Title: Encyclopaedia Britannica, 11th Edition, "Echinoderma" to "Edward, prince of Wales"

Author: Various

Release Date: January 17, 2011 [EBook #34992]

Language: English

Credits: Produced by Marius Masi, Don Kretz and the Online Distributed Proofreading Team at https://www.pgdp.net

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THE ENCYCLOPÆDIA BRITANNICA

A DICTIONARY OF ARTS, SCIENCES, LITERATURE AND GENERAL INFORMATION

ELEVENTH EDITION

VOLUME VIII SLICE X

Echinoderma to Edward

Articles in This Slice

ECHINODERMA.[1] The ἐχινόδερμα, or "urchin-skinned" animals, have long been a favourite subject of study with the collectors of sea-animals or of fossils, since the lime deposited in their skins forms hard tests or shells readily preserved in the cabinet. These were described during the 18th and first half of the 19th centuries by many eminent naturalists, such as J.T. Klein, J.H. Linck, C. Linnaeus, N.G. Leske, J.S. Miller, L. v. Buch, E. Desor and L. Agassiz; but it was the researches of Johannes Müller (1840-1850) that formed the groundwork of scientific conceptions of the group, proving it one of the great phyla of the animal kingdom. The anatomists and embryologists of the next quarter of a century confirmed rather than expanded the views of Müller. Thus, about 1875, the distinction of Echinoderms from such radiate animals as jelly-fish and corals (see Coelentera), by their possession of a body-cavity ("coelom") distinct from the gut, was fully realized; while their severance from the worms (especially Gephyrea), with which some Echinoderrns were long confused, had been necessitated by the recognition in all of a radial symmetry, impressed on the original bilateral symmetry of the larva through the growth of a special division of the coelom, known as the "hydrocoel," and giving rise to a set of water-bearing canals—the water-vascular or ambulacral system. There was also sufficient comprehension of the differences between the main classes of Echinoderms—the sea-urchins or Echinoidea, the starfish or Asteroidea, the brittle-stars and their allies known as Ophiuroidea, the worm-like Holothurians, the feather-stars and sea-lilies called Crinoidea, with their extinct relatives the sac-like Cystidea, the bud-formed Blastoidea, and the flattened Edrioasteroidea—while within the larger of these classes, such as Echinoidea and Crinoidea, fair working classifications had been established. But the study that should elucidate the fundamental similarities or homologies between the several classes, and should suggest the relations of the Echinoderma to other phyla, had scarcely begun. Indeed, the time was not ripe for such discussions, still less for the tracing of lines of descent and their embodiment in a genealogical classification. Since then exploring expeditions have made known a host of new genera, often exhibiting unfamiliar types of structure.

Among these the abyssal starfish and holothurians described by W.P. Sladen and H. Théel respectively, in the Report of the "Challenger" Expedition, are most notable. The sea-urchins, ophiuroids and crinoids also have yielded many important novelties to A. Agassiz ("Challenger," "Blake," and "Albatross" Expeditions), T. Lyman ("Challenger"), Sladen ("Astrophiura," *Ann. Mag. Nat. Hist.*, 1879), F.J. Bell (numerous papers in *Ann. Mag. Nat. Hist.* and in *Proc. Zool. Soc.*), E. Perrier ("Travailleur" and "Talisman," Cape Horn and Monaco Expeditions), P.H. Carpenter "Challenger" Reports), and others. The anatomical researches of these authors, as well as those of S. Lovén ("On Pourtalesia" and "Echinologica," published by the Swedish Academy of Science), H. Ludwig (*Morphologische Studien*, Leipzig, 1877-1882), O. Hamann (*Histologie der Echinodermen*, Jena, 1883-1889), L. Cuénot ("Études morphologiques," *Arch. Biol.*, 1891, and papers therein referred to), P.M. Duncan ("Revision of the Echinoidea," *Journ. Linn. Soc.*, 1890), H. Prouho ("Sur Dorocidaris," *Arch. Zool. Exper.*, 1888), and many more, need only be mentioned to recall the great advance that has been made. In physiology may be instanced W.B. Carpenter's proof of the nervous nature of the chambered organ and axial cords of crinoids (*Proc. Roy. Soc.*, 1884), the researches of H. Durham (*Quart. Journ. Micr. Sci.*, 1891) and others into the wandering cells of the body-cavity, and the study of the

deposition of the skeletal substance (“stereom”) by Théel (in *Festskrift för Lilljeborg*, 1896). Knowledge of the development has been enormously extended by numerous embryologists, *e.g.* Ludwig (*op. cit.*), E.W. MacBride (“Asterina gibbosa,” *Quart. Journ. Micr. Sci.*, 1896), H. Bury (*Quart. Journ. Micr. Sci.*, 1889, 1895), Seeliger (on “Antedon,” *Zool. Jahrb.*, 1893), S. Goto (“Asterias pallida,” *Journ. Coll. Sci. Japan*, 1896), C. Grave (“Ophiura,” *Mem. Johns Hopkins Univ.*, 1899), Théel (“Echinocyamus,” *Nov. Act. Soc. Sci. Upsala*, 1892), R. Semon (“Synapta,” *Jena. Zeitschr.*, 1888), and Lovén (*opp. citt.*); and though the theories based thereon may have been fantastic and contradictory, we are now near the time when the results can be co-ordinated and some agreement reached. But the scattered details of comparative anatomy are capable of manifold arrangement, while the palimpsest of individual development is not merely fragmentary, but often has the fragments misplaced. The morphologist may propose classifications, and the embryologist may erect genealogical trees, but all schemes which do not agree with the direct evidence of fossils must be abandoned; and it is this evidence, above all, that gained enormously in volume and in value during the last quarter of the 19th century. The Silurian crinoids and cystids of Sweden have been illustrated in N.P. Angelin’s *Iconographia crinoideorum* (1878); the Palaeozoic crinoids and cystids of Bohemia are dealt with in J. Barrande’s *Système silurien* (1887 and 1899); P.H. Carpenter published important papers on fossil crinoids in the *Journal* of the Geological Society, on Cystidea in that of the Linnean Society, 1891, and, together with R. Etheridge, jun., compiled the large *Catalogue of Blastoidea in the British Museum*, 1886; O. Jaekel, in addition to valuable studies on crinoids and cystids appearing in the *Zeitschrift* of the German Geological Society, has published the first volume of *Die Stammesgeschichte der Pelmatozoen* (Berlin, 1899), a richly suggestive work; the Mesozoic Echinoderms of France, Switzerland and Portugal have been made known by P. de Loriol, G.H. Cotteau, J. Lambert, V. Gauthier and others (see *Paléontologie française*, *Mém. Soc. paléontol. de la Suisse*, *Trabalhos Comm. Geol. Portugal*, &c.); a beautiful and interesting Devonian fauna from Bundenbach has been described by O. Follmann, Jaekel, and especially B. Stürtz (see *Verhandl. nat. Vereins preuss. Rheinlande, Paläont. Abhandl.*, and *Palaeontographica*); while the multitude of North American palaeozoic crinoids has been attacked by C. Wachsmuth and F. Springer in the *Proceedings* (1879, 1881, 1885, 1886), of the Philadelphia Academy and the *Memoirs* (1897) of the Harvard Museum.

The vast mass of material made known by these and many other distinguished writers has to be included in our classification, and that classification itself must be controlled by the story it reveals. Thus it is that a change, characteristic of modern systematic zoology, is affecting the subdivisions of the classes. It is not long since the main lines of division corresponded roughly to gaps in geological history: the orders were Palaeocrinoidea and Neocrinoidea, Palechinoidea and Euechinoidea, Palaeasteroidea and Euasteroidea, and so forth. Or divisions were based upon certain modifications of structure which, as we now see, affected assemblages of diverse affinity: thus both Blastoidea and Euechinoidea were divided into Regularia and Irregularia; the Holothuroidea into Pneumophora and Apneumona; and Crinoids were discussed under the heads “stalked” and “unstalked.” The barriers between these groups may be regarded as horizontal planes cutting across the branches of the ascending tree of life at levels determined chiefly by our ignorance; as knowledge increases, and as the conception of a genealogical classification gains acceptance, they are being replaced by vertical partitions which separate branch from branch. The changes may be appreciated by comparing the systematic synopses at the end of this article with the classification adopted in 1877 in the 9th edition of the *Ency. Brit.* (vol. vii.), or in any zoological text-book contemporary therewith. In the present stage of our knowledge these minor divisions are the really important ones. For, whereas to one brilliant suggestion of far-reaching homology another can always be opposed, by the detailed comparison of individual growth-stages in carefully selected series of fossils, and by the minute application to these of the principle that individual history repeats race history, it actually is possible to unfold lines of descent that do not admit of doubt. The gradual linking up of these will manifest the true genealogy of each class, and reconstruct its ancestral forms by proof instead of conjecture. The problem of the interrelations of the classes will thus be reduced to its simplest terms, and even questions as to the nature of the primitive Echinoderm and its affinity to the ancestors of other phyla may become more than exercises for the ingenuity of youth. Work has been and is being done by the laborious methods here alluded to, and though the diversity of opinion as to the broader groupings of classification is still restricted only by the number of writers, we can point to an ever-increasing body of assured knowledge on which all are agreed. Unfortunately such allusion to these disconnected certainties as alone might be introduced here would be too brief for comprehension, and we are forced to select a few of the broader hypotheses for a treatment that may seem dogmatic and prejudiced.

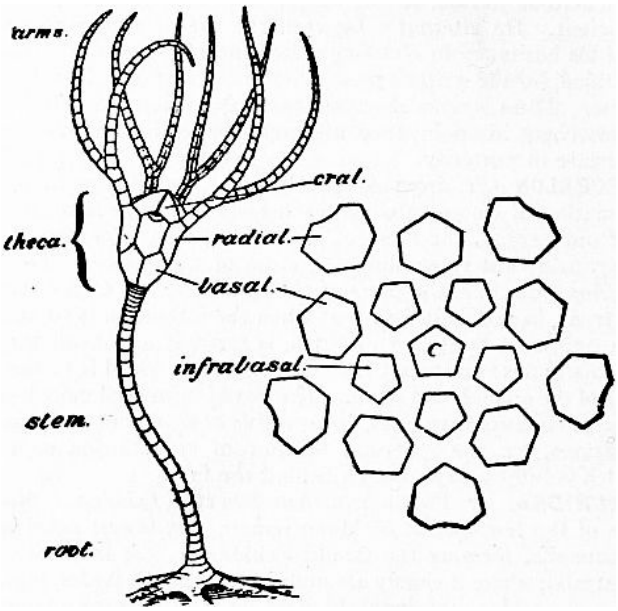


FIG. 1.—Diagram of a simple form of Crinoid, with five arms, each forking once; the one nearest the observer is removed to expose the tegmen of five orals. This crinoid has only two circlets of plates in the cup, but the cup analysed in the adjoining diagram has in addition infrabasals and a centrale *C.*

Calycinal Theory.—The theory which had most influence on the conceptions of Echinoderms in the two concluding decades of the 19th century was that of Lovén, elaborated by P.H. Carpenter, Sladen and others. This, which may be called the *calycinal* theory, will be appreciated by comparing the structure of a simple crinoid with that of some other types. A crinoid reduced to its simplest elements consists of three principal portions—(i.) a theca or test enclosing the viscera; (ii.) five arms stretching upwards or outwards from the theca, sometimes single, sometimes branching; (iii.) a stem stretching downwards from the theca and attaching it to the sea-floor (see fig. 1). That part of the theca below the origins of the free arms is called the "dorsal cup"; the ventral part above the origins of the arms, serving as cover to the cup, is known as the "tegmen." All these parts are supported by plates or ossicles of crystalline carbonate of lime. The cup, in its simplest form, consists of two circlets of five plates. Each plate of the upper circlet supports an arm, and is called a "radial"; the plates of the lower circlet, the "basals," rest on the stem and alternate with those of the upper circlet, *i.e.* are interradial in position. Some crinoids have yet another circlet below these, the constituent plates of which are called "infrabasals," and are situated radially. The tegmen in most primitive forms, as well as in the embryonic stages of the living *Antedon* (fig. 2), consists of five large triangular plates, alternating with the radials, and called "orals," because they roof over the mouth. In addition to these three or four circlets of plates, two other elements were once supposed essential to the ideal crinoid: the dorso-central and the oro-central. The former term was applied to a flattened plate observed in the embryonic stage of a single genus (*Antedon*) at that end of the stem attached to the sea-floor, and comparable to the foot of a wine-glass (fig. 2). In some crinoids which have no trace of a stem (*e.g. Marsupites*) a pentagonal plate is found at the bottom of the cup, where the stem would naturally have arisen ("centrale" in fig. 1); and since it was believed that the stem always grew by addition of ossicles immediately below the infrabasals, it was inferred that this pentagonal plate was the centro-dorsal in its primitive position, as though the wine-glass had been evolved from a tumbler by pulling the bottom out to form the foot. The oro-central was, it must be admitted, a theoretical conception due to a desire for symmetry, and was not confirmed by anything better than some erroneous observations on certain fossils, which were supposed to show a plate at the oral pole between the five orals; but this plate, so far as it exists at all, is now known to be nothing but an oral shifted in position. The theory was that all the plates just described, and more particularly those of the cup, which were termed "the calycinal system," could be traced, not merely in all crinoids, but in all Echinoderms, whether fixed forms such as cystids and blastoids, or free forms such as ophiuroids and echinoids, even—with the eye of faith—in holothurians. It was admitted that these elements might atrophy, or be displaced, or be otherwise obscured; but their complete and symmetrical disposition was regarded as typical and original. Thus the genera exhibiting it were regarded as primitive, and those orders and classes in which it was least obscured were supposed to approach most nearly the ancestral Echinoderm. Every one knows that an "apical system," composed of two circlets known as "genitals" or basals and "oculars" or radials, occurs round the aboral pole of echinoids (fig. 3, A), and that a few genera (*e.g. Salenia*, fig. 3, B) possess a sub-central plate (the "suranal"), which might be identified with the centro-dorsal. It is also the case that many asterids (fig. 3, D) and ophiurids (fig. 3, C) have a similar arrangement of plates on the dorsal (*i.e.* aboral) surface of the disk. Accepting the homology of these apical systems with the calycinal system, the theory would regard the aboral pole of a sea-urchin or starfish as corresponding in everything, except its relations to the sea-floor, with the aboral pole of a fixed echinoderm.

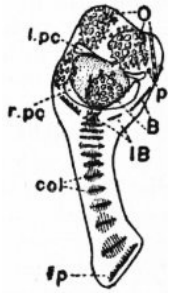


FIG. 2.—An early stage in the development of *Antedon*, showing the foot-plate or "dorso-central" *fp* at the end of the stem *col.* Some of the thecal plates, infrabasals *I B*, basals *B*, and orals *O* are forming around the body-cavities *r.pc* and *l.pc*; *p* is the water-pore. (After Seeliger.)

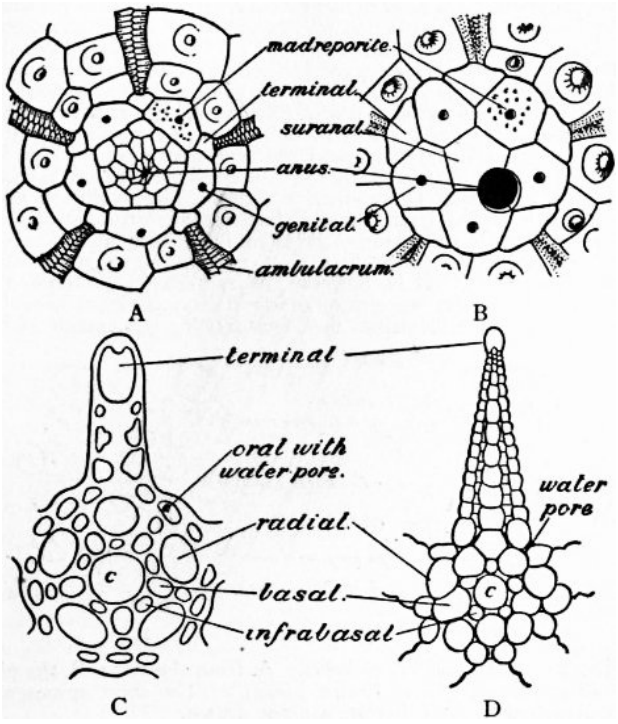


FIG. 3.-Supposed calycinal systems of free-moving Echinoderms. A, regular sea-urchin (*Cidaris*); B, sea-urchin with a suranal plate (*Salenia*); C, developing ophiurid (*Amphiura*); D, young starfish (*Zoroaster*).

The theory has been vigorously opposed, notably by Semon (*op. cit.*), who saw in the holothurians a nearer approach to the ancestral form than was furnished by any calyculate echinoderm, and by the Sarasins, who derived the echinoids from the holothurians through forms with flexible tests (*Echinothuridae*, which, however, are now known to be specialized in this respect). The support that appeared to be given to the theory by the presence of supposed calycinal plates in the embryo of echinoids and asteroids has been, in the opinion of many, undermined by E.W. MacBride (*op. cit.*), who has insisted that in the fixed stage of the developing starfish, *Asterina*, the relations of these plates to the stem are quite different from those which they bear in the developing and adult crinoid. But, however correct the observations and the homologies of MacBride may be, they do not, as Bury (*op. cit.*) has well pointed out, afford sufficient grounds for his inference that the abactinal (*i.e.* aboral) poles of starfish and crinoids are not comparable with one another, and that all conclusions based on the supposed homology of the dorso-central of echinoids and asteroids with that of crinoids are incorrect. Bury himself, however, has inflicted a severe blow on the theory by his proof that the so-called oculars of Echinoidea, which were supposed to represent the radials, are homologous with the “terminals” (*i.e.* the plates at the tips of the rays) in Asteroidea and Ophiuroidea, and therefore not homologous with the radially disposed plates often seen around the aboral pole of those animals. For, if these radial constituents of the supposed apical system in an ophiurid have really some other origin, why can we not say the same of the supposed basals? Indeed, Bury is constrained to admit that the view of Semon and others may be correct, and that these so-called calycinal systems may not be heirlooms from a calyculate ancestor, but may have been independently developed in the various classes owing to the action of similar causes. That this view must be correct is urged by students of fossils. Palaeontology lends no support to the idea that the dorso-central is a primitive element; it exists in none of the early echinoids, and the suranal of *Saleniidae* arises from the minor plates around the anus. There is no reason to suppose that the central apical plate of certain free-swimming crinoids has any more to do with the distal foot-plate of the larval *Antedon* stem than has the so-called centro-dorsal of *Antedon* itself, which is nothing but the compressed proximal end of the stem. As for the supposed basals of Echinoidea, Asteroidea and Ophiuroidea, they are scarcely to be distinguished among the ten or more small plates that surround the anus of *Bothriocidaris*, which is the oldest and probably the most ancestral of fossil sea-urchins (fig. 5). A calycinal system may be quite apparent in the later Ophiuroidea and in a few Asteroidea, but there is no trace of it in the older Palaeozoic types, unless we are to transfer the appellation to the terminals. Those plates are perhaps constant throughout sea-urchins and starfish (though it would puzzle any one to detect them in certain Silurian echinoids), and they may be traced in some of the fixed echinoderms; but there is no proof that they represent the radials of a simple crinoid, and there are certainly many cystids in which no such plates existed. Lovén and M. Neumayr adduced the Triassic sea-urchin *Tiarechinus*, in which the apical system forms half of the test, as an argument for the origin of Echinoidea from an ancestor in which the apical system was of great importance; but a genus appearing so late in time, in an isolated sea, under conditions that dwarfed the other echinoid dwellers therein, cannot seriously be thought to elucidate the origin of pre-Silurian Echinoidea, and the recent discovery of an intermediate form suggests that we have here nothing but degenerate descendants of a well-known Palaeozoic family (*Lepidocentridae*). But to pursue the tale of isolated instances would be wearisome. The calycinal theory is not merely an assertion of certain homologies, a few of which might be disputed without affecting the rest: it governs our whole conception of the echinoderms, because it implies their descent from a calyculate ancestor—not a “crinoid-phantom,” that bogey of the Sarasins, but a form with definite plates subject to a quinqueradiate arrangement, with which its internal organs must likewise have been correlated. To this ingenious and plausible theory the revelations of the rocks are more and more believed to be opposed.

Pentactaea Theory.—In opposition to the calycinal theory has been the *Pentactaea* theory of R. Semon. There have always been many zoologists prepared to ascribe an ancestral character to the holothurians. The absence of an apical system of plates; the fact that radial symmetry has not affected the generative organs, as it has in all other recent classes; the well-developed

muscles of the body-wall, supposed to be directly inherited from some worm-like ancestor; the presence on the inner walls of the body in the family *Synaptidae* of ciliated funnels, which have been rashly compared to the excretory organs (nephridia) of many worms; the outgrowth from the rectum in other genera of caeca (Cuvierian organs and respiratory trees), which recall the anal glands of the Gephyrean worms; the absence of podia (tube-feet) in many genera, and even of the radial water-vessels in *Synaptidae*; the absence of that peculiar structure known in other echinoderms by the names "axial organ," "ovoid gland," &c.; the simpler form of the larva—all these features have, for good reason or bad, been regarded as primitive. Some of the more striking of these features are confined to *Synaptidae*; in that family too the absence of the radial water-vessels from the adult is correlated with continuity of the circular muscle-layer, while the gut runs almost straight from the anterior mouth to the posterior anus. Early in the life-history of *Synapta* occurs a stage with five tentacles around the mouth, and into these pass canals from the water-ring, the radial canals to the body-wall making a subsequent, and only temporary, appearance (fig. 4). Semon called this stage the *Pentactula*, and supposed that, in its early history, the class had passed through a similar stage, which he called the *Pentactaea*, and regarded as the ancestor of all Echinoderms. It has since been proved that the five tentacles with their canals are interradial, so that one can scarcely look on the *Pentactula* as a primitive stage, while the apparent simplicity of the *Synaptidae*, at least as compared with other holothurians, is now believed to be the result of regressive changes. The *Pentactaea*, at all events as it sprang from the brain of Semon, must pass to the limbo of mythological ancestors.

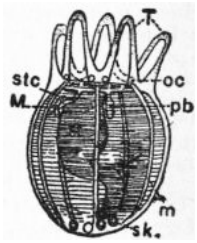


FIG. 4.—The *Pentactula* stage in the development of *Synapta*.

T, The five interradial tentacles.
M, The water-pore, leading by the stone-canal *stc* to the water-ring, from which hangs a Polian vesicle *pb*.
oc, Supposed otocysts.
m, Longitudinal muscles.
sk, Calcareous spicules.
st, Stomach.
(After Semon.)

Pelmatozoic Theory.—The rejection of the calycinal and *Pentactaea* theories need not scatter our conceptions of Echinoderm structure back into the chaos from which they seemed to have emerged. The idea of a calyculate ancestor, though by no means connoting fixation, turned men's minds in the direction of the fixed forms, simply because in them the calyx was best developed. The *Pentactaea* again suggested a search for some primitive type in which quinqueradiate symmetry was exhibited in circumoral appendages, but had not affected the nervous, water-vascular, muscular or skeletal systems to any great extent, and the generative organs not at all. Study of the earliest larval stages has always led to the conclusion that the Echinoderms must have descended from some freely-moving form with a bilateral symmetry, and, connecting this with the ideas just mentioned, we reach the conception that this supposed bilateral ancestor (or *Dipleurula*) may have become fixed, and may have gradually acquired a radial symmetry in consequence of its sedentary mode of life. The different extent of quinqueradiate symmetry in the different classes would thus depend on the period at which they diverged from the sedentary stock. The tracing of this history, and the explanation of the general characters of Echinoderms and of the differentiating features of the classes in accordance therewith, constitutes the *Pelmatozoic* theory.

The word "Pelmatozoa" literally means "stalked animals," but the name is now used to denote all Cystidea, Blastoidea, Crinoidea and Edrioasteroidea, as opposed to the other classes, which may be called Eleutherozoa. Many Pelmatozoa have, it is true, no stalk, while some are freely-moving, but all agree in the possession of certain characters obviously connected with a fixed mode of life. Thus, the mouth is central and turned away from the sea-floor; the animal does not seize its food by tentacles, limbs or jaws, neither does it move in search of it, but a series of ciliated grooves which radiate from the mouth sweep along currents of water, in the eddies of which minute food-particles are caught up and carried down into the gullet; the undigested food is driven out through an anus which is on the upper or oral side of the theca, but as far distant as practicable from the mouth and ciliated grooves. Such characters are found in any primitive, sedentary group. More peculiarly Echinoderm features, in which the Pelmatozoan nature is manifest, are the enclosing of the viscera in a calcified and plated theca, for protection against those enemies from which a fixed animal cannot flee; the development, at the aboral pole of this theca, of a motor nerve-centre giving off branches to the stroma connecting the various plates of the theca and of its brachial, anal, and columnar extensions, and thus co-ordinating the movements of the whole skeleton; the absence of suckers from the podia, which, when present, are respiratory, not locomotor, in function. There are other features of most, if not all, Pelmatozoa that appear to be due to a fixed existence; but those are also found in the Eleutherozoa. The Pelmatozoic theory thus regards the Pelmatozoa as the more ancestral forms, and the Pelmatozoan stage as one that must have been passed through by all Echinoderms during their evolution from the *Dipleurula*. It might be possible to prove the origin of all classes from Pelmatozoa, without thereby explaining the origin of such fundamental features as radial symmetry, the developmental metamorphosis, and the torsion that affects both gut and body-cavities during that process; but the acceptance of a *Dipleurula* as the common ancestor necessitates an explanation of these features. Such explanation is an integral part of the Pelmatozoic theory, but is provided by no other.

