year. To curb the power of the great house of Douglas, which rivalled that of the crown, Crichton had caused Earl William and his brother to be put to death. A politic marriage, however, not only conserved but enhanced the power of the Douglases, and, allying himself with the chief of that house, James held a parliament, which declared Crichton and Livingston rebels, and forfeited their estates. In 1449 he married Mary of Guelderland, and his character at once became more mature and decided. He resolved to free himself from the galling and overmastering influence of Douglas, who was virtually the supreme authority in the kingdom. Inviting him to a conference at Stirling Castle in 1452, on a quarrel having arisen James murdered him with his own hand. His heir, to avenge this perfidy, aided by the house of York, raised the standard of rebellion at the head of an army of 40,000, but he was compelled to flee, and his lands were confiscated. In 1460 James, while besieging the Castle of Roxburgh, in direct violation of an existing truce with England, was killed by the bursting of a cannon in the twenty-ninth year of his age. A prolonged life might have been of great advantage to Scotland, as he was gradually giving evidence of a clearness of perception in the framing of laws akin to that of his father.

JAMES III., King of Scotland, born in 1453, was, like his father James II., whom he succeeded in 1460, a mere boy when he mounted the throne, and of course remained for many years in the hands of guardians, who disregarded his interests, and used their power for factious purposes. On the death of Bishop Kennedy in 1465 James fell into the hands of the Boyd family, who in a short period acquired so great influence that the king gave Sir Thomas Boyd his sister in marriage. In 1469 James married Margaret of Denmark, and in the same year the Boyds were deprived of power. His attachment to worthless favourites was the principal weakness of James. Cochrane, originally a mason, or more probably an architect, was the most conspicuous of these; and through his means one brother of James was compelled to flee the kingdom, while another was put to death. The nobility, impatient of the overweening and dangerous influence of what they deemed upstarts, seized upon Cochrane and five others of the principal favourites, and hanged them at Lauderbridge in 1482, while the Scottish army was marching to meet an invading force of the English under Gloucester. The army was disbanded, and the king himself shut up in Edinburgh Castle. In 1487 the queen died. Not long after a conspiracy of a large portion of the nobles was formed to dethrone the king, whose peaceful and unambitious character was contemptible in the eyes of his turbulent and warlike subjects. Those peers who remained loyal gathered round the king, and parties having levied their forces, the decisive encounter took place at Sauchie, near Stirling, on the 18th of June, 1488, when the king, completely defeated, fled for his life, but falling from his horse, was dragged into a cottage and barbarously murdered. His body, concealed by the murderers, was never found.

JAMES IV., King of Scotland, born 17th March, 1472, was son of James III. by Margaret, daughter of the King of Denmark, and was thus in his sixteenth year when, in consequence of his father's murder, above narrated, he succeeded to the throne. During the rebellion he had been confided to the charge of Shaw of Sauchie, governor of Stirling Castle, who proved a traitor, and delivered him to the rebels. They, to strengthen their cause, immediately recognized him as their king, and he was thus nominally, if not voluntarily, at war with his father, and in league with those who murdered him. What his real intentions were is not clear; but it is difficult to believe that, if he had not been conscious of guilt, he would have expressed so much contrition, and even endeavoured, according to the superstition of the times, to avert the vengeance of Heaven for unfilial conduct by wearing an iron belt or chain round his waist, and adding to its weight every year by way of penance. But for the suspicion which thus attached to him, and some domestic infidelities, James would be worthy of admiration both as a man and as a prince. He was personally handsome, brave, and generous, excelled in all manly exercises, loved letters, though his education was scanty in the extreme; raised the Scottish court to a high degree of

refinement and magnificence, administered justice with great impartiality, and passed many excellent laws. In the beginning of his reign the naval exploits of Sir Andrew Wood of Largo attracted an attention which was not confined to Britain. For various reasons, therefore, James was rewarded with a popularity greater than any previous king of Scotland had enjoyed, and still holds an important place in its ballads and other traditional literature. The interest which thus attaches to his memory was undoubtedly heightened by the disaster which terminated his life. In 1503 he had married Margaret, daughter of Henry VII., king of England, and thus for a time put an end to the unnatural hostility between the two countries. Unfortunately, on the accession of Henry VIII. to the English crown in 1509, the relation between the two courts became less friendly, and at length strained relations were followed by open war in 1513. The causes of quarrel were various, and none of them were of great importance. One of the chief was Henry's refusal to give up to the queen a legacy of jewels bequeathed her by her father. The French ambassador brought provisions and money to Scotland, and also a letter from Anne of Brittany appealing to James as her knight to assist France; and though the war was generally disapproved by the Scots, such was the king's popularity that his summons for an array of the whole kingdom was speedily answered, and he set out for the south at the head of an army of sixty thousand men. He crossed the border, took several castles, and had occupied a strong position, when the Earl of Surrey, with an army about equal to his own, but better trained, advanced to oppose him. The battle fought on the 9th of September, 1513, and only too well known as that of Flodden Field, terminated, after a sanguinary conflict of three hours, in the total defeat with heavy loss of the Scots. James and a large portion of his nobility were among the slain. He died in the forty-second year of his age and twenty-sixth of his reign.

JAMES V. of Scotland, born at Linlithgow, 10th April, 1512, succeeded in 1513, at the death of his father, James IV., though only eighteen months old. His mother, Margaret of England, was named regent during his childhood; but the period of his long minority was one of lawlessness and gross misgovernment. The factions of the Duke of Albany, who had been appointed regent by the Parliament after Margaret's re-marriage, and of the Earl of Angus, who had married the queen-mother, had a fierce struggle for supremacy. The victory remained with Angus, and it was with difficulty that the young king could escape from the power of the Douglases, and at the age of seventeen assume the reins of government. He now reduced Angus's castle of Tantallon, and compelled that noble to flee to England, and he then set himself to put down the lawlessness of the Border district. His policy, like that of most of the Stuart kings of Scotland, was to use the clergy and the commons to curb the great nobles. In 1536 he visited the court of France, and on the 1st January, 1537, he married Madeleine, daughter of Francis I., but the queen died two years after. He afterwards married Mary of Lorraine, daughter of the Duke of Guise and widow of Louis of Orleans. His uncle, Henry VIII., having broken with Rome, was anxious to draw his nephew along with him, but without success. He proposed that they should have an interview at York, and remained in that city for six days, but James never came. A rupture between the two kingdoms was the result of this studied neglect, and the Duke of Norfolk entered Scotland with an army of 20,000 men, ravaged the country, and retired. The Scottish nobles refused to follow the king, who was bent on the invasion of England. This disappointment, and the shameful rout of 10,000 Scots at Solway Moss, which followed immediately thereafter, attributed to his injudicious favouritism for a certain Oliver Sinclair, whose appointment to the command of the expedition had been resented by the leaders, filled the king with the deepest gloom. Almost simultaneously came news of the birth of a daughter, the ill-fated Mary, Queen of Scots. A weary spirit acting on a broken constitution exhausted what strength remained to him, and he died on the 16th of December, 1542, seven days after the birth of his unfortunate daughter. To him Scotland owes the foundation of the College of Justice, which developed into the Court of Session.

JAMES I. of England and VI. of Scotland was the only child of Mary, Queen of Scots, by her cousin Henry Stuart, Lord Darnley. He was born at Edinburgh Castle, 19th June, 1566; and in the following year, Mary being forced to resign the crown, he was solemnly crowned at Stirling, and from that time all public acts ran in his name. In the stormy times which followed, the infant prince was committed to the charge of the Earl and Countess of Mar. His childhood was passed in civil wars, under the regencies of Murray, Mar, and Morton, during which time he resided in Stirling Castle, under the tuition of the celebrated Buchanan. From the first he seems to have imbibed those exalted notions of the royal authority and divine right which proved so injurious to his posterity, but he was naturally cautious and fond of peace. Eager to have the king in their hands, a party of his nobles in 1582 took possession of his person at Ruthven Castle (the Raid of Ruthven). A new confederacy, however, effected his liberation, and he again put himself under the direction of his favourite the Earl of Arran. The policy of Queen Elizabeth, whose apprehensions from the Catholic party in favour of Mary led her to employ every art to keep up a dissatisfied party in Scotland, was greatly assisted by the violent and unprincipled measures of Arran against the connections of the late conspirators, many of whom fled to England, while Gowrie was executed. But James had soon to throw over Arran, and found it advisable to ally himself with Queen Elizabeth and accept a pension from her. When, however, it became apparent that the life of his mother was in danger from the sentence of an English judicature, James sent representatives to England to intercede with Elizabeth; but his whole procedure in the matter shows a singular callousness. As a matter of form he ordered the clergy to pray for his mother, but had considerable difficulty in getting anyone to do so. When the news of Mary's execution arrived James was not much moved, but he attempted to make a show of indignation by condemning one of the commissioners to death, a sentence which, however, he commuted to banishment. On the 23rd of November, 1589, James married Anne, daughter of Frederick II., king of Denmark. On his return home, after passing the winter in festivities at Copenhagen, he was in some danger from the unruliness of the nobles; and for several succeeding years of his reign the history of Scotland displays much turbulence and party contest. In 1600, while the country was in a state of unusual tranquillity, there occurred what is known as the Gowrie Conspiracy. (See GOWRIE CONSPIRACY.) In 1603 James succeeded to the crown of England, on the death of Elizabeth, and proceeded amidst the acclamations of his new subjects to London. One of his first acts was to bestow a profusion of honours and titles on the inhabitants of both countries, in which, as in many other points, he

displayed a contrast to the maxims of the late reign. At a conference held at Hampton Court between the divines of the Established Church and the Puritans James exhibited the ill-will he bore to popular schemes of church government. The meeting of Parliament also enabled him to assert those principles of absolute power in the crown which he could never practically maintain, but the theoretical claim of which provided the increasing spirit of freedom in the House of Commons with constant matter of alarm and contention. Although James had behaved with great lenity to the Catholics in Scotland, those in England were so disappointed in their expectations of favour, that the famous gunpowder plot was concerted in 1605, the object of which was to blow up the king and Parliament. (See GUNPOWDER PLOT.) His cares for reducing and improving Ireland do him honour. In 1612 he lost his eldest son Henry, a prince of great promise, then of the age of nineteen; and in the following year the eventful marriage of his daughter Elizabeth with the elector palatine took place. No circumstance in the reign of James was more unpopular than his treatment of the celebrated Sir Walter Raleigh. (See RALEIGH—SIR WALTER.) James had set his heart on marrying his son Charles to a Spanish princess, but the negotiations failed through the overbearing temper of Buckingham, the royal favourite, who quarrelled with the grandees of the Spanish court. The close of the life of James was marked by violent contests with his Parliament. He was also much disquieted by the misfortune of his son-in-law, the elector palatine, who, having been induced to accept the crown of Bohemia, and to head the Protestant interest in Germany, was stripped of all his dominions by the emperor. Urged by national feelings for the Protestant cause, he was at length, 10th March, 1624, induced to declare war against Spain and the emperor; and troops were sent over to Holland to act in conjunction with Prince Maurice. It is thought that the defeat of this enterprise produced in the king so much uneasiness as to cause the intermittent fever by which he was soon after attacked, and of which he died on the 27th of March, 1625, in the fifty-ninth year of his age.

James was not destitute of abilities nor of good intentions, but the former were not those of a ruler, and the latter were defeated by pliability and unmanly attachments. His reign was inglorious, and he was neither beloved at home nor esteemed abroad. He received during his lifetime a great deal of adulation on the score of his literary abilities. Upon the whole, the good qualities of James were unstatesmanlike, and his bad ones unmanly and puerile.

JAMES II. of England, second son of Charles I. and of Henrietta of France, was born 15th of October, 1633, and immediately declared Duke of York, though only formally raised to that dignity in 1643. After the capture of Oxford by the parliamentary army he escaped in 1648, at the age of fifteen, and was conducted to his sister, the Princess of Orange. He soon after joined his mother at Paris, and when he had reached his twentieth year served in the French army under Turenne, and in 1656 entered the Spanish army in Flanders, under Don John of Austria and the Prince of Condé. At the Restoration in 1660 he took the command of the fleet, as lord high-admiral, and was also made Warden of the Cinque Ports. He had previously married Anne, daughter of Chancellor Hyde, afterwards Lord Clarendon. (See CLARENDON.) In 1671 the Duchess of York died, leaving her husband two daughters, who became successively queens of England. Before her death she declared herself a convert to the Roman Catholic faith, which had been secretly that of the duke for many years, and was now openly avowed by him. This declaration produced a great impression on the people, and laid the foundation of the opposition which finally drove him from the throne. A test act being soon after passed, to prevent Roman Catholics from holding public employments, the duke was obliged to resign his command. On the 21st of November, 1671, he married Mary Beatrice of Este, daughter of the Duke of Modena, and in 1677 his eldest daughter, Mary, was united to William, prince of Orange. During the violent proceedings on account of the supposed Popish plot in 1679, by the advice of the king he retired to Brussels, and a bill passed the Commons for his exclusion from the throne, which was, however, rejected by the Lords. When the royal party again prevailed the duke, in 1681, was sent into Scotland, where he countenanced acts of rigour, not to say cruelty, to the enthusiasts for the Covenant. During the whole of the remaining reign of Charles II., indeed, during which he possessed great influence in the government, he was forward in promoting all the severe measures that disgraced it.

On the death of Charles II., 6th February, 1685, the duke succeeded, under the title of James II., and from the time of his ascending the throne seems to have acted with a steady determination to render himself absolute, and to restore the Roman Catholic religion. After disgusting the great majority of his subjects by attending mass with all the ensigns of his dignity, he proceeded to levy the customs and excise without the authority of Parliament. At variance with his Parliament he was under the necessity of accepting a pension from Louis XIV. He sent an agent to Rome to pave the way for a solemn re-admission of England into the bosom of that church, and received advice, on the score of moderation, from the pope himself. This conduct encouraged the rebellion of the Duke of Monmouth. The unrelenting temper of James was again exhibited in the executions on this account. The legal proceedings under Jeffreys were brutal in the extreme; and no fewer than 320 persons were hanged on the western circuit alone, which attained an unenviable notoriety as the Bloody Assize. The temporary awe produced by this severity, even in Parliament, was so great that James was encouraged to throw off almost all disguise, both in regard to religion and government. By virtue of his assumed dispensing power he rendered tests of no avail, and filled his army and council with Roman Catholics. He put Ireland entirely into their hands, and governed Scotland by a few noblemen who had become converts to the same faith. He gradually proceeded to a direct attack on the Established Church, by the formation of an ecclesiastical commission, which cited before it all clergymen who had done anything to displease the court. To conciliate the Puritans a declaration of indulgence in matters of religion was ordered to be read by the clergy in all the churches of the kingdom. Its real object, however, was to favour the Roman Catholics. Seven bishops met and drew up a loyal and humble petition against this ordinance, and for this act they were sent to the Tower, on a charge of seditious libel. On the 29th of June, 1688, they were acquitted amid the most enthusiastic rejoicings of the populace, and the government and person of James were regarded with even increased dislike. The innovations, in regard both to the religion and government, gradually united opposing interests, and a large body of nobility and gentry concurred in an application to the Prince of Orange, signed by seven of the most prominent and influential political leaders, to come over and occupy the throne. James, who was long kept in ignorance of these transactions, when informed of them by his minister at the Hague,

was struck with terror equal to his former infatuation; and, immediately repealing all his obnoxious acts, he practised every method to gain popularity. All confidence was, however, destroyed between the king and the people. William arrived with his fleet in Torbay, November 5, 1688, and landed his forces, amounting to 14,000 men. The remembrance of Monmouth's rebellion for some time prevented the people in the west from joining him; but at length several men of rank went over, and the royal army began to desert by entire regiments. Incapable of any vigorous resolution, and finding his overtures of accommodation disregarded, he resolved to quit the country. He repaired to St. Germain, where he was received with great kindness and hospitality by Louis XIV. In the meantime the throne of Great Britain was declared *abdicated*, and was occupied, with the national and parliamentary consent, by his eldest daughter, Mary, and her husband, William, conjointly; Anne, who had equally with her sister been educated a strict Protestant, being declared next in succession, to the exclusion of her infant brother, known in history as the Pretender, who had been born on the 10th of June of that year. Assisted by Louis XIV., James was enabled, in March, 1689, to make an attempt for the recovery of Ireland. The battle of the Boyne, fought 1st July, 1690, compelled him to return to France. All succeeding projects for his restoration proved equally abortive, and he spent the last years of his life in acts of ascetic devotion. He is even said to have entered into the Society of Jesus. He died at St. Germain, September 16, 1701, at the age of sixty-eight.

JAMES III., the Pretender. See STUART (JAMES EDWARD FRANCIS).

JAMES, GEORGE PAYNE RAINSFORD, the well-known novelist, was the son of a London physician in good practice, and born in London in 1801. He was educated at a school at Putney, and at the age of fifteen was sent to France, where he passed several years. While still very young he manifested a considerable turn for literary composition, and under the encouragement of Washington Irving produced, in 1822, a Life of Edward the Black Prince. Some years afterwards he composed his first novel, namely Richelieu, which was shown in manuscript to Sir Walter Scott, approved of, and published in 1829. Its success determined him to pursue the writing of works of fiction, and a series of these followed from his pen in rapid succession. So voluminous an author was he that the number of his published romances, almost all in three volumes, amount to upwards of sixty, besides several historical and other works. Among them may be mentioned Darnley, De L'Orme, Philip Augustus, Henry Masterton, Mary of Burgundy, The Gipsy, History of Chivalry, Life of Charlemagne, &c. &c. As a writer, however, he was more remarkable for fecundity than for brilliance or originality. Latterly he accepted the office of British consul in Massachusetts, then at Norfolk, Virginia, and afterwards at Venice. In the latter city he died on 9th May, 1860.

JAMES, JOHN ANGELL, an eminent clergyman and religious author, born at Blandford Forum on 6th June, 1785, was in early life apprenticed to a linen draper, but subsequently entered Gosport Dissenting College as a student for the ministry. He was placed on the preaching list at seventeen, and having, in 1804, temporarily conducted the services in the Independent chapel in Carr's Lane, Birmingham, his ministrations were so acceptable that he received from the congregation a unanimous call to assume the vacant office of pastor, and was ordained the following year. In this position he continued uninterruptedly to the close of his life. His fame gained so rapidly that in a few years the number of his hearers had increased from under two hundred to several thousands. He was one of the most able and popular of Dissenting preachers, and was revered for the purity and sincerity of his character by persons of all denominations. His writings are very numerous, and have had an immense circulation both in Britain and America. They comprise more especially the Sunday-school Teacher's Guide, published shortly after his ordination; The Anxious Inquirer, The Church Member's Guide, The Christian Father's Present to his Children, The Course of Faith, The Family Monitor, The Church in Earnest, and many others, including an Autobiography. In 1855 a great jubilee was celebrated in his honour. He died on 1st October, 1859.

JAMESON, ANNA BROWNELL, author and art critic, was born in Dublin on 17th May, 1794. Her maiden name was Murphy, and her father was painter in ordinary to the Princess Charlotte. In 1827 she was married to Mr. Jameson, a barrister, who was afterwards speaker of the House of Assembly of Upper Canada, and attorney-general, but the union proved an unhappy one. Mrs. Jameson made her first appearance as an authoress by the publication, in 1826, of the Diary of an Ennuyée, which was very favourably received. Her Loves of the Poets, illustrative of the influence of women in developing the character of men of genius, appeared three years afterwards. It was succeeded by Memoirs of Female Sovereigns; Characteristics of Shakspeare's Women; and, in 1833, by a series of biographical sketches of the Beauties of the Court of Charles II., a work illustrative of Sir Peter Lely's well-known pictures at Hampton Court. During a visit to the Continent in 1833 she made the acquaintance of several eminent German authors, and on her return she published her Visits and Sketches (1834). In 1836 Mrs. Jameson visited her husband in Canada, and published afterwards the results of her journey in the form of Winter Studies and Summer Rambles in Canada (1838). In 1842 appeared her Handbook to the Public Picture-galleries of Art in and near London, succeeded by the Companion to the Private Galleries of Art in London (1844), both written in the most attractive manner, and containing much sound information. The most able, however, of Mrs. Jameson's productions were yet to come. In 1845 appeared her Memoirs of the Early Italian Painters, and of the Progress of Painting in Italy from Cimabue to Bassano; in 1846, Memoirs and Essays on Art, Literature, and Social Morals; in 1848, Sacred and Legendary Art; continued, in 1850, by Legends of the Monastic Orders; and in 1852 by Legends of the Madonna. In those the authoress has given a most admirable exposition of the works of the old masters and the religious bearings of mediæval art, forming altogether a most valuable contribution to art literature. Few writers have done so much to refine the public taste, and diffuse sound canons of art criticism. A Commonplace Book of Thoughts, Memories, and Fancies, original and selected, was published in 1854. Mrs. Jameson died on 17th March, 1860. A work on The Scriptural and Legendary History of our Lord and his Precursor John the Baptist was left nearly finished at her death.

JAMESON (or JAMESONE), GEORGE, called by Walpole the *Scottish Vandyck*, the son of an architect at Aberdeen, was born there in 1588, and studied under Rubens at Antwerp, where he had Vandyck as a fellow-pupil. Returning to his native country in 1628, he became the most famous portrait-painter that Scotland has ever possessed, at least till recent

times. He also painted historical pieces and landscapes. Charles I., after sitting to him in Edinburgh, in 1633, was so much pleased that he presented him with a diamond ring off his own finger. It is said that the king having on that occasion allowed him to remain covered while taking his likeness, Jameson ever after painted with his hat on. His excellence consists in delicacy and softness of shading, and a clear and beautiful colouring. The best collection of his works is in possession of the Earl of Breadalbane, whose ancestor, Sir Colin Campbell of Glenorchy, was his first patron. Many of his paintings are in the possession of the nobility of Scotland, and there are several in the halls of the University of Aberdeen. He died at Edinburgh in 1644.

JAMESON, ROBERT, a distinguished geologist, was born in Leith 11th July, 1774, and educated for the medical profession, but early turned his energies in the direction of geology and mineralogy, and the various branches of natural history. With the view of improving himself in these sciences he proceeded in 1800 to the mining school of Freiberg in Saxony, then presided over by the celebrated Werner. On his return to Scotland in 1804 he was appointed professor of natural history in the University of Edinburgh, an office which he held till his death, a period of fifty years. In 1798 he published An Outline of the Mineralogy of the Shetland Islands, and of the Isle of Arran, and in 1809 his Elements of Geognosy. Various other geological works were produced by him, besides numerous papers in the Wernerian Transactions, and in Nicholson's Journal. In conjunction with Sir David Brewster he founded, in 1819, the Edinburgh Philosophical Journal, and in 1826 the Edinburgh New Philosophical Journal, of which he was the sole editor till his death. He formed a magnificent collection in the Edinburgh Museum of geological specimens and objects in natural history. He was a fellow of almost all the learned societies of Europe, and died 19th April, 1854.

JAMES RIVER, a river in Virginia, formed by the union of Jackson's and Cowpasture Rivers, in the Alleghany Mountains. It passes by the flourishing towns of Lynchburg and Richmond, and communicates, through Hampton Roads and the mouth of the Chesapeake Bay, with the Atlantic, having previously expanded to an estuary of considerable width. Its general course is south of east, and its length is 450 miles. It opens a navigation into a country abounding in tobacco, wheat, corn, hemp, coal, &c. The first English settlement in America was formed at Jamestown, 32 miles from the mouth of this river, in 1607.

JAMES'S PALACE, ST., in Pall Mall, London, a royal palace, stands on the site of an hospital dedicated to St. James, which was rebuilt for a mansion by Henry VIII. For more than a century it was the town residence of the English kings after Whitehall was consumed in 1695; but though pleasantly situated on the north side of St. James's Park, and possessing many fine state apartments on the first floor, it is an irregular brick building, without a single external beauty to recommend it as a palace. In the front, next to St. James's Street, little more than an old gate-house appears, which serves as an entrance to a small square court, with a piazza on the west of it, leading to the grand staircase. The buildings are low, plain, and mean. Beyond this are two other courts, which have little appearance of a royal palace. The state apartments look towards St. James's Park. This side is of one story, and has a regular appearance not to be found in other parts of the building. The south-east wing was destroyed by fire in 1808, and has never been rebuilt, though the whole of the palace was repaired in 1821–23. Queen Victoria was married in the Chapel Royal, but in 1837 the royal household was transferred to Buckingham Palace, and St. James's was now used only for ceremonial levees and drawing-rooms; hence 'the court of St. James's' is often spoken of. The office of the Lord Chamberlain's department is accommodated in this building.

JAMES'S PARK, ST., one of the London parks, which comprises 87 acres, was a complete marsh till the time of Henry VIII., who, having bought the St. James's Hospital with the meadows beyond, built a palace and inclosed it with a park and pleasure grounds. This was afterwards much improved by Charles II. He formed a fine canal, and a level public avenue, called a *mall* from the game of ball which was played there. The canal has since become an ornamental lake, with islands and contiguous walks. The *Parade*, on the east side, is the muster-ground of the body-guards on duty; and the park is not only one of the greatest ornaments, but one of the most pleasant recreation grounds of London.

JAMI (or DJAMI), MULLA NUR-ED-DIN ABD-AR-RAHMAN-BEN-AHMED, a celebrated Persian poet, born in 1414, had his surname from his native place, Jam or Djam, in the province of Khorassan. He eclipsed the greatest geniuses of his time. The Sultan Abou Said invited him to his court at Herat; but Jami, who was a follower of the doctrine of the Sufis, preferred the ecstacies of a mystic to the pleasures of the court. He often sat in the hall of the great mosque at Herat, where he conversed in a free and friendly manner with the common people, instructed them in the principles of virtue and religious faith, and won their hearts by his gentle and persuasive eloquence. When he died in 1493 the whole city was in sorrow. The Sultan Hossein Mirza gave him a magnificent funeral at the public cost, and the earth, say the Persian poets, opened of itself, like a shell, to receive this invaluable pearl. He was one of the most fruitful of the Persian authors, leaving, according to one authority, more than forty works, mostly of a mystical character, though according to another authority he produced ninety-nine distinct works. Seven of the most interesting he joined together under the title of the Seven Stars of the Bear. To this belongs Yussuf and Zuleika, one of the most entertaining works in Persian; also the charming fiction Mejnoun and Leila, which has been translated into French and German. His Beharistan, a treatise on morality in verse and prose, is compared to Sadi's Ghulistan, and is as remarkable for the propriety of the thoughts as for the graces of the style. A complete German translation of it was published at Vienna in 1846.

JAMIESON, JOHN, a Scotch antiquarian, philologist, and theologian, was born at Glasgow, 5th March, 1759, educated for the ministry among the Antiburgher Seceders, and after having been settled for a time in Forfar, removed in 1797 to Edinburgh, where he spent the remainder of his life, and died July 12th, 1838. He devoted much of his time to literature, attempted poetry with very limited success, wrote two large volumes on the Socinian controversy, and was the author or compiler of various other works, chiefly on antiquarian subjects. The work by which he is chiefly known is an Etymological Dictionary of the Scottish Language, which does not display much critical acumen, but is valuable as a very extensive and laborious collection of Scotch words, phrases, and customs. Various editions of this work, both in enlarged and in abridged forms, have since been published.

JAMNA, or JUMNA, a river of Hindustan, in the Presidency of Bengal. It rises in the Himálaya Mountains, at an elevation of 10,849 feet above the

sea-level at Jamnotri. From this point it flows first south and then south-east, passing through the districts of Garhwal and Delhi, and after a course of about 860 miles falls into the Ganges at Allahabad. It is generally shallow and unfit for navigation, but some trade is done by means of clumsy boats. Two important irrigation works—the Jumna Eastern and the Jumna Western Canal—derive their supply of water from this river. The cities of Delhi and Agra, as also the towns of Mattra and Etawah, are situated on its banks. The country through which it flows is well cultivated.

JAMNOTRI, or JUMNOUTRI, a celebrated place of pilgrimage in Hindustan, in the province of Garhwal, 185 miles N.N.E. of Delhi, at the source of the Jamna. A series of hot springs, rising in a ledge of rock 10 or 12 feet above the bed of the river, descend through a cleft in a smoking jet of 5 or 6 feet in height. These springs are 10,843 feet above sea-level, and are overhung by cliffs of gray granite, which rise almost perpendicularly to a height of 12,000 or 14,000 feet, and present scenery of the most terrific description. The mountain mass of Jamnotri, in which the springs take their rise, has a height of over 20,000 feet.

JANIN, JULES GABRIEL, a celebrated French critic, and author of a number of novels and other works, was born at St. Etienne, Loire, 16th February, 1804. He was educated partly at St. Etienne, partly at the college of Louis le Grand, Paris. He was destined for the bar, but literature had more charms for him, and he obtained a place on the staff of the Figaro in 1825, and then on that of the Quotidienne in 1827. In 1830 commenced his connection with the Journal des Débats as dramatic critic, a position he occupied until his death. His criticisms, unlike the prolix and pedantic productions of the majority of his contemporaries, were brilliant, dashing, fearless, and often capriciously inconsistent. His first novel, L'Âne mort et la Femme Guillotinée, appeared in 1829, and was quickly followed by the Confession (1830); Barnave, a political novel, one of his most important works (1831); Contes Fantastiques (four vols. 1832); Contes nouveaux (four vols. 1833). For his services to the monarchical party he received from Louis Philippe the Cross of the Legion of Honour, 1836. Meanwhile he not only regularly kept his place in the feuilleton of the Débats, but contributed largely to the Revue de Paris, and many other literary journals and magazines, besides writing biographies and introductions for new books or new editions. Un Cœur pour deux Amours appeared in 1837; the Catacombes, a collection of tales and essays (six vols. 1839); Voyage en Italie (1839); an abridged translation of Clarissa Harlowe (1846); Histoire de la littérature dramatique, a recast of a series of his weekly feuilletons in the Débats (six vols. 1858). In 1865 he competed for the chair in the Academy left vacant by the death of Alfred de Vigny, but found a successful rival in Prévôt-Paradol. He made another attempt on the death of Ste. Beuve in 1870, and obtained the coveted place. His death took place in June, 1874. Among the more important of his later works are Béranger et son temps (1866); Circe (1867); Chevalier de Fosseuse (1868), &c. He contributed largely to the Dictionnaire de la Conversation, La Mode, and the Chronique de Paris.

JANINA, JANNINA, JOANNINA, YANINA, a town in Turkey-in-Europe, capital of Albania, in the pashalic of same name, 425 miles W.S.W. Constantinople, beautifully situated on the margin of a lake of several miles in extent, and stretching along the greater part of its western shore. The streets are tortuous and ill paved; and many of the houses are wretched mud-built cottages. The habitations of the middle ranks make a nearer approach to comfort, being constructed of wood, with a small open gallery under the projecting roof. The dwellings of the higher classes are generally quadrangular structures surrounding an open court, and having wide galleries running round the sides, but almost destitute of windows towards the street. The bazaars have a lively and bustling appearance. Each bazaar is appropriated to the sale of one particular description of goods; and those selling jewelry and articles of dress are richly and abundantly furnished. In front of the town a peninsula stretches into the lake, and terminates in two distinct promontories of rock, on one of which stands a large Turkish mosque, with a lofty minaret and extensive piazzas, and on the other the old seraglio of the pashas of Janina. The whole of this peninsula is fortified, and insulated from the city by a ruinous stone wall and moat. A considerable trade is carried on in cloth, oil, wool, corn, tobacco, embroidered velvets, &c. By order of Ali-Pasha, Janina was burned down in 1820, its population at that time being computed at 50,000, but it has since fallen off very much, and now numbers, according to some authorities, about 20,000, of whom 6000 are Mohammedans, 11,000 Christians, and 3000 Jews.

SUPPLEMENT.

HARELD (*Harelda glacialis*), the long-tailed duck, an oceanic duck having a short thick bill, a high forehead, and two very long feathers in the tail of the male, whilst the females have the tail short and rounded. It inhabits the northern seas, and is frequent in Orkney and Shetland.

HARE'S EAR (*Bupleurum*), a genus of plants of the natural order Umbelliferæ. The most common British species (*B. rotundifolium*), with simple, perfoliate, ovate-elliptic leaves, yellowish flowers, and large bracts in the partial involucres, flourishes best on a chalky soil. Under the name of *thorough-wax* it was at one time used as a vulnerary.

HARICOT, a general term for various species of kidney-bean, genus *Phascolus*, but chiefly applied to *P. vulgaris*, a leguminous plant with three-foliolate leaves and axillary clusters of white or reddish flowers. The beans constitute a palatable and nutritious article of diet.

HÄRING, WILHELM, better known by his pseudonym Wilibald Alexis, German novelist of French descent, was born at Breslau on June 29, 1798. After studying in a Berlin gymnasium for a few years he went through the campaign of 1815 as a volunteer, and on leaving the army he studied law in Berlin and Breslau. He practised for a time in the Berlin supreme court, but he soon abandoned law and devoted himself exclusively to literature. His first important work was a romance in the manner of Walter Scott entitled Walladmor (1824), which he issued under Scott's name. Schloss Avalon, a similar work, appeared in 1827, also under Scott's name. About this time he wrote many excellent shorter stories, of which two collections were published, Gesammelte Novellen (4 vols. 1830–31) and Neue Novellen (2 vols. 1836). With Cabanis (1832), a novel dealing with the time of Frederick the Great, he began his popular series of historical romances based on the history of Brandenburg. Häring also wrote other novels, travel sketches, &c.; and edited the Berliner Konversationsblatt for eight years from 1827. He removed in 1852 to Arnstadt, in Thuringia, where he died on Dec. 16, 1871. His other works include Der neue Pitaval (33 vols. 1842–63; new series, 24 vols. 1866–91), in collaboration with Hitzig, the best of all collections of criminal and detective stories. A collective edition of his works published in 1874 extends to 20 vols., and his German historical romances have been published in a uniform series of 8 vols. (1884).

HARINGTON, SIR JOHN, an English poet of some merit, was born in 1561, and died at Kelston on Nov. 20, 1612. At his baptism Queen Elizabeth stood sponsor. He was educated at Eton and Christ's College, Cambridge, and for a time studied for the bar, but soon determined on a courtier's career. He was in 1596 excluded from court on account of his poem Metamorphoses of Ajax, but was soon allowed to return. His best-known performance is, perhaps, his translation of Orlando Furioso in heroic verse (1591). He also produced a series of Epigrams (1618) and an Apologie for Poetrie. A collection of his letters and miscellaneous writings was published in 1769 by Rev. Dr. Harington, under the title Nugæ Antiquæ. Many of his works are extremely coarse.

HARLEQUIN DUCK (*Clangula histrionica*), a species of duck, so called on account of its party-coloured plumage of white, gray, and black. It inhabits the Arctic regions, and on rare occasions it visits the British Islands in winter. In length it is about 17 inches.

HARMONISTS, a religious sect founded in Würtemberg about 1788 by the brothers George and Frederick Rapp. See RAPP (GEORGE).

HARPY-EAGLE (*Thrasaëtus Harpyia* or *Harpyia destructor*), a rapacious bird which inhabits tropical America from Southern Mexico to Southern Brazil. It is an extremely powerful bird, and in total length slightly in excess of the golden eagle. It has, however, a somewhat shorter expanse of wing. Its shoulder muscles possess enormous strength. Its bill is powerful and crooked, and its claws are extremely strong and sharp. The harpy-eagle feeds on birds, sloths, fawns, raccoons, &c., as well as on fish, water-snakes, and the eggs of the tortoise.

HARRAR, or HARAR, a town and district in North-eastern Africa, now included in the Abyssinian dominion. The town is situated about 150 miles south-east of the French seaport Djibouti (Jiboutil), from which a railway is being constructed, and about the same distance from the seaport Zeila in British Somaliland, on the route to the present Abyssinian capital, Adis Abbaba. The country here is elevated, and the roads are only suitable for mules or other pack animals walking in single file. A considerable trade is carried on at Harrar, the imports consisting especially of cottons; woollens, silks, and miscellaneous manufactured goods also being imported; while the chief exports are coffee, skins, ivory, gold, wax, civet, &c. Pop. 35,000.

HARRIER, a kind of dog employed to hunt the hare. It closely resembles the foxhound, but is smaller in size. Harriers have been much crossed with foxhounds in recent times, and in consequence the pure harrier type is now rare.

HARRIER, the name of several hawks of the genus *Circus*, allied to the buzzards. They strike their prey upon the ground and generally fly very low. The marsh-harrier, the hen-harrier, and the ash-coloured harrier are found in Great Britain. The marsh-harrier (*C. æruginosus*) is from 21 inches to 23 inches long, both sexes being brownish above. The hen-harrier (*C. cyaneus*) is from 20 to 22 inches long; the adult male is of an almost uniform gray, the female brown. It is very destructive in poultry-yards, whence the name.

HARRISON, FREDERIC, English writer on philosophical, literary, historical, and social subjects, was born in London on Oct. 18, 1831. He was educated at King's College School, and afterwards at Wadham College, Oxford. In 1853 he graduated B.A. with first-class honours in classics, and during the succeeding five years he resided at Oxford as a fellow and tutor of his college. He was called to the bar at Lincoln's Inn in 1858, and for a time practised as a conveyancing and equity lawyer. He was a member of the Royal Commission on Trades Unions which sat from 1867 till 1869, and acted as secretary to the Royal Commission on the Digest of the Law, which was appointed in 1869. In 1877 he was appointed by the Council of Legal Education to the professorship of jurisprudence and international law at the Inns of Court, a post which he held till 1889. The London County Council elected him an alderman in 1889, but he resigned in 1892. He was Sir Robert Rede's lecturer at the University of Cambridge in 1900. Mr. Harrison is the chief living representative in England of Positivism and the Religion of Humanity. In 1886 he unsuccessfully contested London University against Sir John Lubbock, now Lord Avebury, in the Home Rule interest. Mr. Harrison's publications comprise: The Meaning of History (1862), two lectures; Order and Progress (1875), in two parts, I. On Government, II. Studies of Political Crises; Social Statics (1875), the second volume of a translation of Auguste Comte's Positive Polity carried out by the chief London positivists; Science and Humanity (1879); The Present and the Future (1880); The Choice of Books, and other Literary Pieces (1886); Oliver Cromwell (1888), in the series of Twelve English Statesmen; Annals of an Old Manor House (1893; new ed. 1899), a finely-illustrated history of Sutton Place in Surrey; The Meaning of History, and other Historical Pieces (1894), an enlarged edition of the work of 1862; Studies in Early Victorian Literature (1895); William the Silent (1897); The Millenary of King Alfred (1897); Tennyson, Ruskin, and Mill (1899); and Byzantine History in the Early Middle Ages (1900), his Rede Lecture. To the Positivist volume on International Policy (new ed. 1884) he contributed the essay on England and France, and for the New Calendar of Great Men (1892), of which he was general editor, he wrote a large number of the biographies. The volume entitled The Religious Systems of the World (1893) includes an account by Mr. Harrison of the Religion of Humanity. He has been an extensive contributor to the leading reviews, and is an advanced Liberal and a staunch opponent of imperialism. All his works claim attention, alike from their excellent style, often rising into impressive eloquence, and from the wide culture displayed in them.

HART. See STAG.

HARTE, FRANCIS BRET, American story-writer and poet, son of a teacher, was born in Albany, New York, on Aug. 25, 1839, and received an ordinary school education. Removing to California with his mother in 1854 after his father's death, he opened a school at Sonora, but soon afterwards turned to mining, in which he was unsuccessful. He thereupon became a compositor and began to write articles for his paper, and in 1857 he returned to San Francisco to become a compositor on The Golden Era Soon afterwards he joined the staff of the Californian, to which he contributed the humorous burlesques afterwards published as Sensation Novels Condensed (1870). In 1864–70 he was secretary of the United States branch mint in San Francisco, and in 1870–71 he held the post of professor of recent literature in the University of California. When the Overland Monthly was started in 1868 Mr. Harte was appointed editor, a post which he resigned in 1871. In the latter year he removed to New York and joined the staff of the Atlantic Monthly. Appointed United States consul at Crefeld in 1878, he was transferred to Glasgow in 1880. His tenure of office as consul came to an end in 1885, and he died on May 5, 1902. His first literary successes, That Heathen Chinee (originally called Plain Talk from Truthful James) and The Luck of Roaring Camp, were originally published in the Overland Monthly. These have been followed up by many other stories and poems, mostly dealing with characters, scenes, and incidents belonging to the rough Western life of former days. Among the shorter stories the following may be mentioned: Stories of the Sierras (1872); M'Liss (1872); Mrs. Skaggs's Husbands, and other Stories (1872); Tales of the Argonauts, and other Sketches (1875); The Twins of Table Mountain (1879); An Heiress of Red Dog, and other Tales (1879); Jeff Briggs's Love-Story, and other Sketches (1880); Flip, and other Stories (1882); On the Frontier (1884); Californian Stories (1884); By Shore and Sedge (1885); Devil's Ford (1887); The Argonauts of North Liberty (1888); A Phyllis of the Sierras, and A Drift from Redwood Camp (1888); The Heritage of Dedlow Marsh, and other Tales (1889); A Sappho of Green Springs, and other Tales (1891); The Bell-Ringer of Angel's, &c. (1894); A Protégé of Jack Hamlin's, and other Stories (1894); Barker's Luck, and other Stories (1896); Tales of Trail and Town (1898); Stories in Light and Shadow (1898); Mr. Jack Hamlin's Mediation, and other Stories (1899); and From Sand Hill to Pine (1900), a collection of short stories. His longer stories and novels include: Gabriel Conroy (1876; new ed. 1899); Thankful Blossom: A Romance of the Jerseys (1877); In the Carquinez Woods (1883); Maruja (1885); Snowbound at Eagle's (1886), much better than the two preceding; The Crusade of the *Excelsior* (1887), his 'first complete failure'; Cressy (1889), one of the best; A Waif of the Plains (1890); A Ward of the Golden Gate (1890); A First Family of Tasajara (1892); Colonel Starbottle's Client, and Some Other People (1892); Clarence (1895), dealing with incidents in the American civil war; In a Hollow of the Hills (1895); and Three Partners (1897). He has written much verse of an original kind, comprised in volumes entitled Poems (1871); East and West Poems (1871); Echoes of the Foot-Hills (1874); and Some Later Verses (1898). Two Men of Sandy Bar (1877) is a drama. In Mr. Harte's pages the life of California in its rougher and wilder mining days is vividly portrayed with abundant humour and insight. Within certain limits his power of character-drawing and his faculty of description are masterly.

HARTEBEEST, or CAAMA (*Bubalis Cuama*), a South African antelope, which measures about 4 feet high at the shoulders, has a long head, horns projecting outwards and backwards, black marks on the face and legs, a white mark on the rump, and a bushy tail. The general colour is dark chestnut. It is generally to be found in small herds. The hartebeest is a very swift and powerful animal. The Tsesebe (*Bubalis lunata*) is called the Bastard Hartebeest by the South African Dutch. It does not occur south of the Limpopo region.

HART'S-TONGUE (*Scolopendrium*), a genus of highly ornamental ferns. Their fronds are simple and undivided, bearing the sori on the under side in straight lines from the midrib to the edges. There are about a dozen species known, the *S. vulgare* being British.

HARVEST-MOON, a name which denotes a peculiarity in the apparent motion of the full moon, by which in Britain and high latitudes generally it rises about the same time in the harvest season (or about the autumnal equinox in September) for several successive evenings. In southern latitudes this phenomenon occurs in March. It is owing to the fact that the moon is then travelling in that part of her orbit at which it makes the least possible angle with the ecliptic.

HARVEY, Sir George, Scottish painter, was born in Feb. 1806, at St. Ninian's, Stirlingshire, where his father was a watchmaker. He was for a few years apprentice to a bookseller in Stirling, but in 1823 he became an art student in the Trustees' Academy, Edinburgh. Only three years later, in 1826, he was elected one of the original associates of the Royal Scottish Academy, of which he became a full member in 1829, and president in 1864, on the death of Sir John Watson Gordon. In the latter year also he received the honour of knighthood. His first picture, A Village School, was exhibited at the Edinburgh Institution in 1826, and for many years afterwards his subjects were drawn mainly from the history and everyday life of the Scottish people. During the latter part of his life he painted many landscapes. His most important works, many of which are well known in engravings, are the following: Covenanters Preaching (1830); Covenanters' Baptism (1831); Battle of Drumclog (1836); Shakespeare before Sir Thomas Lucy (1837); A Castaway (1839); First Reading of the Bible in the Crypt of St. Paul's (1840); Covenanters' Communion (1840); Sabbath Evening (1841); A Highland Funeral (1844); A Schule Skailin' (1846); The Enterkin (1846); Quitting the Manse (1848); Dawn Revealing the New World to Columbus (1852); Children Blowing Soap-Bubbles in Greyfriars' Churchyard, Edinburgh (1857); Bunyan in Bedford Gaol (1857); Ferragon (1857); We Twa Hae Paidl'd in the Burn (1858); Sheep-Shearing (1859); Glen Dhu, Arran (1861); A Mountain Pool (1867); Glen Falloch (1869); Inverarnan, Loch Lomond (1870); Morning on Loch Awe (1872); and The Curlers (1873). He was author of Notes on the Early History of the Royal Scottish Academy (1870; 2nd edit. 1873). He died on Jan. 22, 1876, in the Scottish capital.

HASLAR HOSPITAL. See Gosport.

HASTINGS, Francis Rawdon, first Marquis of Hastings and second Earl of Moira, governor-general of India, was born on Dec. 9, 1754. He was the eldest son of John, Baron Rawdon, afterwards first Earl of Moira, and was educated at Harrow. In his seventeenth year he entered the army as an ensign in the 15th Foot, and shortly afterwards matriculated at University College, Oxford, which he left two years later without taking a degree. He served in America during the Revolution, rapidly rose to the rank of lieutenant-colonel, and was appointed in 1778 adjutant-general to the forces in America. On April 25, 1781, he gained the battle of Hobkirk's Hill, which Lord Cornwallis described as the most splendid of the war. The state of his health necessitated his return to England a few months later, but he was captured on the way by a French cruiser and detained in Brest until an exchange was arranged. In 1781 he was elected a member of the Irish House of Commons, and two years later he was promoted to the English House of Lords with the title of baron. He attained the rank of colonel in 1782, and in 1793, when he succeeded his father in the earldom of Moira, he was promoted major-general. He was in command of a force which sought to aid the royalists of Brittany in 1793, and in the following year he co-operated with the Duke of York in the Netherlands. Elevated to the rank of lieutenant-general in 1798, he was appointed commander-in-chief in Scotland in 1803, becoming general later in the same year. He was sworn of the privy council in 1806, and in the same year received successively the appointments of master of the ordnance and constable of the Tower. During the regency debates and in other matters he strongly supported the Prince of Wales, afterwards George IV. In 1812 he was appointed governor-general of Bengal and commander-in-chief of the forces in India. His administration was distinguished by successful wars against the Goorkhas of Nepaul and the Pindarees of Central India, but in 1821 he resigned because certain charges had been brought against him in connection with a banking firm in which he was interested. In 1817 he had been created Viscount Loudoun, Earl of Rawdon, and Marquis of Hastings in the peerage of the United Kingdom. In 1824 he was appointed governor of Malta, and next year he arrived in England. He died on board a British war-ship off Naples on Nov. 26, 1826. See the biography (1893) in the Rulers of India Series by Major Ross of Bladensburg.

HATHRAS, a town of India, in the United Provinces, Aligarh District, 29 miles north of Agra, formerly one of the strongest fortresses in India, now a great commercial centre. Pop. (1901), 42,578.

HATTON, Joseph, novelist, journalist, and miscellaneous writer, was born at Andover, Hants, on Feb. 3, 1841, and received a private education. At an early age he wrote for his father's newspaper, the Derbyshire Times, and from 1868 till 1874 he was editor of the Gentleman's Magazine. He has acted as a correspondent of the New York Times, the Sydney Morning Herald, and other newspapers, and was at one time a special representative of the Standard in the United States. He has edited several leading journals, among them the Sunday Times, and in 1900 he became editor of The People. He is the author of numerous stories and novels, among which some of the best known are: Christopher Kenrick (1869); In the Lap of Fortune (1873); Clytie: A Novel of Modern Life (1874); The Queen of Bohemia (1877); Cruel London (1878); Three Recruits (1880); A Modern Ulysses (1883); The Old House at Sandwich (1886); Princess Mazaroff (1890) and By Order of the Czar (1891) novels of Russian life; Under the Great Seal (1893), a story of Newfoundland; When Greek meets Greek, The Dagger and the Cross (1897); The White King of Manoa, When Rogues Fall Out (1899); In Male Attire (1900). Mr. Hatton is also favourably known as the author of two plays, The Prince and the Pauper and Jack Sheppard, as well as of dramatic versions of Hawthorne's Scarlet Letter and of several of his own novels. His chief miscellaneous works are: To-Day in America: Studies of the Old World and the New (2 vols. 1881); Journalistic London (1882); The New Ceylon (1882), an account of British North Borneo; Henry Irving's Impressions of America, Narrated in a Series of Sketches, Chronicles, and Conversations (1884); Reminiscences of J. L. Toole, the Comedian, Related by Himself and Chronicled by Joseph Hatton (1888); Old Lamps and New, Cigarette Papers, In Jest and Earnest, Clubland (1890).

HAUFF, Wilhelm, German novelist and writer of humorous and fantastic stories, born at Stuttgart on Nov. 29, 1802, was educated at Blaubeuren convent school, and studied theology in Tübingen. He was a private tutor in his native town when he began

his literary career by the publication of his Märchenalmanach auf das Jahr 1826 (Almanac of Tales for the Year 1826) in 1825. He followed up this successful work with similar collections of tales in the next two years. In 1826 he published anonymously the first part of Mitteilungen aus den Memoiren des Satans (Extracts from the Memoirs of Satan), of which the second part appeared under his name in 1827. This work remains uncompleted, but it contains much of his finest and most fanciful writing. Lichtenstein, published in 1826, is a historical romance after the manner of Sir Walter Scott. Nowhere are his playful fancy and fertile invention more manifest than in the Phantasien im Bremer Ratskeller (Fantasies in the Bremen Council Wine-Cellar, 1827). Among his best-known works are the novelettes, Die Bettlerin vom Pont des Arts (The Beggar Woman of the Pont des Arts) and Das Bild des Kaisers (The Picture of the Emperor). Several of his short lyrics are among the best popular songs of Germany. In 1827 Hauff became editor of the Morgenblatt in his native city, but he died on Nov. 18 of that year, at the early age of twenty-five.

HAURAN, a fertile district in Syria, east of the Jordan and south of Damascus. In the Roman period it was one of the four provinces of Bashan. A railway reaches it from Damascus.

HAÜY, VALENTIN, founder of the first school for the blind. See BLIND, THE.

HAVELBERG, a town in Prussia, province of Brandenburg, on the Havel, 7 miles above its mouth in the Elbe, on an island connected with the land by three bridges. It is engaged in brewing, sugar-refining, and shipbuilding. Its fine old cathedral stands on a hill, and was restored in 1885–90. Pop. (1895), 7164; (1900), 6649.

HAVERHILL, a city in Essex county, Massachusetts, at the head of navigation on the Merrimack river, 18 miles from its mouth, connected by two bridges with Bradford and Groveland, 32 miles north of Boston. The manufacture of boots and shoes is the principal industry. Lasts, shoe-nails, tacks, &c., are also largely made. The town contains a city-hall, several public halls, public library, masonic temple, &c. Pop. (1890), 27,412; (1900), 37,175.

HAWARDEN, a town in Flintshire, with a handsome church, town-hall, public library, &c.; and manufactures of earthenware, bricks, and tiles. Near it is Hawarden Castle, the residence of the late W. E. Gladstone, as a memorial to whom St. Deiniol's Library has been built (1902). Pop. of rural dist. (1901), 15,817; of town, about 8000.

HAWES, STEPHEN, an English poet who lived in the end of the fifteenth and beginning of the sixteenth century. The exact date of his birth and death is unknown. He was connected with the courts of Henry VII. and Henry VIII., and it is in this connection that he is mainly heard of. His principal work is The Historie of Graunde Amour and la Bell Pucell, or The Pastime of Pleasure (1509), a long poetic allegory.

HAWFINCH (*Coccothraustes vulgaris*), one of the largest of the British finches, so called from the belief that it subsisted principally on the fruit of the hawthorn. It resembles the chaffinch in colour, but is distinguished from it by its enormous beak, larger size, and bill-hook formation of some of its wing-feathers. It feeds on all kinds of berries.

HAWKER, ROBERT STEPHEN, poet and divine, son of a physician who afterwards became a clergyman, was born at Stoke Damerel in Devonshire on Dec. 3, 1803. After receiving some education at Liskeard grammar-school he was articled to a solicitor, but his tastes did not incline him to law, and in consequence he was sent to Cheltenham grammar-school to continue his education. From Cheltenham he went to Oxford, where he matriculated at Pembroke College in 1823. Later in the same year, though still under twenty years of age, he married a wealthy lady of forty-one. After his marriage he studied in Magdalen Hall, from which he graduated B.A. in 1828. Before leaving Oxford he had already shown poetic ability, and he won the Newdigate prize in 1827 for a poem on Pompeii. Ordained deacon in 1829 and priest two years later, he was presented to the vicarage of Morwenstow, Cornwall, in 1834. In 1851 he became also vicar of the neighbouring parish of Wellcombe. He died in Plymouth on Aug. 15, 1875. He was an adherent of the High Church party, and just before his death he joined the Roman Catholic Church. His earliest volume of poems, published in 1821, was entitled Tendrils, by Reuben; and among his later poetical works are: Records of the Western Shore (1832 and 1836); Ecclesia (1840–41); Reeds Shaken with the Wind (1843–44); Echoes from Old Cornwall (1846); The Quest of the Sangraal: Chant the First (1864), his best work; and Cornish Ballads and other Poems (1869). His ballad on Trelawny, with its well-known chorus, was regarded by Scott and Macaulay as a true ballad of old Cornwall. In 1870 he published under the title Footprints of Former Men in Far Cornwall a collection of magazine articles on Cornish legends, and this work together with several other articles was republished in 1893 as his Prose Works. An edition of his poetical works appeared in 1879 under the editorship of J. G. Godwin. See Lee's Memorials (1876) and the Life by S. Baring-Gould (last ed. 1886).

HAWKESBURY, a river in New South Wales, flowing into the Pacific near Sydney, and remarkable for its inundations. The scenery of its course is very beautiful. It is 330 miles long and navigable for a good distance up. The Sydney-Newcastle Railway crosses it by a steel bridge completed in 1889, which is one of the most notable structures of its kind in the world.

HAWKWEED (*Hieracium*), a genus of composite plants, sub-order Cichoraceæ, consisting of numerous species with yellow flowers. They are common weeds in Britain and other parts of Europe. The pappus is brown and brittle, and in many species the leaves, involucres, and stems are hairy. *H. Pilosella* is the mouse-ear hawkweed found on heaths and dry pastures in Britain. Its leaves are radical and somewhat spathulate, and its brilliant yellow flowers are borne singly on the leafless scapes. The British forms are classed by some botanists in about seven species, whilst others recognize more than thirty.

HAYES, ISAAC ISRAEL, American Arctic explorer, was born in Chester county, Pennsylvania, on March 5, 1832, and died in New York on Dec. 17, 1881. He was educated in the University of Pennsylvania, and graduated in medicine in 1853. He was a member of the expedition of 1853–55 under Dr Kane, and himself commanded an expedition in 1860–61. He served as an army doctor during the war, and in 1869 he visited Greenland. He wrote An Arctic Boat Journey (1860); The Open Polar Sea (1867); Cast Away in the Cold (1868), a story of adventure; and The Land of Desolation (1871).

HAZARIBAGH, chief town of the district of the same name in Chota Nagpur, Bengal. Pop. (1891), 16,700.

HAZELINE, an alcoholic liquid distilled from the fresh leaves of the *Hamamelis virginica*, the witch-hazel (which see), native to the United States. It is exceedingly useful as an application to wounds, stanching the bleeding and promoting healing. It

is equally useful for bruises, inflammatory swellings, sprains, and the like. It is applied on a pledget of lint to bleeding piles. In internal bleeding, whether from the lungs, stomach, or bowels, it gives very satisfactory results. There are several officinal preparations of the witch-hazel, especially a fluid extract and a tincture, the dose of the former being 15 to 60 drops, and of the latter 2 to 5. Hazeline is the name given to a clear colourless liquid prepared by certain chemists, but not officinal, of which a tea-spoonful may be given. The American patent medicine, Pond's Extract, is the same.

HEAD, Sir Francis Bond, author and colonial governor, brother of Sir George Head, was born at the Hermitage, Higham, Kent, in 1793. Educated at Rochester grammar-school and the Royal Military Academy, Woolwich, he joined the army in 1811 as second lieutenant in the Royal Engineers, and was present at Waterloo. He retired on half-pay in 1825, and became manager of the Rio Plata Mining Association, which proved a failure. While prospecting on behalf of his company he traversed a great part of South America on horseback, and with such rapidity as to gain for himself the name of Galloping Head. He published a well-written and pleasant account of his journeys in 1826, under the title Rough Notes taken during some Rapid Journeys across the Pampas and among the Andes. In 1835 he was appointed lieutenant-governor of Upper Canada, where he had to suppress a rebellion in 1837. He resigned in 1837, and two years later he published a defence of his administration against certain charges. Knighted in 1835, he was created a baronet in the following year, and in 1867 he was sworn of the privy council. He died at Croydon on July 20, 1875. Besides the works already mentioned Head was author of: Life of Bruce (1830); Bubbles from the Brunnen of Nassau, by an Old Man (1834), a delightful work and probably his best; The Emigrant (1846); The Defenceless State of Great Britain (1850); A Faggot of French Sticks (1852); A Fortnight in Ireland (1852); The Horse and his Rider (1860); The Royal Engineer (1869); and Sketch of the Life of Sir J. M. Burgoyne (1872).