The evidence for the Pelmatozoic theory is supplied by palaeontology, embryology, the comparative anatomy of the classes, and a consideration of other phyla. Palaeontology, so far as it goes, is a sure guide, but some of the oldest fossiliferous rocks yield remains of distinctly differentiated crinoids, asteroids and echinoids, so that the problem is not solved merely by collecting fossils. Two lines of argument appear fruitful. First, a comparison of the relative numbers of the representatives of the various classes at different epochs; according to this they may be placed in the following order, with the oldest first: Cystidea, Crinoidea, Blastoidea, Asteroidea, Ophiuroidea, Echinoidea. As for Holothuroidea, the fossil evidence allows us to say no more than that the class existed in early Carboniferous times, if not before. The second method is to work out by slow and sure steps the lines of descent of the different families, orders, and classes, and so either to arrive at the ancestral form of each class, or to plot out the curve of evolution, which may then legitimately be projected into "the dark backward and abysm of time." In this way the many highly modified orders of Cystidea may be traced back to a simple, many-plated ancestor with little or no radiate symmetry (see below). All the complicated structures of Blastoidea are evolved from a fairly simple type, which in its

turn is linked on to one of the cystid orders. That the crinoids are all deducible from some such simple form as that above described under the head “calycinal theory,” is now generally admitted. Although, in the extreme correlation of the radial food-grooves, nerves, water-vessels, and so forth, with a radiate symmetry of the theca, such a type differs from the Cystidea, while in the possession of jointed processes from the radial plates, bearing the grooves and the various body-systems outwards from the theca, it differs from all other Echinoderms, nevertheless ancient forms are known which, if they are not themselves the actual links, suggest how the crinoid type may have been evolved from some of the more regular cystids. The fourth class of Pelmatozoa—the Edrioasteroidea—differs from the others in the structure of its ambulacra. As in all Pelmatozoa these seem to have borne ciliated food-grooves protected by movable covering-plates (fig. 11). Beneath each food-groove was a radial water-vessel and probably a nerve and blood-vessel, all which structures passed either between certain regularly arranged thecal plates, or along a furrow floored by those plates, which were then in two alternating series. The important and distinctive feature is the presence of pores between the flooring-plates, on either side of the groove; and these, we cannot doubt, served for the passage of podia. Thus in a highly developed edrioasteroid, such as *Edrioaster* itself (fig. 11), there was a true ambulacrum, apparently constructed like that of a starfish, but differing in the possession of a ciliated food-groove protected by covering-plates. The simpler forms of Edrioasteroidea, with their more sac-like body and undifferentiated plates, may well have been derived from early Cystidea of yet simpler structure, and there seems no reason to follow Jaekel in regarding the class as itself the more primitive. Turning to fossil Asteroidea, we find the earlier ophiurids scarcely distinguishable from the asterids, while in the alternation of the ambulacrals, which undoubtedly correspond to the flooring-plates of *Edrioaster*, both groups approach the Pelmatozoan type. These facts have been expressed by Sturtz in his names Encrinasteriae and Ophio-encrinasteriae. There is no difficulty in deducing the highly differentiated asterids and ophiurids of a later day from these simpler types. The evolution of the modern Echinoidea from their Palaeozoic ancestors is also well understood, but in this case the ancestral form to which the palaeontologist is led does not at first sight present many resemblances to the Pelmatozoa. It is, however, characterized by simplicity of structure, and a short description of it will serve to clear the problem from unnecessary difficulties. *Bothriocidaris* (fig. 5), a small echinoid from the Ordovician rocks of Esthonia, is in essential structure just the form demanded by comparative palaeontology to make a starting-point. It is spheroidal, with the mouth and anus at opposite poles; there are five ambulacra, and the ambulacral plates are large, simple and alternating, each being pierced by two podial pores which lie in a small oval depression; the ambulacrals next the mouth form a closed ring of ten plates; the interambulacrals lie in single columns between the ambulacra, and are separated from the mouth-area by the proximal ambulacrals just mentioned, and sometimes by the second set of ambulacrals also; the ambulacra end in the five oculars or terminals, which meet in a ring around the anal area and have no podial pores, but one of them serves as a madreporite; within this ring is a star-shaped area filled with minute irregular plates, none of which can safely be selected as the homologues of the so-called basals or genitals of later forms; within the ring of ambulacrals around the mouth are five somewhat pointed plates, which Jaekel regards as teeth, but which can scarcely be homologous with the interradially placed teeth of later echinoids, since they are radial in position; small spines are present, especially around the podial pores. The position of the pores near the centre of the ambulacrals in *Bothriocidaris* need not be regarded as primitive, since other early Palaeozoic genera, not to mention the young of living forms, show that the podia originally passed out between the plates, and were only gradually surrounded by their substance; thus the original structure of the echinoid ambulacra differed from that of the early asteroid in the position of the radial vessels and nerves, which here lie beneath the plates instead of outside them. To this point we shall recur; palaeontology, though it suggests a clue, does not furnish an actual link either between Echinoidea and Asteroidea, or between those classes and Pelmatozoa.

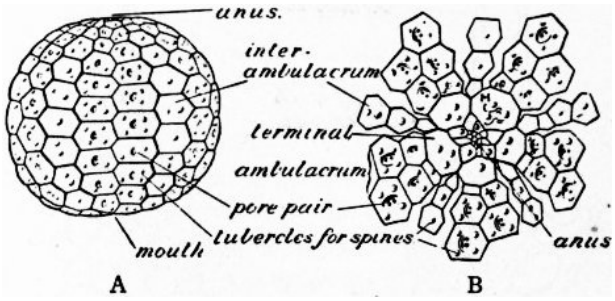


FIG. 5.—*Bothriocidaris globulus.* A, from the side; B, the plates around the aboral pole. (After Jaekel.) The short spines which were attached to the tubercles are not drawn.

The argument from embryology leads further back. First, as already mentioned, it outlines the general features of the *Dipleurula*; secondly, it indicates the way in which this free-moving form became fixed, and how its internal organs were modified in consequence; but when we seek, thirdly, for light on the relations of the classes, we find the features of the adult coming in so rapidly that such intermediate stages as may have existed are either squeezed out or profoundly modified. The difficulty of rearing the larvae in an aquarium towards the close of the metamorphosis may account for the slight information available concerning the stages that immediately follow the embryonic. Another difficulty is due to the fact that the types studied, and especially the crinoid *Antedon*, are highly specialized, so that some of the embryonic features are not really primitive as regards the class, but only as regards each particular genus. Thus inferences from embryonic development need to be checked by palaeontology, and supplemented by comparison of the anatomy of other living genera.

Minute anatomical research has also aided to establish the Pelmatozoic theory by the gradual recognition in other classes of features formerly supposed to be confined to Pelmatozoa. Thus the elements of the Pelmatozoan ventral groove are now detected in so different a structure as the echinoid ambulacrum, while an aboral nervous system, the diminished representative of that in crinoids, has been traced in all Eleutherozoa except Holothurians. The broader theories of modern zoology might seem to have little bearing on the Echinoderma, for it is not long since the study of these animals was compared to a landlocked sea

undisturbed by such storms as rage around the origin of the Vertebrata. This, however, is no more the case. The conception of the *Dipleurula* derives its chief weight from the fact that it is comparable to the early larval forms of other primitive coelomate animals, such as *Balanoglossus*, *Phoronis*, Chaetognatha, Brachiopoda and Bryozoa. So too the explanation of radial symmetry and torsion of organs as due to a Pelmatozoic mode of life finds confirmation in many other phyla. Instead of discussing all these questions separately, with the details necessary for an adequate presentation of the argument, we shall now sketch the history of the Echinoderms in accordance with the Pelmatozoic theory. Such a sketch must pass lightly over debatable ground, and must consist largely of suggestions still in need of confirmation; but if it serves as a frame into which more precise and more detailed statements may be fitted as they come to the ken of the reader, its object will be attained.

Evolution of the Echinoderms.—It is reasonable to suppose that the Coelomata—animals in which the body-cavity is divided into a gut passing from mouth to anus and a hollow (coelom) surrounding it—were derived from the simpler Coelentera, in which the primitive body-cavity (archenteron) is not so divided, and has only one aperture serving as both mouth and anus. We may, with Sedgwick, suppose the coelom to have originated by the enlargement and separation of pouches that pressed outwards from the archenteron into the thickened body-wall (such structures as the genital pouches of some Coelentera, not yet shut off from the rest of the cavity), and they would probably have been four in number and radially disposed about the central cavity. The evolution of this cavity into a gut is foreshadowed in some Coelentera by the elliptical shape of the aperture, and by the development at its ends of a ciliated channel along which food is swept; we have only to suppose the approximation of the sides of the ellipse and their eventual fusion, to complete the transformation of the radially symmetrical Coelenterate into a bilaterally symmetrical Coelomate with mouth and anus at opposite ends of the long axis. We further suppose that of the four coelomic pouches one was in front of the mouth, one behind the anus, and one on each side. Such an animal, if it ever existed, probably lived near the surface of the sea, and even here it may have changed its medusoid mode of locomotion for one in the direction of its mouth. Thus the bilateral symmetry would have been accentuated, and the organism shaped more definitely into three segments, namely (1) a preoral segment or lobe, containing the anterior coelomic cavity; (2) a middle segment, containing the gut, and the two middle coelomic cavities; (3) a posterior segment, containing the posterior coelomic cavity, which, however, owing to the backward prolongation of the anus, became divided into two—a right and left posterior coelom. Each of these cavities presumably excreted waste products to the exterior by a pore. There was probably a nervous area, with a tuft of cilia, at the anterior end; while, at all events in forms that remained pelagic, the ciliated nervous tracts of the rest of the body may be supposed to have become arranged in bands around the body-segments. Such a form as this is roughly represented to-day by the *Actinotrocha* larva of *Phoronis*, the importance of which has been brought out by Masterman. But only slight modifications are required to produce the *Tornaria* larva of the Enteropneusta and other larvae, including the special type that is inferred from the *Dipleurula* larval stages of recent forms to have characterized the ancestor of the Echinoderms. We cannot enter here into all the details of comparison between these larval forms; amid much that is hypothetical a few homologies are widely accepted, and the preceding account will show the kind of relation that the Echinoderms bear to other animals, including what are now usually regarded as the ancestors of the Chordata (to which back-boned animals belong), as well as the nature of the evidence that their study has been, or may be, made to yield. How the hypothetical *Dipleurula* became an Echinoderm, and how the primitive Echinoderms diverged in structure so as to form the various classes, are questions to which an answer is attempted in the following paragraphs:—

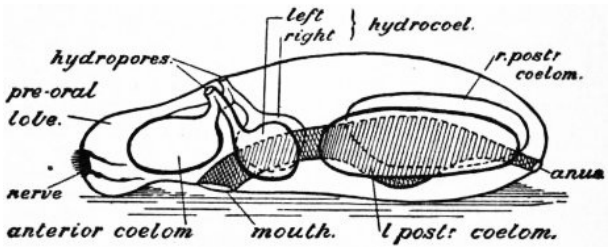


FIG. 6.—Diagrammatic reconstruction of *Dipleurula*. The creature is represented crawling on the sea-floor, but it may equally well have been a floating animal. The ciliated bands are not drawn.

Confining our attention to that form of Dipleurula (fig. 6) which, it is supposed, gave rise to the Echinoderma, we infer from embryological data that its special features were as follow:—The anterior coelomic cavity was wholly or partially divided, and from each half a duct led to the exterior, opening at a pore near the middle line of the back. The middle cavities were smaller, and the ducts from them came to unite with those from the anterior cavities, and no longer opened directly to the exterior; whether these cavities were already specialized as water-sacs cannot be asserted, but they certainly had become so at a slightly later stage. The posterior cavities were the largest, but what had become of their original opening to the exterior is uncertain. The genital products were derived from the lining of the coelomic cavities, but it would not be safe to say that any particular region was as yet specialized for generation. The epithelium of the outer surface was probably ciliated, and a portion of it in the preoral lobe differentiated as a sense-organ, with longer cilia and underlying nerve-centre, from which two nerves ran back below the ventral surface. Into the space between the walls of the coelom and the outer body-wall, originally filled with jelly, definite cells now wandered, chiefly derived from the coelomic walls. Some of these cells produced muscles and connective tissue; others absorbed and removed waste products, iron salts, calcium carbonate and the like, and so were ready to be utilized for the deposition of pigment or of skeletal substance. In some of these respects the *Dipleurula* may have diverged from the ancestor of Enteropneusta and of other animals, but it could not as yet have been recognized as echinodermal by a zoologist, for it presented none of the structural peculiarities of the modern adult echinoderm.

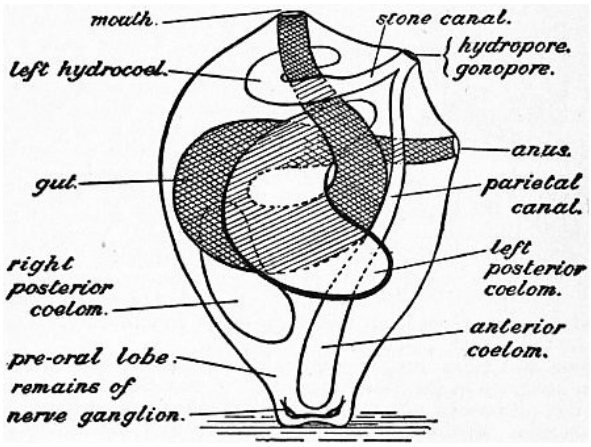


FIG. 7.—Diagrammatic reconstruction of primitive Pelmatozoön, seen from the side. The plates of the test are not drawn; their probable appearance may be gathered from fig. 8.

Now ensued the great event that originated the phylum—the discovery of the sea-floor. This being apprehended by the sensory anterior end, it was by that end that the *Dipleurula* attached itself; not, however, by the pole, since that would have interfered at once with the sensory organ, but a little to one side, the right side being the one chosen for a reason we cannot now fathom; it may be that fixation was facilitated by the presence of the pore on that side, and by the utilization of the excretion from it as a cement. The first result was that which is always seen to follow in such cases—the passage of the mouth towards the upper surface (fig. 7). As it passed up along the left side, the gut caught hold of the left water-sac and pulled it upwards, curving it in the process; this being attached to the left duct from the anterior body-cavity, this structure with its water-pore was also pulled up, and the pore came to lie between mouth and anus. The forward portion of the anterior coelom shared in the constriction and elongation of the preoral lobe; but its hinder portion was dragged up along with the water-pore and formed a canal lying along the outer wall (the parietal canal). As the gut coiled, it pressed inwards the middle of the left posterior coelom of the *Dipleurula*, and drew the whole towards the mouth, while the corresponding cavity on the right was pressed down by the stomach towards the fixed end of the animal and became involved in the elongation of that region. These changes, which may still be traced in the development of *Antedon*, resulted in the primitive Pelmatozoön (fig. 7), represented in the rocks by such a genus as *Aritocystis* (fig. 8). The pear-shaped body is encased in a theca formed by a number of polygonal plates, and is attached by its narrow end. On the broad upper surface are four openings, that nearest the centre being the mouth, which is slit-like, and that nearest the periphery being the anus. The two other openings are minute, and placed between those two; one close to the mouth is almost certainly the water-pore, while that nearer the anus is regarded as a genital aperture. Which of the coelomic cavities this last is connected with is uncertain, for there is considerable doubt as to the origin of the genital glands in the embryonic development of recent echinoderms. It seems clear, however, that there was but a single duct and a single bunch of reproductive cells, as in the holothurians, though perhaps bifurcate, as in some of those animals. The line between mouth and anus, along which these openings are situate, corresponds with the plane of union between the two horns of the curved left posterior coelom, the united walls of which form the “dorsal mesentery.” Since this must have, on our theory, enclosed the parietal canal from the anterior coelom, it is possible that the genital products were developed from the lining cells of that cavity, and that the genital pore was nothing but its original pore not yet united with that from the water-sac. The concrescence of these pores can be traced in other cystids; but as the genital organs became affected by radial symmetry the original function of the duct was lost, and the reproductive elements escaped to the exterior in another way. *Aristocystis* may have had ciliated food-grooves leading to its mouth, but these have left no traces on the structure of the test. Traces, however, are perceptible in genera believed to be descended from such a simple type, and the majority may be grouped under two heads. One group includes those in which the grooves wander outwards from the mouth over the thecal plates, which gradually become arranged regularly on either side of the grooves, while further extensions ascend from the grooves on small jointed processes called “brachioles” (fig. 9). In the other group the grooves do not tend so much to stretch over the theca as to be raised away from it on relatively larger brachioles, arising close around the mouth (fig. 10).

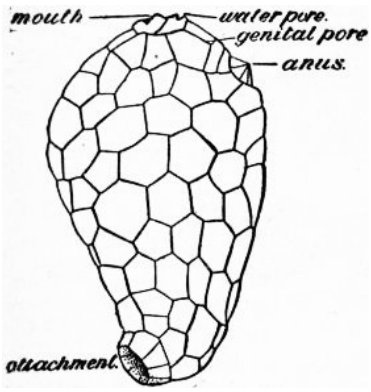


FIG. 8.—*Aristocystis bohemicus*; side-view of the theca. The internal structure may be gathered from fig. 7.

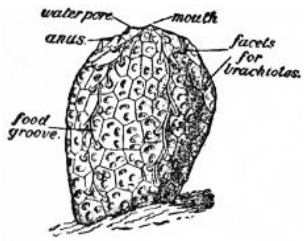


FIG. 9.—*Fungocystis rarissima*, one of the Diploporita, in which the thecal plates bordering the food-grooves are not yet regularly arranged. The brachioles are not drawn.

These two types are, in the main, correlated with two gradual differentiations in the minute structure of the thecal plates. Originally the calcareous substance of the plates (stereom) was pierced by irregular canals, more or less vertical, and containing strands of the soft tissue (stroma) that deposited the stereom, as well as spaces filled with fluid. In the former group (fig. 9) these canals became connected in pairs

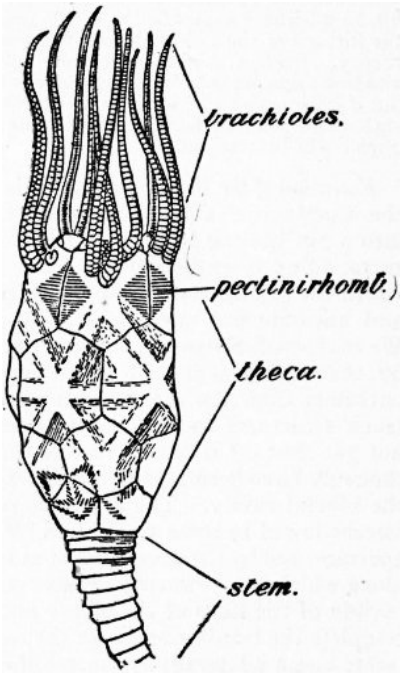


FIG. 10.—*Chirocrinus-alter*, one of the Rhombifera, showing the reduced number and regular arrangement of the thecal plates, and the concentration of the brachioles. (Adapted from Jaekel.)

(diplopores) still perpendicular to the surface, and this structure, combined with that of the grooves, characterizes the order—Diploporita. In the latter group (fig. 10) the canals, that is to say, the stroma-strands, came to lie parallel to the surface and to cross the sutures between the plates, which were thus more flexibly and more strongly united: since the canals crossing each suture naturally occupy a rhombic area, the order is called Rhombifera. At first the grooves were three, one proceeding from each end of the mouth-slit, and the third in a direction opposed to the anus; with reference to the Pelmatozoan structure, the anal side may be termed posterior, and this groove anterior. Eventually each lateral groove forked, so that there were five grooves. These gradually impressed themselves on the theca and influenced the arrangement of the internal organs: it is fairly safe to assume that nerves, blood-vessels and branches from the water-sac stretched out along with these grooves, each system starting from a ring around the gullet. At last a quinqueradiate symmetry influenced the plates of the theca, partly through the development of a plate at the end of each groove (terminal), partly through plates at the aboral pole of the theca (basals and infrabasals) arising in response to mechanical pressure, but soon intimately connected with the cords of an aboral nervous system. Before the latter plates arose, the stem had developed by the elongation and constriction of the fixed end of the theca, the gradual regularization of the plates involved, and their coalescence into rings. The crinoid type was differentiated by the extension of the food-grooves and associated organs along radial outgrowths from the theca itself. These constituted the arms (brachia), and five definite radial plates of the theca were specialized for their support. These radials may be homologous with the terminals already mentioned, but this is neither necessary nor certain. In this development of brachial extensions of the theca the genital organs were involved, and their ripe products formed at the ends of the brachia or in the branches therefrom. The remains of the original genital gland within the theca became the “axial organ” surrounded by the “axial sinus” derived from the anterior coelom, and this again by structures derived from the right posterior coelom, which, as explained above, had been depressed to the aboral pole. These last structures formed a nervous sheath around the axial sinus with its blood-vessels, and became divided into five lobes correlated with the five basals (the “chambered organ”) and forming the aboral nerve-centre. Before these changes were complete the Holothurioidea must have diverged, by the assumption of a crawling existence. Thus in them the mouth and anus reverted to opposite poles, and only the torsion of the gut and coelom, and the radial extensions of the nervous, water-vascular and blood-vascular systems, testified to their Pelmatozoan ancestry. The ciliated grooves, no longer needed for the collection of food, closed over, and are still traceable as ciliated canals overlying the radial nerves. At the same time the thecal plates degenerated into spicules. The Edrioasteroidea followed a different line from that of the cystids above mentioned and their descendants. The theca became sessile, and in its later developments much flattened (fig. 11). Mouth, water-pore and anus remained as in *Aristocystis*, but the five ciliated grooves radiated from the mouth between the thecal plates rather than over them, and were, as usual, protected by covering-plates. The important feature was the extension of radial canals from the water-sac along these grooves, with branches passing between the flooring-plates of the grooves (fig. 12, A). The resemblance of the flooring-plates to the ambulacral ossicles of a starfish is so exact that one can explain it only by supposing similar relations of the water-canals and their branches (podia). On the thinly plated under surface of well-preserved specimens of *Edrioaster* are seen five interradial swellings (fig. 11, B). These are likely to have been produced by the ripe genital glands, which may have extruded their products directly through the membranous integument of the under side. No other way out for them is apparent, and it is clear that *Edrioaster* was not permanently and solidly fixed to the sea-floor.

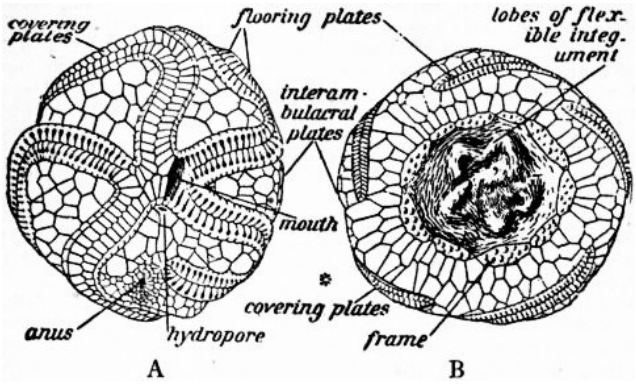


FIG. 11.—*Edrioaster*. A, upper or oral surface of *E. Bigsbyi*, with the covering-plates on the anterior and left posterior food-grooves, but removed from the others, which show only the flooring-plates, between which are pores; B, under surface of *E. Buchianus*, with covering-plates on right posterior and right anterior food-grooves (left hand in the drawing). The * denotes the position of the anal interradius.

Now comes a great change, unfortunately difficult to follow whether in the fossils or in the modern embryos. We suppose some such form as *Edrioaster*, which appears to have lived near the shore, to have

been repeatedly overturned by waves. Those that were able to accommodate themselves to this topsy-turvy existence, by taking food in directly through the mouth, survived, and their podia gradually specialized as sucking feet. Such a form as this, when once its covering-plates had atrophied, would be a starfish without more ado (fig. 12, B); but the sea-urchins present a more difficult problem, on which *Bothriocidaris* sheds no light. An Upper Silurian echinoid, however, *Palaeodiscus*, is believed by W.J. Sollas and W.K. Spencer to have had in its ambulacra an inner as well as an outer series of plates. If this be correct, the only change from *Edrioaster*, as regards the ambulacra, was that in *Palaeodiscus* the covering-plates could no longer open, but closed permanently over the whole groove, while the podia issued through slits between them. In more typical echinoids the covering-plates alone remained to form the ordinary ambulacral plates, while the flooring-plates disappeared, the canals and other organs remaining as before. In any case we have to admit a closure of the integument over the ciliated groove (fig. 12, D, *e*) just as in holothurians, since this is necessitated by anatomical evidence. The genital organs in both Asteroidea and Echinoidea would retain the interradial position they first assumed in *Edrioaster*; and in Echinoidea their primitive temporary openings to the exterior were converted into definite pores, correlated with five interradially placed plates at the aboral pole. The anus also naturally moved to this superior and aboral position. In the Echinoidea the water-canals and associated structures, ending in the terminal plates, stretched right up to these genital plates; but in the Asteroidea they never reached the aboral surface, so that the terminals have always been separated from the aboral pole by a number of plates.

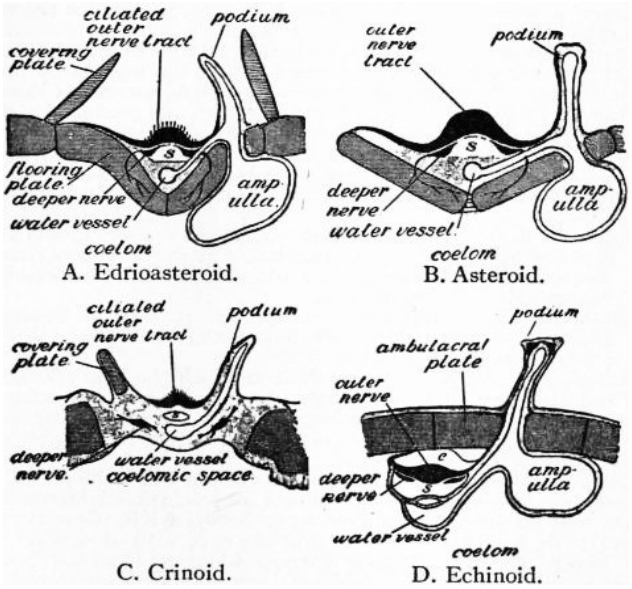
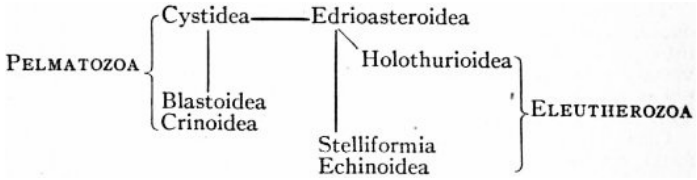


FIG. 12.-Diagrammatic sections across the ambulacra of A, C, PELMATOZOA, and B, D, ELEUTHEROZOA, placed in the same position for comparison. *S*, Blood-spaces, of which the homology is still uncertain.

Analysis of Echinoderm Characters.—Regarding the Echinoderms as a whole in the light of the foregoing account, we may give the following analytic summary of the characters that distinguish them from other coelomate animals:—

They live in salt or brackish water; a primitive bilateral symmetry is still manifest in the right and left divisions of the coelom; the middle coelomic cavities are primitively transformed into two hydrocoels communicating with the exterior indirectly through a duct or ducts of the anterior coelom; stereom, composed of crystalline carbonate of lime, is, with few exceptions, deposited by special amoebocytes in the meshes of a mesodermal stroma, chiefly in the integument; reproductive cells are derived from the endothelium, apparently of the anterior coelom; total segmentation of the ovum produces a coeloblastula and gastrula by invagination; mesenchyme is formed in the segmentation cavity by migration of cells, chiefly from the hypoblast. Known Echinoderms show the following features, imagined to be due to an ancestral pelmatozoic stage:—Increase in the coelomic cavities of the left side, and atrophy of those on the right; the dextral coil of the gut, recognizable in all classes, though often obscured; an incomplete secondary bilateralism about the plane including the main axis and the water-pore or its successor, the madreporite, often obscured by one or other of various tertiary bilateralisms; the change of the hydrocoel into a circumoral, arcuate or ring canal; development through a free-swimming, bilaterally symmetrical, ciliated larva, of which in many cases only a portion is transformed into the adult Echinoderm (where care of the brood has secondarily arisen, this larva is not developed). All living, and most extinct, Echinoderms show the following features, almost certainly due to an ancestral pelmatozoic stage:—An incomplete radial symmetry, of which five is usually the dominant number, is superimposed on the secondary bilateralism, owing to the outgrowth from the mouth region of one unpaired and two paired ciliated grooves; these have a floor of nervous epithelium, and are accompanied by subjacent radial canals from the water-ring, giving off lateral podia and thus forming ambulacra, and by a perihaemal system of canals apparently growing out from coelomic cavities. All living Echinoderms have a lacunar, haemal system of diverse origin; this, the ambulacral system, and the coelomic cavities, contain a fluid holding albumen in solution and carrying numerous amoebocytes, which are developed in special lymph-glands and are capable of wandering through all tissues. The Echinoderms may be divided into seven classes, whose probable relations are thus indicated:—



Brief systematic accounts of these classes follow:—

Grade A. PELMATOZOA.—Echinoderma with the viscera enclosed in a calcified and plated theca, of which the oral surface is uppermost, and which is usually attached, either temporarily or permanently, by the aboral surface. Food brought to the mouth by a subvective system of ciliated grooves, radiating from the mouth either between the plates of the theca (endothecal), or over the theca (epithecal), or along processes from the theca (exothecal: arms, pinnules, &c.), or, in part, and as a secondary development, below the theca (hypothecal). Anus usually in the upper or oral half of the theca, and never aboral. An aborally-placed motor nerve-centre gives off branches to the stroma connecting the various plates of the theca and of its brachial, anal and columnar extensions, and thus co-ordinates the movements of the whole skeleton. The circumoesophageal water-ring communicates indirectly with the exterior; the podia, when present, are respiratory, not locomotor, in function.