HEANOR, a town of England, in the east of Derbyshire, about 8 miles north-east of Derby, with manufactures of hosiery, iron-works, and collieries. Pop. (1901), 16,249.

HEARNE, Thomas, antiquary, was born in July, 1678, at Littlefield Green, Berkshire. His father, a parish clerk, was unable to provide properly for his education, but by the kindness of a wealthy neighbour, who soon afterwards took him into his own house, young Hearne was placed in Bray school. He was entered at Edmund Hall, Oxford, in 1695, and graduated B.A. in 1699 and M.A. in 1703. His strong bent towards historical antiquities soon asserted itself at Oxford. He studied hard in the Bodleian Library, of which he was appointed first an assistant-keeper and afterwards, in 1712, second keeper. In 1716 he was deprived of his librarianship because he would not take the oaths to the Hanoverian dynasty, and from that time till his death, which occurred on June 10, 1735, his life was one of uneventful literary seclusion in Edmund Hall. To the last he remained a staunch Jacobite, and refused several high offices, such as the chief librarianship of the Bodleian and the Camden professorship of history, rather than take the prescribed oaths. During his connection with the Bodleian Library he published Reliquiæ Bodleianæ, and editions of Pliny, Eutropius, Justin, Livy, Spelman's Alfred, Leland's Itinerary and Collectanea, but the rest of his life was almost entirely devoted to the publication of editions of the English chroniclers. These editions, though deficient in many ways when judged from the more modern point of view, are of the utmost value to students of history, partly because of the appendices he added to them. Many of them have been superseded, but some still remain the only editions of their authors. In 1885 Mr C. E. Doble began the publication, under the auspices of the Oxford Historical Society, of Hearne's diary. It extends from 1705 almost to the day of his death, and gives a very large amount of detailed information regarding the Oxford of Hearne's day, besides shedding much fresh light on the political, social, and personal history of its period.

HEATH, Francis George, writer on rural subjects, born at Totnes, Devonshire, on Jan. 15, 1843, entered in 1862 the customs branch of H.M. civil service, in which he is now a surveyor. He has taken a prominent part in many movements for the preservation of open spaces for the use of the public in and around London, especially Epping Forest and Burnham Beeches. His works on country life are well known and justly popular, among the chief being: The Fern Paradise (1875); The Fern World (1877; 8th ed. 1898); Our Woodland Trees (1878); Sylvan Spring (1880); Peasant Life in the West of England (1880); My Garden Wild (1881; new illust. ed. 1900); Where to find Ferns (1881); Autumnal Leaves (1881; new ed. 1899); The Fern Portfolio (1885); Tree Gossip (1885); and Sylvan Winter (1885). He was editor of the Journal of Forestry from 1882 till 1884. He has latterly been identified with the foundation of the Imperial Press and other similar schemes.

HEBBURN, an urban district or town of England, in Durham, on the south bank of the Tyne a little to the west of Jarrow, and carrying on similar industries. Pop. (1901), 20,901.

HEDGE-MUSTARD (*Sisymbrium officinale*), a cruciferous plant formerly in use as a remedy for catarrh. It has runcinate leaves and small yellow flowers of the usual cruciferous type, and is found on hedgebanks and waste places.

HEDGLEY MOOR, in Northumberland, was the scene of a battle in which the Lancastrians were defeated by the Yorkists under Montacute on April 25, 1464.

HEILIGENSTADT, a town of Prussia, in the province of Saxony, on the Leine. Its chief industries are cotton manufacture, cigar-making, &c. Pop. (1895), 6692; (1900), 7249.

HEIMDALL. See Northern Mythology.

HEL. See Northern Mythology.

HELBEH, the seed of a plant of the leguminous genus *Trigonella* (fenugreek), with a somewhat bitter taste, whose flour, mixed with dhurra, is used as food by the labourers of Egypt.

HELENA, a city of the United States, the capital of Montana, in Lewis and Clarke county, in Prickly Pear Valley, at the foot of the Rocky Mountains. The State Capitol is the chief building. The town is chiefly supported by the rich quartz and placer gold-mines in the vicinity. Silver, iron, rubies, and sapphires are also obtained, and there are hot medicinal springs. Pop. (1890), 13,834; (1900), 10,770.

HELIANTHEMUM, a genus of herbaceous undershrubs and shrubby or creeping plants, forming the only British genus of Cistaceæ; the rock-rose genus. See Cistus in Supp.

HELICTIS, the ferret-badger genus of carnivorous quadrupeds, allied to the skunks, of which there are about four species, one (*H. moschata*) found in China, and another (*H. orientalis*) in Nepâl. They resemble elongated badgers with shorter legs and longer tails, and are of nocturnal habits and adapted for climbing. The Nepâl species is about 2 feet long, including the tail.

HELIX, a genus of gasteropodous molluscs, type of the family Helicidæ, comprising the land shell-snails. See SNAIL.

HELLADOTHERIUM, an extinct genus of ungulate quadrupeds allied to the existing giraffe. Fossil remains occur in the upper Miocene rocks of Attica.

HELL-BENDER, a popular name for the Menopoma (which see).

HELL GATE, a formerly dangerous pass in East River, the strait which connects New York Bay with Long Island Sound. Rocks here used to form an obstruction much dreaded by mariners, but by extensive submarine mining operations and the use of the most powerful explosives the passage has been practically cleared.

HELMET-SHELL, the common name of molluscous shells of the genus *Cassis*, gasteropods of the family Buccinidæ. Most of the species are inhabitants of tropical shores, but a few are found on the coast of the Mediterranean. Some of the shells attain a large size. Those of *C. rufa*, *C. cornuta*, *C. tuberosa*, and other species, are the material on which shell cameos are usually sculptured.

HELMHOLTZ, HERMANN LUDWIG FERDINAND VON, German scientist, born at Potsdam on Aug. 31, 1821, studied medicine in the Friedrich Wilhelm Institute in Berlin, and received the appointment of assistant-surgeon in the Charité Hospital there in 1842. Next year he went to Potsdam as a military surgeon, but in 1848 he returned to Berlin to assume the duties of teacher of anatomy at the Academy of Art and assistant in the Anatomical Museum. He was called to the chair of physiology at Königsberg in 1849, and six years later he went to Bonn as professor of anatomy and physiology. In 1858 he was appointed to the professorship of physiology at Heidelberg, whence he returned in 1871 to Berlin as professor of physics. In 1888 he was appointed to the post of president of the new Physikalisch-Technische Reichsanstalt (Imperial Physico-Technical Institute) in Charlottenburg. He died in Charlottenburg on September 8, 1894. Helmholtz was distinguished alike in physical science, in mathematics, and in physiology; but his most valuable and most original work was done in those departments of physics which stand in intimate relations with physiology, especially acoustics and optics. He had an eminently philosophical mind, and his works are no less valuable for their masterly exposition of the methods of experimental science than for the important results contained in them. His scientific fame was securely established even as early as 1847, when he published his work, Über die Erhaltung der Kraft (On the Conservation of Energy). This subject was pursued further in a work published in 1854, Über die Wechselwirkungen der Naturkräfte (On the Interactions of Natural Forces). His greatest works are the Handbuch der Physiologischen Optik (Handbook of Physiological Optics, 1856–66; 2nd ed. 1886–96), and the Die Lehre von der Tonempfindungen (1862; 5th ed. 1896), translated into English by A. J. Ellis under the title Sensations of Tone as a Physiological Basis for the Theory of Music (1875; new ed. 1885; abridgment by J. Broadhouse, 1881). Many of his contributions to mathematics, acoustics, optics, heat, electricity, meteorology, and related sciences are to be found in scientific periodicals. A collection of Vorträge und Reden in two volumes reached a fourth edition in 1896, and has been translated into English as Popular Lectures on Scientific Subjects (1873, 1881). An edition of his scientific treatises was published at Leipzig in three volumes (1882–95), and in 1897 his Lectures on Theoretical Physics appeared in one volume. In his Beschreibung eines Augenspiegels (1851) he described the ophthalmoscope which he had recently invented. Professor Helmholtz received many honours, not only from his own country, but also from abroad. In 1888 he was ennobled by the German emperor.

HELODERMA, a Mexican genus of lizards, of which one species, *H. horridum*, has been proved to be venomous, all its teeth being furnished with poison glands. It is the only venomous lizard, is about 3 feet in length, has a thick and squat body covered with rough scales, forms burrows under the roots of trees, is nocturnal in habit, and is said to feed on insects, worms, millipeds, &c.

HELPS, SIR ARTHUR, D.C.L., K.C.B., a well-known essayist and historian, was born at Streatham, 10th July, 1813, and educated at Eton and Trinity College, Cambridge, where he took the degree of B.A. in 1835. He became private secretary to Lord Monteagle (Mr. Spring Rice) as chancellor of the exchequer, and was afterwards commissioner of French, Danish, and Spanish claims. In 1860 he was appointed clerk of the privy-council, and he held this post till his death. He was created K.C.B. in 1872, and died 7th March, 1875. As an essayist Sir Arthur Helps was one of the most popular writers of his day, and his historical works had also a good reputation. He was a man of very wide and general culture and of sound judgment, painstaking and accurate in details, and in his historical works displaying considerable breadth of view. His style is pure, accurate, and elegant. His principal works are: Thoughts in the Cloister and the Crowd (1835); Essays written in the Intervals of Business (1841); Friends in Council (1st series, 1847; 2d series, 1857); Conquerors of the New World and their Bondsmen (two vols., 1848 and 1852); Companions of my Solitude (1851); History of the Spanish Conquest of America (four vols. 1855–61); Oulita the Serf, a Tragedy (1858); Life of Pizarro (1869); Realmah (1869); Casimir Maremma (1870), the two last mentioned being fiction; Brevia, Short Essays and Aphorisms (1870); Life of Hernando Cortes and Conquest of Mexico, two vols.; Thoughts upon Government (1871); Life and Labours of Mr. Brassey (1872); Social Pressure (1874).

HELVETIAN REPUBLIC, the name given to the republic established in Switzerland by the French in 1798. See SWITZERLAND.

HELVETIC CONFESSION, the name of a document drawn up by Martin Bucer in 1536 to settle the controversy between the Lutherans and the Zwinglians; and also of one drawn up by Bullinger (1566) at the request of Friedrich III., elector of the Palatinate, and adopted in Switzerland, the Palatinate, France, Hungary, Poland, and Scotland.

HEMEL HEMPSTEAD, a market town and municipal borough of England, in Hertfordshire, about 6 miles to the west of St. Albans, carrying on paper-making, iron-founding, straw-plaiting, brewing, &c. Pop. (1901), 11,264.

HEMERALOPIA, a defect of sight in consequence of which a person can see only by artificial light; day blindness. It is also a name of nyctalopia (which see in SUPP.).

HEMIOPIA, a defect of vision in which the patient sees only a part of the object he looks at, the middle of it, its circumference, or its upper or lower part, or more commonly one lateral half being completely obscured.

HEMIPLEGIA. See PALSY.

HEMIPODIUS, a genus of rasorial birds allied to the quails. The swift-flying hemipodius is the little quail of New South Wales.

HEMLOCK, or **Hemlock Spruce**, a name given to an American fir (*Abies canadensis*) from its branches resembling in tenuity and position the common hemlock. See **Fir.**

HEMP-AGRIMONY, a tall-growing simple-stemmed composite (*Eupatorium Cannabinum*) with downy leaves and terminal corymbs of purplish flowers. It is found in moist places in some parts of Britain. See **Eupatorium.**

HEMP-PALM, a Chinese and Japanese species of palm (*Chamærops excelsa*), of the fibres of whose leaves cordage is made, while hats and even cloaks are made from the leaves themselves. See **Chamærops.**

HENEQUEN, the Mexican name for *sisal* or grass hemp (*Agave sisalana*), a native of Mexico and Central America, which yields a strong fibre made into cordage and cloth. The cultivation of the plant in Yucatan and its exportation have immensely increased in recent years.

HEN-HARRIER. See **Harrier** in **Supp.**

HENLEY, William Ernest, poet, critic, and journalist, was born at Gloucester on Aug. 23, 1849, and received his education in the Crypt grammar-school of his native city. In 1875 he entered on a journalistic career in London, and two years later he became first editor of the newly-founded magazine entitled London. He held this post for about a year, and in 1882 accepted the editorship of the Magazine of Art. This he resigned in 1886, and on the foundation of the Scots (later National) Observer in 1888 he was appointed its editor. He resigned that post in 1893 in order to take charge of the New Review, which he edited till 1897, when it ceased publication. His first publication—In Hospital: Rhymes and Rhythms (1888)—was inspired by his own experiences as a patient in Edinburgh Infirmary. The pieces contained in it were subsequently included in A Book of Verses (1890; 4th ed. 1893). A second volume of poems by him, The Song of the Sword and other Poems, appeared in 1892, and was republished in the following year as London Voluntaries. Both of these volumes of verse were incorporated in the collection of his Poems which was published in 1898. A more recent volume of poetry by Mr. Henley is For England's Sake (1900). He collaborated with Mr. R. L. Stevenson in three plays, Deacon Brodie, Beau Austin, and Admiral Guinea, which were published together in 1892. Mr. Henley has also edited, either alone or in co-operation with others, the following anthologies and collections: Lyra Heroica (1891), an anthology of English patriotic verse; London Garland: from Five Centuries of English Verse (1895); Book of English Prose (1896), with Mr. Charles Whibley; and English Lyrics, 1340–1809 (1897); and he was the editor of a series of Tudor Translations. The Centenary Burns (1896–97) is an important work edited by him with the co-operation of Mr. T. F. Henderson. The fourth volume contains an elaborate estimate by Mr. Henley of Burns as a poet and a man, published separately in 1898. In 1897 he issued the first volume of an annotated edition of the works of Byron. Views and Reviews, published in 1890, is a collection of some of the critical articles which he had contributed to the National Observer, the Athenæum, and other journals. In 1893 St. Andrew's University made him LL.D. He died 11th July, 1903.

HENNEGAU, the German name of Hainaut.

HENTY, George Alfred, war correspondent and writer of novels and boys' stories, born at Trumpington, Cambridgeshire, on Dec. 8, 1832, was educated at Westminster School and Caius College, Cambridge. Leaving Cambridge before taking his degree, he went out to the Crimea during the war with Russia, and served there in the purveyor's department of the army. On being invalided home he was appointed purveyor to the forces, and soon afterwards he went to Italy to organize the hospitals of the Italian legion. After his return he held some similar home appointments for a time, but later he resigned them in order to engage in mining operations in Wales, Italy, and elsewhere. As special correspondent of the Standard newspaper he went through the Austro-Italian, Franco-German, Turco-Servian, Abyssinian, and Ashanti campaigns, besides accompanying Garibaldi in the Tyrol and the Prince of Wales (now Edward VII.) in his tour through India. He described two of these campaigns in the works The March to Magdala (1868) and The March to Coomassie (1874). Mr. Henty has written the following novels: A Search for a Secret (1867); All But Lost (1869); The Curse of Carne's Hold (1889); A Hidden Foe (1891); Dorothy's Double (1894); A Woman of the Commune (1895); The Queen's Cup (1897); and Colonel Thorndyke's Secret (1898); but he is much more widely known as the author of a large number of stimulating stories of adventure for boys, many of them based on famous historical events. Among them are: The Young Franc-Tireurs (1871), a story of the Franco-German war; The Young Buglers, a tale of the Peninsular War (1879); In Times of Peril, a tale of India (1881); Under Drake's Flag (1882); With Clive in India (1883); Friends though Divided, a tale of the Civil War (1883); The Young Colonists (1884), a story of the Transvaal revolt and the Zulu war; The Lion of the North (1885), a story of Gustavus Adolphus; The Young Carthaginian (1886), a story of Hannibal; Orange and Green, a tale of the Boyne and Limerick (1887); Bonnie Prince Charlie, a tale of Fontenoy and Culloden (1887); The Cat of Bubastes (1888), treating of life in ancient Egypt; With Lee in Virginia (1889); By Pike and Dyke (1889), a story of the Dutch war of Independence; One of the 28th, a tale of Waterloo (1889); By Right of Conquest (1890), a story of the conquest of Mexico by Cortez; Held Fast for England (1891), a story of the siege of Gibraltar; Beric the Briton (1892), a tale of the days of Nero; The Tiger of Mysore (1895), a story of Tippoo Saib; Through Russian Snows (1895), a tale of Napoleon's retreat from Moscow; At Agincourt (1896); With Moore at Corunna (1897); Both Sides of the Border (1898), a story of Hotspur and Owen Glendower; No Surrender (1899), a story of the royalist rising in La Vendée; In the Irish Brigade (1900). He died on Nov. 16, 1902.

HEPAR SULPHURIS (literally 'liver of sulphur', so called from its brownish-green and liver-like appearance), a mixture of polysulphides of potassium with sulphate or thiosulphate of potash. It is a common homœopathic medicine.

HEPATICA, a genus of plants of the natural order Ranunculaceæ, closely related to *Anemone*, with which it is sometimes united. The best-known species is *H. triloba* (the *Anemone hepatica* of Linnæus), found wild throughout Europe in woods, and widely cultivated for its attractive star-like blue, white, or red flowers, which open in early spring. A still finer species is *H. angulosa*, a native of Galicia and Transylvania, with larger flowers of a fine light blue colour.

HEPATITIS, a disease consisting in inflammation of some part of the liver.

HERACLEUM, a genus of large umbelliferous herbs, the cow-parsnips, of which *H. Sphondylium* (common cow-parsnip or hog-weed), with large bipinnate leaves and white flowers, is very common in

Britain in damp meadow grounds and pastures. *H. giganteum* (the Siberian cow-parsnip), with yellow flowers, is often grown in shrubberies, reaching the height of 10 feet.

HERB-BENNET (that is, Saint Bennet or Benedict's herb), a rosaceous plant, *Geum urbanum*, known also as *Avens*. It is aromatic, tonic, and astringent, and has been used in medicine, and as an ingredient in some ales. See AVENS in SUPP.

HERB-CHRISTOPHER, the bane-berry, *Actæa spicata*. See BANE-BERRY in SUPP.

HERB-GERARD. See BISHOP-WEED in SUPP.

HERB-ROBERT, the *Geranium Robertianum*, called also *Stinking Crane's-bill*, a common British plant, with red flowers and deeply-cleft leaves. It is astringent and aromatic, and has been used in nephritic disorders. See CRANE'S-BILL.

HERCULES-BEETLE, a very large South American lamellicorn beetle, *Dynastes Hercules*. An enormous horn projects from the head of the male, and a smaller one from the thorax. The elytra of the male are of a grayish-green colour, spotted with black. The female is without the horns that give the male such a striking appearance. The length of the male is about 6 inches.

HERKOMER, HUBERT VON, painter, was born at Waal, in Bavaria, on May 26, 1849. His father, a wood carver, went to America in 1851, but returned to Europe and settled in Southampton in 1857. Hubert studied for two or three years at the School of Art in that city, and in 1865 he removed with his father to Munich. In 1866 he entered the South Kensington schools, but soon returned to Southampton, where he assisted in founding a life school for drawing. In 1867 he again studied in South Kensington, and two years later he exhibited in the Dudley Gallery. From this time he gradually gained recognition as a painter in water colours, and in 1871 he was elected a member of the Institute of Water Colour Painters. He also designed for the engravers on wood. His first picture exhibited at the Royal Academy, After the Toil of the Day (1873), a German subject, attracted attention; and two years later he gained a great reputation by his well-known picture representing The Last Muster—Sunday at the Royal Hospital, Chelsea, to which a grand medal of honour was awarded at Paris in 1878. In a contemporary critique of the Academy exhibition it is spoken of as 'this admirably designed picture, a work which is not less remarkable for its fine effect, richness of colour—the latter being a distinguishing feature—and breadth of tone, than for its pathetic characterization'. At Death's Door, exhibited in 1876, and Der Bittgang (1877) are Bavarian subjects, both much inferior to his Last Muster. Since then he has exhibited the following amongst other pictures: Eventide: a Scene in Westminster Union (1878), 'a worthy companion of the other realistic yet more heroic study of old age, which the artist made in his Chelsea Pensioners'; Life, Light, and Melody (1879); Wind-Swept (1880); God's Shrine (1880); My Children (1880); Missing: a Scene at the Portsmouth Dockyard Gates (1881), 'a masterpiece in its way'; Homeward (1882); Natural Enemies (1883); Hard Times (1885); Found (1885), purchased under the Chantrey Bequest; The Chapel of the Charterhouse (1889), also purchased by the Chantrey trustees; On Strike (1891), his diploma work; Back to Life: a District Nurse taking out a Child for the First Walk after a Long Illness (1896); and The Guards' Cheer (1898), representing a scene in the Diamond Jubilee procession. Among many portraits painted by him the best known are those of Wagner, Ruskin, and Tennyson. His best water-colour pictures are: Im Walde, The Woodcutter's Rest, The Poacher's Fate, and At the Well. Mr. Herkomer was elected an associate of the Royal Academy in 1879 and a full member in 1890, and from 1885 till 1895 he held the Slade professorship of fine art at Oxford in succession to Mr. Ruskin. He holds a life professorship at Munich. He superintended till its closing in 1904 an art school founded by himself at Bushey, Herts, and for the theatre connected with it he wrote several plays. Prof. Herkomer also occupies a high place as an etcher and mezzotint engraver. He is a member of the Institute of France and an officer of the Legion of Honour, and has been awarded many other tokens of distinction. He has published a good series of Lectures on Etching and Mezzotint Engraving (1892). See the Life by W. L. Courtney (1892).

HERMON. See LEBANON.

HERMOPOLIS. See SYRA.

HERNE BAY, an English watering-place, on the north coast of Kent, about 7½ miles north by east of Canterbury. It has fine sands, a long marine parade, iron pier and pavilion, &c. Pop. (1901), 6688.

HERNÖSAND, a seaport and cathedral town of Sweden, capital of Westernorrland, on the island Hernö, in the Gulf of Bothnia, with a considerable shipping trade. The island is connected with the mainland by two bridges. Pop. (1900), 7890.

HERODIONES, a modern name for an order of birds including the herons, bitterns, storks, spoonbills, ibises, &c.

HERPES, a skin disease characterized by vesicles which arise in distinct but irregular clusters, and commonly appear in quick succession and near together, on an inflamed base; generally attended with heat, pain, and considerable constitutional disorder. The term includes shingles (which see) and the like.

HERTOGENBOSCH. See BOIS-LE-DUC.

HERVEY ISLANDS. See COOK'S ISLANDS.

HERZOG, JOHANN JAKOB, German theologian, born in Basel on Sept. 12, 1805, received his education in his native city and in Berlin. In 1835 he was appointed to the chair of historical theology at Lausanne. In 1847 he went to Halle as professor of ecclesiastical history, and from 1854 till his retirement in 1877 he occupied a similar chair in Erlangen. He died on Sept. 30, 1882. He was author of the following among other works: Johannes Calvin; Das Leben Ökolampadius' und die Reformation der Kirche zu Basel; Die Waldenser; Abriss der gesamten Kirchengeschichte (Outlines of General Church History; but he is best known by the valuable Realencyklopädie für Protestantische Theologie und Kirche (22 vols. 1854–68) which he edited, and to which he contributed a very large proportion of the articles. In the preparation of the second edition, which was published in 18 vols. from 1877 to 1888, Herzog was assisted by G. L. Plitt and A. Hauck. The third edition began to appear in 1896 under the editorship of Hauck. A condensed English translation with much additional matter was published at New York in 3 vols. (1882–84) under the care of Philip Schaff and others.

HESPERORNIS, a fossil bird found in the chalk formation of Kansas, about 6 feet long, without wings, and having its jaws armed with teeth, which are not set in sockets, but in a common groove. It has been described as 'a kind of swimming, loon-like, raptorial ostrich, without forelimbs, with the gape armed with formidable rows of strong teeth like a gigantic lizard, and with a large, broad, and flattened tail like a beaver'.

HETEROOUSIANS, in ecclesiastical history, a branch of the Arians who held that the Son was of a different substance from the Father. See HOMOOUSIANS.

HETEROPODA, an exclusively pelagic order of molluscs, with transparent shell and tissues, the most highly organized of the Gasteropoda. In this order the foot is compressed into a vertical muscular lamina, serving for a fin, and the gills, when present, are collected into a mass on the hinder part of the back. All the species are carnivorous.

HEYLYN, or HEYLIN, PETER, English theologian, was born in 1600 at Burford, in Oxfordshire, as son of a country gentleman. Educated for a time in the school of his native place, he went about 1614 to Hart Hall, Oxford. Soon afterwards elected a demy of Magdalen College, he graduated B.A. in 1617 and M.A. three years later. He was appointed a fellow of Magdalen College in 1618. He took orders in 1624, became a royal chaplain in 1630, and by the king's favour was appointed in 1631 to a prebend of Westminster Cathedral. Two years afterwards he was presented to the benefice of Alresford in Hants, and in 1637 he became treasurer for the chapter of Westminster. As a pronounced partisan of Laud and the king he made himself numerous enemies, and on the outbreak of the Civil War he lost all his preferments, and for a time lived a somewhat wandering life. Under the Commonwealth and Protectorate he continued to be an active controversialist on the anti-puritan and royalist side, and at the Restoration he returned to Westminster. He died on May 8, 1662, and was buried in Westminster Abbey. For the last eleven years of his life he was totally blind. Among Heylyn's works are: a Geography (1621), afterwards published in an enlarged form as a Cosmography; History of St George of Cappadocia (1631); A Survey of France (1656); History of the Sabbath (1635); Ecclesia Vindicata, or the Church of England Justified (1657); The Stumbling-Block of Disobedience and Rebellion (1658), published in 1681 along with the two preceding and other works as Historical and Miscellaneous Tracts; Ecclesia Restaurata, or the History of the Reformation (1661; edited by the Rev. J. C. Robertson, 1849); Cyprianus Anglicus, or the History of the Life and Death of William Laud, Archbishop of Canterbury (1668), a valuable authority for Laud's life; Aerius Redivivus, or the History of Presbyterianism (1670).

HEYSE, PAUL, German poet and novelist, was born on Mar. 15, 1830, at Berlin, where his father was extraordinary professor of philology. He studied classics in his native city under Lachmann and Boeckh, and in 1850 went to Bonn to attend Diez's lectures on Romance philology. In 1852 he travelled in Switzerland and Italy, and two years later he settled in Munich on the invitation of King Maximilian II. of Bavaria, who granted him a pension. He has lived mainly in Munich ever since, devoted almost exclusively to literature. His first work was Jungbrunnen, Märchen eines fahrenden Schülers (Tales of a Travelling Scholar), published in 1850, and to the same year belongs his tragedy Francesca da Rimini. Die Brüder (The Brothers, 1852) and Urica (1852), his next publications, were narrative poems, and formed part of the volume entitled Hermen (1854), later Novellen in Versen, which did much to establish his reputation. Heyse's genius has found its most perfect expression in his numerous tales or novelettes (Novellen), and in this department of literature he holds almost an unique place among German writers. His work is almost throughout highly finished and artistic, and shows a rich imagination and great fertility in invention. His tales have been published in more than twenty collections, and a selection appeared in 3 vols. in 1890 under the title Auswahl fürs Haus (4th ed. 1895). Some of them, such as L'Arrabiata (1870) and The Romance of the Canoness (1889), have been translated into English. His early successes in narrative verse have been followed up by such works as: Die Braut von Cypern (The Bride of Cyprus, 1856); Thekla (1858); Rafael (1863); Syritha (1867); Der Salamander (1879); Die Madonna im Ölwald (1879); Liebeszauber (1889). His earlier plays, including Francesca da Rimini, already mentioned, are essentially book tragedies, whilst those of his next period are somewhat flimsy productions. His best plays are those of his third period, and some of them, especially Hans Lange and Kolberg, have been acted with great success. They include: Die Hochzeit auf dem Aventin (The Wedding on the Aventine, 1886); Gott schütze mich vor meinen Freunden (God protect me from my Friends, 1888); Hans Lange (1866); Kolberg (1868); Die Göttin der Vernunft (The Goddess of Reason, 1870); Die Weiber von Schorndorf (The Wives of Schorndorf, 1881); Das Recht des Stärkern (The Right of the Stronger, 1883); Die Weisheit Salomos (The Wisdom of Solomon, 1887); Weltuntergang (The End of the World, 1889); Die schlimmen Brüder (The Wicked Brothers, 1891); Wahrheit? (Truth? 1892); and Jungfer Justine (1893). His larger novels, Kinder der Welt (Children of the World, 1873), Im Paradiese (In Paradise, 1875), Merlin (1892), and Über allen Gipfeln (Over all Peaks, 1895), have met with great success. Among the other works of Heyse are his Skizzenbuch (1877), partly in verse and partly in prose; Verse aus Italien (1880); Spruchbüchlein (1885); Gedichte (Poems, 5th ed. 1895); and Neue Gedichte und Jugendlieder (New Poems and Youthful Lyrics, 1897); but the list of his original works does not represent the whole extent of his literary activity, for he has published many excellent translations from Italian and Spanish and edited various collections of poems and tales. His Collected Works have been published in twenty-four vols. (1871–93), and his Dramatic Works extend to thirty vols. in a collective edition (1864–97).

HIBBERT LECTURES, a course of lectures established in 1878 under the will of Robert Hibbert (1770–1849), a Jamaica merchant, for the promotion of comprehensive learning and thorough research in relation to religion, wholly apart from the interest of any particular church or system. By a deed executed in July, 1847, he conveyed to trustees fifty thousand dollars in 6-per-cent Ohio stock and eight thousand pounds in railway stock, directing that after the death of his widow the income was to be applied 'in such manner as they [the trustees] shall from time to time deem most conducive to the spread of Christianity in its most simple and intelligible form, and to the unfettered exercise of the right of private judgment in matters of religion'. Provision was made for periodic revision of the trust, and on the first revision in 1878 the present well-known series of lectures was instituted. The first lecturer was the late Prof. Max Müller, who chose as the subject of his course, The Origin and Growth of Religion as illustrated by the Religions of India. Subsequent lecturers and subjects are: Sir P. Le P. Renouf, The Religion of Ancient Egypt (1879); E. Renan, The Influence of Rome on Christianity (1880); T. W. Rhys Davids, Indian Buddhism (1881); A. Kuenen, National Religions and Universal Religions (1882); C. A. Beard, The Reformation of the Sixteenth Century (1883); A. Réville, The Native Religions of Mexico and Peru (1884); O. Pfleiderer,

Influence of Paul on Christianity (1885); J. Rhys, Celtic Heathendom (1886); A. H. Sayce, The Religion of the Ancient Babylonians (1887); E. Hatch, The Influence of Greek Ideas and Usages upon the Christian Church (1888); J. Darmesteter, The Religion of the Parsis (1890); G. D'Alviella, The Conception of God (1891); C. G. Montefiore, The Religion of the Ancient Hebrews (1892); C. B. Upton, The Basis of Religious Belief (1893); James Drummond, Via, Veritas, Vita (1894).

HIDES. See LEATHER.

HIERACIUM. See HAWKWEED in SUPP.

HIERA PICRA, 'Holy Bitter', a warm cathartic composed of aloes and canella bark made into a powder and mixed with honey, still a favourite in domestic medicine and veterinary practice.

HIERATIC WRITING. See HIEROGLYPHICS.

HIGH CHURCH, a term applied to a party in the Church of England. It was applied first to a party among the younger clergy during the latter part of the reign of Elizabeth who asserted that Calvinism was inconsistent with the ancient doctrine and constitution of the primitive church, and who claimed a divine right for episcopacy. Bishop Andrews was the chief writer of this party, and Laud became its most active leader. The term now generally refers to those who exalt the authority and jurisdiction of the church, and attach great value to ecclesiastical dignities and ordinances, being more or less identified with the ritualistic party. See RITUALISM.

HIGH COMMISSION, COURT OF, an ecclesiastical court created by 1 Eliz. c. i. 1559, by which all spiritual jurisdiction was vested in the crown. Under Charles I. and Laud it assumed illegal powers, and was abolished in 1641.

HIGHGATE, a north-west suburb of London, situated on a hill commanding fine views of the metropolis and the surrounding country, 5½ miles from St. Paul's.

HIGH GERMAN. See *German Language* under GERMANY.

HIGHLAND REGIMENTS, regiments in the British army originally raised in the Highlands of Scotland. Their origin is found in certain companies of Highlanders armed by government about 1725-30, for the purpose of keeping order in the Highlands, and called the *Black Watch* from the sombre colours of their tartans. These were embodied as a regiment of the regular army in 1739, the first Highland regiment being the 43rd, afterwards the 42nd, which has borne a distinguished part in almost all the wars in which Britain has been engaged. Other seven regiments were raised at different times, the 71st and 72nd in 1777; the 74th in 1787; the 78th or Ross-shire Buffs in 1793; the 92nd or Gordon Highlanders in 1796; the 93rd or Sutherland Highlanders in 1800; and the 79th or Cameron Highlanders in 1805. Under the present territorial system the Highland Regiments consist of the Black Watch (Royal Highlanders), with Royal Perth Militia; the Highland Light Infantry, with 1st Royal Lanark Militia; the Seaforth Highlanders (Ross-shire Buffs, Duke of Albany's), with Highland (Rifle) Militia; the Queen's Own Cameron Highlanders, with Highland Light Infantry Militia; the Gordon Highlanders, with Royal Aberdeenshire Militia; Princess Louise's (Argyll and Sutherland Highlanders), with Highland Borderers Militia and Royal Renfrew Militia. Each regiment has its own distinctive tartan, some retaining the kilt, and others wearing trousers. There are also several Highland volunteer regiments which are brigaded with the various corps above mentioned. See HIGHLANDS; and also BLACK WATCH in SUPP.

HIGH PLACES (Hebrew, *bāmōth*), in Scripture, eminences or mounds on which sacrifices were offered. The high places so frequently mentioned in Hebrew history appear to have been old Canaanitish holy places which were adopted along with other elements of worship by the conquering Israelites. They were gradually adapted to the worship of Jehovah or Yahwè, the god of Israel, but prophets like Hosea and Amos denounced the worship practised at them, and the legislation of Deuteronomy is directed against them. 'The history of the high places is the history of the old religion of Israel' (Prof. Moore in Encyclopædia Biblica, vol. ii), and it would appear that the worship of the high places long survived the exile. See the article by Prof. Moore above referred to.

HILDA, SAINT, a grand-niece of Edwin, King of Northumbria, born about 614, died 680. At the age of fourteen she was baptized along with her royal kinsman by Paulinus. She was consecrated by Bishop Aidan, and was successively head of the abbey of Hartlepool, and of the famous monastery founded by her in 657 at Whitby. Cædmon, the Anglo-Saxon poet, was attached to the monastery during her rule, and it was there that the celebrated synod took place in 664 in which the Celtic ritual was condemned.

HILL TIPPERAH, a native state, Hindustan, adjoining the British district of Tipperah, Bengal. The country is hilly, several ranges of hills running parallel from north to south, with broad intervening valleys. Wild elephants and other large game abound in the forests. The principal crop is rice, and tea is indigenous in some parts of the hills. The government is despotic and patriarchal, and a resident political agent protects British interests. Area, 4086 square miles. Pop. (1901), 173,325.

HILO, the chief town of the island of Hawaii, and the second largest in the Sandwich Islands. It has a harbour and a lighthouse. Pop. 6000.

HIMEJI, a town in Hondo Island, Japan, on the north-east coast of the Inland Sea, some 30 miles north-west of Hiogo, connected by railway with Osaka, Kioto, and other leading towns on the island. Cotton and leather goods are manufactured. Pop. in 1899, 35,282.

HIMERA, an ancient Greek town on the north coast of Sicily, the site of which is near the modern Termini. Here Gelon and Theron annihilated the army of Hamilcar the Carthaginian (480 B.C.). In 409 B.C. Hannibal, grandson of Hamilcar, razed the town to the ground.

HIMYARITES, a race or group of races in Arabia, regarded as descendants of Himyar, one of the mythical ancestors of the Arabs. According to tradition they became the dominant race in Yemen about 2500 B.C., and spread to the Euphrates on the one hand and Abyssinia on the other. Their most flourishing period appears to have been from about 100 B.C. till A.D. 629, when they succumbed to Mohammedanism. The *Himyaritic language*, not now spoken, formed, with the Arabic and Ethiopic, the southern branch of the Semitic family of tongues. During the last hundred years several hundreds of Himyaritic inscriptions have been collected, and deciphered by means of alphabets with the corresponding Arabic letters which had been preserved. The Mahrah tribes of S. Arabia are the direct descendants of the ancient Himyarites.

HINDI, one of the languages of India, being that form of Hindustani which employs the Devanágari or Sanskrit character. See INDIA.

HINDUISM. See BRAHMANS.

HINNOM, VALLEY OF. See TOPHET.

HIPPO, sometimes called *Hippo Regius*, to dis-

tinguish it from another town of the same name on the Carthaginian coast; an ancient Numidian city the ruins of which still exist a short distance south of Bona in Algeria. It was the episcopal see of St. Augustine, and was destroyed by the Vandals in 430. See BONA.

HIPPOCRAS, a medicinal drink, composed of wine (generally a mixture of Lisbon and Canary), with an infusion of mixed spices and other ingredients, formerly much used in England, and still common on the Continent.

HIPPOPHAGY, the practice of feeding on horse flesh. Hippophagi was the name given by old geographers to certain nomadic Scythian tribes on the north of the Caspian Sea, who fed on horse flesh. Horse flesh has been eaten for a considerable time in Germany, and it has been regularly sold in Paris since 1866. By an act passed in 1889 the sale of horse flesh for human food is prohibited in Britain, except in shops having a conspicuous sign stating that horse flesh is sold within. A penalty of £20 is imposed on any one not observing the above regulation, or attempting to sell horse flesh (or that of asses or mules) under other names.

HIPPURITES, a genus of fossil bivalves, having the under shell of great depth and of a conical form, with a flat lid or operculum, occurring in the lower chalk. They are allied to the living *Chama* or gaping cockle. The *Hippurite limestone* is an important representative of the cretaceous rocks in the south of France and the Pyrenees, characterized by a large admixture of shells of the family Hippuritidæ. See GEOLOGY.

HIROSAKI, a Japanese town in the north of Niphon, in the province of Aomori, and to the south-west of the town of Aomori. It has an old castle, now used as a barracks. Pop. in 1899, 34,771.

HIROSHIMA, a town on the island of Hondo, Japan, situated on the north coast of the Inland Sea. It is about 160 miles from Kobé, and after Osaka it is the most important port on the Inland Sea. Pop. (1899), 122,306.

HISSAR, a town of Hindustan, in the Punjab, administrative head-quarters of the district of the same name, on the Western Jumna Canal, 102 miles west of Delhi. Pop. (1891), 16,854. The district has an area of 5163 sq. miles. Its soil is fertile, and various grains are grown. Pop. (1901), 781,505.

HITOPADESA. See SANSKRIT LANGUAGE AND LITERATURE.

HOATZIN, or HOACTZIN, *Opisthocomus cristatus* (or *hoatzin*), a singular gregarious South American bird, sometimes called the *Crested Touraco*, referred by some naturalists to the family Cracidæ (curassows), order Gallinaceæ; by others treated as forming a separate family (Opisthocomidæ) in that order; by some made to form an order by itself (Opisthocomi); by others regarded as of the order Insessores, and allied to the plantain-eaters. The plumage is brown streaked with white, and the head has a movable crest. It is of the size of a pheasant, and has an enormous crop with a very small gizzard.

HOBOKEN, a city of the United States in Hudson county, New Jersey, on the Hudson river, and close to Jersey City, which stretches immediately to the south. It lies opposite New York, with which it is connected by steam ferries. The river frontage is lined with wharves, the termini of several lines of European steamers. Its manufacturing industries are rapidly extending, one of the most important being the manufacture of lead pencils. Among the public institutions is the Stevens institute of technology, with a library and valuable sets of apparatus in the departments of physics, engineering, chemistry, &c. The city is regularly laid out and compactly built. Pop. (1890), 43,648; (1900), 59,364.

HOCKEY, a game of ball, forms of which have long been known as *hurley* in Ireland and *shinty* in Scotland, dating in its present form from about 1883, when a definite code of rules was drawn up by the Wimbledon Club. The Hockey Association was formed in 1886, but it was not till 1889 that the present disposition of the players on the field was adopted. According to the standard rules of the Hockey Association, the game is played between two teams of eleven players each, on a ground 100 yards long by 50 to 60 yards wide. A goal is erected at each end of the field, and consists of two uprights 12 feet apart supporting a horizontal bar 7 feet from the ground. In front of each goal a line 12 feet long is drawn parallel to the goal-line and 15 yards from it; and from each end of this line, with the corresponding goal-post as centre, a segment of a circle is drawn outwards to meet the goal-line. Thus, a kind of semicircle flattened at the top is drawn in front of each goal, and no goal is scored unless the ball is hit from within this line or striking-circle. The ball used is an ordinary cricket ball painted white; and each player is provided with a stick, curved at the end, without any metal fittings, and not too thick to be passed through a ring 2 inches in diameter. The players are arranged on the field as in Association football, namely, goal-keeper, two backs, three half-backs, five forwards. The game is started by one player of each side *bullying* the ball in the centre of the ground, that is, by first striking the ground with his stick and then striking his opponent's stick three times, after which either may strike the ball. When the ball is driven between the goal-posts under the bar by a stroke from within the striking-circle, a goal is scored, and the game is won by the side with a majority of goals scored. The ball may be caught or stopped with any part of the body, but it must not be carried, kicked, or knocked on except with the stick; it must be played from right to left only. The goal-keeper is allowed to kick the ball away in defending his goal. Ends are changed at half-time.

HODGE, CHARLES, American theologian, born in Philadelphia on Dec. 28, 1797, was educated in the academy at Somerville, New Jersey, and Princeton College, graduating in 1815. During the three years 1816–19 he studied in the theological seminary at Princeton, in 1820 he was appointed instructor there, and two years later he was made professor of oriental and biblical literature. In 1826–28 he studied at Paris, Halle, and Berlin, and in 1840 he was transferred to the chair of didactic and exegetical theology in the seminary. Twelve years afterwards he was appointed to the additional chair of polemical theology. In 1825 he founded the Biblical Repertory, which four years afterwards was renamed Biblical Repertory and Princeton Review, and was merged in 1872 in the Presbyterian Quarterly and American Theological Review. From the foundation till the absorption in 1872 he was editor of and chief contributor to the Review, and two of his published works, Princeton Theological Essays (2 vols. 1846–47), and Essays and Reviews (1857), were compiled from his numerous articles. His jubilee as a professor was celebrated in 1872. He received the honorary degrees of D.D. and LL.D. He died in Princeton on June 19, 1878. Among his published works are: Commentary on the Epistle to the Romans (1855; rewritten and enlarged, 1866), Constitutional History of the Presbyterian Church in the United States (2 vols. 1840–41); The Way of Life (1842); Systematic Theology (3 vols.

1871–72), a comprehensive treatise giving an exposition of Calvinistic theology; and What is Darwinism? (1874).—His son, ARCHIBALD ALEXANDER HODGE, born in Princeton on July 18, 1823, was educated in the college and theological seminary of that city. After spending three years in India as a missionary, and holding ministerial charges in Maryland, Virginia, and Pennsylvania, he was appointed in 1864 to the chair of didactic theology in the theological seminary at Allegheny, Pennsylvania. In 1877 he became associated with his father in his work in Princeton seminary, and on his father's death in the following year he succeeded him in his chairs. He died at Princeton on Nov. 11, 1886. Among his publications the following are the most important: Outlines of Theology (1860); The Atonement (1868); A Commentary on the Confession of Faith (1869); a biography of his father (1880); and Popular Lectures on Theological Themes (1887).

HODOMETER (from Gr. *hodos*, a way, and *metron*, a measure), an instrument for measuring the length of way travelled by any vehicle. It consists of a clockwork arrangement fixed to the side of the vehicle and connected with the axle. An index records on the dial the distance travelled. See PEDOMETER.

HOE, an instrument for cutting up weeds and loosening the earth in fields and gardens, in shape something like an adze, being a plate of iron, with an eye for a handle, which is set at a convenient angle with the plate. The Dutch hoe differs from the common hand hoe in having the cutting blade set like the blade of a spade. A *horse-hoe* is a frame wheel-mounted, and furnished with ranges of shares spaced so as to work in the intervals between the rows of turnips, potatoes, &c. It is used on farms for the same purpose as the hand hoe, and worked by horse-power. See AGRICULTURE.

HOFFMAN, CHARLES FENNO, American poet and novelist, born in New York in 1806, was educated in a Poughkeepsie academy and privately in New Jersey. He afterwards entered Columbia College, New York, and studied law at Albany, being called to the bar in 1827. In 1830 he became joint-editor of a New York journal, and three years later he started the Knickerbocker Magazine, of which he edited a few numbers. For many years he edited the American Monthly Magazine, and he was also connected for shorter periods with other papers. In 1849 his mind began to give way, and from that time till his death, which occurred on June 7, 1884, he was an inmate of Harrisburg lunatic asylum. His first separate publication was A Winter in the West (1835), containing graphic descriptions of nature and excellent sketches of frontier life. It was followed in 1837 by Wild Scenes in Forest and Prairie (enlarged edit. 1843), and in 1840 by the novel entitled Greyslaer: a Romance of the Mohawk, which met with immediate and remarkable success. An earlier novel, Vanderlyn, appeared in the American Monthly Magazine during 1837. Hoffman is one of America's best lyric poets, and many of his songs have gained great popularity. His published volumes of verse include: The Vigil of Faith, a Legend of the Adirondack Mountains, and other Poems (1842); The Echo: or Borrowed Notes for Home Circulation (1844); Lays of the Hudson, and other Poems (1846); and Love's Calendar, and other Poems (1848). Other works by him are: The Administration of Jacob Leisler (1848), in Sparks's American Biography; and The Pioneers of New York (1848). To the edition of his poems prepared in 1874 by his nephew, E. F. Hoffman, W. C. Bryant contributed a critical sketch of the author.

HOFFMANN, AUGUST HEINRICH, usually known as *Hoffmann von Fallersleben*, German poet and philologist, was born at Fallersleben, in Hanover, on April 2, 1798. He went to Göttingen in 1816 to study theology, but he soon devoted himself chiefly to German philology, and during two years (1819–21) at Bonn he continued his literary studies. After carrying out philological investigations in Holland, he was appointed in 1823 custodian of the university library at Breslau, and in 1830 he became extraordinary, in 1835 ordinary professor of the German language and literature in the university of that city. During the twelve years 1827–39 he travelled throughout Austria, Denmark, Holland, Belgium, Northern France, and Switzerland collecting philological materials. He resigned his librarianship at Breslau in 1838, and in 1842 he was removed from his chair without a pension because of the liberal political views and tendencies represented in his Unpolitsche Lieder (Unpolitical Songs, 2 vols. 1840–41). He led an unsettled, wandering life till 1845, when he obtained the right of domicile in Mecklenburg, and in 1848 he was granted a pension by the Prussian government. In 1853 he accepted an invitation to Weimar, where he edited along with Oskar Schade the Weimarische Jahrbuch fur deutsche Sprache, Litteratur, und Kunst (1854–57). From 1860 he lived at Corvei, on the Weser, as librarian to the Duke of Ratibor, and there on Jan. 19, 1874, he died. Besides his many valuable contributions to philology and literary history he also edited several valuable collections of folk-songs, among which are: Schlesische Volkslieder mit Melodien (1842); Niederländische Volkslieder (2nd edit. 1856); Unsere Volkstümlichen Lieder (1859); Die deutschen Gesellschaftslieder des 16. und 17. Jahrhunderts (1844); and Ruda: Polnische Volkslieder der Oberschlesier (1865). Of his original writings the best known are his songs, not a few of which, especially that beginning Deutschland, Deutschland über Alles (1841), have long received emphatic popular approval. For several of them he composed tunes himself. They were published in several volumes at different times, among these being: Gedichte (1827); Alemannische Lieder (1827); Fünfzig Kinderlieder (Fifty Children's Songs, 1843); Fünfzig neue Kinderlieder (1845); Vierzig Kinderlieder (1847); Hundert Schullieder (A Hundred School Songs, 1848); Deutsches Volksgesangbuch (German People's Song Book, 1848); Liebeslieder (Love Songs, 1851); Soldatenlieder (Soldier Songs, 1851); Kinderwelt in Liedern, and Alte und Neue Kinderlieder (4 vols. 1873). A complete edition of his Kinderlieder was prepared by L. von Donop in 1877. Mein Leben (6 vols. 1868; abridged edition continued to his death, by Gerstenberg, 2 vols. 1892–94), is autobiographical. Gerstenberg has prepared an edition of his Collected Works (8 vols. 1890–93).

HOG-FISH, the popular name given to teleostean fishes of the genus *Scorpæna*, family Scorpænidæ or Triglidæ. The best known species is the *S. scrofa*, common in the Mediterranean, having the head flattened sideways, armed with spines, and adorned with membranous lobes or filaments. It is of a large size and a red colour.

HOG-GUM, a resinous substance used for strengthening plasters, and also as a diuretic, laxative, and stimulant medicine. In the West Indies it is employed as a substitute for pitch in tarring boats, ropes, &c. It appears to be produced by several different trees.

HOG-RAT, a genus (*Capromys*) of rodent animals, family Muridæ (mice), different species of which, including the musk-cavy, are found in the West Indies.

HOISTS. See LIFTS.

HOLBORN, a municipal borough and parish in the county of London, three-quarters of a mile W.N.W. of St. Paul's. The chief buildings and institutions are: the town-hall, of brick dressed with stone; the Birkbeck Library and Scientific Institution; Gray's Inn and Lincoln's Inn, two of the Inns of Court; Furnival's, Staple, and Barnard's Inn, Inns of Chancery; and there are some interesting old houses. Holborn gives name to one of the three divisions of the parliamentary borough of Finsbury. Pop. of parl. div. (1901), 61,949; of mun. bor. (1901), 59,390.

HOLE, VERY REV. SAMUEL REYNOLDS, clergyman and author, was born at Caunton, Nottinghamshire, on Dec. 5, 1819. Educated at the grammar-school of Newark-on-Trent and at Brasenose College, Oxford, he was ordained in 1844 and took priest's orders in the following year. He became curate of Caunton in 1844 and vicar in 1850. Appointed rural dean of Southwell in 1865, he became a prebendary of Lincoln ten years later, and in 1885 was selected by Archbishop Benson as his chaplain. From 1887 till his death, August 27, 1904, he was dean of Rochester. He was select preacher at the University of Oxford in 1885–86. Dean Hole is best known as an author by his Book about Roses: How to Grow and Show Them (1869; many subsequent editions), in which he chats pleasantly, humorously, and instructively on his favourite subject. On horticultural subjects he has also published: The Six of Spades: a Book about the Garden and the Gardener (1872); A Book about the Garden (1892), a pretty little book in praise of gardening, and filled with numerous pertinent stories; and Our Gardens (1899). His other works comprise: A Little Tour in Ireland (1859; reprinted 1892), illustrated by John Leech; Hints to Preachers: with Sermons and Addresses (1880); Nice and her Neighbours (1881); The Memories of Dean Hole (1892), a delightful and characteristic book in his best manner, with subjects arranged in alphabetical order; More Memories: Being Thoughts about England spoken in America (1894); A Little Tour in America (1896); and Addresses to Working Men.

HOLL, FRANCIS MONTAGUE, commonly known as Frank Holl, painter, son of Francis Holl, A.R.A., the well-known engraver, was born in Kentish Town, London, on July 4, 1845. He was educated in a Hampstead school and University College School, and became a student in the Royal Academy in 1861. He gained several medals while still a student, among them a gold medal in 1863 for a historical painting. He sent to the annual exhibition of the Academy in 1864 a portrait of himself and a picture called Turned Out of Church, and from that time till his death he was represented at almost every Academy exhibition. In 1868 he was awarded an Academy travelling studentship for his picture, The Lord Gave and The Lord Hath Taken Away (exhibited 1869). For about two years from 1874 he did much work for the Graphic, and he also provided illustrations for Anthony Trollope's Phineas Redux (1874). Among his other subject pictures the best are the following: A Fern-Gatherer (1865); The Ordeal (1866); Convalescent (1867); Faces in the Fire (1867); Better is a Dinner of Herbs where Love is than a Stalled Ox and Hatred Therewith (1870); No Tidings from the Sea (1871), commissioned by Queen Victoria; Winter (1871); A Milkmaid (1872); I am the Resurrection and the Life (1872); Leaving Home (1873), a railway-station scene, originally a drawing in the Graphic, and also painted in water-colour and exhibited later; Want: The Pawnbroker's Shop (1873); Deserted (1874); Her First-Born (1876); Going Home (1877); Newgate: Committed for Trial (1878); The Gifts of the Fairies (1879); Ordered to the Front (1880); Home Again (1881), showing the Guards' return from the wars; and Did You Ever Kill Anybody, Father? (1884). From about 1876 an increasing proportion of Mr. Holl's pictures were portraits, and latterly he was almost the leading portrait painter of his day. His portrait of Sir George Stephen is generally regarded as his best, but that of Cousins, the engraver, though it did not satisfy Cousins himself, is also a masterly production. The best of his other portraits are those of Major Graham, Captain Sim, Sir Henry Rawlinson, Sir Frederick (now Earl) Roberts, Lord Wolseley, Lord Overstone, John Bright, Duke of Cleveland, and Earl Spencer. Mr. Holl was elected an associate of the Royal Academy in 1878, and in 1883 he became a full Academician as well as an associate of the Royal Society of Painters in Water Colours. He died in London on July 31, 1888, having ruined his health by overwork. Mr. Holl's preference for sad and lugubrious subjects was constantly objected to by critics; but though often slovenly in execution, he showed real power and sympathy in depicting the pathetic and the sorrowful. In portraiture he confined himself almost entirely to men.

HOLLOWAY, THOMAS, patent medicine proprietor and founder of the Royal Holloway College and Sanatorium, son of a warrant officer in the militia who afterwards became an innkeeper, was born at Devonport on Sept. 22, 1800. Educated at Camborne and Penzance, he went, about 1828, to London, where he afterwards engaged in business as a merchant and commercial agent. About 1837 he began to sell his well-known ointment, and soon afterwards he brought his pills before the notice of the public. After encountering some early difficulties, he ultimately succeeded in amassing a very large fortune, which he partly devoted to benevolent objects. He died at Tittenhurst, in Berkshire, on Dec. 26, 1883. The Royal Holloway College for Women, on the equipment and endowment of which he expended about £800,000, was opened by Queen Victoria on June 30, 1886. It contains a collection of pictures valued at £100,000. Under the recent scheme of reorganization the college is affiliated to London University. Near it is the sanatorium founded by him for the mentally afflicted of the lower middle class, which also absorbed a large sum of money.

HOLMFIRTH, a town of England, in the West Riding of Yorkshire, on the river Home, 6 miles south of Huddersfield, amid picturesque scenery. Besides various places of worship, it has a town-hall, volunteer drill-hall, and a technical institute. Its chief manufacture is that of woollens. The bursting of the Bilberry Reservoir, 3 miles above the town, in 1852, caused the loss of eighty-one lives. Pop. (1891), 9744; (1901), 8976.

HOLM-OAK, *Quercus Ilex*, a shrub-like tree, native of the Mediterranean countries, with holly-like leaves. In its native countries it attains a considerable size and age, but in Britain it forms an ornamental evergreen bush of from 20 to 30 feet high, seldom becoming single-stemmed. See OAK.

HOLOFERNES. See JUDITH.

HOLOPTYCHIUS, a genus of fossil ganoid fishes occurring in the upper old red sandstone. The head was covered with large plates, and the body with bony scales, rhombic or cycloid in form. The jaws, besides being armed with numerous sharp-pointed fish-teeth, were furnished with large teeth of a conical form. See GEOLOGY.

HOLY GRASS, *Hierochloe*, a genus of odoriferous

grasses belonging to the Phalarideæ, and consisting of several species spread over the cold parts of both hemispheres. The *H. borealis*, or northern holy-grass, is found in Scotland, Iceland, and throughout Northern Europe, Asia, and America, and occurs also in New Zealand. It has its name from the practice adopted in some parts of Germany of strewing it before the doors of churches on festival days.

HOLY MAID OF KENT. See BARTON, ELIZABETH.

HOLYOAKE, GEORGE JACOB, journalist, secularist, and political agitator, was born at Birmingham on April 13, 1817. He received his education at the Old Mechanics' Institution of that city, and he early became connected with the various advanced movements of which Birmingham was then an important centre. In 1841 he was one of the lecturers chosen to explain Robert Owen's social schemes, and next year he was imprisoned for six months at Gloucester on a charge of atheism. He supported the Chartist demands without associating himself with the hostility of the Chartist leaders to the Whigs, and he played an important part in the agitation for the repeal of the corn-laws. He subsequently in 1861 acted as secretary of the British legion which was sent out to assist Garibaldi. He was closely connected with the Society for Repealing the Taxes upon Knowledge, to whose efforts the repeal of the paper duty and the Newspaper Stamp Act was mainly due, and with the movement in favour of secular affirmations which led to the passing of the Evidence Amendment Act of 1869. Mr. Holyoake is the founder of that form of purely ethical religion, without any theistic element, which is known as Secularism. He was editor of the Reasoner from 1846 till 1866. His most valuable published works deal with the history of the Co-operative movement in Great Britain. Among them are: Thirty-three Years of Co-operation (1872; 2nd ed. 1883), republished in 1893 as History of the Rochdale Pioneers, 1844–1892; History of Co-operation in England: its Literature and its Advocates (vol. i. Pioneer Period (1812–44), 1875; vol. ii. Constructive Period (1845–78), 1878); Self-Help One Hundred Years Ago (1888; new ed. 1890), treating of various schemes for promoting thrift among the poorer classes at the end of the eighteenth century; The Co-operative Movement To-day (1891), a useful, short account of the history of co-operation; and Jubilee History of the Leeds Co-operative Society (1897). In 1881 he published a Life of Joseph Rayner Stephens, preacher and political orator. His numerous publications on secularism and allied subjects are mainly of an ephemeral nature, among the chief being The Logic of Death, The Logic of Life, The Trial of Theism, and The Nature and Origin of Secularism, showing that where free-thought commonly ends secularism begins (1896). Sixty Years of an Agitator's Life (1892) is an interesting autobiographical work, containing many reminiscences of men and movements during the strenuous period of the nineteenth century. Among Mr. Holyoake's other works are: A New Defence of the Ballot; Reasoning from Facts, A Method of Everyday Logic (1877); Among the Americans (1881); and Public Speaking and Debate (1896).