Class I. Cystidea.—Pelmatozoa in which radial polymeric symmetry of the theca is developed either not at all or not in complete correlation with the radial symmetry of the ambulacra (such as obtains in Blastoidea and Crinoidea); in which extensions of the food-grooves are exothecal or epithecal or both combined, but neither endothecal nor pierced by podia (as in some Edrioasteroidea) All Palaeozoic.

This class shows much greater diversity of organization than any other, and the classifications proposed by recent writers, such as E. Haeckel, O. Jaekel and F.A. Bather, start from such different points of view that no discussion of them can be attempted here. Following the narrative given above, we recognize a primitive group—Amphoridea—represented by *Aristocystis* (fig. 8). From this are derived the orders Diploporita (fig. 9) and Rhombifera (fig. 10) and the class Edrioasteroidea, all which have already been described as steps in the evolution of the phylum. But there were also side-branches leading nowhere, and therefore placed in separate orders—Aporita and Carpoidea.

Order 1. *Amphoridea.*—Radial symmetry has affected neither food-grooves nor thecal plates; nor, probably, nerves, ambulacral vessels, nor gonads. Canals or folds when present in the stereom are irregular. Families: Aristocystidae (fig. 8); Eocystidae.

Order 2. *Carpoidea.*—Theca compressed in the oro-anal plane and a bilateral symmetry thus induced, affecting the food-grooves and, usually, the thecal plates and stem. Food-grooves in part epithecal and may be continued on one or two exothecal processes. No pores or folds in the stereom. Families: Anomalocystidae, Dendrocystidae. These correspond to Jaekel's Carpoidea Heterostelea; he also includes, as Eustelea, our Comarocystidae and Malocystidae.

Order 3. *Rhombifera.*—Radial symmetry affects the food-grooves and, in the more advanced families, the thecal plates; probably also the nerves and ambulacral vessels, but not the gonads. The food-grooves are exothecal, *i.e.* are stretched out from the theca on jointed skeletal processes (brachioles). These either are close to the mouth or are removed from it upon a series of ambulacral or sub-ambulacral plates not derived immediately from thecal plates, or are separated from the oral centre by hypothecal passages passing beneath terminal plates. The stereom and stroma become arranged in folds and strands at right angles to the sutures of the thecal plates; in higher forms the stereom-folds are in part specialized as pectini-rhombs. Families: Echinosphaeridae; Comarocystidae; Macrocystellidae; Tiaracrinidae; Malocystidae; Glyptocystidae, with sub-famm. Echinoencrininae, Callocystinae, Glyptocystinae, of which examples are *Cheirocrinus* (fig. 10) and *Cystoblastus* from which Jaekel deduces the blastoids; Caryocrinidae.

Order 4. *Aporita.*—Pentamerous symmetry affects the food-grooves and thecal plates; probably also the nerves and ambulacral vessels, but not the gonads. Food-grooves exothecal and circumoral. The stereom shows no trace of canals, folds, rhombs or diplopores. Family: Cryptocrinidae.

Order 5. *Diploporita.*—Radial symmetry affects the food-grooves, and by degrees the thecal plates connected therewith, but not the interradial thecal plates; probably also the nerves and ambulacral vessels, but not the gonads. The food-grooves are epithecal, *i.e.* are extended over the thecal plates themselves without intermediate flooring; they are also prolonged on exothecal brachioles, which line the epithecal grooves. The stereom of the thecal plates may be thrown into folds, but the mesostroma does not so much tend to lie in strands traversing the sutures, nor are pectini-rhombs or pore-rhombs developed; diplopores are always present in the mesostereom, but often restricted to definite tracts or plates, especially in higher forms. Families: Sphaeronidae; Glyptosphaeridae, *e.g. Fungocystis* (fig. 9); Protocrinidae; Mesocystidae; Gomphocystidae.

The Protocrinidae lead up to *Proteroblastus*, in which the theca is ovoid, sometimes prolonged into a stem, the plates differentiated into (*a*) smooth, irregular, depressed interambulacrals, (*b*) transversely elongate brachioliferous adambulacrals, to which the diplopores, which lie at right angles to the main food-groove, are confined. This leads almost without a break to the Protoblastoidea.

Class II. Blastoidea.—Pelmatozoa in which five (by atrophy four) epithecal ciliated grooves, lying on a lancet-shaped plate (? always), radiate from a central peristome between five interradial deltoid plates, and are edged by alternating side-plates bearing brachioles, to which side-branches pass from the grooves. Grooves and peristome protected by small plates, which can open over the grooves. The generative organs and coelom probably did not send extensions along the rays into the brachioles; but apparently nerves from the aboral centre, after passing through the thecal plates, met in a circumoral ring, from which branches passed into the plate under each main food-groove, and thence supplied the brachioles. The thecal plates, however irregular in some species, always show defined basals and a distinct plate ("radial") at the end of each ambulacrum; they are in all cases so far affected by pentamerous symmetry that their sutures never cross the ambulacra. All Palaeozoic.

Division A. *Protoblastoidea.*—Blastoidea without interambulacral groups of hydrospire-folds hanging into the thecal cavity. Families: Asteroblastidae, Blastoidocrinidae. The former might be placed with Diploporita, were it not for a greater intimacy of correlation between ambulacral and thecal structures than is found in Cystidea as here defined. They form a link between the Protocrinidae and—

Division B. *Eublastoidea.*—Blastoidea in which the thecal plates have assumed a definite number and position in 3 circlets, as follows: 3 basals, 2 large and 1 small; 5 radials, often fork-shaped, forming a closed circlet; 5 deltoids, interradial in position, supported on the shoulders or processes of the radials, and often surrounding the peristome with their oral ends. The stereom of the radials and deltoids on each side of the ambulacra is thrown into folds, running across the radio-deltoid suture, and hanging down into the thecal cavity as respiratory organs (hydrospires).

FIG. 13.—A Eublastoid, *Pentremites*.

These are the forms to which the name Blastoidea is usually restricted. They have been divided into Regulares and Irregulares, but it seems possible to group them according to three series or lines of descent, thus:—

Series *a. Codonoblastida.*—Families: Codasteridae, Pentremitidae (fig. 13).

Series *b. Troostoblastida.*—Families: Troostocrinidae, Eleutherocrinidae.

Series *c. Granatoblastida.*—Families: Nucleocrinidae, Orbitremitidae, Pentephyllidae, Zygocrinidae.

Class III. CRINOIDEA.—Pelmatozoa in which epithecal extensions of the food-grooves, ambulacrals, superficial oral nervous system, blood-vascular and water-vascular systems, coelom and genital system are continued exothecally upon jointed outgrowths of the abactinal thecal plates (*brachia*), carrying with them extensions of the abactinal nerve-system. The number of these processes is primitively and normally five, but may become less by atrophy. The brachia rise from a corresponding number of thecal plates, "radials (RR)." Below these is always a circlet, or traces of a circlet, of plates alternating with the radials, *i.e.* interradial, and called "basals (BB)." Through all modifications, which are numerous and vastly divergent, these elements persist. A circlet of radially situate infrabasals (IBB) may also be present. Below BB or IBB there follows a stem, which, however, may be atrophied or totally lost (see fig. 1).

The classification here adopted is that of F.A. Bather (1899), which departs from that of Wachsmuth and Springer mainly in the separation of forms with infrabasals or traces thereof from those in which basals only are present. These two series also differ from each other in the relations of the abactinal nerve-system. O. Jaekel (1894) has divided the crinoids into the orders Cladocrinoidea and Pentacrinoidea, the former being the Camerata of Wachsmuth and Springer (Monocyclica Camerata, Adunata and Dicyclica Camerata of the present classification), and the latter comprising all the rest, in which the arms are either free or only loosely incorporated in the dorsal cup. In minor points there is fair agreement between the American, German and British authors. The families are extinct, except when the contrary is stated.

Sub-class I. *Monocyclica.*—Crinoidea in which the base consists of BB only, the aboral prolongations of the chambered organ being interradial; new columnals are introduced at the extreme proximal end of the stem.

Order 1. *Monocyclica Inadunata.*—Monocyclica in which the dorsal cup is confined to the patina and occasional intercalated anals; such ambulacrals or interambulacrals as enter the tegmen remain supra-tegminal and not rigidly united. Families: Hybocrinidae, Stephanocrinidae, Heterocrinidae, Calceocrinidae, Pisocrinidae, Zophocrinidae, Haplocrinidae, Allagecrinidae, Symbathocrinidae, Belemnocrinidae, Plicatocrinidae, Hyocrinidae (recent), Saccocomidae.

Order 2. *Adunata.*—Monocyclica with dorsal cup primitively confined to the patina and an occasional single anal; tegmen solid; portions of the proximal brachials and their ambulacrals tend to be rigidly incorporated in the theca. Arms fork once to thrice, and bear pinnules on each or on every other brachial. BB fused to 3, 2 or 1. (Eucladocrinus and Acrocrinidae offer peculiar exceptions to this diagnosis.) Families: Platycrinidae, Hexacrinidae, Acrocrinidae.

Order 3. *Monocyclica Camerata.*—Monocyclica in which the first, and often the succeeding, orders of brachials are incorporated by interbrachials in the dorsal cup, while the corresponding ambulacrals are either incorporated in, or pressed below, the tegmen by interambulacrals; all thecal plates united by suture, somewhat loose in the earliest forms, but speedily becoming close, and producing a rigid theca; mouth and tegminal food-grooves closed; arms pinnulate.

Sub-order i. *Melocrinoidea.*—RR in contact all round; first brachial usually quadrangular. Families: Glyptocrinidae, Melocrinidae, Patelliocrinidae, Clonocrinidae, Eucalyptocrinidae, Dolatocrinidae.

Sub-order ii. *Batocrinoidea.*—RR separated by a heptagonal anal; first brachial usually quadrangular. Families: Tanaocrinidae, Xenocrinidae, Carpocrinidae, Barrandeocrinidae, Coelocrinidae, Batocrinidae, Periechocrinidae.

Sub-order iii. *Actinocrinoidea.*—RR separated by a hexagonal anal; first brachial usually hexagonal. Families: Actinocrinidae, Amphoracrinidae.

Sub-class II. *Dicyclica.*—Crinoidea in which the base consists of BB and IBB, the latter being liable to atrophy or fusion with the proximale, but the aboral prolongations of the chambered organ are always radial; new columnals may or may not be introduced at the proximal end of the stem.

Order 1. *Dicyclica Inadunata.*—Dicyclica in which the dorsal cup primitively is confined to the patina and occasional intercalated anals, and no other plates ever occur between RR (Grade: Distincta); Br may be incorporated in the cup, with or without iBr, but never rigidly, and their corresponding ambulacrals remain supra-tegminal (Grade: Articulata); new columnals are introduced at the extreme proximal end of the stem.

Sub-order i. *Cyathocrinoidea.*—Tegmen stout with conspicuous orals. Families: Carabocrinidae, Palaeocrinidae. Euspirocrinidae, Sphaerocrinidae, Cyathocrinidae, Petalocrinidae, Crotalocrinidae, Codiacrinidae, Cupressocrinidae, Gasterocomidae.

Sub-order ii. *Dendrocrinoidea.*—Tegmen thin, flexible, with inconspicuous orals. Families:

Dendrocrinidae, Botryocrinidae, Lophocrinidae, Scaphiocrinidae, Scytalecrinidae, Graphiocrinidae, Cromyocrinidae, Encrinidae (preceding families are Distincta; the rest Articulata), Pentacrinidae, including the recent *Isocrinus* (fig. 14), Uintacrinidae, Marsupitidae, Bathycrinidae (recent).

Order 2. *Flexibilia.*—Dicyclica in which proximal brachials are incorporated in the dorsal cup, either by their own sides, or by interbrachials, or by a finely plated skin, but never rigidly; plates may occur between RR. Tegmen flexible, with distinct ambulacrals and numerous small interambulacrals; mouth and food-grooves remain supra-tegminal and open. Top columnal a persistent proximale, often fusing with IBB, which are frequently atrophied in the adult.

All the Palaeozoic representatives have non-pinnulate arms, while the Mesozoic and later forms have them pinnulate. There are other points of difference, so that it is not certain whether the latter really descended from the former. But assuming such a relationship we arrange them in two grades.

Grade *a. Impinnata.*—Families: Ichthyocrinidae, Sagenocrinidae, and Taxocrinidae, perhaps capable of further division.

Grade *b. Pinnata.*—Families: Apiocrinidae with the recent *Calamocrinus*, Bourgueticrinidae with recent *Rhizocrinus*, Antedonidae, Atelecrinidae, Actinometridae, Thaumatocrinidae (these four recent families include free-moving forms with atrophied stem, probably derived from different ancestors), Eugeniacrinidae, Holopodidae (recent), Eudesicrinidae.

Order 3. *Dicyclica Camerata.*—Dicyclica in which the first, and usually the second, orders of brachials are incorporated in the dorsal cup by interbrachials, at first loosely, but afterwards by close suture. IBB always the primitive 5. An anal plate always rests on the posterior basal; mouth and tegminal food-grooves closed; arms pinnulate. Families: Reteocrinidae, Dimerocrinidae, Lampterocrinidae, Rhodocrinidae, Cleiocrinidae.

Class IV. Edrioasteroidea.—Pelmatozoa in which the theca is composed of an indefinite number of irregular plates, some of which are variously differentiated in different genera; with no subvective skeletal appendages, but with central mouth, from which there radiate through the theca five unbranched ambulacra, composed of a double series of alternating plates (covering-plates), sometimes supported by an outer series of larger alternating plates (side-plates or flooring-plates). In some forms at least, pores between (not through) the ambulacral elements, or between them and the thecal plates, seem to have permitted the passage of extensions from the perradial water-vessels. Anus in posterior interradius, on oral surface, closed by valvular pyramid. Hydropore (usually, if not always, present) between mouth and anus. Families: Agelacrinidae, Cyathocystidae, Edrioasteridae, Steganoblastidae. All Palaeozoic. The structure and importance of *Edrioaster* have been discussed above (figs. 11, 12).

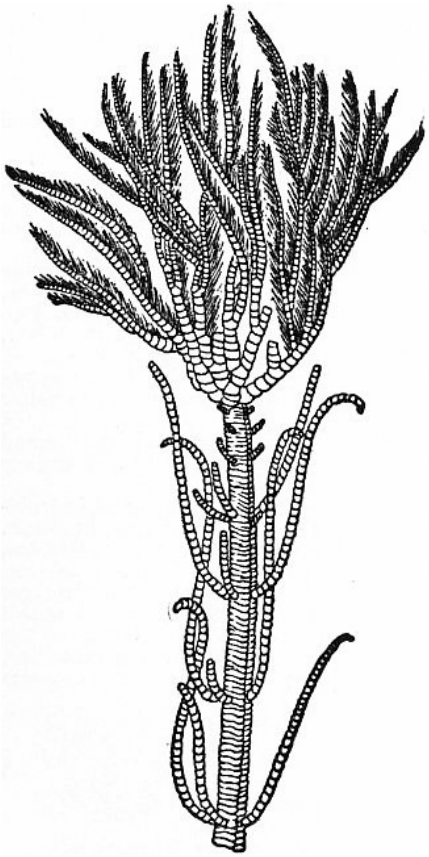


Fig. 14.—A living Pentacrinid, *Isocrinus asteria*; the first specimen found, after Guettard's figure published in 1761.

Grade B. ELEUTHEROZOA—Echinoderma in which the theca, which may be but slightly or not at all calcified, is not attached by any portion of its surface, but is usually placed with the oral surface downwards or in the direction of forward locomotion. Food is not conveyed by a subvective system of ciliated grooves, but is taken in directly by the mouth. The anus when present is typically aboral, and approaches the mouth only in a few specialized forms. The aboral nervous system, if indeed it be present at all, is very slightly developed. The circumoesophageal water-ring may lose its connexion with the exterior medium; the podia (absent only in some exceptional forms) may be locomotor, respiratory or sensory in function, but usually are locomotor tube-feet.

The classes of the Eleutherozoa probably arose independently from different branches of the Pelmatozoan stem. The precise relation is not clear, but the order in which they are here placed is believed to be from the more primitive to the more specialized.

Class I. Holothurioidea.—Eleutherozoa normally elongate along the oro-anal axis, which axis and the dorsal hydropore lie in the sagittal plane of a secondary bilateral symmetry. The calcareous skeleton, which may be entirely absent, is usually in the form of minute spicules, sometimes of small irregular plates with no trace of a calycinal or apical system; to these is added a ring of pieces radiately arranged round the oesophagus. Ambulacral appendages take the form of: (1) circumoral tentacles, (2) sucking-feet, (3) papillae; of these (1) alone is always present. The gonads are not radiately disposed.

The comparative anatomy of living forms, combined with the evolutionary hypothesis sketched above, suggests that the early holothurians possessed the following characters: subvective grooves entirely closed; 5 radial canals, proceeding from the water-ring, gave off branches furnished with ampullae to the podia on each side of them, the 10 anterior podia being changed into cylindrical tentacles; the transverse muscles of the body-wall formed a circular layer, probably interrupted at the radii (though Ludwig believes the contrary); longitudinal muscles as paired radial bands, without those special retractors for withdrawing the anterior part of the body which occur in many recent forms; a hydropore connected with the water-ring by a canal in the dorsal mesentery; a gonopore behind the hydropore connected by a single duct with a bunch of genital pouches on each side of the mesentery; gut dextrally coiled, with a simple blood-vascular system, and with an enlargement at the anus for respiration, this eventually producing branched caeca called

"respiratory trees"; skeleton reduced to a ring of 5 radial and 5 interradial plates round the gullet, and small plates, with a hexagonally meshed network, dispersed through the integument. Such a form gave rise to descendants differing *inter se* as regards the suppression of the radial canals and of the podia, the form of the tentacles, and the development of respiratory trees. These anatomical facts are represented in the following classification by H. Ludwig:—

Order 1. *Actinopoda.*—Radial canals supplying tentacles and podia.

A. With respiratory trees.	
(*a*) With podia	Fam. 1, Holothuriidae. Fam. 4, Cucumariidae. Fam. 5, Molpadiidae.
(*b*) Without podia	
B. Without respiratory trees.	
(*a*) With podia	Fam. 2, Elpidiidae.
(*b*) Without podia	Fam. 3, Pelagothuriidae.

Order 2. *Paractinopoda.*—Neither radial canals nor podia. Tentacles supplied from circular canal. Fam. Synaptidae.

It is admitted, however, that this scheme does not represent the probable descent or relationship of the families. Consideration of the views of Ludwig himself, of H. Östergren, and especially of R. Perrier, suggests the following as a more natural if less obvious arrangement.

Order 1. *Aspidochirota.*—Tentacles more or less peltate; calcareous ring when present simple and radially symmetrical; no retractors; stone-canal often opens to exterior; genital tubes sometimes restricted to left side in consequence of altered position of gut (Fig. 15.) Families: Elpidiidae (deep-sea forms, with sub-famm. Synallactinae, Deimatinae, Elpidiinae, Psychropotinae), Holothuriidae (shallow water), Pelagothuriidae (pelagic).

Order 2. *Dendrochirota.*—Tentacles simple or branched, never peltate; calcareous ring well developed, often bilaterally symmetrical; retractor muscles usually present; stone-canal opens internally; genital tubes in right and left tufts.

Sub-order i. *Apoda.*—No tube-feet or papillae, but tentacular ampullae more or less developed. Mostly burrowers. Families: Synaptidae (sub-famm. Synaptinae, Chirodotinae, Myriotrochinae), Molpadiidae.

Sub-order ii. *Eupoda.*—Tube-feet present, but tentacular ampullae rudimentary or absent. Families: Cucumariidae (climbers and crawlers), Rhopalodinidae (burrowers).

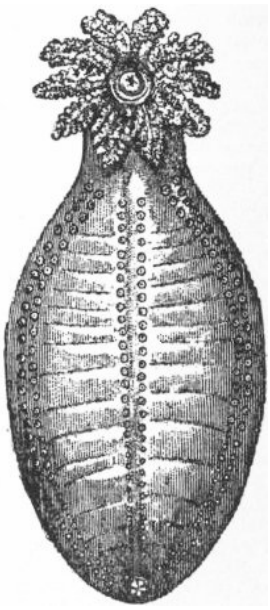


FIG. 15.—An Aspidochirote Holothurian of the family *Holothuriidae*, showing the mouth surrounded by tentacles, the anus at the other end of the body, and three of the rows of podia.

Class II. STELLIFORMIA (= ASTEROIDEA *sensu lato*).—Eleutherozoa with a depressed stellate body composed of a central disk, whence radiate five or more rays; this radiate symmetry affects all the systems of organs, including the genital. The radial water-vessels lie in grooves on the ventral side of flooring-plates (usually called "ambulacrals"); they and their podia are limited to the oral surface of the body and their extremities are separated from the apical plates by a stretch of dorsal integument containing skeletal elements; the opening of the water-vascular system (madreporite) is not connected with a definite apical plate or system of plates.

The starfish, brittle-stars and their allies (see STARFISH) have for the last fifty years usually been divided into two classes—Asteroidea and Ophiuroidea, each equivalent to the Holothurioidea or Echinoidea. Recently, however, some authors, *e.g.* Gregory, have attempted to show that these classes cannot be distinguished. It is true that some specialized forms, such as the *Brisingidae* among starfish, *Astrophiura* and *Ophioteresis* among ophiurans, contravene the usual diagnoses; but this neither obscures their systematic position, nor does it alter the fact that since early Palaeozoic times these two great groups of stellate echinoderms have evolved along separate lines. If then we place these groups in a single class, it is not on account of a few anomalous genera, but because the characters set forth above sharply distinguish them from all other echinoderms, and because we have good reason to believe that the ophiurans did not arise independently but have descended from primitive starfish. For that class Bell's name Stelliformia is selected since it avoids both confusion and barbarism.

Sub-class I. *Asterida.*—Stelliformia in which the ambulacral groove always remains open and the podia serve as tube-feet (fig. 12, B); the rays as a rule pass gradually into the disk, and contain both genital glands and caecal extensions of the digestive system; an anus usually present; respiration is by tubular extensions from the body-cavity (papulae); skeletal appendages, in addition to small spines, are either small grasping organs (pedicellariae), or clumped spines (paxillae), or branched spines bearing a membrane.

No existing classification of the Asterida is satisfactory even for the recent forms, still less when the older fossils are considered. A separation of the latter as Palasterida, because of their alternating ambulacrals, from the recent Euasterida with opposite ambulacrals, is now discarded and an attempt made to arrange the Palasterida in divisions originally established for Euasterida. Those divisions fall under three schemes. C. Viguier has divided the starfish into: *Astéries ambulacraires*, with plates of ambulacral origin prominent in the mouth-skeleton, pedicellariae stalked, and straight or crossed, podial pores usually quadriserial; *Astéries adambulacraires*, with adambulacrals prominent in the mouth-skeleton, pedicellariae sessile, and forcipiform or valvular, podial pores usually biserial. Perrier, at first laying greater stress on the nature of the pedicellariae and afterwards on the form of the mouth-skeleton, has gradually perfected a scheme of five

orders: (1) *Forcipulata*, with pedicellariae stalked, and straight or crossed; (2) *Spinulosa*, with pedicellariae sessile and forcipiform; (3) *Velata*, with membraniferous spines; (4) *Paxillosa*, pedicellariae represented by an ossicle of the test and the spines covering it, the whole forming a paxilla; (5) *Valvata* or *Granulosa*, with pedicellariae sessile and valvular or salt-cellar shaped. A more widely accepted scheme is that of W.P. Sladen, who divided the Euasterida into two orders; (1) *Phanerozonia*, with marginals large and highly developed, the supero-marginals and infero-marginals contiguous, with papulae confined to the dorsal surface, with ambulacrals well spaced and usually broad, adambulacrals prominent in the mouth-skeleton, with pedicellariae sessile; (2) *Cryptozonia*, with marginals inconspicuous and somewhat atrophied in the adult, the supero-marginals separated from the infero-marginals by intercalated plates, with papulae distributed over the whole body, with ambulacrals crowded and narrow, either ambulacrals or adambulacrals prominent in the mouth-skeleton, with pedicellariae stalked or sessile.

We give here a list of the families separated into Sladen's orders and grouped under Perrier's divisions, extinct families being marked †.

1. *Phanerozonia.—Unclassed Famm.*, † Palaeasteridae, † Palasterinidae, † Taeniasteridae, † Aspidosomatidae. *Paxillosa*, Luidiidae, Astropectinidae (fig. 16), Archasteridae restr. Verrill, Porcellanasteridae, Chaetasteridae. *Valvata*, Benthopectinidae, Goniopectinidae, Plutonasteridae, Odontasteridae, Pentagonasteridae, Antheneidae, Pentacerotidae, Gymnasteriidae. *Spinulosa*, Poraniidae, Asterinidae.

2. *Cryptozonia.—Unclassed Famm.*, † Sturtzasteridae (= Palaeocomidae Greg.), † Lepidasteridae, † Tropidasteridae. *Valvata*, Linckiidae restr. Perr. *Spinulosa*, Echinasteridae, Solasteridae (fig. 17), Korethrasteridae. *Velata*, † Palasteriscidae, Pterasteridae, Pythonasteridae, Myxasteridae. *Forcipulata*, Stichasteridae, Zoroasteridae (fig. 3, D), Heliasteridae, Pedicellasteridae, Asteriidae, Brisingidae.

Sub-class II. *Ophiurida.*—Stelliformia in which the ambulacral groove, though open in the oldest forms, soon becomes closed, while the podia cease to serve as tube-feet; the rays as a rule spring abruptly from the disk and contain neither genital glands nor digestive caeca; no anus; respiration may be through clefts at the bases of the rays, but not by papulae; skeletal appendages confined to spines, usually of simple structure.

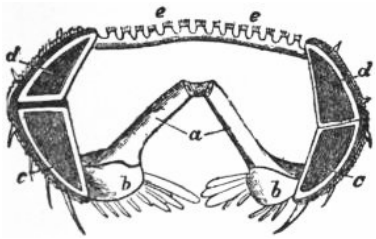


FIG. 16.—Section across the arm-skeleton of a Phanerozonate Asterid, *Astropecten*.

a, Ambulacral plates.
b, Adambulacral plates.
c and *d*, Inferior and superior lateral plates.
e, Dorsal plates with paxillae.
Certain supra-ambulacral plates, which also exist, are not shown.

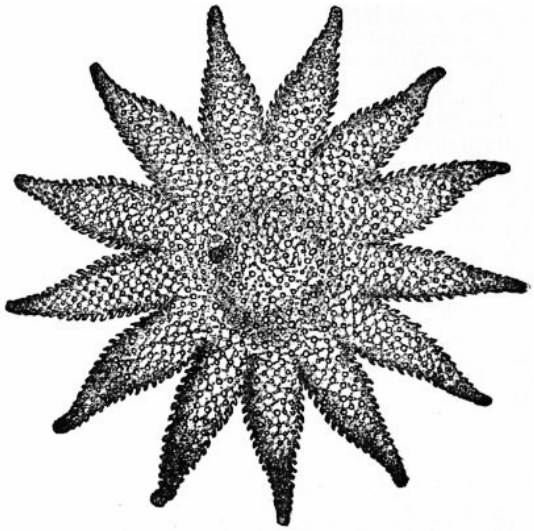


FIG. 17.—A Cryptozonate Asterid, *Solaster papposus*, from the upper or dorsal surface.

There is as yet no satisfactory classification of the Ophiurida into orders expressing lines of descent; even as regards families, leading writers are at variance. The following scheme is based on the attempts of E. Haeckel, F.J. Bell, J.W. Gregory, B. Stürtz, J.O.E. Perrier, and A.E. Verrill. Extinct families marked †.

Grade A. *Palophiurae.*—Ambulacrals not yet forming complete vertebrae; plates of disk not yet specialized into mouth, radial or genital shields.

Stage *a. Allostichia* (= Lysophiurae).—Ambulacrals alternating and unfused, groove uncovered by ventral arm-plates. Families: † Protasteridae, † Protophiuridae.

Stage *b. Zygostichia.*—Ambulacrals opposite and, except in Ophiurinidae, fused; ventral arm-plates developed in some. Families: † Ophiurinidae, † Lapworthuridae, † Furcasteridae, † Palastropectinidae, † Eoluididae, † Palaeophiomyxidae.

Grade B. *Colophiurae.*—Ambulacral pairs fused to form vertebrae with definite articular surfaces; mouth, radial and genital shields developed, though not all need be present in any one form.

Order 1. *Streptophiurae.*—Rays simple and capable of coiling, since the vertebrae articulate by a ball-and-socket joint; arm-plates incompletely developed. Families: † Onychasteridae, Ophiohelidae, Ophioscolecidae, Ophiomyxidae, Hemieuryalidae, Astrophiuridae; unclassified genera, *e.g. Ophioteresis*, *Ophiosciasma*, *Ophiogeron*.

Order 2. *Zygophiurae.*—Rays simple and prevented from coiling by processes on the vertebral joints (fig. 18); dorsal, ventral and lateral arm-plates present.

Sub-order i. *Brachyophiurae.*—Spines short, simple, pointing towards the end of the arm. Families: Pectinuridae (= Ophiodermatidae), Ophiolepididae.

Sub-order ii. *Nectophiurae.*—Spines may be variously elaborated and are set more at right angles to the arm-axis. Families: Amphiuridae, Ophiacanthidae, Ophiocomidae, Ophiothrichidae.

Order 3. *Cladophiurae* (= Euryalae). Rays simple or branched, capable of coiling, since the vertebrae articulate by surfaces of hour-glass shape; ventral arm-plates, and often the others, much reduced; spines reduced or absent. Families: Euryalidae, Gorgonocephalidae, Astrochelidae, Astroschemidae, Astronycidae.

The Silurian genera *Eucladia* and *Euthemon* have the rays greatly reduced and merged in the disk, so that the ambulacrals are unseen. There are a few large dorsal, lateral and ventral arm-plates, and at the angles of the latter emerge huge podia with a granular or plated skin. There are five prominent mouth-shields and a separate madreporite on the ventral surface. These genera attained the Colophiuran grade in respect of external plating, but it is unlikely that they or their ancestors had acquired even the Streptophiuran type of vertebra. Sollas has separated them as an order *Ophiocistia*.

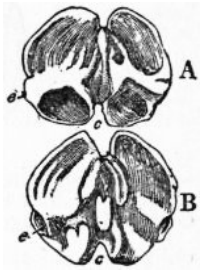


FIG. 18.—A vertebral arm-ossicle (fused ambulacrals) of a Zygophiuran, *Ophiolepis*.

A, Proximal joint-face.
B, Distal joint-face.
c, Ventral groove, where lies the water-vessel, from which branches pass through the ossicle, emerging as podia at *e* and *e*.

Class III. ECHINOIDEA.—Eleutherozoa with a test of roughly circular, subpentagonal or elliptical outline, spheroidal, domed or flattened, of primary pentameric symmetry affecting all systems of organs except the gut. The radial water-vessels lie within the test through which their podia pass (fig. 12, D); the ambulacra thus formed are continuous from the peristome to the apical system of plates; the hydropore is connected with a definite plate of that system, and thus marks a secondary bilateral symmetry. An anus is present either within the apical system (endocyclic, fig. 3, A and B), or outside it in an interradius (exocyclic, fig. 19, 7), thus initiating yet another bilateral symmetry. Skeletal appendages are spines (radioles), pedicellariae, and, in some forms, minute sense-organs called sphaeridia.

The echinoids or sea-archins (see SEA-URCHIN) may be grouped under the following orders, here named in the sequence of their appearance in the rocks.

Order 1. *Bothriocidaroida.*—Ambulacrals simple, each with two pores vertically superposed, 2 columns to each ambulacrum; interambulacrals multi-tuberculate, in 1 column, none passing on to or resorbed by the peristome; mouth central, jaws unknown, no external gills or sphaeridia; anus aboral, endocyclic. Sole genus *Bothriocidaris* (fig. 5), Ordovician.

Order 2. *Melonitoida.*—Ambulacrals simple, each with two pores horizontally juxtaposed, in 2 to 18 columns; interambulacrals granulate with occasional tubercles, in 3 to 11 columns, not more than one row passing on to the peristome; mouth central, with jaws, no external gills or sphaeridia; anus aboral, endocyclic. Families: Palechinidae (fig. 19, 1), Melonitidae and Lepidesthidae, Silurian to Carboniferous.

Order 3. *Cystocidaroida.*—Ambulacrals simple, each with one or two pores, which sometimes pass between rather than through the plates, in 2 columns; interambulacrals, uni- or multi-tuberculate, in numerous (say 10 or more) columns, none passing on to peristome; mouth central with jaws, no external gills or sphaeridia; position of anus doubtful, acyclic, *i.e.* no apical system so far as known. Include only *Echinocystis*, *Palaeodiscus* and (?) *Myriastiches*, all Upper Silurian.

Order 4. *Cidaroida.*—Ambulacrals simple, each with two pores horizontally juxtaposed, in 2 columns; interambulacrals unituberculate, in 2 to 11 columns, some rows may pass on to the peristome; mouth central, with jaws, no external gills or sphaeridia; anus aboral, endocyclic. Families: Lepidocentridae and Archaeocidaridae (fig. 19, 2), Devonian and Carboniferous; Cidaridae (fig. 19, 3, 4). Permian to present; Diplocidaridae and Tiarechinidae, Mesozoic.

Order 5. *Diademoida.*—Ambulacrals generally compound, with two pores obliquely juxtaposed, in 2 columns as in all subsequent orders; interambulacrals usually with large radioles surrounded by smaller ones, as in Cidaroida, in 2 columns as in all subsequent orders, only one plate resorbed; mouth central, with jaws and external gills, sphaeridia present; anus aboral endocyclic. J.W. Gregory divides this into four suborders, each representing a distinct evolutionary series; i. *Calycina*, Saleniidae (fig. 19, 5) and Acrosaleniidae; ii. *Arbacina*, Hemicidaridae and Arbaciidae; iii. *Diademina*, Orthopsidae, Diadematidae, Diplopodiidae, Pedinidae, Cyphosomatidae, and Echinothuridae; iv. *Echinina*, Temnopleuridae, Triplechinidae, Strongylocentrotidae and Echinometridae. The order is Triassic to Recent.

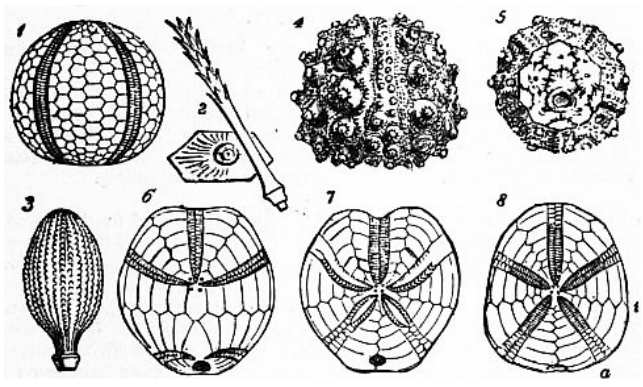


FIG. 19.—Denuded tests of some fossil Echinoids.

1, *Palaeechinus*; Carboniferous.
2, A plate and radiole of *Archaeocidaris*; Carboniferous.
3, A radiole of *Cidaris*; Jurassic.
4, *Hemicidaris*; Mid. Jurassic.
5, *Salenia*; Cretaceous.
6, *Dysaster*; Jurassic.
7, *Enallaster*; Cretaceous.
8, *Catopygus*; Cretaceous.

Order 6. *Holectypoida.*—Ambulacrals sometimes compound, with one or two pores to a plate, some dorsal podia begin to assume respiratory function; interambulacrals multi-tuberculate, none resorbed; mouth central, with jaws weak or wanting, with external gills and sphaeridia; anus exocyclic. Families: Pygasteridae, Discoidiidae, Galeritidae, Conoclypeidae; Jurassic to Recent.

Order 7. *Spatangoida.*—Ambulacrals simple, with two pores juxtaposed, dorsal podia respiratory; interambulacrals bearing numerous small spines, none resorbed; mouth central or shifted forwards, with no jaws or external gills, sphaeridia numerous; anus exocyclic. As the mouth moves forward and the anus downward, the posterior interambulacrals between them are enlarged and strengthened so as to form a sternum. The order may therefore be divided into: (i.) *Asternata*, Famm. Echinoneidae, Nucleolitidae and Cassidulidae (fig. 19, 8); (ii.) *Sternata*, Famm. Collyritidae (fig. 19, 6), Echinocorytidae, Spatangidae (fig. 19, 7), Palaeostomidae, and Pourtalesiidae; Jurassic to Recent.

Order 8. *Clypeastroida.*—Ambulacrals simple or compound, with two pores juxtaposed, dorsal podia respiratory; interambulacrals multi-tuberculate, none resorbed; mouth central with flattened unequal jaws, reduced external gills, and few sphaeridia; anus exocyclic. Families: Fibulariidae, Laganidae, Scutellidae, Clypeastridae; Cretaceous to Recent.

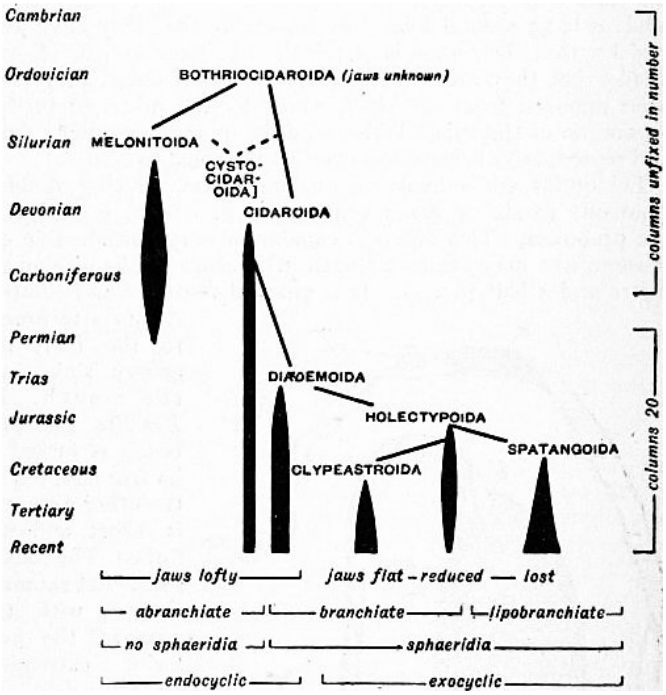


FIG. 20.

The probable relationship of these orders is shown in the annexed table. Here the Cystocidaroida occupy an isolated position. It is, however, quite possible that *Echinocystis* may some day be referred to the Cidaroida, and *Palaeodiscus* to the Melonitoida. This would leave the Echinoid scheme remarkably simple, with the Melonitoida and Cidaroida as divergent branches from an ancestor like *Bothriocidaris*; but while the former branch soon decayed, the latter continues to flourish at the present day. To take the Echinoidea now living, and to divide them into Endocyclica and Exocyclica, Branchiate and Abranchiate, Gnathostomata and Atelostomata, is easy and convenient; or again to distinguish as Palechinoidea those pre-Jurassic genera which do not conform to the fixed type of twenty vertical columns found in the later Euechinoidea, is to express an interesting fact; but all such divisions obscure the true relationships, and the corresponding terms should be recognized as descriptive rather than classificatory.

AUTHORITIES.—In addition to the works referred to at the beginning of the article, the following deal with the general subject: Bather, Gregory and Goodrich, "Echinoderma," in Lankester's *Treatise on Zoology* (London, 1900); F.J. Bell, *Catalogue of the British Echinoderms in the British Museum* (London, 1892); P.H. Carpenter, "Notes on Echinoderm Morphology," *Quart. Journ. Micr. Sci.*, 1878-1887; Y. Delage and E. Hérouard, *Traité de zoologie concrète, iii., Échinodermes* (Paris, 1904); A. Lang, *Text-Book of Comparative Anatomy*, transl., part ii. (London, 1896); Ludwig and Hamann, "Echinodermen," in Bronn's *Klassen und Ordnungen des Tierreichs* (Leipzig, 1889), in progress; M. Neumayr, *Die Stämme des Tierreiches* (Wien, 1889); P.B. and C.F. Sarasin, "Über die Anatomie der Echinothuriden und die Phylogenie der Echinodermen," *Ergebnisse naturw. Forsch. auf Ceylon*, Bd. i Heft 3 (Wiesbaden, 1888); R. Semon, "Die Homologien innerhalb des Echinodermenstammes," *Morph. Jahrb.* (1889); W.P. Sladen, "Homologies of the Primary Larval Plates in the Test of Brachiate Echinoderms," *Quart. Journ. Micr. Sci.*, 1884; K.A. v. Zittel, *Handbuch der ... Paläozoologie*, i. pp. 308-560 (München, 1879); also Grundzüge, translated and revised by C.R. Eastman as *Text-Book of Palaeontology* (New York and London, 1899). The larger treatises here mentioned contain very full bibliographies, and a complete analytical index to the annual literature of the

Echinoderma has for many years been published in the *Zoological Record* (London).

(F. A. B.)

1 Sometimes called “Echinodermata,” a Greek name meaning “sea-urchin-skins,” which was invented by J.T. Klein (1734) to denote the tests of the Echini or sea-urchins; its later use for the animals themselves, or for the whole phylum, was an error in both history and etymology.

ECHINUS (Gr. for “hedge-hog” or “sea-urchin”), in architecture, the convex moulding which supports the abacus of the Doric column. The term is sometimes given to the *ovolo* of the Ionic capital, especially when curved with the egg-and-tongue enrichment. The origin of this use of the word in architecture, which comes down from ancient times, is uncertain.

ECHIUROIDEA (Gr. ἔχις, adder, and οὐρά, tail), the zoological name for a small group of marine animals which show in their larval life-history a certain degree of segmentation, and are therefore grouped by some authorities as Annelids. Formerly, together with the Sipunculoidea and Priapuloidea, they made up the class Gephyrea, but on the ground that they retain in the adult a large preoral lobe (the proboscis), that they have anal vesicles, that their anus is terminal, that setae are found, and finally that they are segmented in the larval stage, they have been removed from the class, which by the proposed further separation of the Priapuloidea on account of their unique renal and reproductive organs, has practically ceased to exist.

Echiuroids are animals of moderate size, varying roughly from one to six or seven centimetres in length, exclusive of the proboscis. This organ is capable of very considerable extension, and may attain a length in *Bonellia viridis* of about a metre and a half (fig. 1). It is grooved ventrally and ciliated. At its attachment to the body the groove sinks into the mouth. In *Bonellia* the proboscis is forked at its free end, but in the other genera it is short and unforked. The body is somewhat sausage-shaped, with the anus at the posterior extremity, surrounded in *Echiurus* by a single or double ring of setae. The skin is usually wrinkled, and in *B. viridis*, *Thalassema lankesteri*, *Th. baronii*, *Hamingia arctica*, and in the larva of many species, is of a lively green colour. A pair of curved bristles, formed in true setal sacs as in Chaetopoda, project from the body a short distance behind the mouth, and are moved by special muscles; they are of use in helping the animal to move slowly about, and they take a large share in the burrowing movements (C.B. Wilson, *Biol. Bull.*, 1900), for some species tunnel in the mud and sand and form more or less permanent burrows, the walls of which are strengthened by mucus secreted from the skin. The openings of the burrows become silted up, leaving, however, a small aperture through which the proboscis is extruded. This organ carefully searches the neighbourhood for particles of food. When these are found the grooved proboscis folds its walls inwards, and the cilia pass the particles down the tube thus formed to the mouth. Echiuroids also move by extending the proboscis, which takes hold of some fixed object, and, then contracting, draws the body forwards. Recently it has been shown that *Echiurus* swims freely at night-time, using for locomotion both the proboscis and the contraction of the muscles of its body-wall. The motion is described as “gyratory,” and the anterior end is always carried foremost. Those species which do not burrow usually conceal themselves in crevices of the rocks or under stones, or at times in empty Mollusc or Echinid shells. They are occasionally used by fishermen for bait.

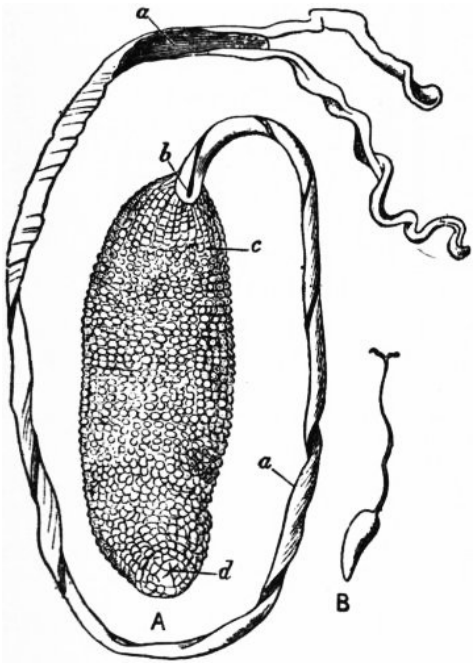


FIG. 1.—A, *Bonellia viridis*, Rol., ♀; B, *B. fuliginosa*. Both natural size. *a*, grooved proboscis; *b*, mouth; *c*, ventral hooks; *d*, anus.

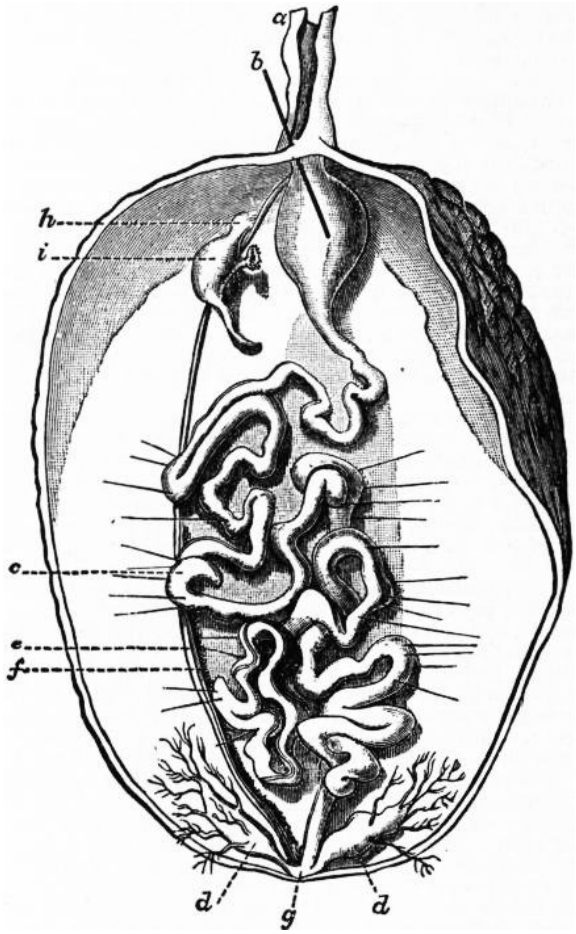


FIG. 2.—Female *Bonellia viridis*, Rol. Opened along the left side.

a, Proboscis cut short.
b, Bristle passing through the mouth into the pharynx.
c, Coiled intestine.
d, Anal tufts or vesicles.
e, Ventral nerve cord.
f, Ovary borne on ventral vessel running parallel with e.
g, Position of anus.
h, Position of external opening of nephridium.
i, Nephridium—the line points towards, but does not reach, the internal opening.

Anatomy (fig. 2).—A thin cuticle covers the epidermis, which contains mucus-secreting glands. Beneath the epidermis is a layer of circular muscles, then a layer of longitudinal, and finally in some cases a layer of oblique muscle-fibres. The inner face of this muscular skin is lined by a layer of epithelium. The coelomic body-cavity is spacious. It does not extend into the proboscis, which is a solid organ traversed by the nervous and vascular rings, but otherwise largely built up of muscle fibres and connective tissue. Many sense-cells lie in the epidermis. The ciliated ventral groove of the proboscis leads at its base into the simple mouth, which gives access to the thin-walled alimentary canal. This is longer than the body, and to tuck it away it is looped from side to side. The loops are supported by strands of connective tissue, which in some species are united so as to form a dorsal mesentery, whilst traces of a ventral mesentery are met with anteriorly and posteriorly (H.L. Jameson, *Zool. Jahrb. Anat.*, 1899). The alimentary canal is divisible into fore-gut, mid-gut and hind-gut, and the first-named can be further divided into pharynx, oesophagus, gizzard and crop, mainly on histological grounds. The mid-gut is characterized by the presence of a ciliated groove, from which arises the collateral intestine or siphon, a second tube which rejoins the alimentary canal lower down. Similar collateral intestines are familiar in the Echinids and certain Polychaets (Capitellidae). The rectum receives the openings of a pair of very characteristic organs, the anal vesicles. Each consists of a branching tube, the tips of whose twigs terminate in minute ciliated funnels. The anal vesicles are thought to be excretory; whether this be so or not, they undoubtedly have some influence on the amount of fluid found in the coelom. The coelomic fluid contains as a rule both

amoeboid and rounded corpuscles, and, when ripe, the products of the gonads. A closed system of vessels, usually called the vascular system, is present. There are, however, no capillaries connected with this, and it is confined to certain portions of the body. It can possess few of the functions usually associated with a vascular system, and its main use is probably to assist in the expansion of the proboscis. The system consists of the following parts:—A dorsal vessel applied to the alimentary canal is continued anteriorly into a median vessel, which traverses the proboscis to its tip. Here the vessel splits, and each half returns along the lateral edge of the proboscis; they reunite around the oesophagus and form a single ventral vessel, which lies above the ventral nerve-cord. The ventral vessel, which ends solidly behind, sends off a branch which forms a ring around the intestine and opens into the posterior extremity of the dorsal vessel. In *Echiurus* and *Thalassema* the same vessel forms a ring round a stout muscle, which connects the bases of the two ventral setae before passing to surround the intestine. Amoeboid corpuscles float in the fluid contents. The nephridia vary in number from a single one in *Bonellia* to three pairs in many species of *Thalassema*. Their external openings are ventral, and on the same level as the ciliated funnel-shaped nephrostomes. The posterior wall of the organ is produced into a long blind sac, which is lined by secretory cells. The nervous system is a single ventral cord, which starts from a circumoesophageal ring. This ring is involved in the growth of the proboscis, and is drawn out with it. Thus there is a lateral nerve near each edge of the proboscis which unites with its fellow dorsally above the oesophagus at the tip of the proboscis, and ventrally beneath the oesophagus, where they fuse to form the ventral nerve-cord. There are no specialized ganglia, but ganglion-cells are scattered uniformly along the nerve-cords. The ventral cord gives off rings, which run into the skin at regular intervals. The reproductive cells are modified coelomic cells, which lie on the ventral vessel. They escape into the coelomic fluid and there develop. When mature they leave the body through the nephridia. *Bonellia* and *Hamingia* are very interesting examples of sexual dimorphism. The female has the normal Echiuroid structure, but the male is reduced to a minute, flattened, planarian-like organism, which passes its life usually in the company of two or three others in a special recess of the nephridia of the female. Its structure may be gathered by a reference to fig. 3.

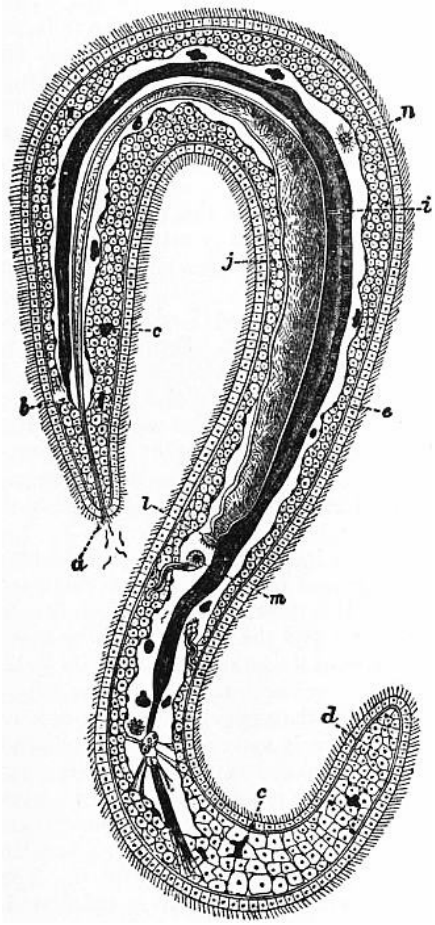


FIG. 3.—Adult male, *Bonellia viridis*, Rol. The original was 1.5 mm. long. The nervous system is not shown. (After Selenka.)

a, Generative pore with spermatozoa coming out.
b, Anterior blind end of intestine attached to the parenchymatous tissue by muscular strands.
c, Green wandering cells containing chlorophyll.
d, Parenchymatous connective tissue.
e, Epidermis.
i, Intestine.
j, Vas deferens.
l, Internal opening of vas deferens.
m, The left anal vesicle.
n, Spermatozoa in the body-cavity.

Larva.—The larva is a typical trochosphere, which, although of a temporary character, shows a distinct segmentation of the mesoblast, of the nervous system, and of the ciliated and pigmented structures in the skin, resembling that of Chaetopods. The preoral lobe persists as the proboscis. The sexes of the larvae are not determinable in the early stages, but when a certain growth has been reached in Bonellia the males seek the proboscis of the adult females, and passing into the mouth undergo there the transformation into the planarian-like parasite which is the fully-formed male. This now creeps along the body of the female and takes up its home in her nephridia.

Classification and Distribution.—The Echiuroidea consists of the following genera:—(1) *Bonellia* (Rol.), with four species, widely distributed, but inhabiting the temperate and warmer waters of each hemisphere. (2) *Echiurus* (Guérin-Méneville), with four species. This genus reaches from the Arctic waters of both hemispheres into the cooler temperate regions. (3) *Hamingia* (Kor. and Dan.), with one species, which has been taken in the Arctic Sea and the Hardanger Fjord. (4) *Saccosoma* (Kor. and Dan.) was described from a single specimen dredged about half-way between Iceland and Norway. (5) *Thalassema* (Gaertner, Lamarck), with twenty-one species. This genus is in the main a denizen of the warmer waters of the globe. Sixteen species are found only in tropical or subtropical seas, three species are Mediterranean (*Mt. Stat. Neapel*, 1899), whilst three species are from the eastern Atlantic, where the temperature is modified by the Gulf Stream (Shipley; see Willey's *Zoological Results*, part iii. 1899; *Proc. Zool. Soc. Lond.*, 1898, 1899; and *Cambridge Natural History*, ii.). The following are found in the British area:—*E. pallasii* (Guérin-Méneville), *Th. neptuni* (Gaertner), and *Th. lankesteri* (Herdman, *Q.J.M.S.*, 1898).

Affinities.—The occurrence of trochosphere larva and the temporary segmentation of the body have led to the belief that the Echiuroids are more nearly allied to the Annelids than to any other phylum. This view is strengthened by certain anatomical and histological resemblances to the genus *Sternaspis*, which in one species, *S. spinosa*, is said to carry a bifid proboscis resembling that of the Echiuroids.

(A. E. S.)