HOLYOKE, a city of the United States, in Hampdem county, Massachusetts, on the Connecticut river, 8 miles north of Springfield. The river here forms rapids and is crossed by a great dam, thus supplying water power for the numerous paper-mills and other industrial establishments, such as cotton factories, woollen factories, &c. There is a fine city hall in the town. Pop. (1880), 21,915; (1890), 35,637; (1900), 45,712.

HOLY ROMAN EMPIRE, a title which the German Empire received in 962 when Otho I. was crowned at Rome by Pope John XII. It came to an end when Francis II. became hereditary emperor of Austria in 1804.

HOLY SEPULCHRE, KNIGHTS OF THE, an order of knighthood founded by Godfrey of Bouillon, 1099, for the guardianship of the Holy Sepulchre at Jerusalem, and for the protection of pilgrims. It was revived by Pope Alexander VI., 1496, and reorganized in 1847 and 1868.

HOLY SPIRIT PLANT, an orchidaceous plant (*Peristeria elata*) of Central America, known also as the *dove-plant*, from the resemblance of the united stamens and pistil of the flower to a dove hovering with expanded wings, somewhat like the conventional dove seen in artistic representations of the Holy Ghost. It has a spike of almost globose, sweet-scented flowers of a creamy white, dotted with lilac on the base of the lip.

HOLY THURSDAY, Ascension-day, in the Anglican Church, a movable feast, always falling on the Thursday but one before Whitsuntide. In the Roman Catholic Church it is the Thursday in Holy Week. See HOLY WEEK.

HOME DEPARTMENT, that department of the executive government of Britain in which the interior affairs of the country are regulated. It is analogous to the ministry of the interior of other countries; its head-quarters is the home-office, and its chief is the home-secretary. This official is one of the five secretaries of state of the British government. He is responsible for the internal administration of justice, the maintenance of peace in the country, the supervision of prisons, police, sanitary affairs, &c. The secretary for the home department is assisted by a parliamentary under-secretary and a permanent under-secretary. See SECRETARY OF STATE.

HOMING PIGEON. See CARRIER PIGEON.

HOMOIOUSIANS. See HOMOOUSIANS.

HONAWAR, a seaport and chief town of the North Kanara district, Bombay, on an estuary into which the Gersoppa river falls, 90 miles south-south-east of Goa. It has an important and growing coasting trade. Pop. (1891), 6658.

HONEY-ANT, an ant (*Myrmecocystus mexicanus*) inhabiting Mexico, and living in communities in subterranean galleries. In summer a certain number of these insects secrete a kind of honey in their abdomens, which become so distended as to appear like small pellucid grapes. Later in the season, when food is scarce, these ants are devoured by the others, and they are also dug up and eaten by the inhabitants of the country.

HONEY-BADGER. See RATEL.

HONEY-GUIDE, a name given to the South African cuckoos, of the genus *Indicator*, which by their motions and cries conduct persons to the nests of wild honey-bees.

HONEY-STONE. See MELLITE in SUPP.

HONVÉD, the name applied to the Hungarian militia.

HOOBLY. See HUBLI in SUPP.

HOOD, THOMAS, generally known as Tom Hood, miscellaneous writer, son of the celebrated humorist of the same name, was born at Wanstead, Essex, on Jan. 19, 1835. He was educated first at a private school, and afterwards at University College School, and the grammar-school of Louth in Lincolnshire. He matriculated at Pembroke College, Oxford, in 1853, with a view to a clerical career, but left the university without taking a degree. He edited the Liskeard Gazette in 1858–59, and from 1860 till 1865 he was a clerk in the accountant-

general's department at the War Office. In 1865 he became editor of the comic paper called Fun. His first separate publication was Pen and Pencil Pictures (1857), and among his subsequent works are: The Daughters of King Daher, and other Poems (1861); Quips and Cranks (1861); A Disputed Inheritance: the Story of a Cornish Family (1863); Vere Vereker's Vengeance: A Sensation in Several Paroxysms (1864); Jingles and Jokes for the Little Folks (1865); Captain Masters's Children (1865), his best novel; A Golden Heart (1867); The Lost Link (1868); The Rules of Rhyme: A Practical Guide to English Versification (1869), a work which has gone through two later editions; Money's Worth (1870); Love and Valour (1871); and From Nowhere to the North Pole (1874). From 1867 he produced Tom Hood's Comic Annual, and he also edited many collections of anecdotes, readings, &c. He died at Peckham Rye, Surrey, on Nov. 20, 1874. A volume of his Favourite Poems, with a memoir by his sister, Mrs. Broderip, was published in America in 1877.

HOOK, Walter Farquhar, divine and ecclesiastical biographer, son of the Rev. James Hook, latterly Dean of Worcester, and nephew of the novelist, Theodore Edward Hook, was born in London on March 13, 1798. After attending schools at Hertford and Tiverton he was about five years at Winchester School, and in 1817 he entered Christ Church, Oxford, whence he graduated as B.A. in 1821. He took orders in the latter year, and for the following five years he was curate to his father at Whippingham, in the Isle of Wight. Appointed perpetual curate of Moseley, near Birmingham, in 1826, he was presented two years afterwards to the living of Holy Trinity, Coventry, and in 1837 he was elected vicar of Leeds, where he did an immense amount of work on behalf of the church. In 1859 he became dean of Chichester, and in that town he died on Oct. 20, 1875. Dean Hook was never formally connected with the Tractarians, but his sympathies were with the high church movement which they represented. Though a Tory in politics, he warmly supported the Ten Hours Bill, the movement in favour of early closing, and other schemes aiming at improvement in the condition of the working-classes. Hook's chief literary work is his Lives of the Archbishops of Canterbury, which was published in twelve volumes between 1860 and 1876. The first volume deals with the period 597–1070 (Augustine to Stigand); the second with 1070–1229 (Lanfranc to Langton); the third with 1229–1333 (Grant to Mapeham); the fourth with 1333–1408 (Stratford to Arundel); the fifth with 1408–1503 (Chicheley to Dean); the sixth and seventh with 1503–56 (Warham and Cranmer); the eighth with 1556–58 (Pole); the ninth with 1558–75 (Parker); the tenth with 1575–1633 (Grindal to Abbott); the eleventh with 1633–63 (Laud and Juxon); and the twelfth contains an index to the whole work. His Church Dictionary, originally published in 1842, has undergone extensive alteration in subsequent editions, and the fourteenth edition (1887) was revised and in great part re-written by the Rev. Walter Hook and the Rev. W. R. W. Stephens. Another important lexicographical work by Dean Hook is a Dictionary of Ecclesiastical Biography (8 vols. 1845–52). His other works comprise: The Last Days of our Lord's Ministry (1832), a series of lectures; Five Sermons preached before the University of Oxford (1837); Sermons on Various Subjects (2 vols. 1841–42); Three Reformations: Lutheran—Roman—Anglican (1847); Sermons on the Miracles (2 vols. 1847–48); Sermons on the Ordinances of the Church (1847); Discourses bearing on the Controversies of the Present Day (1853); and The Christian Taught by the Church Services (1865). In 1876 his son, Rev. Walter Hook, edited a collection of his sermons in two volumes, entitled The Church and her Ordinances. His Life and Letters appeared in 1878 (2 vols.; new ed. 1896), under the editorship of Rev. W. R. W. Stephens.

HOOKER, Sir Joseph Dalton, botanist, only surviving son of Sir William Jackson Hooker, the distinguished botanist, was born at Halesworth, Suffolk, on June 30, 1817. Three years after his birth his father removed to Glasgow to take up the post of regius professor of botany in the university, and in consequence he was educated in that city, first at the High School and afterwards at the University, where he graduated as M.D. in 1839. He accompanied Sir James Clark Ross's Antarctic expedition of 1839–43 as assistant-surgeon and naturalist, and in 1847 he published an account of its botanical results in two splendid volumes, entitled The Botany of the Antarctic Voyage of H.M. Discovery Ships Erebus and Terror in the years 1839–43. After a year's service as botanist to the Geological Survey of Great Britain he went to India in 1847, in order to investigate the botany of part of the Himalayan region. In 1848 and 1849 he published several preliminary reports of his observations, and in 1854, three years after his return to England, he issued his Himalayan Journals, or Notes of a Naturalist in Bengal, the Sikkim and Nepal Himalayas, the Khasia Mountains, &c. (2 vols.) During his journey he and a companion, Dr. Campbell, were imprisoned for a time in 1849 by the Rajah of Sikkim, and this event was the immediate cause of the assertion of British authority over the small Himalayan state. In his work on the Rhododendrons of the Sikkim Himalaya (1849) he first introduced to the notice of European gardeners many splendid and now familiar species of these favourite shrubs. He travelled in Syria and Palestine in 1860, and in 1871 he set sail for Morocco with Mr. John Ball, F.R.S. In May of that year he and his companions reached the summits of the Great Atlas, which till then had never been trodden by any European foot, and about a month later he returned to England with a splendid collection of the plants of Morocco. A record of this journey is contained in the work written by him and Mr. Ball, Journal of a Tour in Marocco and the Great Atlas, with an Appendix, including a Sketch of the Geology of Marocco by G. Maw (1879). He travelled in the Rocky Mountains and California in 1877. In 1855 he was appointed assistant to his father in the directorship of Kew Gardens, and on his father's death in 1865 he succeeded him as director. He retired in 1885, and was succeeded by his son-in-law, Sir William T. Thiselton-Dyer. His presidential address before the British Association at its Norwich meeting in 1868 gave rise to some controversy because of the complete adhesion expressed in it to the views recently propounded by Charles Darwin. He was president of the Royal Society during the five years 1873–1878. Among his other works are the following: Introductory Essay to the Flora of New Zealand (1853); Introductory Essay to the Flora Indica (1855), with Thomas Thomson; Flora Novæ Zealandæ (two parts, 1853–55); The Flora of Tasmania (1856–60); On the Flora of Australia: its Origin, Affinities, Distribution, &c. (1859); Handbook to the Flora of New Zealand (two parts, 1864–1867); Genera Plantarum (3 vols. 1862–83), in collaboration with George Bentham, an epoch-making revision of the natural system of classification; The Student's Flora of the British Islands (1870; new ed. 1883), an excellent and popular work;

The Distribution of the North American Flora (1878); and the great Flora of British India (six vols. 1875-97). He has also issued a new edition (1887) of his friend Bentham's Handbook of the British Flora. He is joint-editor with B. D. Jackson of the Index Kewensis (1893-94), a dictionary of the names of all known flowering plants, with author's names, synonyms, native countries, &c., based on a plan proposed by Charles Darwin, and published out of a fund left by him for the purpose. Appointed a Companion of the Bath in 1869, he was created K.C.S.I. in 1877, and G.C.S.I. in 1897. He has had several honorary degrees conferred upon him, and has been awarded the Royal Medal (1854), the Copley Medal (1887), and the Darwin Medal (1892) of the Royal Society, the Founders' Medal (1884) of the Royal Geographical Society, the Albert Medal (1883) of the Society of Arts, and the medals of the Linnæan Society (1888) and the Manchester Philosophical Society (1898). He is a corresponding member of the Institute of France.

HOOP-ASH (*Celtis crassifolia*), an American tree of the order Urticaceæ, found in the forests of Ohio and in the Western States. It is a fine tree, attains a height of 80 feet, and is employed for charcoal. Its fruit is round, and in size nearly equal to a pea. See HACKBERRY and NETTLE-TREE.

HOOSAC TUNNEL, the longest railway tunnel in America, in the western part of Massachusetts, on the railway from Boston to Troy, N.Y. It pierces the Hoosac Mountain, the summit range extending southward through Massachusetts from the Green Mountains of Vermont. It is 4⅘ miles long, and has a double line of rails. It was opened in 1875, after having been several times abandoned.

HOP-CLOVER (*Trifolium procumbens*), a plant of the order Leguminosæ, distinguished from other species of clover by its bunch of yellow flowers, which wither to the bright brown of a strobile of hops. See CLOVER.

HOR (JEBEL HAROUN), a mountain of Arabia Petræa, south-east of Palestine, forming part of the range of Seir or Edom, and the scene of the death of Aaron; height, 4800 feet. See EDOM.

HORNE, RICHARD HENRY (or *Richard Hengist Horne*, as he called himself after his return from Australia), poet and miscellaneous author, was born in London on Jan. 1, 1803, and was educated at the Royal Military College, Sandhurst, with a view to entering the military service of the East India Company. Before receiving an appointment, however, he joined the Mexican navy and served throughout the war against Spain, being present at the siege of Vera Cruz and the capture of San Juan de Ulloa. On the conclusion of the war he was prostrated for a time by yellow fever, and after his recovery he travelled in the United States, visiting several Indian encampments. Near the Falls of Niagara he accidentally broke two of his ribs, and soon afterwards he was shipwrecked in the Gulf of St Lawrence. This chequered period of his career was fittingly closed by the return voyage from Nova Scotia, during which the crew mutinied and the ship afterwards took fire. In 1828 he began his literary career by contributing to the Athenæum a poem entitled Hecatompylos, but his first separate publication was the Exposition of the False Medium and Barriers excluding Men of Genius from the Public (1833). In the following year appeared his Spirit of Peers and People: a National Tragicomedy, and in 1836-37 he edited the Monthly Repository. In 1837 he published his first drama, Cosmo de' Medici: an Historical Tragedy (new ed. with other poems, 1875), and in the same year he issued a one-act tragedy, The Death of Marlowe. Gregory VII.: A Tragedy, was published in 1840, with an introductory Essay on Tragic Influence. He was associated with Leigh Hunt, Miss Barrett, and others in producing The Poems of Geoffrey Chaucer Modernized (1841). During the next two years he was occupied as a member of the Royal Commission on the Employment of Children and Young Persons in Mines and Factories, whose report called forth Miss Barrett's well-known Cry of the Children. In 1843 he published Orion, an Epic Poem in Ten Books, which went through six editions in the year of its publication. The first three editions were sold at one farthing per copy, in sarcastic appeal to an unpoetic public. A New Spirit of the Age (1844), in which he co-operated with Mrs. Browning and Robert Bell, consisted of a large number of appreciations of distinguished contemporaries. In 1852 he accompanied William Howitt to Australia, where he was appointed successively commander of the gold escort of Victoria, commissioner of crown lands for the gold-fields, magistrate at the Blue Mountains, water supply commissioner, and registrar of mines. His Australian experiences furnished material for his Australian Facts and Prospects (1859). Under the impression that the government of Victoria had not treated him fairly, he returned to England in 1869. From 1874 till the end of his life he was in receipt of a civil list pension. He died at Margate on March 13, 1884. In addition to the works above enumerated the following should be mentioned: Judas Iscariot: A Miracle Play, in Two Acts (1848), republished in a volume of Bible Tragedies in 1881; The Dreamer and the Worker: a Story of the Present Time (1851); Prometheus the Fire-Bringer (1864), a lyrical drama; The South-Sea Sisters: A Lyric Masque (1866), written to celebrate the opening of the Intercolonial Exhibition of Australasia; The Great Peace-Maker: A Submarine Dialogue (1872), a poem on the laying of the Dover-Calais cable; Laura Dibalzo, or the Patriot Martyrs: a Tragedy (1880); King Nihil's Round Table, or The Regicide's Symposium: A Dramatic Scene (1881); The Last Words of Cleanthes: a Poem (1883), and Sithron the Star-Stricken: translated from an ancient Arabic manuscript, by Salem ben Uzair, of Bassora (1883), a curious anonymous work.

HORNED-HORSE, the gnu (which see).

HORNED-POUT. See CAT-FISH in SUPP.

HORNED-TOAD, a name given to a genus of spiny-scaled lizards (*Phrynosoma*), of toad-like appearance, found in America west of the Mississippi.

HORNSEY, a northern suburb of London, forming an urban district by itself and giving name to one of the parliamentary divisions of Middlesex. Pop. (1901) of urban district, 72,056; of parl. div. 111,453.

HORSE, MASTER OF THE, one of the great officers of the British Court. He has the management of all the royal stables and bred horses, with authority over all the equerries and pages, coachmen, footmen, grooms, &c. In state cavalcades he rides next behind the sovereign.

HORSE-LATITUDES, a space in the Atlantic Ocean between the westerly winds of higher latitudes and the trade-winds, notorious for baffling winds and tedious calms.

HORSE-MACKEREL. See BLUE-FISH in SUPP. and SCAD.

HORSE-RADISH TREE, an Indian tree (*Moringa pterygosperma*), of an order very closely allied to Leguminosæ, having pinnate leaves and long three-valved pod-like capsules, from which an oil called *ben-oil* is obtained. The fresh root has a pungent odour and warm taste, much like that of a horse-radish. See BEN, OIL OF, in SUPP.

HOSHANGÁBÁD, chief town and head-quarters of district of the same name, Central Provinces of India, on the Nerbudda, connected by rail with Bhopal, &c. It is a chief seat of the British piece-goods trade, and does business in cotton, grain, &c. Pop. (1891), 13,495. The district is in the Nerbudda division, and has an area of 4594 square miles, and a pop. (1901) of 449,197.

HOSHIARPUR, chief town and seat of administration of the district of same name, Punjab, India, about 5 miles from the foot of the Siwalik Hills. Pop. (1891), 21,552. The district is in the Jalandhar division, and has an area of 2244 square miles, and a pop. (1901) of 989,176.

HOSMER, HARRIET, American sculptor, was born at Watertown, Massachusetts, on Oct. 6, 1830. She early showed skill as a modeller in clay, and consequently, after receiving a general education in Lenox, Massachusetts, she studied anatomy in a medical college at St. Louis. Her first work, a reduced copy of Canova's Napoleon, was followed by an ideal head of Hesper (1852). She went to Rome in 1852 and studied under John Gibson, the English sculptor. About this period she produced ideal busts of Daphne and Medusa, and in 1855 she completed her first life-size figure, Œnone. To the same year belongs Puck, which gained her a great reputation among her own countrymen, and next year she executed a Will-o'-the-Wisp. The statue of Beatrice Cenci which adorns the public library of St. Louis was finished in 1857, and her colossal statue of Zenobia in 1859. Her next work was a statue of T. H. Benton, the Missouri statesman, a bronze cast of which was erected in Lafayette Park, St. Louis. Her other works include: Sleeping Fawn, exhibited at Dublin in 1865 and at Paris in 1867; a statue of the Queen of Naples as the Heroine of Gaëta; a monument to Abraham Lincoln; and Waking Fawn. Miss Hosmer has much technical skill, but lacks creative genius. She has devised some new processes in connection with her art, especially one for converting the ordinary limestone of Italy into marble.

HOTTENTOT'S BREAD. See ELEPHANT'S-FOOT in SUPP.

HOUGHTON, RICHARD MONCKTON MILNES, first BARON, poet and miscellaneous writer, only son of Robert Pemberton Milnes, of Fryston Hall, near Wakefield, was born in London on June 19, 1809. He received his earlier education partly at a school near Doncaster and partly under private teachers, and in 1827 he matriculated at Trinity College, Cambridge, where he was intimate with Thackeray and Tennyson, and had Thirlwall as his tutor. After graduating in 1831 he studied at University College, London. He travelled in Germany, Italy, and Greece, his companion on his journey through the last-mentioned country being Christopher Wordsworth, brother of the great poet. He returned to England in 1835, and soon became a prominent member of the most distinguished London society. He was returned to parliament in 1837 as member for Pontefract in the Conservative interest, but he never played any important part in politics, and from 1846 he supported the Liberal party. He frequently visited the Continent, where he made the acquaintance of many of the leading actors in the stirring events of European politics in the middle of last century. On his return from Paris in 1848 he published a letter to Lord Lansdowne, which gave rise to much warm controversy because of his strongly-expressed sympathy with the Italian patriots and the other continental liberals. In 1863 he was raised to the peerage by the title Baron Houghton of Great Houghton. He acted as president of the group of liberal arts at the Paris Exhibition of 1867, and in 1869 he attended the ceremony at the opening of the Suez Canal as representative of the Royal Geographical Society. He visited America in 1875, and formed the personal acquaintance of the distinguished group of authors then living in New England. He died at Vichy, in France, on Aug. 11, 1885. He was a fellow of the Royal Society, and received several honorary degrees and other marks of distinction. Lord Houghton was a man of wide sympathies and a generous patron of literature, but he was essentially a dilettante, and produced no original works of much permanent value. Among the literary men who were generously assisted by him were Thomas Hood, at the end of his life, and David Gray. Lord Houghton's published works include the following: Memorials of a Tour in Some Parts of Greece, chiefly Poetical (1834); Poems of Many Years (1838); Memorials of a Residence on the Continent, and Historical Poems (1838); Memorials of Many Scenes (1840); Poetry for the People, and other Poems (1840); One Tract More, by a Layman (1841), a pamphlet in favour of tractarianism; Poems, Legendary and Historical (1844); Palm Leaves (1844), poems inspired by a tour in Egypt and the Levant, in which he attempts to give expression to the finer spirit of Mohammedanism; Life, Letters, and Literary Remains of John Keats (1848), containing the memoir, which was afterwards prefixed in an abridged form to his edition of Keats's poems (1854); and Monographs, Personal and Social (1873), comprising sketches of celebrated persons whom he had known. In 1875 he edited a collection of Peacock's novels, and in the following year appeared a collected edition of his own poetical works in two volumes. See the Life, Letters, and Friendships of Richard Monckton Milnes, first Lord Houghton (1890), by T. W. Reid. —His only son, ROBERT OFFLEY ASHBURTON CREWE-MILNES, born in 1858, was lord-lieutenant of Ireland in 1892–95, and in the latter year was created Earl of Crewe. In 1899 he married the youngest daughter of the Earl of Rosebery. He has published a volume of Stray Verses (1890).

HOUND'S-TONGUE. See CYNOGLOSSUM in SUPP.

HOUR-CIRCLE. See GLOBE.

HOUSEHOLD SUFFRAGE, suffrage based on the occupancy of a house or a distinct part of a house for not less than a year. In Britain it was established in boroughs by the Reform Act of 1867, and extended to the counties in 1884. Lodgers occupying lodgings which would let unfurnished for £10 a year are also entitled to rank under this suffrage.

HOUSEMAID'S KNEE, an acute inflammation of the bursa or sac between the knee-pan and the skin, so called because it is common amongst housemaids from their kneeling on hard damp stones. It is treated like all other local inflammations by fomentations, and, if necessary, leeches. Mild purgatives are also useful, and the limb ought to have complete rest.

HOVAS, a native race of Madagascar (which see).

HOWELLS, WILLIAM DEAN, American author, was born at Martin's Ferry, Belmont county, Ohio, on March 1, 1837. About 1840 his father, who was a printer, went to Hamilton in the same state, where he bought a weekly journal called the Intelligencer, and in the office of this paper young Howells learned type-setting. Removing in 1849 to Dayton, his father conducted a daily newspaper for a time with the assistance of his sons, but it proved unsuccessful, and in 1851 we find Howells

working as a compositor in Columbus. In 1856 he became Columbus correspondent of the Cincinnati Gazette, and two years afterwards he was appointed news editor of the Ohio State Journal. About this time he began to contribute poems to the Atlantic Monthly, and in 1860 he issued a Life of Abraham Lincoln. The proceeds of this work enabled him to visit Montreal and Boston, and in the latter city he made the acquaintance of Lowell and Holmes. From 1861 to 1865 he resided in Venice as United States consul, occupying his leisure in mastering Italian and French. Soon after his return appeared a series of papers under the title Venetian Life (1866; new ed. 1891), followed next year by a similar volume, Italian Journeys. After his return to the United States he obtained a position on the editorial staff of the New York Tribune, and became a salaried contributor to the Nation. He was assistant-editor of the Atlantic Monthly during the period 1866–72, and editor-in-chief from 1872 till his resignation in 1881. In 1886–92 he conducted the critical department of Harper's Monthly called The Editor's Study. The realist tendency predominates in most of his novels and stories, the long series of which began with Their Wedding Journey, published in 1871, and includes: A Chance Acquaintance (1874); A Foregone Conclusion (1875); The Lady of the Aroostook (1879); The Undiscovered Country (1880); Doctor Breen's Practice (1882); A Modern Instance (1882); A Woman's Reason (1883); The Rise of Silas Lapham (1885); Indian Summer (1886); The Minister's Charge (1886); April Hopes (1887); A Hazard of New Fortunes (1889); The Shadow of a Dream (1890); An Imperative Duty (1892); The Quality of Mercy (1892); The World of Chance (1893); The Coast of Bohemia (1893); A Traveller from Altruria (1894), in which the novelist's main purpose is to give glimpses into an ideal Socialist commonwealth; The Landlord at Lion's Head (1897); An Open-Eyed Conspiracy (1898); The Story of a Play (1898); Ragged Lady (1899); and Their Silver Wedding Journey (1900), with the same hero and heroine as his first novel and some later ones. Mr. Howells has also written some farces and comedies, including The Parlor-Car (1876); A Counterfeit Presentment (1877); The Sleeping-Car (1883); The Register (1884); The Elevator (1885); A Sea Change (1888); A Letter of Introduction (1897); Five o'Clock Tea (1897); The Mouse-Trap (1897); The Unexpected Guests (1898); and The Albany Depôt (1898); and he has issued the following volumes of verse: Poems of Two Friends (1860), in collaboration with J. J. Piatt; No Love Lost: A Romance of Travel (1868); and Poems (1873). His other works include Suburban Sketches (1871); Life of, and Essays on Alfieri (1877); Three Villages (1884); Tuscan Cities (1885); Modern Italian Poets: Essays and Versions (1887); Criticism and Fiction (1891); and Impressions and Experiences (1896), an autobiographical work. In 1877 he edited a series of Choice Autobiographies in eight volumes, with introductory essays. As a novelist Mr. Howells is chiefly notable for his accurate pictures of every-day American life and his charming style. His novels seldom have any plot of importance, but the characters are clearly and vividly drawn.

HOWRAH, a town of India, on the right bank of the Hugli, opposite Calcutta, of which it is practically a suburb, and with which it communicates by a floating bridge. It is an important railway terminus, has large dockyards, jute and saw mills, and various manufactories. Pop. (1891), 116,606; (1901), 157,594.

HOYLAKE, a rising English watering-place, in north-west Cheshire, on the Wirral peninsula at the entrance of the estuary of the Dee. Besides its celebrated golf-links it has various other attractions for visitors; and a considerable fishery is carried on, partly by trawlers. Pop. (1891), 6545; (1901), 10,911.

HUBLI, chief town of a sub-division of the same name in Dhárwár district, Bombay Presidency, 274 miles south-east of Poona. It has a large trade in cotton, silk goods, copper vessels, grain, salt, &c. Pop. (1891), 52,595; (1901), 60,214.

HUCKLEBERRY, an American name for the whortleberry (which see).

HUCKNALL TORKARD, a town of England, in Nottinghamshire, about 6 miles north by west of Nottingham. In the parish church of St. Mary Magdalene the body of Lord Byron lies buried, with other members of the family. There are two other churches, various chapels, a public hall, free library, &c. Coal-mining and other industries are carried on. Pop. (1891), 13,094; (1901), 15,250.