ECHMIADZIN, or Itsmiadsin, a monastery of Russian Transcaucasia, in the government of Erivan, the seat of the Catholicus or primate of the Armenian church. It is situated close to the village of Vagarshapat, in the plain of the Aras, 2840 ft. above the sea, 12 m. W. of Erivan and 40 N. of Mount Ararat. The monastery comprises a pretty extensive complex of buildings, and is surrounded by brick walls 30 ft. high, which with their loopholes and towers present the appearance of a fortress. Its architectural character has been considerably impaired by additions and alterations in modern Russian style. On the western side of the quadrangle is the residence of the primate, on the south the refectory (1730-1735), on the east the lodgings for the monks, and on the north the cells. The cathedral is a small but fine cruciform building with a Byzantine cupola at the intersection. Its foundation is ascribed to St Gregory the Illuminator in 302. Of special interest is the porch, built of red porphyry, and profusely adorned with sculptured designs somewhat of a Gothic character. The interior is decorated with Persian frescoes of flowers, birds and scroll-work. It is here that the Catholicus confers episcopal consecration by the sacred hand (relic) of St Gregory; and here every seven years he prepares with great solemnity the holy oil which is to be used throughout the churches of the Armenian communion. Outside of the main entrance are the alabaster tombs of the primates Alexander I. (1714), Alexander II. (1755), Daniel (1806) and Narses (1857), and a white marble monument, erected by the English East India Company to mark the resting-place of Sir John Macdonald Kinneir, who died at Tabriz in 1830, while on an embassy to the Persian court. The library of the monastery is a rich storehouse of Armenian literature (see Brosset's *Catalogue de la bibliothèque d'Etchmiadzin*, St Petersburg, 1840). Among the more remarkable manuscripts are a copy of the gospels dating from the 10th or 11th century, and three bibles of the 13th century. A type-foundry, a printing-press and a bookbinding establishment are maintained by the monks who supply religious and educational works for their co-religionists.

To the east of the monastery is a modern college and seminary. Half a mile to the east stand the churches of St Ripsime and St Gaiana, two of the early martyrs of Armenian Christianity; the latter is the burial-place of those primates who are not deemed worthy of interment beside the cathedral. From a distance the three churches form a fairly striking group, and accordingly the Turkish name for Echmiadzin is Uch-Kilissi, or the Three Churches. The town of Vagarshapat dates from the 6th century B.C.; it takes its name from King Vagarsh (Vologaeses), who in the 2nd century A.D. chose it as his residence and surrounded it with walls. Here the apostle of Armenia, St Gregory the Illuminator, erected a church in 309 and with it the primacy was associated. In 344 Vagarshapat ceased to be the Armenian capital, and in the 5th century the patriarchal seat was removed to Dvin, and then to Ani. The monastery was founded by Narses II., who ruled 524-533; and a restoration was effected in 618. The present name of the monastery was adopted instead of Vagarshapat in the 10th century. At length in 1441 the primate George brought back the see to the original site.

(P. A. K.; J. T. Be.)

ECHO (Gr. ἠχώ), in Greek mythology, one of the Oreades or mountain nymphs, the personification of the acoustical phenomenon known by this name. She was beloved by Pan, but rejected his advances. Thereupon the angry god drove the shepherds of the district mad; they tore Echo in pieces, and scattered her limbs broadcast, which still retained the gift of song (Longus iii. 23). According to Ovid (*Metam.* iii. 356-401), Echo by her incessant talking having prevented Juno from surprising Jupiter with the Nymphs, Juno changed her into an "echo"—a being who could not speak till she was spoken to, and then could only repeat the last words of the speaker. While in this condition she fell in love with Narcissus, and in grief at her unrequited affection wasted away until nothing remained but her voice and bones, which were changed into rocks. The legends of Echo are of late, probably Alexandrian, origin, and she is first personified in Euripides.

In acoustics an "echo" is a return of sound from a reflecting surface (see Sound: *Reflection*).

See F. Wieseler, *Die Nymphe Echo* (1854), and *Narkissos* (1856); P. Decharme in Daremberg and Saglio's *Dictionnaire des antiquités*.

ECHTERNACH, a town in the grand duchy of Luxemburg, on the Sûre, close to the Prussian frontier. Pop. (1905) 3484. It is the oldest town in Luxemburg, and was the centre from which the English Saint Willibrord converted the people to Christianity in the 7th century. There are the Benedictine abbey, the hospital almshouse, which is said to be the oldest hospital in Europe except the Hôtel-Dieu in Paris, and the church of St Peter and St Paul. The Benedictine abbey has been greatly shorn of its original dimensions, but the basilica remains a fair monument of Romano-Gothic art. The church of St Peter and St Paul stands on an isolated mound, and for the ascent sixty steps have been built in the side, and these are well worn by the tread of numerous pilgrims who come in each succeeding year. The interior of the church is curious more than imposing, and is specially noteworthy only for its gloom. Under the altar, and below a white marble effigy of himself, lies Saint Willibrord.

Echternach is famous, however, in particular for the dancing procession held on Whit-Tuesday every year. The origin of this festival is uncertain, but it dates at least from the 13th century and was probably instituted during an outbreak of cholera. Nowadays it is an occasion of pilgrimage, among Germans and Belgians as well as Luxemburgers, for all sick persons, but especially for the epileptic and those suffering from St Vitus'

dance. The ceremony is interesting, and the Roman Catholic Church lends all its ritual to make it more imposing. The archbishop of Trier attends to represent Germany, and the bishop of Luxemburg figures for the grand duchy. There is a religious ceremony on the Prussian side of the bridge over the Sûre, and when it is over the congregation cross into the duchy to join the procession, partly religious, partly popular, through the streets of the town. The religious procession, carrying cross and banners and attended by three hundred singers, comes first, chanting St Willibrord's hymn. Next comes a band of miscellaneous instruments playing as a rule the old German air "Adam had seven sons," and then follow the dancers. Many of these are young and full of life and health and dance for amusement, but many others are old or feeble and dance in the hope of recovery or of escaping from some trouble, but on all alike the conditions of the dance are incumbent. There are three steps forward and two back; five steps are thus taken to make one in advance. This becomes especially trying at the flight of steps mounting to the little church where the procession ends in front of the shrine of the great saint. There are sixty steps, but it takes three hundred to reach the top for the final time. It is said that those who fall from age or weariness have to be dragged out of the way by onlookers or they would be trampled to death by the succeeding waves of dancers. The procession, although it covers a distance of less than a mile, is said to take as much as five hours in its accomplishment. In olden days the abbey was the goal of the procession, and King William I. of the Netherlands—great-grandfather of Queen Wilhelmina—changed the day from Tuesday to Sunday so that a working day should not be lost. This reform did not answer, and the ancient order was restored. Some critics see in the dancing procession of Echternach merely the survival of the spring dance of the heathen races, but at any rate it invests the little town with an interest and importance that would otherwise be lacking.

ECHUCA, a borough of the county of Rodney, Victoria, Australia, 156 m. by rail N. of Melbourne. Pop. (1901) 4075. It is situated on the river Murray, across which it is connected by bridge with Moama, on the New South Wales side, whence a railway runs to Deniliquin. The town is the terminus of the Murray River railway and the entrepot of the overland intercolonial trade; it has large wool stores, saw-mills, coach factories, breweries and soap-works. The rich agricultural district is noted for its vineyards.

ÉCIJA, a town of southern Spain, in the province of Seville; on the Cadiz-Cordova railway and the left bank of the river Genil. Pop. (1900) 24,372. The river, thus far navigable, is here crossed by a fine old bridge; and the antiquity of the town betrays itself by the irregularity of its arrangement, by its walls and gateways, and by its numerous inscriptions and other relics. Its chief buildings include no fewer than twenty convents, mostly secularized. The principal square is surrounded with pillared porticoes, and has a fountain in the centre; and along the river bank there runs a fine promenade, planted with poplar trees and adorned with statues. From an early period the shoemakers of Écija have been in high repute throughout Spain; woollen cloth, flannel, linen and silks are also manufactured. The vicinity is fertile in corn and wine, and cotton is cultivated. The heat is so great that the spot has acquired the sobriquet of *El Sarten*, or the "Frying-pan" of Andalusia. Écija, called *Estija* by the Arabs, is the ancient *Astigis*, which was raised to the rank of a Roman colony with the title of *Augusta Firma*. According to Pliny and Pomponius Mela, who both wrote in the 1st century A.D., it was the rival of Cordova and Seville. If local tradition may be believed, it was visited by the apostle Paul, who converted his hostess Santa Xantippa; and, according to one version of his life, it was the see of the famous St Crispin (*q.v.*) in the 3rd century.

ECK, JOHANN MAIER (1486-1543), German theologian, the most indefatigable and important opponent of Martin Luther, was born on the 13th of November 1486 at Eck in Swabia, from which place he derived his additional surname, which he himself, after 1505, always modified into Eckius or Eccius, *i.e.* "of Eck." His father, Michael Maier, was a peasant and bailiff (*Amtmann*) of the village. The boy's education was undertaken by his uncle Martin Maier, parish priest at Rothenburg on the Neckar, who sent him at the age of twelve to the university of Heidelberg, and subsequently to those of Tübingen, Cologne and Freiburg in the Breisgau. His academic career was so rapidly successful that at the age of twenty-four he was already doctor and professor of theology. During this period he was distinguished for his opposition to the scholastic philosophy; and, though he did not go to all lengths with the "modernists" (*Moderni*) of his day, his first work—*Logices exercitamenta* (1507)—was distinctly on their side. This attitude brought him into conflict with the senate of the university, a conflict which Eck's masterful temper, increased by an extreme self-confidence perhaps natural in one so young and so successful, did not serve to allay. His position in Freiburg becoming intolerable, he accepted in 1510 an invitation from the duke of Bavaria to fill the theological chair at Ingolstadt, where he was destined for thirty years to exercise a profound influence as teacher and vice-chancellor (*Prokanzler*).

A ducal commission, appointed to find a means for ending the interminable strife between the rival academic parties, entrusted Eck with the preparation of fresh commentaries on Aristotle and Petrus Hispanus. He had a marvellous capacity for work, and between 1516 and 1520, in addition to all his other

duties, he published commentaries on the *Summulae* of Petrus Hispanus, and on the *Dialectics*, *Physics* and lesser scientific works of Aristotle, which became the text-books of the university. During these early years Eck was still reckoned among the "modernists," and his commentaries are inspired with much of the scientific spirit of the New Learning. His aim, however, had been to find a *via media* between the old and new; his temper was essentially conservative, his imagination held captive by the splendid traditions of the medieval church, and he had no sympathy with the revolutionary attitude of the Reformers. Personal ambition, too, a desire to be conspicuous in the great world of affairs, may have helped to throw him into public opposition to Luther. He had won laurels in a public disputation at Augsburg in 1514, when he had defended the lawfulness of putting out capital at interest; again at Bologna in 1515, on the same subject and on the question of predestination; and these triumphs had been repeated at Vienna in 1516. By these successes he gained the patronage of the Fuggers, and found himself fairly launched as the recognized apologist of the established order in church and state. Distinguished humanists might sneer at him as "a garrulous sophist"; but from this time his ambition was not only to be the greatest scientific authority in Germany but also the champion of the papacy and of the traditional church order. The first-fruits of this new resolve were a quite gratuitous attack on his old friend, the distinguished humanist and jurist Ulrich Zasius (1461-1536), for a doctrine proclaimed ten years before, and a simultaneous assault on Erasmus's *Annotationes in Novum Testamentum*.

It is, however, by his controversy with Luther and the other reformers that Eck is best remembered. Luther, who had some personal acquaintance with Eck, sent him in 1517 copies of his celebrated 95 theses. Eck made no public reply; but in 1518 he circulated, privately at first, his *Obelisci*, in which Luther was branded as a Hussite. Luther entrusted his defence to Carlstadt, who, besides answering the insinuations of Eck in 400 distinct theses, declared his readiness to meet him in a public disputation. The challenge was accepted, and the disputation took place at Leipzig in June and July 1519. On June 27 and 28 and on July 1 and 3 Eck disputed with Carlstadt on the subjects of grace, free will and good works, ably defending the Roman Semipelagian standpoint. From July 4 to 14 he engaged with Luther on the absolute supremacy of the papacy, purgatory, penance, &c., showing a brilliant display of patristic and conciliar learning against the reformer's appeals to Scripture. The arbitrators declined to give a verdict, but the general impression was that victory rested with Eck. He did, indeed, succeed in making Luther admit that there was some truth in the Hussite opinions and declare himself against the pope, but this success only embittered his animosity against his opponents, and from that time his whole efforts were devoted to Luther's overthrow. He induced the universities of Cologne and Louvain to condemn the reformer's writings, but failed to enlist the German princes, and in January 1520 went to Rome to obtain strict regulations against those whom he called "Lutherans." He was created a protonotary apostolic, and in July returned to Germany, as papal nuncio, with the celebrated bull *Exsurge Domine* directed against Luther's writings. He now believed himself in a position to crush not only the Lutheran heretics, but also his humanist critics. The effect of the publication of the bull, however, soon undeceived him. Bishops, universities and humanists were at one in denunciation of the outrage; and as for the attitude of the people, Eck was glad to escape from Saxony with a whole skin. In his wrath he appealed to force, and his *Epistola ad Carolum V.* (February 18, 1521) called on the emperor to take measures against Luther, a demand soon to be responded to in the edict of Worms. In 1521 and 1522 Eck was again in Rome, reporting on the results of his nunciature. On his return from his second visit he was the prime mover in the promulgation of the Bavarian religious edict of 1522, which practically established the senate of the university of Ingolstadt as a tribunal of the Inquisition, and led to years of persecution. In return for this action of the duke, who had at first been opposed to the policy of repression, Eck obtained for him, during a third visit to Rome in 1523, valuable ecclesiastical concessions. Meanwhile he continued unabated in his zeal against the reformers, publishing eight considerable works between 1522 and 1526.

His controversial ardour was, indeed, somewhat damped by Luther's refusal to answer his arguments, and with a view to earning fresh laurels he turned his attention to Switzerland and the Zwinglians. At Baden-in-Aargau in May and June 1526 a public disputation on the doctrine of transubstantiation was held, in which Eck and Thomas Murner were pitted against Johann Oecolampadius. Though Eck claimed the victory in argument, the only result was to strengthen the Swiss in their memorial view of the Lord's Supper, and so to diverge them further from Luther. At the Augsburg diet in 1530 Eck was charged by Charles V. to draw up, in concert with twenty other theologians, the refutation of the Protestant Confession, but was obliged to rewrite it five times before it suited the emperor. He was at the colloquy of Worms in 1540 and at the diet of Regensburg (Ratisbon) in 1541. At Worms he showed some signs of a willingness to compromise, but at Regensburg his old violence reasserted itself in opposing all efforts at reconciliation and persuading the Catholic princes to reject the Interim.

Eck died at Ingolstadt on the 10th of February 1543, fighting to the last and worn out before his time. He was undoubtedly the most conspicuous champion produced by the old religion in the age of the Reformation, but his great gifts were marred by greater faults. His vast learning was the result of a powerful memory and unwearied industry, and he lacked the creative imagination necessary to mould this material into new forms. He was a powerful debater, but his victories were those of a dialectician rather than a convincing reasoner, and in him depth of insight and conviction were ill replaced by the controversial violence characteristic of the age. Moreover, even after discounting the bias of his enemies, there is evidence to prove that his championship of the Church was not the outcome of his zeal for Christianity; for he was notoriously drunken, unchaste, avaricious and almost insanely ambitious. His chief work was *De primatu Petri* (1519); his *Enchiridion locorum communium adversus Lutherum* ran through 46 editions between 1525 and 1576. In 1530-1535 he published a collection of his writings against Luther, *Opera contra Ludderum*, in 4 vols.

See T. Wiedemann, *Dr Johann Eck* (Regensburg, 1865).

ECKERMANN, JOHANN PETER (1792-1854), German poet and author, best known owing to his association with Goethe, was born at Winsen in Hanover on the 21st of September 1792, of humble parentage, and was brought up in penury and privation. After serving as a volunteer in the War of Liberation (1813-1814), he obtained a secretarial appointment under the war department at Hanover. In 1817, although twenty-five years of age, he was enabled to attend the gymnasium of Hanover and afterwards the university of Göttingen, which, however, after one year's residence as a student of law, he left in 1822. His acquaintance with Goethe began in the following year, when he sent to him the manuscript of his *Beiträge zur Poesie* (1823). Soon afterwards he went to Weimar, where he supported himself as a private tutor. For several years he also instructed the son of the grand duke. In 1830 he travelled in Italy with Goethe's son. In 1838 he was given the title of grand-ducal councillor and appointed librarian to the grand-duchess. Eckermann is chiefly remembered for his important contributions to the knowledge of the great poet contained in his *Conversations with Goethe* (1836-1848). To Eckermann Goethe entrusted the publication of his *Nachgelassene Schriften* (posthumous works) (1832-1833). He was also joint-editor with Friedrich Wilhelm Riemer (1774-1845) of the complete edition of Goethe's works in 40 vols. (1839-1840). He died at Weimar on the 3rd of December 1854.

Eckermann's *Gespräche mit Goethe* (vols. i. and ii. 1836; vol. iii. 1848; 7th ed., Leipzig, 1899; best edition by L. Geiger, Leipzig, 1902) have been translated into almost all the European languages, not excepting Turkish. (English translations by Margaret Fuller, Boston, 1839, and John Oxenford, London, 1850.) Besides this work and the *Beiträge zur Poesie*, Eckermann published a volume of poems (*Gedichte*, 1838), which are of little value. See *J.P. Eckermanns Nachlass*, herausgegeben von F. Tewes, vol. i. (1905), and an article by R.M. Meyer in the *Goethe-Jahrbuch*, xvii. (1896).

ECKERNFÖRDE, a town of Germany, in the Prussian province of Schleswig-Holstein, on a fjord of the Baltic, 20 m. by rail N.W. from Kiel. Pop. (1905) 7088. It has a good harbour, fishing, trade in agricultural products, and manufactures of tobacco, salt and iron goods. There are a technical school of building and a Protestant teachers' seminary. Eckernförde is mentioned as far back as 1197. It was taken by Christian IV. of Denmark in 1628 from the Imperial troops. In 1813 the Danes were defeated here, while in 1849 the harbour was the scene of the blowing up of the Danish line-of-battle ship "Christian VIII." and of the surrender of the frigate "Gefion" after an engagement with the German shore batteries. The place lost most of its trade after the union with Germany in 1864, and suffered severely from a sea-flood in 1872. In the immediate neighbourhood is the village of Borby, much frequented for sea-bathing.

ECKERSBERG, KRISTOFFER (1783-1853), Danish painter, was born in south Jutland. He became successively the pupil of Nikolaj Abildgaard and of J.L. David. From 1810 to 1813 he lived at Paris under the direction of the latter, and then proceeded, as an independent artist, to Rome, where he worked until 1816 in close fellowship with Thorwaldsen. His paintings from this period—"The Spartan Boy," "Bacchus and Ariadne" and "Ulysses"—testify to the influence of the great sculptor over the art of Eckersberg. Returning to Copenhagen, he found himself easily able to take the first place among the Danish painters of his time, and his portraits especially were in extreme popularity. It is claimed for Eckersberg by the native critics that "he created a Danish colour," that is to say, he was the first painter who threw off conventional tones and the pseudo-classical landscape, in exchange for the clear atmosphere and natural outlines of Danish scenery. But Denmark has no heroic landscape, and Eckersberg in losing the golden commonplaces scarcely succeeds in being delightful. His landscapes, however, are pure and true, while in his figure-pieces he is almost invariably conventional and old-fashioned. He was president of the Danish Academy of Fine Arts in Charlottenburg.

ECKHART,[1] JOHANNES ["Meister Eckhart"] (?1260-?1327), German philosopher, the first of the great speculative mystics. Extremely little is known of his life; the date and place of his birth are equally uncertain. According to some accounts, he was a native of Strassburg, with which he was afterwards closely connected; according to others, he was born in Saxony, or at Hochheim near Gotha. Trithemius, one of the best authorities, speaks of him merely as "Teutonicus." 1260 has frequently been given as the date of his birth; it was in all probability some years earlier, for we know that he was advanced in age at the time of his death, about 1327. He appears to have entered the Dominican order, and to have acted for some time as professor at one of the colleges in Paris. His reputation for learning was very high, and in 1302 he was summoned to Rome by Boniface VIII., to assist in the controversy then being carried on with Philip of France. From Boniface he received the degree of doctor. In 1304 he became provincial of his order for Saxony, and in 1307 was vicar-general for Bohemia. In both provinces he was distinguished for his practical reforms and for his power in preaching. Towards 1325 we hear of him as preaching with great effect at Cologne, where he gathered round him a numerous band of followers. Before this time, and in all probability at Strassburg, where he appears to have been for some years, he had come in contact with the Beghards

(see Beguines) and Brethren of the Free Spirit, whose fundamental notions he may, indeed, be said to have systematized and expounded in the highest form to which they could attain. In 1327 the opponents of the Beghards laid hold of certain propositions contained in Eckhart's works, and he was summoned before the Inquisition at Cologne. The history of this accusation is by no means clear. Eckhart appears, however, to have made a conditional recantation—that is, he professed to disavow whatever in his writings could be shown to be erroneous. Further appeal, perhaps at his own request, was made to Pope John XXII., and in 1329 a bill was published condemning certain propositions extracted from Eckhart's works. But before its publication Eckhart was dead. The exact date of his death is unknown. Of his writings, several of which are enumerated by Trithemius, there remain only the sermons and a few tractates. Till the middle of the 19th century the majority of these were attributed to Johann Tauler, and it is only from Pfeiffer's careful edition (*Deutsche Mystiker d. XIV. Jahrhunderts*, vol. ii., 1857) that one has been able to gather a true idea of Eckhart's activity. From his works it is evident that he was deeply learned in all the philosophy of the time. He was a thorough Aristotelian, but by preference appears to have been drawn towards the mystical writings of the Neoplatonists and the pseudo-Dionysius. His style is unsystematic, brief and abounding in symbolical expression. His manner of thinking is clear, calm and logical, and he has certainly given the most complete exposition of what may be called Christian pantheism.

Eckhart has been called the first of the speculative mystics. In his theories the element of mystical speculation for the first time comes to the front as all-important. By its means the church doctrines are made intelligible to the many, and from it the church dogmas receive their true significance. It was but natural that he should diverge more and more widely from the traditional doctrine, so that at length the relation between his teaching and that of the church appeared to be one of opposition rather than of reconciliation. Eckhart is in truth the first who attempted with perfect freedom and logical consistency to give a speculative basis to religious doctrines. The two most important points in his, as in all mystical theories, are first, his doctrine of the divine nature, and second, his explanation of the relation between God and human thought. (See Mysticism.)

For the German writings of Eckhart see F. Pfeiffer, *Deutsche Mystiker*, vol. ii. (Leipzig, 1857), and F. Jostes, *Meister Eckhart und seine Jünger* (Freiburg, 1895); for the Latin works, H. Denifle in *Archiv f. Litt- und Kirchengeschichte d. Mittelalters*, ii. (1886), pp. 417-652, and v. (1889), pp. 349-364; German translations by G. Landauer, *Meister Eckarts mystische Schriften* (Berlin, 1903), and Büttner (Leipzig, 1903 foll.). See also A. Lasson, *Meister Eckhart der Mystiker* (1868); H.L. Martensen, *Meister Eckhart* (1842); J. Bach, *Meister Eckhart der Vater der deutschen Speculation* (1864); C. Ullmann, *Reformatoren vor der Reformation* (1842); W. Preger, *Geschichte d. deutschen Mystik*, i. (1874); and "Ein neuer Traktat M. Eckharts und d. Grundzüge der Eckhartischen Theosophie" in *Zeitschr. f. hist. Phil.* (1864), pp. 163 foll.; A. Bullinger, *Das Christenthum im Lichte der deutschen Philos.* (Dillingen, 1895); H. Delacroix, *Le Mysticisme spéculatif en Allemagne au XIV^e siècle* (Paris, 1900); E. Kramm, *Meister Eckhart im Lichte der Denifleschen Funde* (Bonn, 1889); R. Langenberg, *Über die Verhältnisse Meister Eckharts zur niederdeutschen Mystik* (Göttingen, 1896); W. Schopff, *Meister Eckhart* (Leipzig, 1889); A. Jundt, *Hist. du panthéisme populaire au moyen âge* (Paris, 1875); art. in Herzog-Hauck, *Realencyklopädie* (S.M. Deutsch); R.M. Jones, *Mystical Religion* (1909).

1 The name is variously spelled: Eckehart, Eckart, Eckhard.

ECKHEL, JOSEPH HILARIUS (1737-1798), Austrian numismatist, was born at Enzersfeld in lower Austria, 1737. His father was farm-steward to Count Zinzendorf, and he received his early education at the Jesuits' College, Vienna, where at the age of fourteen he was admitted into the order. He devoted himself to antiquities and numismatics. After being engaged as professor of poetry and rhetoric, first at Steyer and afterwards at Vienna, he was appointed in 1772 keeper of the cabinet of coins at the Jesuits' College, and in the same year he went to Italy for the purpose of personal inspection and study of antiquities and coins. At Florence he was employed to arrange the collection of the grand duke of Tuscany; and the first-fruits of his study of this and other collections appeared in his *Numi veteres anecdoti*, published in 1775. On the dissolution of the order of Jesuits in 1773, Eckhel was appointed by the empress Maria Theresa professor of antiquities and numismatics at the university of Vienna, and this post he held for twenty-four years. He was in the following year made keeper of the imperial cabinet of coins, and in 1779 appeared his *Catalogus Vindobonensis numorum veterum*. Eckhel's great work is the *Doctrina numorum veterum*, in 8 vols., the first of which was published in 1792, and the last in 1798. The author's rich learning, comprehensive grasp of his subject, admirable order and precision of statement in this masterpiece drew from Heyne enthusiastic praise, and the acknowledgment that Eckhel, as the Coryphaeus of numismatists, had, out of the mass of previously loose and confused facts, constituted a true science. A volume of *Addenda*, prepared by Steinbüchel from Eckhel's papers after his death, was published in 1826. Among his other works are—*Choix de pierres gravées du Cabinet Impérial des Antiques* (1788), a useful school-book on coins entitled *Kurzgefasste Anfangsgrunde zur alten Numismatik* (1787), of which a French version enlarged by Jacob appeared in 1825, &c. Eckhel died at Vienna on the 16th of May 1798.

ECKMÜHL, or Eggmühl, a village of Germany, in the kingdom of Bavaria, on the Grosse Laaber, 13 m. S.E. of Regensburg by the railway to Munich. It is famous as the scene of a battle fought here on the 22nd of

April 1809, between the French, Bavarians and Wurttembergers under Napoleon, and the Austrians under the Archduke Charles, which resulted in the defeat of the latter. Napoleon, in recognition of Marshal Davout's great share in the victory, conferred on him the title of prince of Eckmuhl. For an account of this action and those of Abensberg and Landshut see Napoleonic Campaigns.

ECLECTICISM (from Gr. ἐκλέγω, I select), a term used specially in philosophy and theology for a composite system of thought made up of views borrowed from various other systems. Where the characteristic doctrines of a philosophy are not thus merely adopted, but are the modified products of a blending of the systems from which it takes its rise, the philosophy is not properly eclectic. Eclecticism always tends to spring up after a period of vigorous constructive speculation, especially in the later stages of a controversy between thinkers of pre-eminent ability. Their respective followers, and more especially cultured laymen, lacking the capacity for original work, seeking for a solution in some kind of compromise, and possibly failing to grasp the essentials of the controversy, take refuge in a combination of those elements in the opposing systems which seem to afford a sound practical theory. Since these combinations have often been as illogical as facile, "eclecticism" has generally acquired a somewhat contemptuous significance. At the same time, the essence of eclecticism is the refusal to follow blindly one set of formulae and conventions, coupled with a determination to recognize and select from all sources those elements which are good or true in the abstract, or in practical affairs most useful *ad hoc*. Theoretically, therefore, eclecticism is a perfectly sound method, and the contemptuous significance which the word has acquired is due partly to the fact that many eclectics have been intellectual trimmers, sceptics or dilettanti, and partly to mere partisanship. On the other hand, eclecticism in the sphere of abstract thought is open to this main objection that, in so far as every philosophic system is, at least in theory, an integral whole, the combination of principles from hostile theories must result in an incoherent patchwork. Thus it might be argued that there can be no logical combination of elements from Christian ethics, with its divine sanction, and purely intuitional or evolutionary ethical theories, where the sanction is essentially different in quality. It is in practical affairs that the eclectic or undogmatic spirit is most valuable, and also least dangerous.

In the 2nd century B.C. a remarkable tendency toward eclecticism began to manifest itself. The longing to arrive at the one explanation of all things, which had inspired the older philosophers, became less earnest; the belief, indeed, that any such explanation was attainable began to fail. Thus men came to adopt from all systems the doctrines which best pleased them. In Panaetius we find one of the earliest examples of the modification of Stoicism by the eclectic spirit; about the same time the same spirit displayed itself among the Peripatetics. In Rome philosophy never became more than a secondary pursuit; naturally, therefore, the Roman thinkers were for the most part eclectic. Of this tendency Cicero is the most striking illustration—his philosophical works consisting of an aggregation, with little or no blending, of doctrines borrowed from Stoicism, Peripateticism, and the scepticism of the Middle Academy.

In the last stage of Greek philosophy the eclectic spirit produced remarkable results outside the philosophies of those properly called eclectics. Thinkers chose their doctrines from many sources—from the venerated teaching of Aristotle and Plato, from that of the Pythagoreans and of the Stoics, from the old Greek mythology, and from the Jewish and other Oriental systems. Yet it must be observed that Neoplatonism, Gnosticism, and the other systems which are grouped under the name Alexandrian, were not truly eclectic, consisting, as they did, not of a mere syncretism of Greek and Oriental thought, but of a mutual modification of the two. It is true that several of the Neoplatonists professed to accept all the teaching both of Plato and of Aristotle, whereas, in fact, they arbitrarily interpreted Aristotle so as to make him agree with Plato, and Plato so as to make his teachings consistent with the Oriental doctrines which they had adopted, in the same manner as the schoolmen attempted to reconcile Aristotle with the doctrines of the church. Among the early Christians, Clement of Alexandria, Origen and Synesius were eclectics in philosophy.

The eclectics of modern philosophy are too numerous to name. Of Italian philosophers the eclectics form a large proportion. Among the German we may mention Wolf and his followers, as well as Mendelssohn, J.A. Eberhard, Ernst Platner, and to some extent Schelling, whom, however, it would be incorrect to describe as merely an eclectic. In the first place, his speculations were largely original; and in the second place, it is not so much that his views of any time were borrowed from a number of philosophers, as that his thinking was influenced first by one philosopher, then by another.

In the 19th century the term "eclectic" came to be applied specially to a number of French philosophers who differed considerably from one another. Of these the earliest were Pierre Paul Royer-Collard, who was mainly a follower of Thomas Reid, and Maine de Biran; but the name is still more appropriately given to the school of which the most distinguished members are Victor Cousin, Théodore Jouffroy, J.P. Damiron, Barthélemy St Hilaire, C.F.M. de Rémusat, Adolphe Garnier and Ravaisson-Mollien. Cousin, whose views varied considerably at different periods of his life, not only adopted freely what pleased him in the doctrines of Pierre Laromiguière, Royer-Collard and Maine de Biran, of Kant, Schelling and Hegel, and of the ancient philosophies, but expressly maintained that the eclectic is the only method now open to the philosopher, whose function thus resolves itself into critical selection and nothing more. "Each system," he asserted, "is not false, but incomplete, and in reuniting all incomplete systems, we should have a complete philosophy, adequate to the totality of consciousness." This assumes that every philosophical truth is already contained somewhere in the existing systems. If, however, as it would surely be rash to deny, there still remains philosophical truth undiscovered, but discoverable by human intelligence, it is evident that eclecticism is not the only philosophy. Eclecticism gained great popularity, and, partly owing to Cousin's position as minister of public instruction, became the authorized system in the chief seats of learning in France, where it has

given a most remarkable impulse to the study of the history of philosophy.

ECLIPSE (Gr. ἔκλειψις, falling out of place, failing), the complete or partial obscuration of one heavenly body by the shadow of another, or of the disk of the sun by the interposition of the moon; then called an eclipse of the sun. Eclipses are of three classes: those of the sun, as just defined; those of the moon, produced by its passage through the shadow of the earth, and those of the satellites of other planets, produced by their passage through the shadow of their primary. Jupiter (*q.v.*) is the only planet of whose satellites the eclipses can be observed, unless under very rare circumstances.

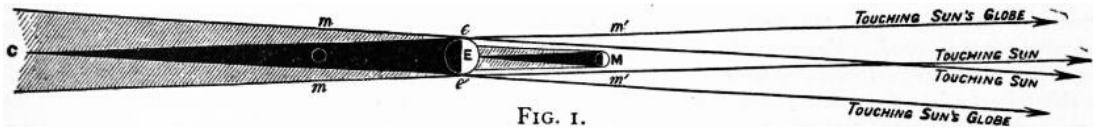


FIG. 1.

The geometrical conditions of an eclipse of the sun or moon are shown in fig. 1, which represents the earth E as casting its shadow towards C, and the moon M between the earth and sun as throwing its shadow towards some part of the earth and eclipsing the sun. The dark conical regions are those within which the sun is entirely hidden from sight. This portion of the shadow is called the *umbra*. Around the umbra is an enveloping shaded cone with its vertices directly towards the sun. To an observer within this region the sun is partly hidden from view. As the apparent path of the moon may pass to the north or south of the line joining the earth and sun, the axis of its shadow may pass to the north or south of the earth, and not meet it at all. An eclipse of the sun is called *central* when the shadow axis strikes any part of the earth; partial when only the penumbra falls upon the earth. It is evident that an eclipse can be seen as central only at those points of the earth's surface over which the axis of the shadow passes.

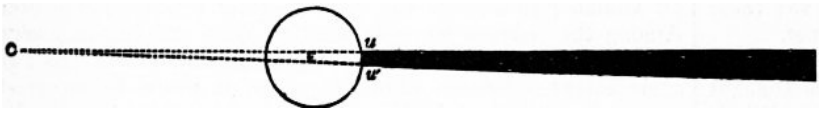


FIG. 2.

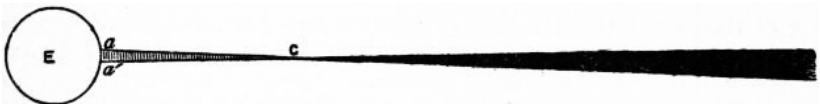


FIG. 3.

A central eclipse is *total* when the umbra actually reaches the earth; *annular* when it does not. These two cases are shown in figs. 2 and 3. In the first of these the sun is entirely hidden within the region uu′. In fig. 3 within the region aa′ the apparent diameter of the sun is slightly greater than that of the moon, and at the moment of greatest eclipse a narrow ring of sunlight is seen surrounding the dark body of the moon.

We shall treat the subject in the following sections:—

I. Phenomena of Eclipses of the Sun and conclusions derived from their observation.

II. Eclipses of the Moon.

III. The Laws and Cycles of recurrences of Eclipses of the Sun and Moon.

IV. Chronological list of remarkable eclipses of the Sun, past and future, to the end of the 20th century.

V. Description of the methods of computing eclipses.

I. *Phenomena of Eclipses of the Sun.*

While an eclipse of the sun, whether partial, annular or total, is in progress, no striking phenomena are to be noted until, in the case of total eclipses, the moment of the total phase approaches. It will, however, be noticed that as the moon advances on the solar disk the sharply defined and ragged edge of the moon's disk contrasts strongly with the soft and uniform outline of the sun's limb. As the total phase approaches, the phenomenon known as *shadow bands* may sometimes be seen. These consist of seeming vague and rapidly moving wave-like alternations of light and shade flitting over any white surface illuminated by the sun's rays immediately before and after the total phase. They are probably due to a flickering of the light from the thin crescent, produced by the undulations of the air, in the same way that the twinkling of the stars is produced. The rapid progressive motion sometimes assigned to them may be regarded as the natural result of an optical illusion. A few seconds before the commencement of the total phase the red light of the chromosphere becomes visible, and will be seen most distinctly as continuations of the solar crescent at its two ends. Owing to the inequalities of the lunar surface, the diminution of the solar crescent does not go on with perfect uniformity, but, just before the last moment, what remains of it is generally broken up into separate portions of light, which, magnified and diffused by the irradiation of the telescope, present the

phenomenon long celebrated under the name of “Baily’s beads.” These were so called because minutely and vividly described by Francis Baily as he observed them during the annular eclipse of May 15, 1836, when he compared them to a string of bright beads, irregular in size and distance from each other. The disappearance of the last bead is commonly taken as the beginning of totality. An arc of the chromosphere will then be visible for a few seconds at and on each side of the point of disappearance, the length and duration of which will depend on the apparent diameter of the moon as compared with that of the sun, being greater in length and longer seen as the excess of diameter of the moon is less. The red prominences may now generally be seen here and there around the whole disk of the moon, while the effulgence of soft light called the corona surrounds it on all sides. Before the invention of the spectroscope, observers of total eclipses could do little more than describe in detail the varying phenomena presented by the prominences and the corona. Drawings of the latter showed it to have the appearance of rays surrounding the dark disk of the moon, quite similar to the glory depicted by the old painters around the head of a saint. The discrepancies between the outlines as thus pictured, not only at different times, but by different observers at the same time and place, are such as to show that little reliance can be placed on the details represented by hand drawings.

During the eclipse of July 8, 1842, the shadow of the moon passed from Perpignan, France, through Milan and Vienna, over Russia and Central Asia, to the Pacific Ocean. Very detailed physical observations were made, but none which need be specially mentioned in the present connexion.

The eclipse of July 28, 1851, was total in Scandinavia and Russia. It was observed in the former region by many astronomers, among them Sir George B. Airy and W.R. Dawes. It was specially noteworthy for the first attempt to photograph such a phenomenon. A daguerreotype clearly showing the protuberances was taken by Berkowski at the Observatory of Königsberg. An attempt by G.A. Majocchi to daguerreotype the corona was a failure. Photographs of the eclipse of July 18, 1860, were taken by Padre Angelo Secchi and Warren De La Rue, which showed the prominences well, and proved that they were progressively obscured by the edge of the advancing moon. It was thus shown that they were solar appendages, and did not belong to the moon, as had sometimes been supposed. The corona was barely visible on De La Rue’s plates, but those of Secchi showed it, with its rifts and the bases of the tall coronal wings, to about 15’ from the sun’s limb. The sketches taken at this eclipse proved that the corona extended in some regions 1° from the sun’s limb. As the sensitiveness of photographic plates has increased, they have gradually been wholly relied upon for information respecting the corona, so that at the present time naked-eye descriptions are regarded as of little or no scientific value. Owing to the great contrast between the brilliancy of the coronal light at its base and its increasing faintness as it extends farther from the sun, no one photograph will bring out all the corona. An exposure of one or two seconds is ample to show the details of inner corona to the best advantage, while longer exposures give greater extent of the brighter portions. The most extended streamers are very little brighter than the sky, and must be photographed with long exposures.

The first application of the spectroscope to the phenomenon was made during the total solar eclipse of August 18, 1868, by P.J.C. Janssen and other observers in India. By them was made the capital discovery that the red solar prominences give a spectrum of bright lines, and are therefore immense masses of incandescent gases, chiefly hydrogen and the vapours of calcium and helium. Janssen also found that this bright-line spectrum could be followed after the eclipse was over, and, in fact, could be observed at any time when the air was sufficiently transparent. By one of those remarkable coincidences which frequently occur in the history of science, this last discovery was made independently by Sir Norman Lockyer in England before the news of Janssen’s success had reached him. It was afterwards found that, by giving great dispersing power to the spectroscope, the prominences could be observed in a wide slit, in their true form. At this eclipse the spectrum of the corona was also observed, and was supposed to be continuous, while polariscopic observation by Lieutenant Campbell showed it polarized in planes passing through the sun’s centre. The conclusion from these two observations was that the light was composed, at least in great part, of reflected sunlight.

At the total eclipse of August 7, 1869, it was independently found by Professors C.A. Young of Princeton and W. Harkness of Washington that the continuous spectrum of the corona was crossed by a bright line in the green, which was long supposed to be coincident with 1474 of Kirchhoff’s scale. This coincidence is, however, now found not to be real, and the line cannot be identified with that of any terrestrial substance. The name “coronium” has therefore been given to the supposed gas which forms it. It is now known that 1474 is a double line, one component of which is produced by iron, while the other is of unknown origin. The wave-length of the principal component is 5317, while that of the coronal line was found at the eclipses of 1896 and 1898 to be 5303.

The eclipse of December 28, 1870, passed over the south-western corner of Spain, Gibraltar, Oran and Sicily. It is memorable for the discovery by Young of the “reversing layer” of the solar atmosphere. This term is now applied to a shallow stratum resting immediately upon the photosphere, the absorption of which produces the principal dark lines of the solar spectrum, but which, being incandescent, gives a spectrum of bright lines by its own light when the light of the sun is cut off. This layer is much thinner than the chromosphere, and may be considered to form the base of the latter. Owing to its thinness, the phenomenon of the reversed bright lines is almost instantaneous in its nature, and can be observed for a period exceeding one or two seconds only near the edge of the shadow-path, where the moon advances but little beyond the solar limb. Near the central line it is little more than a flash, thus giving rise to the term “flash-spectrum.” Young also at this eclipse saw bright hydrogen lines when his spectroscope was directed to the centre of the dark disk of the moon. This can only be attributed to the reflection of the light of the prominences and chromosphere from the atmosphere between us and the moon. The coronal light as observed in the spectroscope may thus be regarded as a mixture of true coronal light with chromospheric light reflected from the air, and it is therefore probable that the H and K (calcium) lines of the coronal spectrum are not true coronal lines, but chromospheric.

At the eclipse of December 12, 1871, visible in India and Australia, Janssen observed, as he supposed,

some of the dark lines of the solar spectrum in the continuous spectrum of the corona, especially D, *b* and G. This would show that an important part of the coronal light is due to reflected sunshine. This feature of the spectrum, however, is doubtful in the most recent photographs under the best conditions. At this eclipse the remarkable observation was also made by Colonel John Herschel and Colonel J.F. Tennant that the characteristic line of the coronal spectrum is as bright in the dark rifts of the corona as elsewhere. This would show that the gas coronium does not form the streamers of the corona, but is spherical in form and distributed uniformly about the sun. Photographs were also taken on wet plates by a party in Java and by the parties of Lord Lindsay (at Baikul, India) and of Colonel Tennant (at Dodabetta). The Baikul and Dodabetta photographs were of small size (moon's diameter = $\frac{3}{10}$ in.), but of excellent definition. A searching study was made of them by A. C Ranyard and W.H. Wesley (*Memoirs R.A.S.* vol. xli., 1879), and for the first time a satisfactory representation of the corona was obtained. The drawings in the volume quoted show its polar rays, wings, interlacing filaments and rifts as they are now known to be, as well as the forms and details of the prominences.

The eclipse of April 16, 1874, was observed in South Africa by E.J. Stone, H.M. astronomer at the Cape, who traced the coronal line about 30′ (430,000 m.) from the sun's limb. The visual corona was seen to extend in places some 90′ from the limb.

The eclipse of April 6, 1875, was observed in Siam by Sir J. Norman Lockyer and Professor Arthur Schuster. Their photographs showed the calcium and hydrogen lines in the prominence spectrum.

The eclipse of July 29, 1878, was observed by many astronomers in the United States along a line extending from Wyoming to Texas. A number of the stations were at high altitudes (up to 14,000 ft.), and the sky was generally very clear. The visible corona extended on both sides of the sun along the ecliptic for immense distances—at least twelve lunar diameters, about eleven million miles. Photographs taken by the parties of Professors A. Hall and W. Harkness gave the details of the inner corona and of the polar rays, showing the filamentous character of the corona, especially at its base in the polar regions. A photograph taken by the party of Professor E.S. Holden showed the outer corona to a distance of 50′ from the moon's limb. The bright-line spectrum of the corona was excessively faint and, as the solar activity (measured by sun-spot frequency) was near a minimum, it was concluded that the brilliancy of the coronium line varied in the sun-spot period, a conclusion which subsequent eclipse observations seem to have verified. It is not yet certain that the other coronal spectrum lines vary in the same way.

The eclipse of May 17, 1882, was observed in Egypt. On the photographs of the corona the image of a bright comet was found, the first instance of the sort. (A faint comet was found on the plates of the Lick Observatory eclipse expedition to Chile in 1893.) The slitless spectroscope showed the green line (coronium) and D_3 (helium) in the coronal spectrum.

The eclipse of May 6, 1883, was observed from a small coral atoll in the South Pacific Ocean by parties from America, England, France, Austria and Italy. A thorough search was made by Holden (with a 6 in. telescope) for an intra-Mercurial planet, without success, during an unusually long totality (5 m. 23 s.). J. Palisa also searched for such a planet. Janssen again reported the presence of dark lines in the coronal spectrum. "White" prominences were seen by P. Tacchini.

The eclipse of August 29, 1886, was observed in the West Indies. The English photographs of the corona, taken with a slitless spectroscope, show the hydrogen lines as well as K and f. Tacchini devoted his attention to the spectra of the prominences, and showed that their upper portions contained no hydrogen lines, but only the H and K lines of calcium. He also observed a very extensive "white" prominence. It was shown on the photographs of the corona, but could not be seen in the Hα line with the spectroscope. It has been suggested by Professor G.E. Hale that the colour of a "white" prominence may be due to the fact that the H and K lines (calcium) are of their normal intensity, while the less refrangible prominence lines are, from some unknown cause, comparatively faint. It is known that the intensity of such lines does, in fact, vary, though it is not yet certain that the "white" prominences are produced in this way. The subject is one demanding further observation. High prominences are generally "white" at their summits, "red" at their bases. The Harvard College Observatory photographs show the corona out to 90′ from the moon's limb, though no detail is visible beyond 60′. W.H. Pickering made a series of photographic photometric measures of the corona, some of which are given below, together with results deduced by Holden from the eclipses of January and December 1889:—

	August 1886.	January 1889.	December 1889.
Intrinsic actinic brilliancy of the brightest parts of the corona	0.031	0.079	0.029
Do. of the polar rays	· ·	0.053	0.016
Do. of the sky near the sun	0.0007	0.0050	0.0009
Ratio of intrinsic brilliancy of the brightest parts of the corona to that of the sky (actinic)	44 to 1	16 to 1	32 to 1
Magnitude of the faintest star shown on the eclipse negatives	· ·	2.3	· ·

The results in the first and third columns are derived from plates taken in a very humid climate, and are not very different.

The eclipse of August 19, 1887, was total in Japan and Russia, but cloudy weather prevented successful observations except in Siberia and eastern Russia.

The eclipse of January 1, 1889, was observed in California and Nevada by many American astronomers. The photographs of the corona, especially those by Charoppin and E.E. Barnard, show a wealth of detail. Those of Barnard, of the Lick Observatory party, were studied by Holden, and exhibited the fact that rays, like the "polar-rays," extended all round the sun, instead of being confined to the polar regions only. The outer corona was registered out to 100′ from the moon's limb on Charoppin's negatives, to 130′ on those of

Lowden and Ireland. On other plates the outline of the moon is visible projected on the corona before totality began. The spectrum of the corona showed few bright lines besides those of coronium and hydrogen.

The eclipse of December 22, 1889, was observed in Cayenne, S. America, by a party from the Lick Observatory under rather unfavourable conditions. Expeditions sent to Africa were baffled by cloudy weather. Father Stephen Joseph Perry observed at Salute Islands, French Guiana, and obtained some photographs of value. The effort cost him his life, for he died of malarial fever five days after the eclipse.

The eclipse of April 16, 1893, was observed by British and French parties in Africa and Brazil, and by Professor J.M. Schaeberle of the Lick Observatory in Chile. The Chile photographs of the corona were taken with a lens of 40 ft. focus, and are extremely fine. They show a faint comet near the sun. No great extensions to the corona were shown on any of the negatives, or seen visually, though they were specially looked for by British parties. The neighbourhood of the sun was carefully examined by G. Bigourdan without finding any planet. The spectrum of the corona was the usual one. The following lines were photographed in slitless spectroscopes, and undoubtedly belong to the corona: W. L. 3987; 4086; 4217; 4231; 4240; 4280; 4486; 5303 (the last number is the wave-length of the green coronium line). All of these have been seen in slit spectroscopes also. It is possible that two lines observed by Young in 1869, namely, W. L. (Ångstrom) 5450 and 5570, should be added to the list of undoubted coronal lines. It is not likely that helium or hydrogen or calcium vapour forms part of the corona. The wave-lengths of some 700 lines belonging to the chromosphere and prominences were determined by the British parties.

The eclipse of August 9, 1896, was total in Norway, Novaya Zemlya and Japan. The day was very unfavourable as to weather, but good photographs of the corona were obtained by Russian parties in Siberia and Lapland. Shackelton, in Novaya Zemlya, with a prismatic camera obtained a photograph of the reversing-layer at the beginning of totality. This photograph completely confirms Young's discovery, and shows the prominent Fraunhofer lines bright, the bright lines of the chromosphere spectrum being especially conspicuous.

At the solar eclipse of January 22, 1898, the shadow of the moon traversed India from the western coast to the Himalaya. The duration of totality was about 2 m. The eclipse was very fully observed, more than 100 negatives of the corona being secured. The equatorial extension of the visible corona was short and faint, and the invisible (spectroscopic) corona was also very faint. The spectrum of the reversing-layer was successfully photographed; one set of negatives shows the polarization of one of the longest streamers of the corona, and proves the presence of dust particles reflecting solar light. The bright-line spectrum of hydrogen in the chromosphere was followed to the thirtieth point of the series, and the wave-lengths were shown to agree closely with Balmer's formula (see Spectroscopy). The wave-length of coronium was found to be 5303 (not 5317 as previously supposed), and the brightness of the corona was measured. E.W. Maunder made the curious observation of coronal matter enveloping a prominence in the form of a hood.

Observations of the eclipse of May 28, 1900, were favoured in a remarkable degree by the absence of clouds. The photographs of the corona obtained by W.W. Campbell extended four diameters of the sun on the west side. The sun's edge was photographed with an objective-prism spectrograph composed of two 60° prisms in front of a telescope of 2 in. aperture and 60 in. focus. A fine photograph, 6 in. long, of the bright- and dark-line spectra of the sun's edge at the end of totality was thus obtained. It shows 600 bright lines sharply in focus besides the dark-line spectrum, to which the bright lines gave way as the sun reappeared. The coronal material radiating the green light was found to be markedly heaped up in the sun-spot regions. No dark lines were found in the spectrum of the inner corona. G.E. Hale and E.B. Frost also photographed the combined bright- and dark-line spectra of the solar cusps at the instants before and after totality. On one photograph showing no dark lines 70 bright lines could be measured between 4070 and 4340. On another were 70 bright lines between H*b* and H*s*. On a third were 266 bright lines between 4026 and 4381, and some dark lines. These lines show a marked dissimilarity from the solar spectrum.

(S. N.)

The eclipse of May 18, 1901, was observable in Mauritius with 3½ minutes of totality, and in Sumatra with 6½ minutes. Unfortunately there was cloudy weather in Sumatra, which at some stations prevented observations entirely and at others neutralized the advantages promised by the long duration of totality. Thus spectroscopic observations for the detection of motion of the corona, for which the long totality gave a special opportunity, failed owing to cloud; and the search for intra-Mercurial planets had only a negative result, though stars down to magnitude 8.8 were photographed on the plates. But though no particular step in advance was taken, successful records of the eclipse were obtained, which will enable comparison to be made with other eclipses and will contribute their share to the discussion of the whole series. These include photographs of the corona, showing that it was of the sun-spot minimum type, and available for measures of its brightness; photographs of the spectra of the chromosphere and corona which are of the same general character as those obtained at previous eclipses; photographs showing the polarization of the corona, available for quantitative measures of polarization at different points. Photographs of the spectrum of the outer corona taken by the Lick Observatory party show a strong Fraunhofer dark-line spectrum, consistent with the view that the light is reflected sunlight. At Mauritius there was no cloud, but the definition was poor. Successful photographs of the corona were obtained for comparison with those taken in Sumatra one and a half hours later, but nothing of great interest was revealed by the comparison.

The eclipse of August 30, 1905, offered a duration of 3½ minutes in Spain, the track running from Labrador through Spain to North Africa, and affording excellent opportunities for observers, who flocked to the central line in great numbers. Unfortunately it was cloudy in Labrador, so that the special advantages of the long line of possible stations were lost. Exceptionally good weather conditions were enjoyed in Algeria and Tunisia, and full advantage was taken of them by H.F. Newall, C. Trépied and others at Guelma, by the party from Greenwich and G. Bigourdan at Sfax. That G. Newall's spectroscopic photographs for rotation of the corona again gave no result is a clear indication of the faintness of the corona at 3′ from the limb; but F.W. Dyson at Sfax obtained two new lines at 5536 and 5117 in the spectrum of the corona; and a very large number of photographs of the corona (including many in polarized light on several different plans), of its

spectrum, and of the spectrum of the chromosphere, were obtained by the various parties, which will afford copious material for discussion. Newall also obtained a polarized spectrum of the corona. Altogether no less than eighty stations were occupied. There were English, American, Russian and German observers in Egypt; English and French in Algeria and Tunisia; English in Majorca; observers of almost all nationalities in Spain; and English and American in Labrador. In Egypt the weather was bright, though the sun was low; in Majorca and Spain there were local clouds. Consequently many observations, in addition to those in Labrador, were lost, notably the special spectroscopic observations undertaken by Evershed on the northern limit of totality, and the observations of radiation undertaken by H.L. Callendar. A search for intra-Mercurial planets was conducted on an elaborate plan, with similar batteries of telescopes, in Egypt, Spain and Labrador, by three parties from the Lick Observatory, but the examination of the plates showed nothing noteworthy. Pending discussion of the greater part of the material, some interesting preliminary results were published in 1906 by the French observers. C.E.H. Bourget and Montangerand conclude that there is a marked division of the chromosphere into two regions or shells, a lower or "reversing-layer," extending only 1″ from the limb, and a chromospheric layer extending to 3″ or 4″; and that the coronal light contains less blue and violet, but more green and yellow, than sunlight; while Fabry, by visual methods, obtained measures of the total and intrinsic intensity of the light from the corona closely confirming recent photographic observations, finding the total brightness about equal to that of the full moon, and the intrinsic brightness at 5′ from the limb about one quarter of that of the full moon.

(H. H. T.)

II. *Eclipses of the Moon.*

The physical phenomena attending eclipses of the moon are no longer of a high order of interest either to the layman or scientific observer. A brief statement of them and their causes will therefore be sufficient. An observer watching such an eclipse from the moon would see the earth, which has nearly four times the apparent diameter of the sun, impinging on the sun's disk and slowly hiding it. The phenomenon would be quite similar to that of an eclipse of the sun seen from the earth, until the sun was completely covered. During the progress of this partial eclipse the moon would be passing into the earth's penumbra. As the moment of total obscuration approached, a red band of light would rapidly form in the neighbourhood of the disappearing limb of the sun, and gradually extend around the earth. This would arise from the refraction of the sun's light by the earth's atmosphere, and the absorption of its blue rays. When the light of the sun was completely hidden, a reddish ring of great brilliancy would, owing to this cause, surround the entire dark body of the earth during the period of the total eclipse.

The aspect of the moon, as seen from the earth, corresponds to this view from the moon. The fading of the moon's light, due to its entrance into the penumbra, is scarcely noticeable without direct photometric determination until near the beginning of the total phase. Then, as the limb of the moon approaches the earth's shadow, it begins to darken. When only a small portion has entered into the shadow, that portion is completely hidden. But, as the total phase approaches, the part of the moon's disk immersed in the penumbra becomes visible by a reddish coppery light—that of the sun refracted through the lower parts of the earth's atmosphere. The brightness of this illumination is different in different eclipses, a circumstance which may be attributed to the greater or less degree of cloudiness in those regions of the earth's atmosphere through which the light of the sun passes in order to reach the moon. Its colour is due to absorption in passing through the earth's atmosphere.

III. *Laws and Cycles of Recurrences of Eclipses of the Sun and Moon.*

It has been known since remote antiquity that eclipses occur in cycles. These cycles are known now to be determined principally by the motion of the moon's node and the relations between the revolutions of the earth round the sun and the moon round the earth.