HUGGINS, Sir William, one of the founders of the new branch of astronomy known as astrophysics, was born in London on Feb. 7, 1824. He received his earlier education in the City of London School, on leaving which he continued his studies in classics, mathematics, modern languages, and especially physics and chemistry, under private tutors. For a time he devoted himself to the study of animal and vegetable physiology with the aid of the microscope, and in 1852 he was elected a member of the Microscopical Society. In 1856 he erected an observatory at Tulse Hill, in north-eastern Surrey, a few miles south of London, and during the three succeeding years he went through the ordinary routine work of an astronomical observer. From the first, however, he sought to leave the beaten tracks of astronomy; and when in 1859 Professor Kirchhoff of the University of Heidelberg announced the true interpretation of the dark Fraunhofer lines in the solar spectrum, he at once saw the possibility of using his practical knowledge of chemistry and physics in the service of astronomy. With Dr. W. A. Miller, Professor of Chemistry at King's College, London, he at once set about the the task of constructing a star-spectroscope. The two friends then began the observation of stellar spectra with a view to ascertaining the physico-chemical structure of the stars. Their first results were communicated to the Royal Society in 1863, in a preliminary note On the Lines of Some of the Fixed Stars, in which they furnished diagrams of the spectra of Sirius, Betelgeux, and Aldebaran, and stated that they had up till that time examined the spectra of some forty stars and of the planets Jupiter and Mars. In that year also they attempted to obtain photographs of the spectra of Sirius and Capella, but the photographic methods then available were found ill adapted to celestial work, and the attempt was therefore abandoned for the time. A full statement of their results was read before the Royal Society in 1864, the essence of the statement being, in Huggins's own words, that the chemistry of the solar system prevails, essentially at least, wherever a star twinkles. Dr. Miller, owing to the pressure of other duties, then ceased from co-operating with Mr. Huggins, so that the distinction of bringing the nebulæ and the comets within the domain of chemistry belongs to the latter alone. In August 1864 he directed his star-spectroscope towards a planetary nebula in Draco, and found its spectrum to be a monochromatic one, thus proving that the nebula consists of a luminous gas, and unexpectedly verifying Herschel's prophetic surmise of the existence in space of a widely-diffused shining fluid 'more fit to produce a star by its condensation than to depend on the star

for its existence'. In 1868 he was able to announce to the Royal Society the results of his first measurements of the motion of stars in the line of sight. These measurements depended on the observation and measurement of minute displacements of lines in the stellar spectra, and they have since been carried out with extreme accuracy by other astronomers, notably Professor Vogel in Germany. By enabling us to detect and measure such movements, formerly regarded as eternally beyond our ken, the astrophysicist has immensely increased the resources of sidereal astronomy, and opened up the possibility of comprehending something of the plan of the sidereal universe. He began his observations of comet spectra with that of Winnecke's comet in 1868, and soon convinced himself that the main portion of its light proceeded from glowing hydrocarbons, a result also obtained by himself and others in the case of many other comets. In 1868–69 Mr. Huggins made spectroscopic observations of the solar prominences, and in 1882–83 he was engaged in attempts, as yet only partially successful, to obtain photographs of the solar corona without an eclipse. About 1876 he resumed his abandoned efforts to photograph stellar spectra, using the gelatine dry plate process then recently introduced, and this time he was completely successful. His photographs of the invisible ultra-violet portions of stellar spectra have proved of the utmost value, for from them we have gained a more complete knowledge of the hydrogen spectrum than terrestrial observations had previously furnished, and they provide the only reliable data for determining the relative ages of the stars. He was elected a fellow of the Royal Society in 1865, and was awarded by that body a Royal Medal (1866), the Rumford Medal (1880), and the Copley Medal. He and Dr. Miller in 1867 received the Gold Medal of the Royal Astronomical Society for their spectroscopic researches, and in 1885 he was awarded the medal a second time in recognition of the value of his subsequent researches. He has also received many distinctions from foreign countries. He delivered the Rede lecture at Cambridge in 1869, was president of the Royal Astronomical Society in 1876–78, presided over the Cardiff meeting of the British Association in 1891, and in 1900 succeeded Lord Lister as President of the Royal Society. In 1897 he was created a Knight Commander of the Bath. Various honorary degrees have been conferred upon him. In 1875 he married Miss Margaret Murray of Dublin, a lady of considerable scientific attainments who has assisted him in his later work. In 1900 they were associated in the production of a valuable Atlas of Representative Stellar Spectra, together with a Discussion of the Evolutional Order of the Stars and the Interpretation of their Spectra. See the introduction to that work, and also Sir William Huggins's article in the Nineteenth Century of June 1897, entitled The New Astronomy: A Personal Retrospect.

HUGHES, David Edward, inventor of the printing telegraph and other electrical instruments, was born in London on May 16, 1831, and when very young went with his parents to the United States. He was educated at the college of Bardstown in Kentucky, where he was appointed at the age of nineteen professor of music. Four years later he exchanged this post for the chair of natural philosophy in the same college, and in 1855 he patented his first important invention, that of the well-known printing telegraph which bears his name. It was at once adopted in America, but his efforts to introduce it into England were unsuccessful, and he consequently went to France in 1860 to secure its adoption by the government of that country. After extended trials by experts he had the satisfaction of seeing it introduced on all the main French lines in 1861. In 1862 Napoleon III. created Prof. Hughes a Knight of the Legion of Honour, and gave him an appointment on the Telegraph Commission. The success of his invention was now assured, and by 1876 practically every European country had adopted the Hughes telegraph. In 1878 he announced to the Royal Society his invention of the microphone, an ingenious instrument which not only transmits sound, but magnifies faint sounds so as to make them distinctly audible. The microphone is now in universal use as a transmitter to the telephone. Another important invention was completed by Prof. Hughes in 1879, that of the induction balance, and in 1880 he was elected a fellow of the Royal Society. He read numerous papers on electrical subjects before that society, and in 1885 he was awarded one of its Royal Medals. The Society of Arts expressed its sense of the commercial and industrial importance of his inventions by presenting their Albert Medal to him in 1897. He died in London on Jan. 22, 1900.

HUGHES, Thomas, English judge, author, and philanthropist, was born on Oct. 20, 1823, at Uffington, Berkshire, where his grandfather was vicar. Educated at Twyford, near Winchester, and at Rugby under Dr. Arnold, he proceeded to Oriel College, Oxford, whence he graduated in 1845. He was called to the bar at Lincoln's Inn in 1848, took silk in 1869, and was appointed a county court judge in 1882. He represented Lambeth in the House of Commons from 1865 to 1868 as an advanced Liberal, and during the six years 1868–74 he sat for Frome. He was deeply interested in the well-being of the working-classes, and devoted much of his time to the support of the co-operative movement and other social schemes of a similar kind. He assisted F. D. Maurice and other Christian Socialists in founding the Working Men's College in London, and he took an active part in the anti-gambling crusade. As an author, Thomas Hughes is best known by his first work, Tom Brown's School Days, by an Old Boy, published in 1856, which has gone through many editions and been translated into several languages. Its sequel, Tom Brown at Oxford (1861), has not proved so popular. He wrote many other works of various kinds, including: The Scouring of the White Horse: or The Long Vacation Ramble of a London Clerk (1858), an account of Berkshire Life; Religio Laici (1861), republished in 1868 under the title A Layman's Faith; Alfred the Great (1869); Memoir of a Brother (1873), a well-written, touching account of the life of his brother; The Old Church: What shall we do with it? (1878), an able argument against the disestablishment of the Church of England; The Manliness of Christ (1879); Rugby, Tennessee (1881), an account of English settlements there; Memoir of Daniel Macmillan (1882), an excellent account of the founder of the well-known publishing firm of Macmillan & Co.; James Fraser, second Bishop of Manchester: A Memoir (1887), a sympathetic biography of a close friend; David Livingstone (1889); and Vacation Rambles (1895). He was joint-editor with E. Vansittart Neale of a Manual for Co-operators (1881, 2nd ed. 1888), and he issued an edition of J. Russell Lowell's Poetical Works, with an introduction, in 1891. In 1885 he edited a work entitled Gone to Texas: Letters from Our Boys, containing an account of the experiences of his sons, who had settled in Texas. He died rather suddenly at Brighton on March 22, 1896.

HULL, Edward, geologist, was born at Antrim, Ireland, on May 21, 1829, being the son of a curate who afterwards became vicar of Wickhambrook in

Suffolk. He received his earlier education in a school at Edgeworthstown, and afterwards entered Trinity College, Dublin, where he graduated in 1850. He studied geology in Dublin under Prof. Oldham, and through the influence of his teacher he obtained an appointment on the staff of the Geological Survey of Great Britain. After seventeen years' service he was appointed district-surveyor to the Scottish survey, and in 1869, on the death of Prof. Jukes, he became director of the geological survey of Ireland, and professor of geology in the Royal College of Science, Dublin. He retired from both these posts in 1890, after having superintended a complete survey of northern Ireland and a revision of the formations in a large part of southern Ireland, with a view to bringing their arrangement into harmony with that of the British formations. In 1883 Prof. Hull was chosen by the Committee of the Palestine Exploration Fund to conduct a scientific expedition to Arabia Petræa and Southern Palestine. The general results of his investigations during this journey are contained in his work entitled Mount Seir, Sinai, and Western Palestine (1885), and fresh light was thrown upon the geology of the district in his Memoir on the Physical Geology and Geography of Arabia Petræa, Palestine, and adjoining Districts (1886). He visited Egypt in 1893 for the purpose of making geological observations in the Nile valley. He gave important evidence before the Royal Commission which inquired about 1870 into the possibility of exhaustion of the coal-fields of the United Kingdom, and he drew up the part of the Commission's report which dealt with the coal-fields of Ireland. Among his remaining published works the following are the most important: The Coal-fields of Great Britain: their History, Structure, and Resources (1865; 4th ed. 1881); A Treatise on the Building and Ornamental Stones of Great Britain and Foreign Countries (1872); The Physical Geology and Geography of Ireland (1878; 2nd ed. 1891); Contributions to the Physical History of the British Isles (1882); A Sketch of Geological History, being the Natural History of the Earth and of its Pre-human Inhabitants (1887); Text-book of Physiography, or Physical Geography (1888); Volcanoes, Past and Present (1892); and Our Coal Resources at the Close of the Nineteenth Century (1897). Prof. Hull was elected a fellow of the Geological Society of London in 1855, and of the Royal Society in 1867. He was president of the Royal Geological Society of Ireland in 1873, and from 1874 till 1877 he was one of the examiners in geology to the University of London. In 1879 Glasgow University conferred upon him the honorary degree of LL.D.

HULLAH, John Pyke, musical composer, of Huguenot descent, was born at Worcester on June 27, 1812. At an early age he went to London with his parents, and in 1829 he began the study of the pianoforte, vocal music, and composition under William Horsley. In 1833 he entered the Royal Academy of Music. His first important composition, an opera entitled The Village Coquettes, of which the words were by Charles Dickens, was successfully produced at St. James's Theatre in 1836. The two operas, The Barbers of Bassora (1837) and the Outpost (1838), with which he sought to follow up his first success, were failures, and in consequence he ceased altogether to write operatic music. During a visit to Paris in 1839 he became acquainted with Wilhem's method of teaching singing, and in 1840 he began to teach music in accordance with it at the recently-opened Battersea training college for teachers. Early in 1841 he opened classes in Exeter Hall for the instruction in vocal music of schoolmasters and the general public, and from 1849 he continued them in St. Martin's Hall, which had been specially built for him by his friends and supporters. His classes were remarkably successful despite much adverse criticism of his method of teaching, and during the twenty years of their continuance he organized many excellent concerts with the aid of his senior pupils. Destruction by fire of St. Martin's Hall in 1860 brought them to an abrupt conclusion. In 1858 he had succeeded his former teacher Horsley as organist at the Charterhouse, and in 1861 he delivered a series of lectures at the Royal Institution on the history of modern music. He was an unsuccessful candidate for the Reid professorship of music in Edinburgh University in 1865, but in 1872 he received the appointment of musical inspector of training schools for the United Kingdom. He conducted the Philharmonic concerts at Edinburgh in 1866–67, and those of the Royal Academy of Music during 1870–73. He also held professorships in King's College, Queen's College, and Bedford College. In 1876 he received the honorary degree of LL.D. from the University of Edinburgh. He died in London on Feb. 21, 1884. Dr. Hullah's best-known compositions are songs, of which several, such as The Sands of Dee, Three Fishers, The Storm, and O that We Two were Maying, have become very popular. He issued many excellent collections of songs and other musical pieces, mainly for the use of his pupils. Among these are: Part Music, in three series (1842–45), comprising five pieces by Dr. Hullah himself, the whole forming 'a collection unexampled (at least in England) for extent, excellence, and variety, and for the clearness and accuracy of its production'; Vocal Scores (1846 onwards), an admirable collection of sacred and secular music; School Songs (1851); Sea Songs; The Singer's Library of Concerted Music (1859); and the Song Book (1866). Dr. Hullah was the author of the following among other works on the history and theory of music; Wilhem's Method of Teaching Singing, adapted to English Use (1841); Grammar of Vocal Music (1843); On Vocal Music (1849), lectures delivered at Queen's College; Grammar of Musical Harmony (1852); The History of Modern Music (1862); Grammar of Counterpoint (1864); Lectures on the Third or Transition Period of Musical History (1865); The Cultivation of the Speaking Voice (1870); and Music in the House (1877). See the Life by his wife (1886).

HUMANISM, a term used in a narrower sense to denote the study of classical antiquity during the Renaissance period, and in a wider sense applied to the central animating spirit of the Renaissance, manifested in the region of scholarship as a passionate return to classical antiquity, but declaring itself also in the fine arts, in science, in philosophy, in theology, in politics, and in other departments of thought and action, in ways which often have little or no direct connection with humanism in the narrower sense. According to Mr. J. A. Symonds (Ency. Brit., 9th ed., art. Renaissance): 'Humanism, which was the vital element in the Revival of Learning, consists mainly of a just perception of the dignity of man as a rational, volitional, and sentient being, born upon this earth with a right to use and enjoy it. Humanism implied the rejection of those visions of a future and imagined state of souls as the only absolute reality, which had fascinated the imagination of the Middle Ages. It involved a vivid recognition of the goodliness of man and nature, displayed in the great monuments of human power recovered from the past. It stimulated the curiosity of latent sensibilities, provoked fresh inquisition into the ground-work of existence, and

strengthened man's self-esteem by knowledge of what men had thought and felt and done in ages when Christianity was not. It roused a desire to reappropriate the whole abandoned provinces of mundane energy, and a hope to emulate antiquity in works of living loveliness and vigour.' Again, the same writer says: 'It (humanism) indicates the endeavour of man to reconstitute himself as a free being, not as the thrall of theological despotism, and the peculiar assistance he derived in this effort from Greek and Roman literature, the *litteræ humaniores*, letters leaning rather to the side of man than of divinity'.

The humanist movement originated in Italy, and from Italy it passed to Germany, France, Spain, Holland, and England. The founder of humanism, in so far as it had an individual founder, was Francesco Petrarca or Petrarch (1304–74), the great lyric poet, but in Dante (1265–1321), though he is best regarded as giving final expression to the loftiest spirit of mediævalism, we see clearly the advent of the new spirit. Petrarch was an enthusiastic student of Roman antiquity, and an untiring collector of manuscripts. He perceived the importance of a knowledge of Greek, though he never really learned it himself. Boccaccio (1313–75) also had the passion for collecting which was to characterize all the early humanists, and he may be regarded as the first Grecian of the modern world, since he learned the Greek language from Leontius Pilatus, a Greek resident in Florence. The real introducer of the Greek language into Italy, however, was Manuel Chrysoloras, a native of Byzantium, who began to teach at Florence in 1396. Other Greek scholars came to Italy at different subsequent times, and when Constantinople was taken by the Turks in 1453 a very large number of scholars fled to Italy with their manuscripts. The humanists soon attained a position of the greatest importance in Italy. Their lectures were attended by immense numbers from all ranks of society, and their services were in demand by dignitaries of all kinds, ecclesiastical as well as civil. Wealthy men vied with one another in patronizing them, and sought to acquire something of the new learning themselves. For long the popes were in the main favourably disposed towards humanism, and some of them, notably Nicholas V., Pius II., and Leo X. were humanists of no mean order themselves. Among other notable patrons of the humanist movement the names of Cosmo and Lorenzo de' Medici in Florence, and Alfonso, King of Naples, are pre-eminent. The fifteenth century saw the invention of printing and the establishment of the celebrated press at Venice by Aldus Manutius. A notable feature of the Italian Renaissance was the foundation of academies of scholars, of which the most famous was the Platonic Academy established at Florence by Ficino, Pico, and others. The passion for antiquity which characterized the great Italian humanists led many of them to virtual paganism, and in not a few cases their lives were characterized by disgusting sensuality. Among the greater humanists of the other European countries are Erasmus, Reuchlin, Von Hutten, Sir Thomas More, Colet, Rabelais. See Symonds's Renaissance in Italy (vol. ii, Revival of Learning), and article RENAISSANCE.

HUMBERT I., UMBERTO RANIERI CARLO EMANUELE, King of Italy, eldest son of Victor Emmanuel II. and Queen Marie Adelaide, daughter of the Arch-duke Regnier of Austria, was born at Turin on March 14, 1844. He took part as a youth in the War of Independence, and in 1866 was sent to Paris to ascertain the views of the French government with regard to the alliance of Italy with Prussia in the Austro-Prussian war. In that war King Humbert, then Prince of Piedmont, served against Austria under General Cialdini. He narrowly escaped capture at the battle of Custozza, but his valour and presence of mind enabled his force to hold out till reinforcements arrived. On April 22, 1868, he married his cousin, Princess Margherita of Savoy, daughter of the Duke of Genoa. On the death of his father in 1878 he succeeded to the throne of Italy. In 1879, and again in 1897, his life was unsuccessfully attempted, but on July 29, 1900, he was shot dead at Monza, in Lombardy, by an anarchist named Bresci. He was succeeded by his eldest son Victor Emmanuel III., who was born at Naples on Nov. 11, 1869, and married in 1896 Princess Helen of Montenegro.

HUMERUS, the long cylindrical bone of the arm, situated between the shoulder and the fore-arm. The name is also applied to the corresponding bone in the lower animals. See HAND.

HUNGARY-BALSAM, a kind of turpentine procured from *Pinus Pumilio*, the mountain pine of Hungary.

HUNGARY-WATER, a distilled water consisting of dilute alcohol aromatized with the tops of flowers of rosemary or other aromatic substances, used as a perfume. It is so called because it is said to have been first made for the use of a queen of Hungary.

HUNSTANTON, a watering-place of England, in Norfolk, on the Wash, 15 miles north by east of King's Lynn. It consists of Hunstanton or Old Hunstanton and Hunstanton St. Edmunds or New Hunstanton, the latter being of recent growth. There is an extensive stretch of sands, with good bathing facilities, overlooked by a line of cliff 60 feet high; also promenade-pier, golf-links, and a chalybeate spring. The church at Old Hunstanton is a fine old Decorated building containing a number of monuments; the Church of St. Edmund is a handsome modern edifice. Pop. in 1901, 2401.

HUNT, WILLIAM HOLMAN, Pre-Raphaelite painter, was born in London on April 2, 1827. At first engaged in business, he entered the schools of the Royal Academy in 1845, and next year he exhibited his first picture, Hark! representing a child holding a watch to her ear. This was followed in 1847 by Dr. Rochecliffe performing Divine Service in the Cottage of Joceline Joliffe at Woodstock, and in 1848 by the more important Flight of Madeline and Porphyro, based on Keats's Eve of St. Agnes. About this time Mr. Hunt, D. Rossetti, and J. E. Millais formed the Pre-Raphaelite Brotherhood, which was afterwards enlarged by the admission of other painters and writers, and attained a position of great influence through the eloquent support of Ruskin. Each of the three founders exhibited in 1849 a picture painted in strict accordance with the principles of the Brotherhood. Mr. Hunt's picture represented Rienzi vowing to obtain Justice for the Death of his Younger Brother slain in a Skirmish between the Colonna and Orsini Factions, and was exhibited at the Royal Academy along with Millais's Lorenzo and Isabella. The Rienzi of Mr. Hunt's work was painted from Rossetti; and as to the picture itself, a contemporary critic spoke of its 'force of thought and concentration of purpose, though expressed in such affected language'. In 1850 Mr. Hunt exhibited A Converted British Family Sheltering a Christian Missionary from the Persecution of the Druids; and in the following year he was represented at the Academy exhibition by a painting of a scene from The Two Gentlemen of Verona, Valentine rescuing Sylvia from Proteus, in which the two chief figures were painted from Rossetti and his future wife. The Hireling Shepherd followed in 1852, and next year his Claudio

and Isabella, a scene from Measure for Measure, marked a notable advance. Strayed Sheep, also known as Our English Coasts, exhibited in the same year, is an admirable landscape. The exhibition of 1854 included two of his greatest pictures, one of them the well-known Light of the World (with Rev. iii. 20 as motto), the other The Awakening Conscience. Both are characterized by the careful draughtsmanship and attention to detail which form notable features of the best Pre-Raphaelite work, but their full meaning is far from clear to the average spectator. In 1854 Mr. Hunt went to Palestine in order to obtain a living acquaintance with the scenes of the Biblical stories, and since then he has worked much in that country and drawn from it no small part of his artistic inspiration. The first-fruits of his study of Eastern life was the picture of The Scapegoat (1856), one of his most original and most poetical works; but much finer is his Finding of the Saviour in the Temple, which cost years of constant labour, and which he exhibited at the German Gallery in 1860. A writer in the Athenæum of that year prefaces a long detailed description of it with the statement that it is 'almost unequalled, in our time, for power of design and splendour of execution'. Among the subsequent works of Mr. Hunt are: A Street Scene in Cairo—the Lantern-Maker's Courtship (1861), one of his few humorous pictures; Portrait of the Right Hon. Stephen Lushington (1863) 'a solid, noble, subtle, and faithful study of character, such as a portrait should be, a masterpiece of manly execution'; The King of Hearts (1863); The Festival of St. Swithin (1867), representing pigeons gathered about a cote on a rainy day; In Dolce Far Niente (1867), and The Birthday (1869), both portraits of ladies; Portrait of a Lady (1869); all exhibited at the Royal Academy; and the following shown elsewhere: Portrait of D. G. Rossetti (1850); Canon Jenkins (1852); Fairlight Downs (1858); Asparagus Island, Cornwall (1860); The Children's Holiday (1865); The After-Glow in Egypt (1865), 'that modern masterpiece of technical art'; London Bridge on the Night of the Marriage of the Prince of Wales (1866); Isabella, or the Pot of Basil (1868), based on the well-known story from Boccaccio utilized by Keats, and in respect of colouring the finest of the artist's works; Interior of Salerno Cathedral (1868); Camaldoli, near Naples, Sunset (1868); A Maid of Tuscany (1869); The Shadow of Death (1873), showing a prevision of the Crucifixion in the carpenter's shop where Jesus is working beside his mother—described at great length in the Athenæum of 1873; Berne by Moonlight (1875); The Plain of Esdraelon, from the Heights above Nazareth (1877); The Ship (1878), suggested by lines in In Memoriam; Portrait of Sir Richard Owen (1881); Rebekah (1881); The Bride of Bethlehem (1884), a study for the Virgin's head in The Triumph of the Innocents; The Triumph of the Innocents (1885), one of his masterpieces, in which the glorified spirits of the massacred innocents are seen accompanying the Holy Family in their flight to Egypt; The Shepherdess (1886); The Choristers of Magdalen College, Oxford, singing the May-Day Hymn (1889); Christ among the Doctors (1890). In 1886 he contributed to the Contemporary Review several articles on the early days of the Pre-Raphaelite movement. See the biography by Dean Farrar and Mrs. Meynell (1893); also Modern Painters and other works by John Ruskin.

HUNTER, Sir William Wilson, Indian historian and statistician, born on July 15, 1840, received his education at Glasgow Academy and University, and afterwards studied in Paris and Bonn. He entered the Indian civil service by open competition in 1862, and after passing through the usual appointments in Bengal he was chosen to superintend Orissa and south-western Bengal on the outbreak of famine in 1866. When the period of scarcity was over he received the thanks of government for his services, and was invalided home. During his stay in England he devoted himself to the preparation of two important works, The Annals of Rural Bengal, and A Comparative Dictionary of the Languages of India and High Asia, with a Dissertation. The first volume of the former was published in 1868, and the other two volumes in 1872 under the title Orissa: or the Vicissitudes of an Indian Province under Native and British Rule; and the whole forms a contribution of the utmost value to our knowledge of real Indian history. The latter, published in 1869, is of interest not only to the student of language, but also to the student of Indian administration. The work on Bengal rapidly passed through several editions, and led to his appointment in 1871, at the early age of thirty-one, to the post of director-general of statistics to the government of India. In this capacity he planned and directed a comprehensive statistical survey of India, including the taking of the first regular and reliable census in 1871–72. The results of this great work were published at length in a series of volumes, comprising A Statistical Account of Bengal (20 vols. 1875–77) and A Statistical Account of Assam (2 vols. 1880), compiled by Sir William Hunter himself, besides works on the other provinces prepared under his general supervision. The whole, as completed in 1885, extends to 119 volumes, aggregating 54,504 pages, not including nine volumes dealing with native states. The immense mass of material contained in these volumes has been rendered more accessible to the general public by being condensed and consolidated in The Imperial Gazetteer of India, published under the general editorship of Sir William Hunter (1st ed., 9 vols., 1881; 2nd ed., 14 vols., 1885–87), and this in turn has been still further condensed into a single volume, entitled The Indian Empire: its Peoples, History, and Products (1882; 3rd ed. 1893). Appointed in 1878 one of the original companions of the Order of the Indian Empire, he became in 1881 a member of the Viceroy's Legislative Council, and next year president of the Indian Education Commission. In 1886 he was appointed to the Finance Commission, and in the following year he was created a Knight Commander of the Star of India. From 1887, when he retired from the service of India, till his death, which took place near Oxford on Feb. 7, 1900, he lived in England, occupied in literary and scholastic work. Among the many marks of distinction conferred upon him were honorary degrees from Oxford, Cambridge, and Glasgow. Sir William Hunter planned and edited the generally excellent series of twenty-three biographies of Rulers of India, published at the Clarendon Press in 1890–95, and contributed to it the volumes on the Marquess of Dalhousie (1890) and the Earl of Mayo (1891). His other published works include: The Indian Mussulmans: Are they Bound in Conscience to Rebel against the Queen? (1871; 3rd ed. 1876); Famine Aspects of Bengal Districts (1874); A Life of the Earl of Mayo, Fourth Viceroy of India (2 vols. 1875); England's Work in India (1881); A Brief History of the Indian People (1882; several editions); Bombay, 1885 to 1890: A Study in Indian Administration (1892); The Old Missionary (1895), a pathetic story of life and work in India; Life of Brian Houghton Hodgson (1896), an account of a forgotten Indian administrator and scholar;

and The Thackerays in India, and some Calcutta Graves (1897), a valuable contribution to the biography of the great Victorian Anglo-Indian novelist. Sir William Hunter collected a great mass of material for a history of India, but owing to the loss of the greater part in a shipwreck and for other reasons he abandoned his original plan and began a History of British India, of which the first volume was published in 1899. Owing to his untimely death this work remains a fragment.

HUON ISLANDS, a group of islets situated about 150 miles north-west of New Caledonia, of which they form a dependency.

HUON PINE (*Dacrydium Franklinii*), a pine, or rather yew, growing in Tasmania, and yielding a useful timber.

HURA, a genus of tropical American plants belonging to the natural order Euphorbiaceæ. The only species, *H. crepitans*, the sand-box tree, is remarkable for the loud report with which its seed-vessel bursts. It is a large branching tree with glossy poplar-like leaves, inconspicuous dicecious flowers, and large, furrowed, roundish fruits of the size of an orange.

HURONIAN ROCKS. See GEOLOGY.

HUSCH, a town of Roumania, on the Pruth, seat of a Greek bishop. The vine is cultivated in the neighbourhood. Pop. 13,000.

HUSO (*Acipenser huso*), the great or white sturgeon. See STURGEON.

HUSUM, a seaport of Prussia, in Schleswig-Holstein, 20 miles west of Schleswig, with a good trade. Pop. (1895), 7470; (1900), 8268.

HYA-HYA. See COW-TREES.

HYDATID, a term applied to the encysted larval stage of a small tape-worm, the *Tænia echinococcus*, found in the dog and wolf. The eggs set free from a dog may find entrance into the human body, in some part of which, especially the liver, the hydatid may develop into a sac of considerable size, causing serious illness.

HYDROCELE, a collection of serous fluid in some of the coverings of the testicle or spermatic cord, or in the areolar texture of the scrotum. It is generally the result of a strain or an inflammation of the testes. A large tumour is formed, filled with fluid, which has often to be drawn off three or four times a year. A radical cure may be effected by setting up an inflammation which brings the opposite surfaces of the sac into adhesion, and thus obliterates the cavity.

HYDROCHARIDACEÆ, a natural order of monocotyledonous floating and creeping plants, inhabiting ditches, rivers, and lakes in various parts of the world. The genera *Vallisneria* and *Anacharis* belong to it. See ANACHARIS and VALLISNERIA.

HYDROCYANIC ACID, same as PRUSSIC ACID (which see).

HYDRO-ELECTRIC MACHINE, a machine invented by Lord Armstrong, in which electricity is generated by the friction of steam against the sides of orifices through which it is allowed to escape under high pressure.

HYDROFLUORIC ACID. See FLUORINE.

HYDROKINETICS. See HYDRODYNAMICS.

HYDROPHORA, one of the three divisions into which Huxley and other authors divide the Hydrozoa, the other two being the Discophora and the Siphonophora.

HYDROSULPHURIC ACID, a gas also known as sulphuretted hydrogen. See SULPHUR.

HYDROTHORAX, a dropsical condition of the pleura, in which the pleural cavity contains a serous fluid exuded from the blood-vessels, not due to inflammation. It may be the result of organic disease in the heart or kidneys, or of pressure on vessels obstructing the return of blood.