Eclipse seasons.

Owing to the inclination of the moon's orbit to the plane of the ecliptic, an eclipse of the sun can occur only when the conjunction of the sun and moon takes place within about 16° of one of the nodes of the moon's orbit. The eclipse can be total only within about 11° of the node. An eclipse of the moon can occur only when the line sun-moon-earth makes an angle less than about 11° with the line of nodes; and the eclipse can be total only within about 8° of the node, the average limiting distances varying 1° or 2° according to the circumstances. These conditions being understood, the cycles of recurrence of eclipses of either kind can be worked out geometrically from the mean motions of the sun, moon, node and perigee by the aid of geometric conceptions shown in their simplest form in fig. 4. Here E is the earth, at the centre of a circle representing the mean orbit of the moon around it. MN is the line of nodes which is moving in the retrograde direction from N towards S_1, at a rate of about 19.3° in a year, making a complete revolution in 18.6 years. Let the sun at the moment of some new moon be in the line ES_1, continued. If the angle NES_1 is less than 16° there will probably be an eclipse of the sun, which may be central if the angle is less than 11°. Let the next new moon take place in the line ES_2 a month later. The mean value of the angle S_1ES_2 is about 29°; but as the node N has moved towards S_1 about 1.4° during the interval, the sum of the angles NES_1 and NES_2 will be somewhat greater than S_1ES_2 by about 1.6°. The result is that if these two angles are nearly equal there may be two small partial eclipses of the sun, after which no more can occur until, by the annual revolution of the earth, the direction of the sun approaches the opposite line of nodes EM, nearly six months later. The result is that there are in the course of any one year two "eclipse seasons" each of about one month in duration, in which at least one eclipse of the sun, or possibly two small partial eclipses, may occur. One eclipse of the moon will generally, but not always, occur during a season.

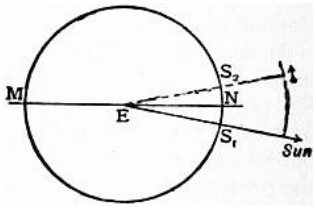


FIG. 4.

Owing to the retrograde motion of the node the direction ES of the sun returns to the node at the end of about 347 days, so that a third eclipse season may commence before the end of a year. In this way there is a possible but very rare maximum of five eclipses of the sun in a year. Owing to the motion of the line of nodes each eclipse season occurs about 19 days earlier in the year than it did the year before. Another conclusion from the greater eclipse limit for the sun than for the moon is that in the long run eclipses of the sun, as regards the earth generally, occur oftener than those of the moon. But as any eclipse of the sun is visible only from a limited region of the earth's surface, while one of the moon may be seen from an entire hemisphere, more eclipses of the moon are visible at any one place than of the sun.

If, starting with a conjunction along some line ES_1, we mark by radial lines from E the successive conjunctions year after year, we shall find that at the end of 18 years and about 11 days the 223rd conjunction will fall once more very near the line ES_1, the angle NES_1 being about 24′ greater than before. Successive eclipses will then occur very nearly in the same order as they did 18 years and 11 days before. This period of recurrence has been known from remote antiquity and is called the *Saros*. What is most remarkable in this period is that in addition to the distance from the node being nearly the same as before, the longitude of the sun increases by only 11° and the distance of the moon from its perigee has changed less than 3°. The result of this approach to coincidence is that the recurring eclipse will generally be of the same kind—total, annular or partial—through a number of successive periods.

To see the law of recurrence of corresponding eclipses in the successive periods let us suppose the line of conjunction ES_1 to be that at which there is a very small eclipse, visible only in high northern or southern latitudes. At the end of 18 years 11 days a second eclipse will occur along a line nearly half a degree nearer EN, the line of nodes. The successive eclipses will occur at the same interval through about ten periods, or 180 years, when the line of conjunction will pass within 11° of EN. Then the eclipse will be central, whether annular or total depending on circumstances: in the first one the central lines will pass only over the polar regions; but in successive eclipses of the series it will pass nearer and nearer to the equator until the conjunction line coincides with the node. The path of centrality will then cross in the equatorial region. During 22 or 23 more recurrences the path will continually approach to the opposite pole and finally leave the earth entirely. The entire number of central eclipses in any one series will generally be about forty-five. Then a series of continually diminishing partial eclipses will go on for about ten periods more. The whole series of eclipses will therefore extend through about sixty-five periods; and interval of time of about twelve hundred years.

Another remarkable eclipse period recurs at the end of 358 lunations. At the end of this period the line of mean conjunction ES_1 falls so near its former position relative to the node that we find each central eclipse visible in our time to be one of an unbroken series extending from the earliest historic times to the present, at intervals equal to the length of the period. The recurring eclipses in this period do not, however, have the remarkable similarity of those belonging to the Saros, but may differ to any extent, owing to the different positions of the line of conjunction with respect to the moon's perigee. Moreover, they recur alternately at the ascending and descending node. The length of the period is 10,571.95 days, or 29 Julian years less 20.3 days. Hence 18 periods make 521 years, so that at the end of this time each eclipse recurs on or about the same day of the year. As an example of this series, starting from the eclipse of Nineveh, June 15, 763 B.C., recorded on the Assyrian tablets, we find eclipses on May 27, 734 B.C., May 7, 705 B.C., and so on in an unbroken series to 1843, 1872 and 1901, the last being the 93rd of the series. Those at the ends of the 521-year intervals occurred on June 15, O.S., of each of the years 763, 242 B.C., A.D. 280, 801, 1322 and 1843. As the lunar perigee moves through 242.4° in a period, the eclipses will vary from total to annular, but at the end of 3 periods the perigee is only 7.1° in advance of its original position relative to the node. Hence in a series including every third eclipse the eclipses will be of the same character through a thousand years or more. Thus the eclipses of 1467, 1554, 1640, 1727, 1814, 1901, 1988, &c., are total.

IV. *Chronological Lists of Eclipses of the Sun.*

Notable eclipses.

The following is a brief chronological enumeration of those total eclipses of the sun which are of interest, either from their historic celebrity or the nature of the conclusions derived from them. In numbering the years before the Christian era the astronomical nomenclature is used, in which the number of the year is one less than that used by the chronologists. The Chinese eclipses are passed over, owing to the generally doubtful character of the records pertaining to them.

—1069 June 20 and —1062 July 31; total eclipses recorded at Babylon.

—762, June 14; a total eclipse recorded at Nineveh. Computation from the modern tables shows that the path of totality passed about 100 m. or more north of Nineveh.

—647, April 6; total eclipse at or near Thasos, mentioned by Archilochus.

—584, May 28; the celebrated eclipse of Thales. For an account of this eclipse see THALES.

—556, May 19, the eclipse of Larissa. The modern tables show that the eclipse was not total at Larissa, and the connexion of the classical record with the eclipse is doubtful.

—430, August 3; eclipse mentioned by Thucydides, but not total by the tables.

—399, June 21; eclipse of Ennius. Totality occurred immediately after sunset at Rome. The identity of this eclipse is doubtful.

—309, August 14; eclipse of Agathocles. This eclipse would be one of the most valuable for testing the tables of the moon, but for an uncertainty as to the location of Agathocles, who, at the time of the occurrence, was at sea on a voyage from Syracuse to Carthage.

F.K. Ginzel (*Spezieller Kanon der Finsternisse*) has collected a great number of passages from classical

authors supposed to refer to eclipses of the sun or moon, but the difficulty of identifying the phenomenon is frequently such as to justify great doubt as to the conclusions. In a few cases no eclipse corresponding to the description can be found by our modern table to have occurred, and in others the latitude of interpretation and the uncertainty of the date are so wide that the eclipse cannot be identified.

Of medieval eclipses we mention only the dates of those visible in England, referring for details to the works mentioned in the bibliography. The letter C following a date shows that the eclipse is mentioned in the Anglo-Saxon Chronicles. The dates in question are:—

A.D. 538, February 15, C. (partial).
540, June 12, C. (partial).
594, July 23.
603, August 12.
639, September 3.
664, May 1, C.
733, August 14 (annular).
764, June 4 (annular).
878, October 29, C.
885, June 15.
1023, January 24.
1133, August 1, C.
1140, March 20, C.
1185, May 1, C.
1191, June 23, C. (annular).
1330, July 16.

Besides these, the tables show that the shadow of the moon passed over some part of the British Islands on 1424, June 26; 1433, June 17; 1598, March 6; 1652, April 8; 1715, May 2; 1724, May 22. Of these the eclipse of 1715 is notable for the careful observations made in England, and published by Halley in the *Philosophical Transactions*. The next dates are 1927, June 29, when a barely total eclipse will be seen soon after sunrise in the northern counties near the Scottish border, and 1999, August 11, when the moon's shadow will graze England at Land's End.

We give below, in tabular form, a list of the principal total eclipses during the 19th and 20th centuries, omitting a few visible only in the extreme polar regions, and some others of which the duration is very short. The first column gives the civil date of the point on the earth's surface at which the eclipse is central at noon. The next two columns give the position of this point to the nearest degree. The fourth column shows the Greenwich astronomical time of conjunction in longitude. The next column gives the duration of the total phase at the noon-point; this is sometimes 0.1′ less than the absolutely greatest duration at any point. Next is given the node near which the eclipse occurs; and then the number in the Saros. Corresponding eclipses at intervals of 18 y. 11 d. have the same number, and occur near the same node of the noon, which is indicated in the next column.

Date at Noon-Point.	Point where Central at Noon.		Greenwich M.T. of conjunction in Longitude.			Duration of Totality.	Node	Series.	Regions Swept by Shadow.
	Lat.	Long.	d.	h.	m.	m.			
1803, Feb. 21	11 S.	136 W.	21	9	20	4.2	Asc.	1	Pacific Ocean, Mexico.
1804, Aug. 5	38 S.	66 W.	5	4	6	1.2	Desc.	2	Pacific Ocean, Chile, Argentina.
1806, June 16	42 N.	66 W.	16	4	22	4.6	Desc.	3	New England, Atlantic, Africa.
1807, Nov. 29	11 N.	2 E.	28	23	48	1.4	Asc.	4	Central Africa, Areolia.
1810, April 4	12 N.	154 E.	3	13	41	Ann.	Desc.	5	Pacific Ocean, Borneo.
1811, Mar, 24	39 S.	26 W.	24	2	19	3.4	Desc.	6	South Atlantic to and across South Africa.
1814, July 17	31 N.	84 E.	16	18	33	6.6	Asc.	7	Africa, Central Asia, China.
1815, July 6	88 N.	175 W.	6	11	52	3.2	Asc.	8	Polar Regions, Western Siberia.
1816, Nov. 19	43 N.	30 E.	18	22	9	1.8	Desc.	9	Eastern Europe, Central Asia.
1817, Nov. 9	7 S.	149 E.	8	13	53	4.7	Desc.	10	Burma, Pacific Ocean.
1821, Mar. 4	8 S.	96 E.	3	17	50	4.3	Asc.	1	Indian and Pacific Oceans.
1822, Aug. 16	36 S.	176 W.	16	11	22	1.4	Desc.	2	Australia, Pacific Ocean.
1824, June 26	47 N.	175 W.	26	11	43	4.4	Desc.	3	Pacific Ocean, Japan, China.
1825, Dec. 9	9 N.	127 W.	9	8	27	1.5	Asc.	4	Pacific Ocean, Mexico.
1828, April 14	18 N.	39 E.	13	21	18	0.3	Desc.	5	Northern Africa, India.
1829, April 3	32 S.	149 W.	3	10	24	4.1	Desc.	6	South Pacific Ocean.
1832, July 27	24 N.	28 W.	27	2	2	6.8	Asc.	7	West Indies and across Central Africa.
1833, July 17	78 N.	76 E.	16	19	16	3.5	Asc.	8	North-eastern Asia and Polar Regions.
1834, Nov. 30	40 N.	101 W.	30	6	48	1.9	Desc.	9	Southern and Western United States.
1835, Nov. 20	10 S.	20 E.	19	22	31	4.6	Desc.	10	Central Africa, Madagascar.
1839, Mar. 15	6 S.	31 W.	15	2	14	4.4	Asc.	1	South America, Africa, Egypt.
1840, Aug. 27	34 S.	72 E.	26	18	45	1.6	Desc.	2	Africa, Madagascar, Indian Ocean.
1842, July 8	51 N.	77 E.	7	19	2	4.1	Desc.	3	Spain, France, Russia to China, and Pacific Ocean.
1843, Dec. 21	8 N.	102 E.	20	17	10	1.6	Asc.	4	Indian and North Pacific Oceans and India.
1846, April 25	25 N.	75 W.	25	4	49	0.9	Desc.	5	Mexico, West Indies, Africa.
1847, April 15	24 S.	90 E.	14	18	22	4.7	Desc.	6	Indian Ocean, Australia.
1850, Aug. 7	18 N.	142 W.	7	9	34	6.8	Asc.	7	Pacific Ocean.
1851, July 28	70 N.	34 W.	28	2	41	3.7	Asc.	8	Scandinavia, Russia and North America.
1852, Dec. 11	37 N.	127 E.	10	15	32	2.0	Desc.	9	China, Pacific Ocean.
1857, Mar. 25	4 S.	155 W.	25	10	30	4.5	Asc.	1	Pacific Ocean, Mexico.
1858, Sept. 7	33 S.	41 W.	7	2	16	1.7	Desc.	2	Peru, South Brazil, Uruguay.
1860, July 18	56 N.	31 W.	18	2	21	3.7	Desc.	3	British America, France, Egypt.
1861, Dec. 31	9 N.	29 W.	31	1	55	1.8	Asc.	4	Caribbean Sea to North Africa.
1864, May 6	32 N.	173 E.	5	12	14	1.4	Desc.	5	Pacific Ocean.
1865, April 25	16 S.	30 W.	25	2	13	5.3	Desc.	6	Brazil to Central Africa.
1868, Aug. 18	10 N.	103 E.	17	17	12	6.8	Asc.	7	India to Pacific Ocean.
1869, Aug. 7	61 N.	145 W.	7	10	8	3.8	Asc.	8	United States and Alaska.
1870, Dec. 22	36 N.	5 W.	22	0	19	2.1	Desc.	9	Gibraltar, Northern Africa, Sicily.
1871, Dec. 12	12 S.	118 E.	11	16	2	4.4	Desc.	10	Southern India, Northern Australia.
1875, April 6	2 S.	83 E.	5	18	36	4.7	Asc.	1	Indian Ocean, Siam, Pacific.
1876, Sept. 17	33 S.	156 W.	17	9	54	1.8	Desc.	2	Pacific Ocean.
1878, July 29	60 N.	139 W.	29	9	40	3.2	Desc.	3	United States and Canada.
1880, Jan. 11	10 N.	160 W.	11	10	40	2.1	Asc.	4	Pacific Ocean, California.
1882, May 17	39 N.	63 E.	16	19	34	1.8	Desc.	5	Egypt, Central Asia, China.

1883, May	6	9 S.	147 W.	6	9	58	6.0	Desc.	6	Pacific Ocean, Caroline Islands.
1886, Aug.	29	3 N.	14 W.	29	0	54	6.6	Asc.	7	South America, Central Africa.
1887, Aug.	19	53 N.	102 E.	18	17	39	3.8	Asc.	8	Northern Europe, Siberia, Japan.
1889, Jan.	1	37 N.	138 W.	1	9	8	2.2	Desc.	9	California, Oregon, British America.
1889, Dec.	22	12 S.	13 W.	22	0	52	4.2	Desc.	10	Central Africa and South America.
1893, April	16	1 S.	37 W.	16	2	35	4.8	Asc.	1	Venezuela to West Africa.
1894, Sept.	29	34 S.	86 E.	28	17	43	1.8	Desc.	2	East Africa, Indian Ocean.
1896, Aug.	9	65 N.	112 E.	8	17	2	2.7	Desc.	3	North Europe, Siberia, Japan.
1898, Jan.	22	13 N.	69 E.	21	19	24	2.3	Asc.	4	East Africa, India, China.
1900, May	28	45 N.	45 W.	28	2	50	2.1	Desc.	5	United States, Spain, North Africa.
1901, May	18	2 S.	97 E.	17	17	38	6.5	Desc.	6	Sumatra, Borneo.
1904, Sept.	9	5 S.	133 W.	9	8	43	6.4	Asc.	7	Pacific Ocean.
1905, Aug.	30	45 N.	12 W.	30	1	13	3.8	Asc.	8	Canada, Spain, North Africa.
1907, Jan.	14	39 N.	89 E.	13	17	57	2.3	Desc.	9	Russia, Central Asia.
1908, Jan.	3	12 S.	145 W.	3	9	44	4.2	Desc.	10	Pacific Ocean.
1911, April	28	1 S.	155 W.	28	10	26	5.0	Asc.	1	Australia, Polynesia.
1912, Oct.	10	35 S.	33 W.	10	1	41	1.8	Desc.	2	Colombia, Ecuador, Brazil.
1914, Aug.	21	71 N.	2 E.	21	0	27	2.1	Desc.	3	Scandinavia, Russia, Asia Minor.
1916, Feb.	3	16 N.	62 W.	3	4	6	2.5	Asc.	4	Pacific Ocean, Venezuela, West Indies.
1918, June	8	51 N.	152 W.	8	10	3	2.4	Desc.	5	British Columbia, United States.
1919, May	29	4 N.	18 W.	29	1	12	6.9	Desc.	6	Peru, Brazil, Central Africa.
1922, Sept.	21	12 S.	106 E.	20	16	38	6.1	Asc.	7	East Africa, Australia.
1923, Sept.	10	38 N.	128 W.	10	8	53	3.6	Asc.	8	California, Mexico, Central America.
1925, Jan.	24	42 N.	44 W.	24	2	46	2.4	Desc.	9	United States.
1926, Jan.	14	10 S.	82 E.	13	18	35	4.2	Desc.	10	East Africa, Sumatra, Philippines.
1927, June	29	78 N.	84 E.	28	18	32	0.7	Asc.	11	England, Scotland, Scandinavia.
1929, May	9	1 S.	89 E.	8	18	8	5.1	Asc.	1	Sumatra, Malacca, Philippines.
1930, Oct.	21	36 S.	155 W.	21	9	47	1.9	Desc.	2	Pacific Ocean, Patagonia.
1932, Aug.	31	78 N.	109 W.	31	7	55	1.5	Desc.	3	Canada.
1934, Feb.	14	19 N.	168 E.	13	12	44	2.7	Asc.	4	Borneo, Celebes.
1936, June	19	56 N.	101 E.	18	17	15	2.5	Desc.	5	Greece to Central Asia and Japan.
1937, June	8	10 N.	131 W.	8	8	43	7.1	Desc.	6	Pacific Ocean, Peru.
1940, Oct.	1	19 S.	16 W.	1	0	42	5.7	Asc.	7	Colombia, Brazil, South Africa.
1941, Sept.	21	30 N.	114 E.	20	16	39	3.3	Asc.	8	Central Asia, China, Pacific Ocean.
1943, Feb.	4	47 N.	176 W.	4	11	31	2.5	Desc.	9	China, Alaska.
1947, May	20	2 S.	25 W.	20	1	44	5.2	Asc.	1	Argentina, Paraguay, Central Africa.
1948, Nov.	1	37 S.	82 E.	31	18	3	1.9	Desc.	2	Central Africa, Congo.
1952, Feb.	25	22 N.	39 E.	24	21	17	3.0	Asc.	4	Nubia, Persia, Siberia.
1954, June	30	62 N.	5 W.	30	0	27	2.5	Desc.	5	Canada, Scandinavia, Russia, Persia.
1955, June	20	15 N.	117 E.	19	16	12	7.2	Desc.	6	Ceylon, Siam, Philippines.
1958, Oct.	12	26 S.	139 W.	12	8	52	5.2	Asc.	7	Chile, Argentina.
1959, Oct.	2	23 N.	6 W.	2	0	32	3.0	Asc.	8	Canaries, Central Africa.
1961, Feb.	15	53 N.	53 E.	14	20	11	2.6	Desc.	9	France, Italy, Austria, Siberia.
1962, Feb.	5	4 S.	179 E.	4	12	11	4.1	Desc.	10	New Guinea.
1963, July	20	62 N.	126 W.	20	8	43	1.5	Asc.	11	Alaska, Hudson’s Bay Territory.
1965, May	30	4 S.	137 W.	30	9	14	5.3	Asc.	1	Pacific Ocean.
1966, Nov.	12	38 S.	43 W.	12	2	27	1.9	Desc.	2	Bolivia, Argentina, Brazil.
1970, Mar.	7	25 N.	88 W.	7	5	43	3.3	Asc.	4	Mexico, Georgia, ? Florida. 894
1972, July	10	67 N.	111 W.	10	7	40	2.7	Desc.	5	North-East Asia, North-East America and Atlantic Ocean.
1973, June	30	19 N.	6 E.	29	23	39	7.2	Desc.	6	South America, Africa and Atlantic Ocean.
1974, June	20	32 S.	107 E.	19	16	56	5.3	Desc.	12	South-West Australia and Indian Ocean.
1976, Oct.	23	31 S.	95 E.	22	17	10	4.9	Asc.	7	Africa, Australia, Indian and Pacific Oceans.
1977, Oct.	12	16 N.	127 W.	12	8	31	2.8	Asc.	8	Venezuela, Pacific Ocean.
1979, Feb.	26	61 N.	77 W.	26	4	47	2.7	Desc.	9	United States, British America, Pacific Ocean, N. Polar Se
1980, Feb.	16	1 N.	48 E.	15	20	52	4.3	Desc.	10	Africa, Atlantic and Indian Oceans, and India.
1981, July	31	54 N.	127 E.	30	15	53	2.2	Asc.	11	Pacific Ocean, Asia.
1983, June	11	7 S.	111 E.	10	16	38	5.4	Asc.	1	Java, Atlantic Ocean.
1984, Nov.	22	39 S.	170 W.	22	10	58	2.1	Desc.	2	Pacific Ocean, Patagonia.
1987, Mar.	29	17 S.	6 W.	29	0	45	0.3	Asc.	13	Atlantic, Equatorial Africa.
1988, Mar.	18	28 N.	146 E.	17	14	3	4.0	Asc.	4	Indian and Pacific Oceans, Sumatra.
1990, July	22	72 N.	142 E.	21	14	54	2.6	Desc.	5	Finland, North Atlantic.
1991, July	11	22 N.	105 W.	11	7	6	7.1	Desc.	6	Pacific Ocean, Hawaii, Central America.
1992, June	30	26 S.	5 W.	30	0	19	5.4	Desc.	12	South Atlantic.
1994, Nov.	3	36 S.	31 W.	3	1	36	4.6	Asc.	7	Pacific Ocean, South America.
1995, Oct.	24	10 N.	110 E.	23	16	37	2.4	Asc.	8	Pacific and Indian Oceans.
1997, Mar.	9	71 N.	154 E.	8	13	16	2.8	Desc.	9	North-East Asia, Arctic Sea.
1998, Feb.	26	6 N.	81 W.	26	5	27	4.4	Desc.	10	Pacific and Atlantic Oceans, Central America.
1999, Aug.	11	46 N.	18 E.	10	23	8	2.6	Asc.	11	Central and Southern Europe touching England.

Recurrence of Remarkable Eclipses.

From the property of the Saros it follows that eclipses remarkable for their duration, or other circumstances depending on the relative positions of the sun and moon, occur at intervals of one saros (18 y. 11 d.). Of interest in this connexion is the recurrence of total eclipses remarkable for their duration. The absolute maximum duration of a total eclipse is about 7′ 30″; but no actual eclipse can be expected to reach this duration. Those which will come nearest to the maximum during the next 500 years belong to the series numbered 4 and 6 and in the list which precedes. These occurring in the years 1937, 1955, &c., will ultimately fall little more than 20″ below the maximum. But the series 4, though not now remarkable in this respect, will become so in the future, reaching in the eclipse of June 25, 2150, a duration of about 7′ 15″ and on July 5, 2168, a duration of 7′ 28″, the longest in human history. The first of these will pass over the Pacific Ocean; the second over the southern part of the Indian Ocean near Madras.

All the national annual Ephemerides contain elements of the eclipses of the sun occurring during the year. Those of England, America and France also give maps showing the path of the central line, if any, over the

earth's surface; the lines of eclipse beginning and ending at sunrise, &c., and the outlines of the shadow from hour to hour. By the aid of the latter the time at which an eclipse begins or ends at any point can be determined by inspection or measurement within a few minutes.

V. *Methods of computing Eclipses of the Sun.*

The complete computation of the circumstances of an eclipse ab initio requires three distinct processes. The geocentric positions of the sun and moon have first to be computed from the tables of the motions of those bodies. The second step is to compute certain elements of the eclipse from these geocentric positions. The third step is from these elements to compute the circumstances of the eclipse for the earth generally or for any given place on its surface. The national Astronomical Ephemerides, or "Nautical Almanacs," give in full the geocentric positions of the sun and moon from at least the early part of the 19th century to an epoch three years in advance of the date of publication. It is therefore unnecessary to undertake the first part of the computation except for dates outside the limits of the published ephemerides, and for many years to come even this computation will be unnecessary, because tables giving the elements of eclipses from the earliest historic periods up to the 22nd century have been published by T. Ritter von Oppolzer and by Simon Newcomb. We shall therefore confine ourselves to a statement of the eclipse problem and of the principles on which such tables rest.

Elements of eclipses.

Two systems of eclipse elements are now adopted in the ephemerides and tables; the one, that of F.W. Bessel, is used in the English, American and French ephemerides, the other—P. A. Hansen's—in the German and in the eclipse tables of T. Ritter von Oppolzer. The two have in common certain geometric constructions. The fundamental axis of reference in both systems is the line passing through the centres of the sun and moon; this is the common axis of the shadow cones, which envelop simultaneously the sun and moon as shown in figs. 1, 2, 3. The surface of one of these cones, that of the umbra, is tangent to both bodies externally. This cone comes to a point at a distance from the moon nearly equal to that of the earth. Within it the sun is wholly hidden by the moon. Outside the umbral cone is that of the penumbra, within which the sun is partially hidden by the moon. The geometric condition that the two bodies shall appear in contact, or that the eclipse shall begin or end at a certain moment, is that the surface of one of these cones shall pass through the place of the observer at that moment. Let a plane, which we call the fundamental plane, pass through the centre of the earth perpendicular to the shadow axis. On this plane the centre of the earth is taken as an origin of rectangular co-ordinates. The axis of Z is perpendicular to the plane, and therefore parallel to the shadow axis; that of Y and X lie in the plane. In these fundamental constructions the two methods coincide. They differ in the direction of the axis of Y and X in the fundamental plane. In Bessel's method, which we shall first describe, the intersection of the plane of the earth's equator with the fundamental plane is taken as the axis of X. The axis of Y is perpendicular to it, the positive direction being towards the north. The Besselian elements of an eclipse are then:—x, y, the co-ordinates of the shadow axis on the fundamental plane; d, the declination of that point in which the shadow axis intersects the celestial sphere; μ, the Greenwich hour angle of this point; l, the radius of the circle, in which the penumbral or outer cone intersects the fundamental plane; and l', the radius of the circle, in which the inner or umbral cone intersects this plane, taken positively when the vertex of the cone does not reach the plane, so that the axis must be produced, and negatively when the vertex is beyond the plane.

Hansen's method differs from that of Bessel in that the ecliptic is taken as the fundamental plane instead of the equator. The axis of X on the fundamental plane is parallel to the plane of the ecliptic; that of Y perpendicular to it. The other elements are nearly the same in the two theories. As to their relative advantages, it may be remarked that Hansen's co-ordinates follow most simply from the data of the tables, and are necessarily used in eclipse tables, but that the subsequent computation is simpler by Bessel's method.