HYLÆOSAURUS, a gigantic fossil lizard discovered in the Wealden formation of Tilgate Forest. Its probable length was about 25 feet. It is one of the Ornithoscelida, the group which presents a structure intermediate between that of existing birds and reptiles.

HYOID BONE, in anatomy, a bone shaped somewhat like the letter U, but with a wide bend and shorter limbs in proportion to the body, and having two pairs of upward projections or *cornua* (horns). It is suspended horizontally in the substance of the soft parts of the neck between the root of the tongue and the larynx.

HYOSCYAMUS. See HENBANE.

HYPERÆMIA, an excessive flow of blood to any structure of the body; also synonymous with plethora (which see).

HYPERICACEÆ HYPERICINÆ, a widely-distributed natural order of plants, of which the genus *Hypericum* or St. John's wort is the type. They are herbs, shrubs, or (rarely) trees, with simple, opposite (rarely whorled), generally glandular leaves. They have terminal or axillary, solitary, cymose or paniculate flowers, usually yellow; the stamens are often polyadelphous. They abound in resinous juice, and many of them possess medicinal properties. Several species of St. John's wort (*Hypericum*), with pellucid-dotted leaves, grow in Britain, among them being *H. perforatum*, *H. calycinum*, and *H. Androsæmum*.

HYPERIDES, an Athenian orator, the pupil of Plato and Isocrates, born about 400 B.C. Along with Demosthenes and Lycurgus he was one of the leaders of the patriotic and anti-Macedonian party. As as orator he was specially distinguished for his grace and subtlety of expression, as well as for his tact in handling the question under consideration. He was murdered at Ægina by the emissaries of Antipater in 322 B.C. Of his orations one has reached us nearly entire, the others only in fragments.

HYPERSTHENE, a mineral of a colour between grayish and greenish black, but nearly copper-red on the cleavage. It was first found on the coast of Labrador, and was called Labrador hornblende. It is a double silicate of iron and magnesium.

HYPNUM, one of the largest genera of mosses, including many British species.

HYPOPHOSPHITES, salts of hypophosphorous acid. The hypophosphites of potassium, sodium, and calcium have been used with considerable advantage in disorders of the blood and the digestive organs, and have also been found of benefit in consumption.

HYPOSULPHITES, salts of hyposulphurous acid (H_2SO_2). Among the most important are the hyposulphites of sodium and calcium, the former of which is used in medicine as an external remedy in parasitic skin disorders and an internal one in checking fermentation in zymotic diseases. It is also used in bleaching and for reducing indigo. Sodium hyposulphite ($NaHSO_2$) is obtained from sodium bisulphite by the action of metallic zinc, the bisulphite being itself prepared by saturating sodium carbonate solution with sulphur dioxide. Commercial hyposulphite of sodium is a salt otherwise known as sodium thiosulphate ($Na_2S_2O_3 . 5H_2O$). It is made by acting on sulphur with caustic soda solution, or it is obtained as a by-product in the Leblanc soda process. This salt is used in chrome tanning, in photography, and in paper-bleaching.

HYRACOTHERIUM, a genus of fossil Ungulata, belonging to the odd-toed division, intermediate between the hog and the hyrax, occurring in the tertiary strata of England. The species are of the size of a hare.

I.

IANTHINA, a genus of oceanic gasteropodous mollusca, with a thin violet-coloured snail-like shell. When irritated they pour out a violet secretion, which serves for concealment, in the manner of the ink of the cuttle-fish.

IBADAN, a town of Western Africa, in the Yoruba country, about 70 miles north of the Bight of Benin, and connected by railway with Lagos. It is the centre for the agriculture of the surrounding country, and has been called 'the London of Negroland'. Pop. 100,000.

IBAGUÉ, a town of South America, in the Republic of Colombia, capital of the department of Tolima. Near it are hot springs and mines of silver and sulphur. Pop. 10,000.

IBERIS, a genus of cruciferous plants, of which several species are cultivated in English gardens under the name of *candytuft* (which see in SUPP.).

IBIGAU (*Nyctibius grandis*), a very large goat-sucker inhabiting South America; sometimes called the *grand goat-sucker*. It has a remarkably weird cry, which 'consists of five notes, descending gradually one-fifth in the scale'. It is also known as the great wood-nightjar.

IBN-BATÚTAH, properly ABÚ-ABD-ALLAH-MOEAMMAD, Arab traveller, was born at Tangier in 1304. When about twenty-one years of age he travelled to Tunis, and soon afterwards he set out for Mecca as khádi of a caravan of pilgrims, proceeding by way of Egypt and Syria. His subsequent travels, which extended over more than twenty-five years, included Persia, Mesopotamia, Arabia, the east coast of Africa, Egypt, Asia Minor, the Crimea, Southern Russia, Constantinople, Samarkand, Bokhara, Northern and Southern India, Maldive Islands, Ceylon, Assam, Andaman Islands, Sumatra, Java, Tongking, China, and the Niger region. After his return to his native country he wrote, by command of the Sultan, an account of his travels, in which 'he displays great power of observation and memory, allied with the most contemptible morals'. He died at Fez in 1378. An edition of his travels, with French translation, was issued at Paris by Defrémery and Sanguinetti in four volumes (1853–58; 3rd ed. 1893). See an article in the Scottish Geographical Magazine (1888).

IBSEN, HENRIK, Norwegian dramatist and poet, was born at Skien, in southern Norway, on March 20, 1828. At the time of his birth his father was a prosperous merchant, but in 1836 he failed, and young Ibsen was thus compelled to forego all prospects of a university education. He was apprenticed in 1843 to an apothecary in Grimstad, a small coast town to the north-east of Christiansand, but after seven years' drudgery he set out for Christiania in 1850 with but scant means in order to study medicine. He soon drifted into journalism and political agitation, went to Bergen in 1851 on the invitation of Ole Bull, to take charge of the theatre, and during his six years' connection with it he wrote a play each year. Only two of these plays, Fru Inger til Oestraad (Lady Inger of Oestraad, 1855), dealing with pre-Reformation Norway, and Gildet paa Solhaug (the Banquet at Solhaug, 1856), have been published. In 1857 he removed to Christiania to become director of the national theatre. To this period of his career belong the dramas Hærmændene paa Helgeland (The Vikings at Helgeland, 1858), Kongsemnerne (The Pretenders to the Crown, 1864), and Kjærlighedens Komedie (Love's Comedy, 1862, in the last of which the features of his later social dramas are already distinctly foreshadowed. The Christiania theatre failed in 1862, and two years later, angry at his country's refusal to assist the Danes against Prussia, Ibsen took up his residence abroad. Till 1868 he lived in Rome, from that year till 1875 he resided in Dresden, after which he spent three years in Munich, seven in Rome again, and other six (1885–91) in Munich. Since 1891 he has resided in Christiania. He was awarded a travelling pension by the Storthing in 1864, and since 1866 he has enjoyed a full poet's pension. During his first residence in Rome he wrote the two dramatic poems, Brand (1866) and Peer Gynt (1867); the latter a scathing exposure of the typical Norwegian and, less directly, of the conventional modern man everywhere. De Unges Forbund (The League of Youth, 1869) was the first of his satirical prose dramas; but before finally devoting himself to this kind of work he produced in 1873 the double drama Kejser og Galilæer (Emperor and Galilean), which many regard as his greatest work, and which deals with the apostasy of the emperor Julian. The series of social prose dramas comprises, besides that already mentioned, Samfundets Stœtter (The Pillars of Society, 1877), exposing the hollowness and hypocrisy of modern society; Et Dukkehjem (A Doll's House, also called Nora, 1879), treating of modern education and the position of woman; Gjengangerne (Ghosts, 1881), treating of heredity—described by one critic as dull, undramatic, revolting in subject, but fiercely moral; En Folkefjende (An Enemy of the People, 1882), on public opinion; Vildanden (The Wild Duck, 1884); Rosmersholm (1886); Fruen fra Havet (The Lady from the Sea, 1888); Hedda Gabler (1890), 'grim and unholy, but painfully actual and true'; Bygmester Solness (Master-Builder Solness, 1892); Lille Eyolf (Little Eyolf, 1894); John Gabriel Borkman (1896); and When we Dead Awaken (1900). These plays, which have exercised a powerful influence on the modern drama, have been translated into German, English, and other languages, and have been produced on the stages of several countries besides Ibsen's own. In 1890–91 Mr. Archer edited a series of translations of the Prose Dramas of Henrik Ibsen in five volumes. Ibsen also stands in the front rank of Scandinavian lyric poets. Ibsen's psychological naturalism has been the theme of much controversy, but it has created a new school of drama in Scandinavia and Germany, and has not been without influence elsewhere. His interest is not with the external events in the lives of his characters, but with their thoughts, ideas, and emotions, and thus he presents us scenes from the soul-life of typical persons. In following out his intense desire for truth, however, he does not shrink from representing scenes of a repugnant and almost disgusting nature. What he regards as the shams and diseases of an artificial and conventional society are exposed with powerful sarcasm. Some of Ibsen's work betrays a mystical and symbolist tendency which does not make his realism more attractive. Of biographies of Ibsen we may mention those by Passarge (Leipzig, 1883), Jaeger (Norwegian; Eng. trans. 1891), and Brandes (Copenhagen, 1898). Among the numerous critical appreciations the best are those by P. H. Wicksteed (Four Lectures on Henrick Ibsen, 1891), Havelock Ellis (in The New Spirit, 1890), E. Gosse (in Northern Studies, 1883), G. Moore (in Impressions and

Opinions, 1891), G. B. Shaw (The Quintessence of Ibsenism, 1891), W. Watson (in Excursions in Criticism, 1893), E. R. Russell and P. Staading (Ibsen on his Merits, 1897), and G. Brandes (Henrik Ibsen and Björnstjerne Björnson, Eng. trans. 1899).

ICE-BREAKER, a strong heavy screw-steamer with powerful engines, used for opening up navigable channels in frozen rivers and seas. Ships of this kind are of recent introduction, and are usually built so as to rise on the ice and break it by means of their great weight. An ice-breaker known as the *Yermak*, built by Armstrong, Whitworth, & Co. in 1899 for use in St. Petersburg Harbour and the Kara Sea, was 305 feet long and 71 feet broad. The bow was inclined to the vertical at an angle of 70°, her sides at 20°, and her stern at 65°. With 3000 tons of coal her displacement was 8000 tons. She had four engines working four propellers, three behind and one in front. The total horse-power of the engines was 10,000. The sides and bottom were double, and the ship was divided into forty-eight compartments. Each propeller had an additional auxiliary engine for use under ordinary conditions. The ship was tried in heavy polar ice, and, after being strengthened and deprived of her front propeller, she worked very satisfactorily. The late Vice-Admiral Makaroff of the Russian navy, who superintended the trials of the *Yermak*, was of opinion that for breaking ice in seas like the Baltic the force of the engine is the main factor and the forward propeller is useful; but for arctic work the strength of the ship is of more importance and the forward propeller is objectionable. He believed that the best way to reach the North Pole is by means of a specially constructed ice-breaker of great power and strength, using liquid fuel instead of coal.

ICENI, a warlike tribe of ancient Britain, occupying the modern counties of Suffolk, Norfolk, Cambridge, and Huntingdon. They fought against the Romans under their queen Boadicea. The story of the 'British warrior queen' and the vengeance she exacted from the Romans for their cruelty to her and her daughters forms the subject of a poem by William Cowper.

ICH DIEN ('I serve'), motto of the Prince of Wales, said to have been assumed by Edward the Black Prince from that of the King of Bohemia, slain at the battle of Cressy, at which he served as a volunteer in the French army.

ICHTHYORNIS (Greek, *ichthys*, a fish, *ornis*, a bird), a fossil genus of carnivorous and probably aquatic birds, one of the earliest known American forms. It is so named from the character of the vertebræ, which, even in the cervical region, have their articular faces biconcave as in fishes. It is also characterized by having teeth set in distinct sockets. Its wings were well developed, and the scapular arch and bones of the legs conformed closely to the true bird type.

ICHTHYOSIS, or Fish-skin Disease, a disease consisting in an enormous overgrowth of the scarf-skin, accompanied by thickening of the true skin. Furrows are deepened, and thus the skin becomes mapped out into irregular areas. Masses of the overgrown cells may vary in colour, being of a pearly colour, or varying to brown and black. The disease is usually most marked over the elbows and knees. It may be transmitted from parent to child. This disease seldom yields permanently to any plan of treatment, but frequent use of warm baths is often beneficial. The scaly masses may be softened and removed by means of oil, soft soap, &c.

ICICA, a genus of plants of the natural order Amyridaceæ, mostly large trees indigenous in tropical America. They have alternate, unequally pinnate, leathery leaves, and small flowers. *I. altissima*, the cedar wood of Guiana, is a useful timber. All of these trees yield a transparent fluid resembling turpentine in many of its properties, and sometimes named *icica*, also *elemi* or *copal*.

IDE, a fish of the carp family (Cyprinidæ), the *Leuciscus idus*, found in rocky lakes of Northern Europe. It is a good table-fish, which might be introduced into British waters. A golden variety called the *orfe* is bred in Germany.

IDLE, a town of England in the West Riding of Yorkshire, about 3 miles north of Bradford. There are several stone and slate quarries in the vicinity, but the manufacture of worsted and woollen cloth is the chief industry. The Church of the Holy Trinity, built in 1830, is an imposing structure. The town also contains a mechanics' institute and a church institute. It is now incorporated with Bradford.

IDOCRASE, a mineral sometimes massive, and very often in shining prismatic crystals. Its primitive form is a four-sided prism with square bases. It is called also *Vesuvian* or *Pyramidal Garnet*, and differs from common garnet chiefly in form.

IESI, or Jesi, a walled town of Italy, in the province of Ancona, 17 miles S.W. of Ancona. It is a cathedral town, and has manufactures of paper, leather, linen, &c. Frederick Barbarossa was born here. Pop. about 13,000.

IF, a small island near Marseilles, on which is the Château d'If, formerly a French state prison, in which several celebrated persons were at different times confined. It is also well-known through Dumas' romance of Monte Cristo.

IGLESIAS, a walled town of Sardinia, in the province of Cagliari, in the south-west of the island, 6 miles from the west coast. In its vicinity are lead, zinc, and other mines. The town contains a cathedral dating from the thirteenth century, and a castle built in the fourteenth. Pop. 7885.

IGLO, or Neudorf, a manufacturing and mining town of northern Hungary, in the comitat of Zips, on the left bank of the Hernad. Pop. (1890), 7345.

IGNATIUS (St.) BEANS, the seeds of a large climbing shrub (*Ignatiana philippinica* or *Strychnos Ignatii*) of the natural order Loganiaceæ, nearly allied to that which produces nux-vomica, inhabiting the Philippines, and cultivated in Cochin China. It was so called by the Jesuits in honour of their founder, Ignatius Loyola.

ILANG-ILANG (*Cananga odorata*), a large tree of the order Anonaceæ, cultivated in India and the Philippines, and yielding from its flowers a rich perfume.

ILCHESTER, a decayed town of England, in Somersetshire, on the river Yeo or Ivel, 5 miles north-west of Yeovil, anciently an important Roman station, and furnishing numerous Roman remains. The old Fosse Way still forms its principal street, and it contains an old church (restored in 1880), a town hall, reading-rooms, &c. Pop. (1901), 433.

ILFORD, a town and parish of Essex, in the Eastern suburban district of London, about 8 miles E.N.E. of St Paul's, on the Roding, to the north of Barking. There is an ancient charitable foundation, forming the hospital of St. Mary and St. Thomas, for lepers, with a chapel, a lunatic asylum of the London County Council, &c. There are here a paper-mill and other industrial works, and the place is very rapidly increasing. Pop. in 1891, 10,913; in 1901, 41,240.

ILLAMPU. See Sorata in Supp.

ILLICIUM, a genus of eastern Asiatic and North American evergreen shrubs, belonging to the natural order Magnoliaceæ, containing five species. The plants of this genus are called aniseed-trees, from

their fine aromatic scent. The fruit of *I. anisatum* or *I. verum* (Chinese anise) is the star-anise of the shops (see ANISE). *I. religiosum* is a poisonous Japanese species, held sacred by the natives, who decorate the tombs of their dead with wreaths of it, and burn the fragrant bark as incense before their deities.

ILLIMANI, one of the loftiest peaks in the Bolivian Andes, 12 miles south-east of La Paz, fully 21,000 feet high, and covered with glaciers. See ANDES.

ILMENAU, a town of Central Germany, in the Grand-duchy of Saxe-Weimar, on the river Ilm, and on the north side of the Thuringian Forest. It has a grand-ducal castle, manufactures of porcelain, papier-maché, terra-cotta ware, gloves, glass, &c., a hydropathic establishment, and a sanatorium for nervous diseases. Pop. (1895), 7958; (1900), 10,416.

ILORIN, a town in the Western Sudan, about 150 miles N.E. of the Bight of Benin, in Nupe, a great centre of trade. Pop. 70,000, mostly Mohammedans.

IMPATIENS, a genus of curious annuals which rank among the Balsaminaceæ, an order sometimes regarded as a tribe of Geraniaceæ. One species, *I. noli-me-tangere*, indigenous in England, is called touch-me-not. *I. balsamina* is much grown for the beauty of its flowers, and is well known as a highly ornamental annual by the name of garden balsam. The species are numerous, and inhabit chiefly the East Indies, although they sometimes extend into Europe, Siberia, and North America. *I. tricornis*, *I. glandulifera*, and *I. candida* are Indian species; and among perennial species grown in gardens and plant-houses are: *I. Mariannæ*, *I. Sultana*, *I. Hawkeri*, and *I. Hookeri*. The name refers to the elasticity of the valves of the seed-pod, which discharge the seeds when ripe or when touched.

IMPERIAL INSTITUTE, an institution recently established in London. This institution, which was founded in 1887 and received its charter of incorporation in 1888, was established at the suggestion of the Prince of Wales (now Edward VII.) for the purpose of advancing the social, industrial, and commercial relationships of the Colonies, India, and the United Kingdom. The desirability of such an institution was suggested by the success of the Colonial and Indian Exhibition held in 1886, and in the following year this great enterprise took the form of an imperial memorial of Her Majesty's Jubilee. Some of the objects sought to be obtained by this Institute are: Permanent and periodic exhibitions of the best natural and manufactured products of the Colonies and India; the formation of an Indian and Colonial library and map-room; an educational department in which oriental languages, science, arts, and industries shall be taught as in a technical college; an intelligence department in which the fullest information shall be collected and diffused regarding products, manufactures, commerce, and emigration; a large hall for lectures and discussions on Indian and Colonial subjects; and all the social advantages to be derived from a well-appointed club. The building which accommodates these varied interests is situated at West Kensington, on the site of the Colonial and Indian Exhibition, and was designed by Mr. T. E. Collcutt. The Institute building is one of the finest in London, and a large portion of it is now used as the head-quarters of the University of London. It was partially opened in June, 1892, and a formal opening by Queen Victoria took place on May 11, 1893. In the beginning of 1895 a monthly called the Imperial Institute Journal was founded. It is devoted to the commerce, finance, agriculture, &c., of the Empire. The management of the Imperial Institute has since 1903 been transferred to the Board of Trade.

IMPETIGO, popularly known as *Pustular Tetter*, *Honey Scab*, and *Honey Sickness*, a skin disease found mostly in children, consisting in an eruption of itching pustules, appearing in clusters, and terminating in a yellow, thin, scaly crust. They appear chiefly on the head and face, and sometimes on the hands. Feverishness and sensations of chilliness accompany the disease. The treatment is both external and internal, the former consisting in the application of ointments, &c., and the latter in the administering of various medicines calculated to improve and maintain the health of the patient.

IMPOST, in architecture, the point of junction between an arch and the column, pier, or wall on which it rests. It is often marked by horizontal mouldings, though these may be absent. Imposts have received various names, according to their character. Thus, a *continuous impost* is one in which the mouldings are carried down the pier; a *discontinuous impost*, one where there are no mouldings, but the pier is of a different section from the arch; *shafted imposts* are those in which the arch mouldings spring from a capital and differ from those of the pier.

INAGUA, GREAT and LITTLE, two islands of the Bahamas, the former about 40 miles from the eastern extremity of Cuba, low and intersected with lagoons, and affording good pasture land. Area, 660 square miles; pop. 1500. Little Inagua is quite small. See BAHAMA ISLANDS.

INAJA PALM (*Maximiliana regia*), a South American palm growing to the height of over 100 feet, with leaves 30 to 50 feet long. The spathes are so hard and woody as to serve for cooking food on the fire; they are also used as baskets, &c. The fruit is edible.

INCE-IN-MAKERFIELD, a township of Lancashire, about a mile from Wigan, of which it forms a suburb. Pop. (1901), 21,270.

INCREMENT, UNEARNED, a name applied to the increase in the value of lands or houses consequent on their proximity to large centres of population. Of late years it has been often maintained that since this increase is in no way due to the industry or labour or sacrifice of the owner but entirely to the general progress of society, it ought to be taxed for the benefit of the community.

INDIA, ORDERS OF KNIGHTHOOD OF, consist of *The Most Exalted Order of the Star of India*, instituted in 1861, and comprising the Viceroy of India as Grand Master, and a number of Knights Grand Commanders (G.C.S.I.), Knights Commanders (K.C.S.I.), and Companions (C.S.I.); *The Most Eminent Order of the Indian Empire*, instituted 1st Jan. 1878, and comprising the Viceroy of India as Grand Master, a number of Knights Grand Commanders (G.C.I.E.), Knights Commanders (K.C.I.E.), and Companions (C.I.E.); and *The Imperial Order of the Crown of India*, instituted 1st Jan. 1878, and comprising the Princess of Wales and the princesses of the blood-royal, and other British and Indian ladies. The ribbon of the first named is light-blue edged with white, and the motto is Heaven's Light our Guide.

INDIA MATTING, a matting woven from the stems of *Papyrus Pangorei* or *corymbosus*, a plant belonging to the Cyperaceæ, and chiefly exported from Bengal.

INDIAN ARCHIPELAGO. See MALAY ARCHIPELAGO.

INDIAN ARCHITECTURE comprehends a great variety of styles, among which we may distinguish, as the most important, the Buddhist style, the Jaina style, the Dravidian or style of Southern

India, the Chalukyan style, the Modern Hindu or Indian-Saracenic style. The history of Indian architecture commences in the third century B.C. with the religious buildings and monuments of the Buddhists. Amongst the principal forms of BUDDHIST ARCHITECTURE are the following: First, the *topes, stupas*, or towers built to mark some sacred spot, and the *dagobas*, constructions of a similar nature, containing relics of Buddha or Buddhist saints. These buildings generally consisted of a circular stone basement, varying from 10 or 12 to 40 feet in height, and from 40 to 120 feet in diameter, on which rose a rounded domical structure, generally of brick or small stones laid in mud, the whole edifice rising sometimes 50, sometimes 100 feet high. Second, the rock-cut *chaitya halls* or churches, and the *viharas* or monasteries. Most of these are found in the Bombay Presidency; some also in Bengal and Behar. In rock-cut buildings architectural skill is confined to the façade and the interior. Amongst the most notable for beauty of design are those at Ajanta, and, finest and largest of all, the great Chaitya cave at Karli, near Bombay, the date of which is probably about 80 B.C. (See KARLI in SUPP.) Another interesting example is at Ellora (which see). The JAINA STYLE is a development or corruption of the pure Buddhist. It is characterized by the square or polygonal court, the twelve-pillared dome, the slenderness and elegance of the columns, the horizontal arch, the *sikras* or towers surmounting the cells containing the images, and, lastly, by the peculiar grouping of many temples together on hill-tops. Prominent examples of Jaina architecture are found at Girnar in Gujerat, and at Mount Abu. The most flourishing epoch of the DRAVIDIAN STYLE comprises the sixteenth, seventeenth, and even eighteenth centuries of our era. To this late period belong the great temples at Tanjore, Tiruvalur, &c. The distinctive parts of a Dravidian temple are the *vimana* or temple proper, with storied pyramidal roof; the *mantapas* or porches, covering the door which leads to the cell; the *gopuras* or gate-pyramids, in the quadrangular inclosures surrounding the vimanas; and the *choultries* or pillared halls, used for various purposes. The general characteristics of a Dravidian temple of the first class are the storied pyramidal towers, the hall of 1000 columns, the bold cornice with double flexure, the detached shafts, the richly-carved stylobate, and the large tanks with flights of stone steps. The CHALUKYAN STYLE, so named from a dynasty which rose in the sixth century in what is now Mysore and the Nizam's Territory, reached its perfection in Mysore from the eleventh to the fourteenth century. The characteristic features are the open porch, the straight-lined, conical-shaped tower, the star-shaped temple, and the basement terrace of stone. The INDIAN-SARACENIC STYLE is a general name for a number of somewhat varying styles, the result of the mixture of Saracenic principles of architecture, brought with them by the Mohammedan conquerors of India, and the distinctive architectural features of the different localities where they settled. Under the Mogul emperors in the sixteenth century were erected some most magnificent buildings, such as the tomb of Humayun Shah at Old Delhi; that of Akbar at Secundra; the palaces of Shah Jehan at Agra and Delhi; and the Taj Mahal, built by the same monarch at Agra. (See AGRA.) The Moslem architecture of India contrasts with the native Indian styles in its use of the radiating arch, in the superior simplicity and grandeur of its style—its flat ornamentation not interfering with the lines of true architectural construction. A characteristic feature also is its fine conventionalism of vegetable forms for decoration and tracery. (See *Saracenic Architecture* under ARCHITECTURE.)

INDIAN CIVIL SERVICE includes the civil and judicial administration, the medical service, the forest department, and officers of the staff corps in civil employ. Candidates must be between twenty-one and twenty-three years of age (for ordinary civil appointments), and are selected by competition once a year in London, after which they must undergo two years' probation, and have to pass during that time a second examination in special subjects of study before proceeding to India. After his arrival in India, the candidate must within a given time choose whether he will enter the executive or the judicial branch of the service. He commences with a salary of 4800 rupees a year, and may attain in the one department a lieutenant-governorship, and in the other a judgeship of the High Court.

INDIAN FIG, a name given to the *Opuntia Tuna* and *O. ficus-indica*, and other species of the Cactus family common in the tropical and sub-tropical countries of America, and now naturalized in Africa, Asia, and Southern Europe. They are generally from 10 to 12 feet high. Their fruit, which is egg-shaped and from 2 to 3 inches long, is cooling and wholesome, and yields a juice used for colouring confectionery. The wood of the stems become very hard with age. See CACTUS and PRICKLY PEAR.

INDIAN INK. See CHINA INK.

INDIAN SHOT (*Canna indica*), an ornamental plant of the Arrow-root family found in most tropical countries. The seeds are round, hard, and black; hence the common name of the plant. See ARROW-ROOT.

INDIAN YELLOW, or PUREE, a pigment of a bright yellow colour, but not permanent; used in water-colour painting, and also in India for colouring walls, doors, &c. It is made by heating the urine of cows that have been fed upon mango leaves, and Monghyr in Bengal is almost the only place where it is produced.

INDIGIRKA, a river of Eastern Siberia, in the government of Yakutsk, rises in the Stanovoi range of mountains, and flows northwards into the Arctic Ocean. Its length is about 850 miles, and it is almost always covered with ice.

INDIGO-BIRD, a North American bird (*Cyanospiza cyanea*) of the Finch family. It is of a deep-blue colour, and is a good songster. Its size is about equal to that of the chaffinch.

INDIGOFERA, a large genus of plants of the natural order Leguminosæ, including about 220 species, indigenous in the warmer parts of Asia, Africa, and America. See INDIGO.

INDIVIDUALISM is the name often applied to social systems founded on principles opposed to the essential principle of Socialism (which see), or to that theory of society which is opposed to state interference in industrial and economic and other relations. In its extreme form it is identical with one phase of anarchism, just as another phase of the anarchist theory, distinguished as anarchist communism, may be regarded as the most extreme form of Socialism. The word is also applied to social theories involving other and deeper views of individual rights than the mere non-interference referred to above.

INDUSTRIAL VILLAGES, villages proposed to be established by English philanthropists for the improvement of the condition of the working people of the country, and for preventing their continual influx into towns, as well as to enable the working population of towns to leave these and to obtain

better and healthier dwellings, and to live their lives in improved conditions.

INEBRIETY, habitual or chronic drunkenness. The Inebriates Acts is the name by which several acts of Parliament relating to habitual drunkards are known. The first, passed in 1879, was called the Habitual Drunkards Act, and was to expire after ten years. Before the completion of that period, however, it was amended and made perpetual by the Inebriates Act of 1888. These make provision for the licensing of retreats authorized to receive habitual drunkards seeking admission with a view to cure. The Inebriates Acts of 1898 and 1899 provided for compulsory detention in certain cases. See DRUNKARDS (HABITUAL) in SUPP

INFECTIOUS DISEASES. See CONTAGION.

INFEFTMENT, in Scots law, a term used to denote the act of giving symbolical possession of heritable property, the legal evidence of which is an instrument of sasine.

INFIRMARY. See HOSPITAL.

INFUSION, a solution of some vegetable substance in hot or cold water, such as are often used for medicinal purposes. The water employed may be at boiling heat, but if the substance is itself boiled the result is a *decoction*. In preparing certain infusions cold water is preferable, as bringing out the constituent desired. The process of making an infusion is much the same as that of making tea.

INGBERT, ST., town of Germany, in Rhenish Bavaria, on the Rohrbach, with iron, coal, and quicksilver mines, and manufactures of glass, iron, chemicals, gunpowder, soap, &c. Pop. (1900), 14,050.

INGELOW, JEAN, poet and story-writer, the daughter of a banker, was born at Boston, Lincolnshire, in 1820. Her first published work appeared anonymously in 1850 under the title A Rhyming Chronicle of Incidents and Feelings, edited by Edward Harston, M.A., Vicar of Tamworth. It was very favourably reviewed in the Athenæum, and was followed by Allerton and Dreux: or the War of Opinion (1851), a story, and Tales of Orris (1860); but not till the publication of Poems in 1863 did Miss Ingelow become famous. This volume won the enthusiastic praise of critics and the instant approval of the public, and has now passed through twenty-three editions. The most widely appreciated poems in it are those entitled The High Tide on the Coast of Lincolnshire, Songs of Seven, Honours, Divided, The Wedding Song, Supper at the Mill, Reaping, and Brothers: and a Sermon. Of Studies for Stories (1864), a contemporary critic wrote: 'Simple in style, warm with human affection, and written in faultless English, these five stories are studies for the artist, sermons for the thoughtful, and a rare source of delight for all who can find pleasure in really good works of prose fiction'. This high standard was maintained in Stories told to a Child (1865), and these were followed by other stories published, like them, anonymously. In 1867 she enhanced her poetic reputation by the publication of A Story of Doom, and Other Poems. In the main piece she sought to picture the world before the Deluge, and among the 'other poems' are Night Watches, Songs on the Voices of Birds, and Gladys and her Island. From that time she wrote a great many stories and novels, including: Mopsa the Fairy (1869); Off the Skelligs (1872), her first long story; The Little Wonder Horn (1872), a new series of stories told to a child; Fated to be Free (1875); Sarah de Berenger (1880); Don John (1881), and John Jerome (1886). A third volume of Poems was published in 1885. Miss Ingelow latterly lived in London, engaged in benevolent and charitable works, and she died at Kensington on July 20, 1897. Much of her finest verse is filled with the strange ecstasy and tragedy of the sea, which was familiar to her in her childhood. Her works have been even more popular in America than in her native country.

INGLEBOROUGH, a mountain in the West Riding of Yorkshire, one of the highest of the Pennine chain, 2373 feet. See YORK.

INGOLDSBY, THOMAS. See BARHAM, R. H.

INHALER, an apparatus for inhaling vapours and volatile substances, as steam of hot water, vapour of chloroform, iodine, &c. In one form it consists of a tin can containing a small spirit-lamp, and above this a small kettle for hot water, the steam of which is driven out with some force when the apparatus is used. Attached to the can is a receptacle for receiving a small phial containing the substance whose vapour is to be inhaled, this being drawn off and forced through a funnel by the steam.

INHAMBANE, a Portuguese town and seaport on the east coast of South Africa, unhealthy, but with a good harbour, at which rubber and other products are exported. Pop. about 3000, of whom very few are Europeans.

INIA, a genus of Cetacea belonging to the dolphin family, containing only one known species, *I. boliviensis*, remarkable for the distance at which it is found from the sea, frequenting the remote tributaries of the river Amazon, and even some of the elevated lakes of Peru. It has bristly hairs on its snout, and is from 7 to 12 or 14 feet long.

INSERTION, in botany, the place or mode of attachment of an organ to its support, used especially in regard to the parts of a flower. Insertion is described as *epigynous* when it occurs on the summit of the ovary, as *hypogynous* when beneath the ovary, and *perigynous* when upon the calyx surrounding the ovary.

INTERLOCUTOR, in Scots law, a judgment or sentence pronounced in the course of a suit, but which may not finally determine it.

INTERNUNCIO, an envoy of the pope, sent to small states and republics, distinguished from the nuncio who represents the pope at the courts of emperors and kings.

INTERPLEADER, in law, the right or process by which a man who is called upon by two opposite parties to pay a sum or deliver over goods, and who is not sure which party is the rightful claimant, can call upon the parties to come forward as against each other, and so relieve him.

INTROIT, a psalm or passage of Scripture sung or chanted while the priest proceeds to the altar to celebrate mass: now used for any musical composition designed for opening the church service.

INTUSSUSCEPTION, in pathology, the descent of a higher portion of intestine into a lower one: generally of the ileum into the colon. When it takes place downwards, it may be termed *progressive*; when upwards, *retrograde*. It is almost impossible to effect a complete cure.—In physiology, the term signifies the process of nutrition, or the transformation of the components of the blood into the organized substance of the various organs.

IODOFORM (CHI_3), a substance analogous to chloroform in composition, but in which iodine replaces chlorine; also known as triodomethane. It is in the form of small, solid, yellow hexagonal plates, and is prepared by the action of alcohol and other bodies on iodine and potash. It is nearly insoluble in water, but dissolves in ether, oils, and alcohol Its smell is very disagreeable. It is used in medicine as an antiseptic, and acts slightly as an anodyne; it is successfully applied to ulcers and sores of various

kinds, and is used as a snuff for cold in the head. It may be prepared as an ointment.

IOLITE. See DICHROITE.

IONIAN MODE. See GREGORIAN MUSIC.

IPOMÆA, a large genus of plants of the natural order Convolvulaceæ, consisting mostly of twining prostrate herbs, widely distributed in warm regions. The species of most importance is *I. Purga*, which yields the jalap of commerce. Some are cultivated for the beauty of their flowers, and are known to gardeners as convolvuli. *I. purpurea* is the best-known garden species. See JALAP.

IPSICA. See MODICA.

IPSUS, in ancient geography, a small town of Phrygia, in Asia Minor, famous as the scene of a great battle fought in B.C. 301. See ANTIGONUS.

IRELAND, WILLIAM HENRY, son of a London bookseller and publisher (author of various illustrated works), was born in 1777, and died at St. George's-in-the-Fields on April 17, 1835. He imposed spurious Shaksperian MSS. upon his father, who was a Shakspere enthusiast, and also upon other men of letters, and latterly produced two 'Shaksperian' plays, Vortigern and Henry II., the former of which was purchased by Sheridan and acted at Drury Lane, but was a complete failure. The criticisms of Malone led to the exposure of the fraud, which was acknowledged by Ireland in 1796. Several novels, poems, &c., proceeded from his pen, besides his Confessions (1805), containing an account of his forgeries. He lived latterly in straitened circumstances.

IRIARTEA, a genus of South American palms, tall-growing trees, of which one species, *I. exorrhiza*, the pashuiba or paxuiba palm, yields a hard kind of wood used for building, and exported for umbrella handles, &c.

IRIDACEÆ, a natural order of monocotyledonous herbaceous plants, with sword-shaped or linear equitant leaves (that is, leaves overlapping entirely in a parallel manner), three stamens with extrorse antlers, and an inferior ovary. They are natives chiefly of the middle parts of Europe and North America and the Cape Colony. They have beautiful flowers, and include the iris, gladiolus, crocus, ixia, &c.

IRIDOSMINE, IRIDOSMIUM, a native compound of iridium and osmium, forming an osmide of iridium, in which the iridium is less or more replaced by platinum, rhodium, and ruthenium. It is used for pointing gold pens, and iridium is obtained from it.

IRON-BARK (*Eucalyptus resinifera*, one of the 'gum-trees'), an Australian tree growing to the height of 100–150 feet, with heavy, strong, and durable timber, difficult to work and apt to be 'shaky'.

IRON GATE, a narrow part in the course of the Danube below where it leaves Austrian territory and becomes the boundary between Servia and Roumania, formerly dangerous to shipping from rocks and rapids, the river being confined between steep precipices; but extensive operations carried out in 1890–96 by the Austrian government have resulted in making a clear channel. See DANUBE.

IRON-STONE, a general name for some ores of iron. See IRON.

IRONTON, a city of the United States, capital of Lawrence county, Ohio, on the river Ohio, 145 miles above Cincinnati, the centre of an iron and bituminous coal district. Pop. (1900), 11,868.

IRVING, SIR HENRY (originally John Henry Brodribb), English actor, was born near Glastonbury on Feb. 6, 1838, and educated at a London school. He was for a time a clerk in London, but adopted the theatrical profession, his first appearance being at Sunderland in 1856. After playing for nearly three years in Edinburgh he appeared at the Princess's Theatre, London, in 1859. After a short stay here, and a few months in Glasgow, he went to Manchester, where he remained for five or six years. Having returned to London in 1866 he took part in the Belle's Stratagem, Hunted Down, Uncle Dick's Darling, &c.; but his first marked success was as Digby Grant in Albery's Two Roses (in 1870), which was followed by his powerful impersonation of Mathias in The Bells (founded on Erckmann-Chatrian's Polish Jew). His next noteworthy parts were Charles I., Eugene Aram, and Richelieu, in the plays so named. In 1874, at the Lyceum Theatre, he sustained the part of Hamlet so successfully as to raise himself to the first place among English actors. His chief Shaksperian parts subsequently played are Macbeth, Othello, Shylock, and Richard III. In 1878 he leased the Lyceum Theatre for himself, and has since put on the stage in excellent style Othello, The Merchant of Venice, Much Ado About Nothing, Romeo and Juliet, Twelfth Night, Faust, Macbeth, &c., playing in them the principal character along with Miss Ellen Terry. His appearances in the provinces have been equally successful with those in London, and he has met with like favour in his repeated visits to the United States. Of his more recent rôles we may mention Becket in Tennyson's play of that name (1893), King Arthur in a play of that name (1895), Napoleon in Madame Sans-Gêne (1897), the title rôle in his son's play of Peter the Great (1898), and Robespierre in a play of that name (1899) specially written for him by M. Victorien Sardou. He has contributed a few papers to the magazines on subjects connected with his art, and has delivered addresses at Oxford and Harvard Universities. He was knighted in 1895, and in 1898 Cambridge University conferred on him the honorary degree of LL.D. In 1892 a number of his addresses were collected and published under the title of The Drama.

ISABELLA II., ex-queen of Spain, daughter of Ferdinand III., was born in 1830, and succeeded her father three years after, her mother being appointed queen-regent. The early years of her reign were disturbed by a rising in favour of her uncle, Don Carlos, who, if the Salic law had not been set aside, would have ascended the throne instead of her; but this was finally quelled in 1839. She was declared of age in 1843, and in 1846 was married to her cousin, Don Francisco d'Assisi. Her reign was so despotic that a revolution took place in 1868, which drove her from the country. She resigned her claims to the crown in favour of her son Alfonso, who ascended the throne in 1875. She lives sometimes in Spain, sometimes in Paris. See SPAIN.

ISCHIUM, the inferior posterior part of the pelvic arch in vertebrates; a part of the hip-bone. See PELVIS.

ISHIM, a river of Western Siberia, a left-bank tributary of the Irtish. It rises in the government of Akmolinsk, and flows first west and then north-north-east, joining the Irtish after a course of over 1000 miles. It is of very little use for navigation, and is poor in fish.

ISIS, a name of comparatively modern origin given to the upper part of the river Thames, before its junction with the Thame. It is applied to the river especially in the neighbourhood of Oxford. There is an erroneous notion current that the name *Thames* is a compound *Thame* and *Isis*.

ISLA DE PINOS ('Isle of Pines'), an island lying south of the western portion of Cuba, to which it belongs. It is 40 miles by 34, and has good pastures and valuable timber. It has also quarries of marble, and iron, silver, and other metals are found in it.

ISLE OF PINES, a small island in the Pacific, south-east of New Caledonia, of which it is a dependency. See CALEDONIA, NEW.

ISMID, IZMID, a town of Asia Minor, on the Sea of Marmora, 53 miles in a south-easterly direction from Constantinople, seat of a Greek metropolitan and an Armenian archbishop. It represents the ancient Nicomedia. It has railway communication with Scutari and Angora. Silk-weaving and the manufacture of pottery are the chief industries. Pop. 15,000.

ISNIK. See NICÆA.

ISOCHEIMAL LINES. See ISOTHERMAL LINES.

ISOCLINIC LINES. See ISOGONIC LINES.

ISONANDRA, a genus of trees belonging to the order Sapotaceæ, one species of which, *I. gutta*, is known as the gutta-percha tree. There are about seven other species, natives of India and Ceylon. See GUTTA-PERCHA.

ISSIK-KUL, ISSYK-KUL, a lake of Central Asia, in the Thian-Shan Highlands, between the Kungei Ala-Tau range on the north and the Terskei Ala-Tau on the south, included in the Russian province of Semirechensk, south of Lake Balkhash, about 110 miles long by 36 broad, with brackish water abounding in fish. It receives many streams, but is gradually decreasing in size. It drains intermittently westwards towards streams flowing to Lake Aral. It is about 5000 feet above sea-level.

ISSUE, in surgery, a sore intentionally made and kept open with the view of keeping up a discharge from the surface, so as to produce a degree of counter-irritation. Issues are principally had recourse to in treating diseases of joints, chronic diseases of bones, and also in cases where there is a tendency to determination of blood to the head. The usual method of establishing an issue is to make an incision through the skin, and then to introduce into it one or two medicated peas (or small wooden beads made for the purpose), so as to keep the sore open and induce suppuration. The foreign body is retained by means of adhesive plaster for three or four days, or until discharge has fairly commenced, and then the peas are removed and fresh ones introduced, the issue being thus kept open as long as may be deemed requisite. Issues may also be made by means of either the actual or potential cautery; the slough formed by the application is allowed to separate, and then the raw surface is dressed with some irritating ointment so as to keep it open. The *seton* (which see) is another form of issue.

ITRI, a town of South Italy, in the province of Caserta, 6 miles north-west of Gaeta, on a lofty hill. It has a ruined castle. The famous brigand known as Fra Diavolo was a native of Itri. Pop. 6375.

ITU, HITU, or YTU, a town of Brazil, in the province of Sao Paulo, on the Tiete. The surrounding district is very fertile. Pop. 6000.

ITURÆA, ITUREA, a district on the north of ancient Palestine, stretching north-eastward from Mount Hermon.

IULUS, a genus of *Myriapoda*, belonging to the order Chilognatha, including worm-like animals known as millipedes, allied to the centipedes. See MILLEPEDE in SUPP.

IVANOVO-VOZNESENSK, a town of Russia, in the government of Vladimir, an important centre of the Russian cotton manufacture, and hence styled 'the Russian Manchester'. Machinery and chemicals are also manufactured, and dyeing is carried on. Pop. (1897), 35,930.

IVORY, VEGETABLE. See IVORY-PALM below.

IVORY-PALM (*Phytelephas macrocarpa*), a low-growing, palm-like plant, of the order Pandanaceæ (screw-pine family), native of the warmer parts of South America. It has a creeping caudex or trunk, terminal pinnatifid leaves of immense size, male and female flowers on different plants, and fruit in the form of a cluster of drupes, weighing about 25 lbs. when ripe. Each drupe contains 6 to 9 seeds as large as a hen's egg, the albumen of which when ripe is close-grained and very hard, resembling the finest ivory in texture and colour. It is therefore often wrought into buttons, knobs for doors or drawers, umbrella handles, and other articles, and is called *Vegetable Ivory*. The seeds are also known as *Corozo-nuts*, and are imported in considerable quantities.

IXIA, a genus of plants of the Iris family (Iridaceæ), containing some twenty-five species, mostly natives of South Africa, and prized for their large and showy flowers. *I. viridiflora* has black-spotted, sea-green flowers. Other species are *I. crocata*, with spotted orange flowers; *I. crispa*, with variously coloured flowers and curled leaves; *I. grandiflora*, with very large flowers of dark purple colour; and *I. maculata*, with variously coloured, spotted flowers.

IXMIQUILPAN, a town of Mexico, in the state of Hidalgo, 80 miles north of the city of Mexico, with silver mines in its neighbourhood. Pop. 13,000.

IXTLE, a Mexican fibre obtained from species of the pine-apple and agave.

IZUCAR, or MATAMOROS IZUCAR, a town of Mexico, in the state of Puebla, 90 miles south-east of the capital, at the base of Popocatepetl, the centre of a rich sugar region. Iron and lead are found in the neighbourhood. It has railway communication with Puebla, Vera Cruz, and Mexico. Pop. 12,000.

J.

JAAL-GOAT (*Capra Jaala*), a species of goat found in Egypt, Abyssinia, and Mount Sinai.

JABALPUR, JUBBULPORE, a town of Hindustan, capital of Jabalpur district, Central Provinces, a modern town with wide and regular streets, an important railway-station and centre of trade, situated amidst rocks at an elevation of about 1500 feet above the level of the sea. It has a school of industry, in which large quantities of tents and carpets are made. Pop. in 1891, (with cantonment) 84,481; in 1901, 89,708. The district has an area of 3948 sq. miles, a pop. (1901) of 680,485. A division or commissionership of the Central Provinces has also the same name. It has an area of 19,040 sq. miles, a pop. (1891) of 2,375,642. It comprises the districts of Jabalpur, Sagar, Damoh, Seoni, and Mandla.

JABIRU, a name of wading birds of the crane kind, resembling the stork, and inhabiting South America, Africa, and Australia. The Brazilian species, *Myeteria americana*, is about 5 feet long. It is of a white colour except the head and neck,

which are bare and black. In West Africa is found *M. senegalensis*, and a third species, *M. australis*, inhabits Australia. The two latter are sometimes classed in a distinct genus, but all three are very similar to one another and to the true storks, from which they are distinguished mainly by the upward curve of the bill.

JABORANDI, a name for several drugs obtained from certain South American plants, especially from *Pilocarpus pinnatifolius*, a shrub of the rue family (Rutaceæ), the dried leaves or leaflets of which are also known as Jaborandi. Of these there are used in medicine an infusion, a tincture, and an extract, the active ingredient in which is an alkaloid called pilocarpine. The nitrate and the muriate of pilocarpine are also used in medicine, chiefly as an injection. This drug causes profuse sweating and flow of saliva, as well as an increase of certain other secretions, and it has been administered with success in dropsy, asthma, bronchitis, &c. Belladonna acts as an antidote to pilocarpine, and vice versa.

JACARANDA, a popular name of several South American trees belonging to the natural order Leguminosæ, yielding the fancy woods known as violet-wood, king-wood, and tiger-wood. A genus of tropical American trees is also called *Jacaranda*. It belongs to the natural order Bignoniaceæ, and contains about 30 species. The species have opposite, usually bipinnate leaves, and large blue or red flowers. *J. brasiliana* yields a wood known as jacaranda wood, or blue ebony. It is a very hard wood, capable of receiving a fine polish.

JACITARA-PALM (*Desmoncus macracanthus*), a palm found in the forests of the lowlands of the Amazon district in South America. It has a slender flexible stem, often 60 or 70 feet long, and various parts of it are used in various ways by the inhabitants of the districts where it is found.

JACK-BY-THE-HEDGE, a British plant. See ALLIARIA in SUPP.

JACKSON, a city of the United States, capital of Madison county, Tennessee, on the Forked Deer River, 150 miles W.S.W. of Nashville. It contains the South-western Baptist University, the West Tennessee College, a Female Institute, a public library, &c. There are railway works, foundries, woollen and flour mills, engine-works, ice-factories, &c., and a large trade in cotton. Pop. (1880), 5377; (1890), 10,039; (1900), 14,511.

JACMEL, a seaport in the republic of Hayti, on the south coast, 30 miles from Port-au-Prince. It exports coffee, cotton, logwood, &c. Pop. 6000. See HAYTI.

JACOBABAD, a town of Hindustan, the military and civil head-quarters of the Upper Sind frontier district, Bombay. Pop. (1896), 12,396, including cantonment.

JACOBEAN ARCHITECTURE, a term applied to the later style of Elizabethan architecture from its prevailing in the time of James I. (L. *Jacobus*, James). It differed from the pure Elizabethan chiefly in having a greater admixture of debased Italian forms. See ARCHITECTURE.

JAFFNA, or JAFNAPATAM, a town of Ceylon, in the extreme north, on a small island separated from Ceylon by a narrow channel, which becomes at times almost dry. In has broad and regular streets, planted with lines of trees. When Ceylon was in possession of the Dutch, Jaffna was one of the most important settlements, and it is still thoroughly Dutch in its architecture and aspects. There are still a considerable number of inhabitants of Dutch descent, but the greater number are Tamils and Moors. There is here a fort containing some excellent buildings, a residence for the commandant, an old church, a college established in 1872, and a public library. Jaffna is a busy place, the inhabitants being very industrious, and engaged in commerce, in weaving cottons, in fishing, and in extracting cocoa-nut oil; the goldsmiths are also very skilful workmen. Pop. (1891), 43,092; (1901), 33,860.

JAGGANNÂTHA, more correct form of Juggernauth (which see).

JAGHIRE, in Hindustan, an assignment of the government share of the produce of a portion of land to an individual, either personal or for the support of a public establishment.

JAINTIA HILLS, a collection of hills in Assam. The district known as Khasi and Jaintia Hills has an area of 6041 square miles and a population (1891) of 197,904.

JAISALMER, or JEYSULMEER. See JESSULMEER.

JAJPUR, JAJPORE, town of Hindustan, on the Baitarani, in Cuttack district, Bengal. It is held in considerable sanctity among the Brahmans, who celebrate an annual fair in honour of the 'Goddess of the Waters' of Hindu mythology. Pop. (1891), 11,992.

JALALPUR, a town of Hindustan, in Gujrat district, Punjab, with a government school and a shawl manufacture. Pop. (1891), 11,065.—Another town of the same name, in the Multan district of the Punjab, has a pop. (1891) of 3884.

JALANDHAR, or JULLUNDUR, a town of Hindustan, head-quarters of district of same name, in the Punjab. It has a good trade, a military cantonment, an excellent American Presbyterian mission school, &c. Pop. with cantonment (1901), 67,735.—The district, in a division of the same name, a fertile tract between the Sutlej and the Beas, has an area of 1433 square miles, a pop. (1891), of 907,583.—The division has an area of 13,251 square miles; pop. (1891), 2,682,272. It comprises the districts of Jalandhar, Hoshiarpur, and Kangra.

JALAUN, a town of India, in a district of the same name in the United Provinces of Agra and Oudh, 110 miles S.E. of Agra, in a swampy and unhealthy locality. Pop. (1891), 8159.—The district is in the Allahabad division, and consists of a plain west of the Jumna; area, 1480 square miles; pop. (1891), 396,361.

JALESAR, a town of Hindustan, in Etah district, United Provinces, in the Doab plain. Pop. (1891), 13,420.

JALISCO, or GUADALAJARA, a state of Mexico, bounded on the west by the Pacific and on other sides by the states of Sinaloa, Durango, Zacatecas, Aguas Calientes, San Luis Potosi, Guanajuato, Michoacan, and Colima; area, 31,846 square miles. It is partly mountainous and partly level, well watered and well wooded, and possesses a healthy climate. Agriculture is vigorously pursued, the produce being grain, cotton, cochineal, and vanilla. Sugar, cotton, and tobacco are also cultivated. Mining for gold, silver, and copper is also carried on to some extent. Woollens, cottons, leather goods, &c., are manufactured. The capital is Guadalajara. Pop. (1895), 1,107,227

JALPAIGURI, a town of Hindustan, head-quarters of district of same name, in Bengal, on the Teesta. It was formerly a cantonment town. Pop. (1891), 9682.—The district is in the Rajshahi division, and lies south of Bhutan and north of Kuch Behar. It has a fertile soil. Rice is the chief crop, and there are few towns or manufactures of importance. Area, 2962 square miles; pop. (1891), 681,352.

JALUIT, or JALUT, capital of the Marshall Islands, standing on an atoll of the same name. The island is 38 miles long, N.N.W. to S.S.E., by 22

broad, E. to W. The town of Jaluit is the seat of the German imperial commissioner, and carries on considerable trade, especially in copra.

JAMALPUR, a town of Hindustan, in Monghyr district, Bengal, with large workshops belonging to the East India Railway Company. Pop. (1891), 18,089.—There is also a town of this name in Maimansingh district, Bengal, on the Brahmaputra. Up till the beginning of the Mutiny it was a military station. Pop. (1891), 15,388.

JAMES, HENRY, American novelist and essayist, was born at New York on April 15, 1843. He was the son of an American clergyman, Henry James (1811–82), who gained some fame as a writer on philosophico-theological subjects, first from the Sandemanian, and afterwards from the Swedenborgian stand-point. The novelist, who was known until his father's death as Henry James, Junior, was educated under his father's guidance in New York, Geneva, Paris, and Boulogne. He lived in Europe with his parents during the years 1855–59, and after his return to the United States he studied in the Harvard law school in 1862. He began his literary career about 1865 as a contributor to American magazines, and soon afterwards published The Story of a Year, a tale of the American Civil War. In 1869 he took up his residence in Europe. Since then he has resided chiefly in England and Italy, of late years mainly in London. Roderick Hudson, published in 1875, was his first long novel. His subsequent novels include: Watch and Ward (1878), originally published in 1871 in the Atlantic Monthly; The American (1877), by some regarded as his best; Daisy Miller (1878); The Europeans: a Sketch (1878); Confidence (1880); Washington Square (1880); A Bundle of Letters (1880); Diary of a Man of Fifty (1880); The Portrait of a Lady (1881); The Bostonians (1886); Princess Casamassima (1886); The Tragic Muse (1892); The Other House (1896); The Spoils of Poynton (1897); What Maisie Knew (1897); and The Awkward Age (1899). He has also written a great many short stories, among which are: A Passionate Pilgrim, and other Tales (1875); Pension Beaurepas (1878); An International Episode (1879); The Madonna of the Future, and other Tales (1879); The Siege of London (1883); The Point of View (1883); Tales of Three Cities (1884); The Author of Beltraffio, and other Stories (1885); Stories Revived (1885); The Aspern Papers, and other Stories (1888); A London Life, and other Stories (1889); The Lesson of the Master, and other Stories (1892); The Real Thing, and other Tales (1893); The Private Life (1893), a collection of stories; The Album (1894); The Reprobate (1894); Tenants (1894); Disengaged (1894); Terminations, and other Stories (1896); In a Cage (1898); The Two Magics (1898), consisting of two stories; and The Soft Side (1900), a series of stories. In most of his stories Mr. James describes the life of Americans in Europe, and they depend for much of their interest upon the contrasts between American and European character and institutions. Though a very prolific novelist, he is never careless or slovenly, but his touch is always superficial. He has been called an episodist rather than a novelist, and his marked preference for what may be called the apparent faults of providence has been regarded as a blemish. In these limitations he stands in marked contrast with his fellow-countryman Mr. Howells, but he possesses an equally pleasant and felicitous style. A dramatic version of The American was produced in London in 1891, but neither it nor his subsequent play Guy Domville (1895) was successful. He has turned his intimate knowledge of modern French literature to good account in his volume of essays entitled French Poets and Novelists (1878). Other works of a similar kind are Transatlantic Sketches (1875); Portraits of Places (1884); A Little Tour in France (1884; new ed. 1900); Partial Portraits (1888); and Essays in London and Elsewhere (1893). The volume on Hawthorne (1879) in the English Men of Letters Series is from his pen.

JAMES BAY, the southern extension of Hudson's Bay, 350 miles long, named from Captain James, who wintered here in 1631–32 while trying to find the north-west passage. It has numerous rocks and islands, the largest of the latter being Agoomska and Charlton, and its navigation is dangerous. It is very shallow, except for a fairly wide channel leading down the centre to the mouth of the Moose river. The water is brackish.

JAMES'S FEVER POWDERS, a patent medicine, consisting of one part of oxide of antimony mixed with two of calcium phosphate. It was formerly much used to produce sweating.

JAMESTOWN, a city of the United States, in Chautauqua county, New York, on the navigable outlet of Chautauqua Lake, 70 miles S.W. of Buffalo by rail. The outlet from the lake provides water-power for the various manufactures, which include woollens, furniture, boilers, engines, boots and shoes, &c. Natural gas occurs not far from the town. Among the buildings and institutions are three libraries, an orphan asylum, a hospital, &c. Jamestown is a favourite holiday resort. Pop. (1880), 9357; (1890), 16,038; (1900), 22,892.

JAMMU, JAMU, or JUMMOO, a portion of Cashmere (which see).

JAMUNA, the name of several rivers of Northern India, the chief being the lower section of the Brahmaputra, and that which connects it directly with the Ganges. On it stands Sirajganj, in Pábna district, the chief mart for the agricultural produce of the district.

JANESVILLE, a city of the United States, capital of Rock county, Wisconsin, situated on both sides of the Rock River, 70 miles W.S.W. of Milwaukee, and about 90 miles N.W. of Chicago. The river, having been dammed back at various points, is of service in furnishing water-power. Boots and shoes, agricultural implements, carriages, cottons, &c., are manufactured, and agriculture and horse-breeding are extensively carried on in the district. It contains the Wisconsin School for the Blind. Pop. (1890), 10,836; (1900), 13,185.