Several problems are involved in the complete computation of an eclipse from the elements. First, from the values of the latter at a given moment to determine the point, if any, at which the shadow-axis intersects the surface of the earth, and the respective outlines of the umbra and penumbra on that surface. Within the umbral curve the eclipse is annular or total; outside of it and within the penumbral curve the eclipse is partial at the given moment. The penumbral line is marked from hour to hour on the maps given annually in the American Ephemeris. Second, a series of positions of the central point through the course of an eclipse gives us the path of the central point along the surface of the earth, and the envelopes of the penumbral and umbral curves just described are boundaries within which a total, annular or partial eclipse will be visible. In particular, we have a certain definite point on the earth's surface on which the edge of the shadow first impinges; this impingement necessarily takes place at sunrise. Then passing from this point, we have a series of points on the surface at which the elements of the shadow-cone are in succession tangent to the earth's surface. At all these points the eclipse begins at sunrise until a certain limit is reached, after which, following the successive elements, it ends at sunrise. At the limiting point the rim of the moon merely grazes that of the sun at sunrise, so that we may say that the eclipse both begins and ends at that time. Of course the points we have described are also found at the ending of the eclipse. There is a certain moment at which the shadow-axis leaves the earth at a certain point, and a series of moments when, the elements of the penumbral cone being tangent to the earth's surface, the eclipse is ending at sunset. Three cases may arise in studying the passage of the outlines of the shadow over the earth. It may be that all the elements of the penumbral cone intersect the earth. In this case we shall have both a northern and a southern limit of partial eclipse. In the second case there will be no limit on the one side except that of the eclipse beginning or ending at sunrise or sunset. Or it may happen, as the third case, that the shadow-axis does not intersect the earth at all; the eclipse will then not be central at any point, but at most only partial.

The third problem is, from the same data, to find the circumstances of an eclipse at a given place—especially the times of beginning and ending, or the relative positions of the sun and moon at a given moment. Reference to the formulae for all these problems will be given in the bibliography of the subject.

AUTHORITIES.—The richest mine of information respecting eclipses of the sun and moon is T.R. von Oppolzer's "Kanon der Finsternisse," published by the Vienna Academy of Sciences in the 52nd volume of its *Denkschriften* (Vienna, 1887). It contains elements of all eclipses both of the sun and moon, from 1207 B.C. to A.D. 2161, a period of more than thirty centuries. Appended to the tables is a series of charts showing the paths of all central eclipses visible in the northern hemisphere during the period covered by the table. The points of the path at which the eclipse occurs, at sunrise, noon and sunset, are laid down with precision, but the intermediate points are frequently in error by several hundred miles, as they were not calculated, but projected simply by drawing a circle through the three points just mentioned. For this reason we cannot infer from them that an eclipse was total at any given place. The correct path can, however, be readily computed from the tables given in the work. Eduard Mahler's memoir, "Die centralen Sonnenfinsternisse des 20. Jahrhunderts" (*Denkschriften*, Vienna Academy, vol. xlix.), gives more exact paths of the central eclipses of the 20th century, but no maps. General tables for computing eclipses are Oppolzer's "Syzygientafeln für den Mond" (Publications of the *Astronomische Gesellschaft*, xvi.), and Newcomb's, in *Publications of the American Ephemeris*, vol. i. part i. Of these, Oppolzer's are constructed with greater numerical accuracy and detail, while Newcomb's are founded on more recent astronomical data, and are preferable for computing ancient eclipses. F.K. Ginzel's *Spezieller Kanon der Sonnen- und Mondfinsternisse* (Berlin, 1899) contains, besides the historical researches already mentioned, maps of the paths of central eclipses visible in the lands of classical antiquity from 900 B.C. to A.D. 500, but computed with imperfect astronomical data. Maguire, "Monthly Notices," *R.A.S.* xlv. and xlvi., has mapped the total solar eclipses visible in the British Islands from 878 to 1724. General papers of interest on the same subject have been published by Rev. S.J. Johnson. A résumé of all the observations on the physical phenomena of total solar eclipses up to 1878, by A.C. Ranyard, is to be found in *Memoirs of the Royal Astronomical Society*, vol. xli. A very copious development of the computation of eclipses by Bessel's method is found in W. Chauvenet's *Spherical and Practical Astronomy*, vol. i. *The Theory of Eclipses*, by R. Buchanan (Philadelphia, 1904), treats the subject yet more fully. Hansen's method is developed in the *Abhandlungen* of the Leipzig Academy of Sciences, vol. vi. (Math.-Phys. Classe, vol. iv.). The formulae of computation by this method are found in the introductions to Oppolzer's two works cited above.

(S. N.)

ECLIPTIC, in astronomy. The plane of the ecliptic is that plane in or near which the centre of gravity of the earth and moon revolves round the sun. The ecliptic itself is the great circle in which this plane meets the celestial sphere. It is also defined, but not with absolute rigour, as the apparent path described by the sun around the celestial sphere as the earth performs its annual revolution. Owing to the action of the moon on the earth, as it performs its monthly revolution in an orbit slightly inclined to the ecliptic, the centre of the earth itself deviates from the plane of the ecliptic in a period equal to that of the nodal revolution of the moon. The deviation is extremely slight, its maximum amount ranging between 0.5′ and 0.6″. Owing to the action of the planets, especially Venus and Jupiter, on the earth, the centre of gravity of the earth and moon deviates by a yet minuter amount, generally one or two tenths of a second, from the plane of the ecliptic proper. Owing to the action of the planets, the position of the ecliptic is subject to a slow secular variation amounting, during our time, to nearly 47″ per century. The rate of this motion is slowly diminishing.

The obliquity of the ecliptic is the angle which its plane makes with that of the equator. Its mean value is now about 23° 27′. The motion of the ecliptic produces a secular variation in the obliquity which is now diminishing by an amount nearly equal to the entire motion of the ecliptic itself. The laws of motion of the ecliptic and equator are stated in the article PRECESSION OF THE EQUINOXES.

Attempts have been made by Laplace and his successors to fix certain limits within which the obliquity of the ecliptic shall always be confined. The results thus derived are, however, based on imperfect formulae. When the problem is considered in a rigorous form, it is found that no absolute limits can be set. It can, however, be shown that the obliquity cannot vary more than two or three degrees within a million of years of our epoch.

The formula for the obliquity of the ecliptic, as derived from the laws of motion of it and of the equator, may be developed in a series proceeding according to the ascending powers of the time as follows: we put T, the time from 1900, reckoned in solar centuries as a unit. Then,

$$\text{Obliquity} = 23° 27′ 31.68″ - 46.837″\ T - 0.0085″\ T^2 + 0.0017″\ T^3.$$

From this expression is derived the value of the obliquity at various epochs given in the following table. The left-hand portion of this table gives the values for intervals of 500 years from 2000 B.C. to A.D. 2500 as computed from modern data. For dates more than three or four centuries before or after 1850 the result is necessarily uncertain by one or more tenths of a minute, and is therefore only given to 0.1′.

B.C.	2000;	obl.	= 23°	55.5″	A.D.	1700;	obl.	= 23°	28′	41.91″
	1500	″	= 23	52.3		1750	″	= 23	28	18.51
	1000	″	= 23	48.9		1800	″	= 23	27	55.10
	500	″	= 23	45.4		1850	″	= 23	27	31.68
	0	″	= 23	41.7		1900	″	= 23	27	8.26
A.D.	500	″	= 23	38.0		1950	″	= 23	26	44.84
	1000	″	= 23	34.1		2000	″	= 23	26	21.41
	1500	″	= 23	30.3		2050	″	= 23	25	57.99
	2000	″	= 23	26.4		2100	″	= 23	25	34.56
	2500	″	= 23	22.5						

(S. N.)

ECLOGITE (from Gr. ἐκλογή, a selection), in petrology, a typical member of a small group of metamorphic rocks of special interest on account of the variety of minerals they contain and their microscopic structures and geological relationships. Typically they consist of pale green or nearly colourless augite (omphacite), green hornblende and pink garnet. Quartz also is usually present in these rocks, but felspar is rare. The augite is mostly a variety of diopside and is only occasionally idiomorphic. The garnet sometimes forms good dodecahedra, but may occur as rounded grains, and encloses quartz, rutile, kyanite, and other minerals very frequently. The hornblende is usually pale green and feebly dichroic, but, in some eclogites which are allied to garnet-amphibolites, it is of dark brown colour. Among the commoner accessory minerals are kyanite (of blue or greyish-blue tints), rutile, biotite, epidote and zoisite, sphene, iron oxides, and pyrites. The rutile is 896
invariably in small brown prisms; the kyanite forms bladed crystals, with perfect cleavage; felspar, if present, belongs to basic varieties rich in lime. Other minerals which have been found in eclogites are bronzite, olivine and glaucophane. The last mentioned is a bright blue variety of hornblende with striking pleochroism. The eclogites in their chemical composition show close affinities to gabbros; they often exhibit relationships in the field which show that they were primarily intrusive rocks of igneous origin, and occasionally contact alteration can be traced in the adjacent schists. Examples are known in Saxony, Bavaria, Carinthia, Austria, Norway. A few eclogites also occur in the north-west highlands of Scotland. Glaucophane-eclogites have been met with in Italy and the Pennine Alps. Specimens of rock allied to eclogite have been found in the diamantiferous peridotite breccias of South Africa (the so-called “blue ground”), and this has given rise to the theory that these are the parent masses from which the Kimberley diamonds have come.

(J. S. F.)

ECLOGUE, a short pastoral dialogue in verse. The word is conjectured to be derived from the Greek verb ἐκλέγειν, to choose. An eclogue, perhaps, in its primary signification was a selected piece. Another more fantastic derivation traces it to αἴξ, goat, and λόγος, speech, and makes it a conversation of shepherds. The idea of dialogue, however, is not necessary for an eclogue, which is often not to be distinguished from the idyll. The grammarians, in giving this title to Virgil’s pastoral conversations (*Bucolica*), tended to make the term “eclogue” apply exclusively to dialogue, and this has in fact been the result of the success of Virgil’s work. Latin eclogues were also written by Calpurnius Siculus and by Nemesianus. In modern literature the term has lost any distinctive character which it may have possessed among the Romans; it is merged in the general notion of pastoral poetry. The French “Églogues” of J.R. de Segrais (1624-1701) were long famous, and those of the Spanish poet Garcilasso de La Vega (1503-1536) are still admired.

See also Bucolics; Pastoral.

ECONOMIC ENTOMOLOGY, the name given to the study of insects based on their relation to man, his domestic animals and his crops, and, in the case of those that are injurious, of the practical methods by which they can be prevented from doing harm, or be destroyed when present. In Great Britain little attention is paid to this important branch of agricultural science, but in America and the British colonies the case is different. Nearly every state in America has its official economic entomologists, and nearly every one of the British crown colonies is provided with one or more able men who help the agricultural community to battle against the insect pests. Most, if not all, of the important knowledge of remedies comes from America, where this subject reaches the highest perfection; even the life-histories of some of the British pests have been traced out in the United States and British colonies more completely than at home, from the creatures that have been introduced from Europe.

Some idea of the importance of this subject may be gained from the following figures. The estimated loss by the vine *Phylloxera* in the Gironde alone was £32,000,000; for all the French wine districts £100,000,000 would not cover the damage. It has been stated on good evidence that a loss of £7,000,000 per annum was caused by the attack of the ox warble fly on cattle in England alone. In a single season Aberdeenshire suffered nearly £90,000 worth of damage owing to the ravages of the diamond back moth on the root crops; in New York state the codling moth caused a loss of $3,000,000 to apple-growers. Yet these figures are nothing compared to the losses due to scale insects, locusts and other pests.

The most able exponent of this subject in Great Britain was John Curtis, whose treatise on *Farm Insects*, published in 1860, is still the standard British work dealing with the insect foes of corn, roots, grass and stored corn. The most important works dealing with fruit and other pests come from the pens of Saunders, Lintner, Riley, Slingerland and others in America and Canada, from Taschenberg, Lampa, Reuter and Kollar in Europe, and from French, Froggatt and Tryon in Australia. It was not until the last quarter of the 19th century that any real advance was made in the study of economic entomology. Among the early writings, besides the book of Curtis, there may also be mentioned a still useful little publication by Pohl and Kollar, entitled *Insects Injurious to Gardeners, Foresters and Farmers*, published in 1837, and Taschenberg’s *Praktische Insecktenkunde*. American literature began as far back as 1788, when a report on the Hessian fly

was issued by Sir Joseph Banks; in 1817 Say began his writings; while in 1856 Asa Fitch started his report on the "Noxious Insects of New York." Since that date the literature has largely increased. Among the most important reports, &c., may be mentioned those of C.V. Riley, published by the U.S. Department of Agriculture, extending from 1878 to his death, in which is embodied an enormous amount of valuable matter. At his death the work fell to Professor L.O. Howard, who constantly issues brochures of equal value in the form of Bulletins of the U.S. Department of Agriculture. The chief writings of J.A. Lintner extend from 1882 to 1898, in yearly parts, under the title of *Reports on the Injurious Insects of the State of New York*. Another author whose writings rank high on this subject is M.V. Slingerland, whose investigations are published by Cornell University. Among other Americans who have largely increased the literature and knowledge must be mentioned F.M. Webster and E.P. Felt. In 1883 appeared a work on fruit pests by William Saunders, which mainly applies to the American continent; and another small book on the same subject was published in 1898 by Miss Ormerod, dealing with the British pests. In Australia Tryon published a work on the *Insect and Fungus Enemies of Queensland* in 1889. Many other papers and reports are being issued from Australia, notably by Froggatt in New South Wales. At the Cape excellent works and papers are prepared and issued by the government entomologist, Dr Lounsbury, under the auspices of the Agricultural Department; while from India we have Cotes's *Notes on Economic Entomology*, published by the Indian Museum in 1888, and other works, especially on tea pests.

Injurious insects occur among the following orders: *Coleoptera*, *Hymenoptera*, *Lepidoptera*, *Diptera*, *Hemiptera* (both *heteroptera* and *homoptera*), *Orthoptera*, *Neuroptera* and *Thysanoptera*. The order *Aptera* also contains a few injurious species.

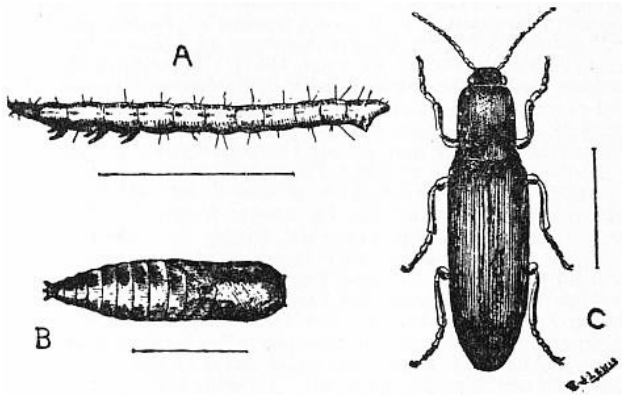


Fig. 1.—A, Wireworm; B, pupa of Click Beetle; C, adult Click Beetle (*Agriotes lineatum*).

Among the *Coleoptera* or beetles there is a group of world-wide pests, the *Elateridae* or click beetles, the adults of the various "wireworms." The insects in the larval or wireworm stage attack the roots of plants, eating them away below the ground. The eggs deposited by the beetle in the ground develop into yellowish-brown wire-like grubs with six legs on the first three segments and a ventral prominence on the anal segment. The life of these subterranean pests differs in the various species; some undoubtedly (*Agriotes lineatum*) live for three or four years, during the greater part of which time they gnaw away at the roots of plants, carrying wholesale destruction before them. When mature they pass deep into the ground and pupate, appearing after a few months as the click beetles (fig. 1). Most crops are attacked by them, but they are particularly destructive to wheat and other cereals. With such subterranean pests little can be done beyond rolling the land to keep it firm, and thus preventing them from moving rapidly from plant to plant. A few crops, such as mustard, seem deleterious to them. By growing mustard and ploughing it in green the ground is made obnoxious to the wireworms, and may even be cleared of them. For root-feeders, bisulphide of carbon injected into the soil is of particular value. One ounce injected about 2 ft. from an apple tree on two sides has been found to destroy all the ground form of the woolly aphis. In garden cultivation it is most useful for wireworm, used at the rate of 1 ounce to every 4 sq. yds. It kills all root pests.

In Great Britain the flea beetles (*Halticidae*) are one of the most serious enemies; one of these, the turnip flea (*Phyllotreta nemorum*), has in some years, notably 1881, caused more than £500,000 loss in England and Scotland alone by eating the young seedling turnips, cabbage and other *Cruciferae*. In some years three or four sowings have to be made before a "plant" is produced, enormous loss in labour and cost of seed alone being thus involved. These beetles, characterized by their skipping movements and enlarged hind femora, also attack the hop (*Haltica concinna*), the vine in America (*Graptodera chalybea*, Illig.), and numerous other species of plants, being specially harmful to seedlings and young growth. Soaking the seed in strong-smelling substances, such as paraffin and turpentine, has been found efficacious, and in some districts paraffin sprayed over the seedlings has been practised with decided success. This oil generally acts as an excellent preventive of this and other insect attacks.

In all climates fruit and forest trees suffer from weevils or *Curculionidae*. The plum curculio (*Conotrachelus nenuphar*, Herbst) in America causes endless harm in plum orchards; curculios in Australia ravage the vines and fruit trees (*Orthorrhinus klugii*, Schon, and *Leptops hopei*, Bohm, &c.). In Europe a number of "long-snouted" beetles, such as the raspberry weevils (*Otiorhynchus picipes*), the apple blossom weevil (*Anthonomus pomorum*), attack fruit; others, as the "corn weevils" (*Calandra oryzae* and *C. granaria*), attack stored rice and corn; while others produce swollen patches on roots (*Ceutorhynchus sulcicollis*), &c. All these *Curculionidae* are very timid creatures, falling to the ground at the least shock. This habit can be used as a means of killing them, by placing boards or sacks covered with tar below the trees, which are then gently shaken. As many of these beetles are nocturnal, this trapping should take place at night. Larval "weevils" mostly feed on the roots of plants, but some, such as the nut weevil (*Balaninus nucum*), live as larvae inside fruit. Seeds of various plants are also attacked by weevils of the family *Bruchidae*, especially beans and peas. These seed-feeders may be killed in the seeds by subjecting them to the fumes of bisulphide

of carbon. The corn weevils (*Calandra granaria* and *C. oryzae*) are now found all over the world, in many cases rendering whole cargoes of corn useless.

The most important Hymenopterous pests are the sawflies or *Tenthredinidae*, which in their larval stage attack almost all vegetation. The larvae of these are usually spoken of as "false caterpillars," on account of their resemblance to the larvae of a moth. They are most ravenous feeders, stripping bushes and trees completely of their foliage, and even fruit. Sawfly larvae can at once be recognized by the curious positions they assume, and by the number of pro-legs, which exceeds ten. The female lays her eggs in a slit made by means of her "saw-like" ovipositor in the leaf or fruit of a tree. The pupae in most of these pests are found in an earthen cocoon beneath the ground, or in some cases above ground (*Lophyrus pini*). One species, the slugworm (*Eriocampa limacina*), is common to Europe and America; the larva is a curious slug-like creature, found on the upper surface of the leaves of the pear and cherry, which secretes a slimy coating from its skin. Currant and gooseberry are also attacked by sawfly larvae (*Nematus ribesii* and *N. ventricosus*) both in Europe and America. Other species attack the stalks of grasses and corn (*Cephus pygmaeus*). Forest trees also suffer from their ravages, especially the conifers (*Lophyrus pini*). Another group of Hymenoptera occasionally causes much harm in fir plantations, namely, the *Siricidae* or wood-wasps, whose larvae burrow into the trunks of the trees and thus kill them. For all exposed sawfly larvae hellebore washes are most fatal, but they must not be used over ripe or ripening fruit, as the hellebore is poisonous.

The order Diptera contains a host of serious pests. These two-winged insects attack all kinds of plants, and also animals in their larval stage. Many of the adults are bloodsuckers (*Tabanidae*, *Culicidae*, &c.); others are parasitic in their larval stage (*Oestridae*, &c.). The best-known dipterous pests are the Hessian fly (*Cecidomyia destructor*), the pear midge (*Diplosis pyrivora*), the fruit flies (*Tephritis Tyroni* of Queensland and *Halterophora capitata* or the Mediterranean fruit fly), the onion fly (*Phorbia cepetorum*), and numerous corn pests, such as the gout fly (*Chloropstaeniopus*) and the frit fly (*Oscinis frit*). Animals suffer from the ravages of bot flies (*Oestridae*) and gad flies (*Tabanidae*); while the tsetse disease is due to the tsetse fly (*Glossina morsitans*), carrying the protozoa that cause the disease from one horse to another. Other flies act as disease-carriers, including the mosquitoes (*Anopheles*), which not only carry malarial germs, but also form a secondary host for these parasites. Hundreds of acres of wheat are lost annually in America by the ravages of the Hessian fly; the fruit flies of Australia and South Africa cause much loss to orange and citron growers, often making it necessary to cover the trees in muslin tents for protection. Of animal pests the ox warbles (*Hypoderma lineata* and *H. bovis*) are the most important (see fig. 2). The "bots" or larvae of these flies live under the skin of cattle, producing large swollen lumps—"warbles"—in which the "bots" mature (fig. 2). These parasites damage the hide, set up inflammation, and cause immense loss to farmers, herdsmen and butchers. The universal attack that has been made upon this pest has, however, largely decreased its numbers. In America cattle suffer much from the horn fly (*Haematobia serrata*). The dipterous garden pests, such as the onion fly, carrot fly and celery fly, can best be kept in check by the use of paraffin emulsions and the treatment of the soil with gas-lime after the crop is lifted. Cereal pests can only be treated by general cleanliness and good farming, and of course they are largely kept down by the rotation of crops.

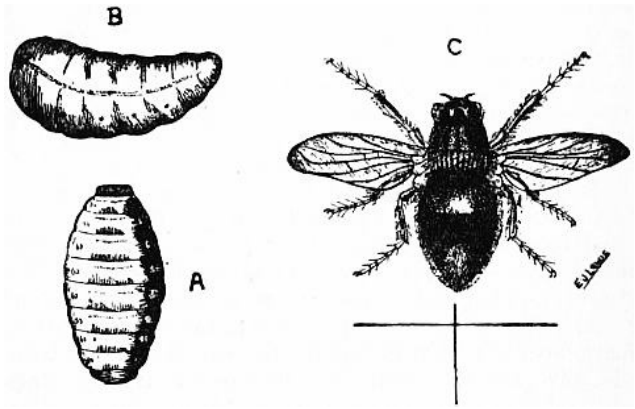


FIG. 2.—A, Ox Bot Maggot; B, puparium; C, Ox Warble Fly (*Hypoderma bovis*).

Lepidopterous enemies are numerous all over the world. Fruit suffers much from the larvae of the *Geometridae*, the so-called "looper-larvae" or "canker-worms." Of these geometers the winter moth (*Cheimatobia brumata*) is one of the chief culprits in Europe (fig. 3). The females in this moth and in others allied to it are wingless. These insects pass the pupal stage in the ground, and reach the boughs to lay their eggs by crawling up the trunks of the trees. To check them, "grease-banding" round the trees has been adopted; but as many other pests eat the leafage, it is best to kill all at once by spraying with arsenical poisons. Among other notable Lepidopterous pests are the "surface larvae" or cutworms (*Agrotis spp.*), the caterpillars of various Noctuae; the codling moth (*Carpocapsa pomonella*), which causes the maggot in apples, has now become a universal pest, having spread from Europe to America and to most of the British Colonies. In many years quite half the apple crop is lost in England owing to the larvae destroying the fruit. Sugar-canes suffer from the sugar-cane borer (*Diatioca saccharl*) in the West Indies; tobacco from the larvae of hawk moths (*Sphingidae*) in America; corn and grass from various Lepidopterous pests all over the world. Nor are stored goods exempt, for much loss annually takes place in corn and flour from the presence of the larvae of the Mediterranean flour moth (*Ephestia kuniella*); while furs and clothes are often ruined by the clothes moth (*Tinea trapezella*).

FIG. 3.—Looper-larva of Winter Moth (*Cheimatobia brumata*).

By far the most destructive insects in warm climates belong to the Hemiptera, especially to the *Coccidae* or scale insects. All fruit and forest trees suffer from these curious insects, which in the female sex always remain apterous and apodal and live attached to the bark, leaf and fruit, hidden beneath variously formed scale-like coverings. The male scales differ in form from the female; the adult male is winged, and is rarely seen. The female lays her eggs beneath the scaly covering, from which hatch out little active six-legged larvae, which wander about and soon begin to form a new scale. The *Coccidae* can, and mainly do, breed asexually (parthenogenetically). One of the most important is the San José scale (*Aspidiotus perniciosus*), which in warm climates attacks all fruit and many other trees, which, if unmolested, it will soon kill (fig. 4). These scales breed very rapidly; Howard states one may give rise to a progeny of 3,216,080,400 in one year. Other scale insects of note are the cosmopolitan mussel scale (*Mytilaspis pomorum*) and the Australian *Icerya purchasi*. The former attacks apple and pear; the latter, which selects orange and citron, was introduced into America from Australia, and carried ruin before it in some orange districts until its natural enemy, the lady-bird beetle, *Vedalia cardinalis*, was also imported.

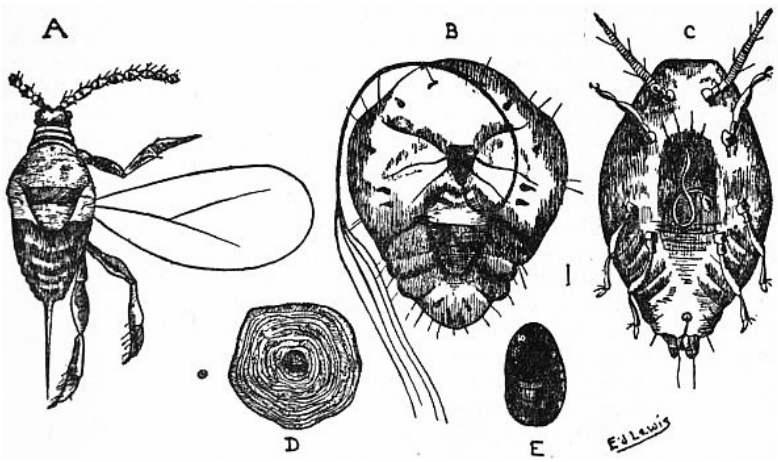


FIG. 4.—San José Scale (*Aspidiotus perniciosus*). A, Male scale insect; B, female; C, larva; D, female scale; E, male scale.

After the *Coccidae* the next most important insects economically are the plant lice or *Aphididae*. These breed with great rapidity under favourable conditions: one by the end of the year will be accountable, according to Linnaeus, for the enormous number of a quintillion of its species. Aphides are born, as a rule, alive, and the young soon commence to reproduce again. Their food consists mainly of the sap obtained from the leaves and blossom of plants, but some also live on the roots of plants (*Phylloxera vastatrix* and *Schizoneura lanigera*). Aphides often ruin whole crops of fruit, corn, hops, &c., by sucking out the sap, and not only check growth, but may even entail the death of the plant. Reproduction is mainly asexual, the females producing living young without the agency of a male. Males in nearly all species appear once a year, when the last female generation, the ovigerous generation, is fertilized, and a few large ova are produced to carry on the continuity of the species over the winter. Some aphides live only on one species of plant, others on two or more plants. An example of the latter is seen in the hop aphis (*Phorodon humuli*), which passes the winter and lives on the sloe and damson in the egg stage until the middle of May or later, and then flies off to the hops, where it causes endless harm all the summer (fig. 5); it flies back to the prunes to lay its eggs when the hops are ripe. Another aphis of importance is the woolly aphis (*Schizoneura lanigera*) of the apple and pear: it secretes tufts of white flocculent wool often to be seen hanging in patches from old apple trees, where the insects live in the rough bark and form cankered growths both above and below ground. Aphides are provided with a mealy skin, which does not allow water to be attached to it, and thus insecticides for destroying them contain soft soap, which fixes the solution to the skin; paraffin is added to corrode the skin, and the soft soap blocks up the breathing pores and so produces asphyxiation.

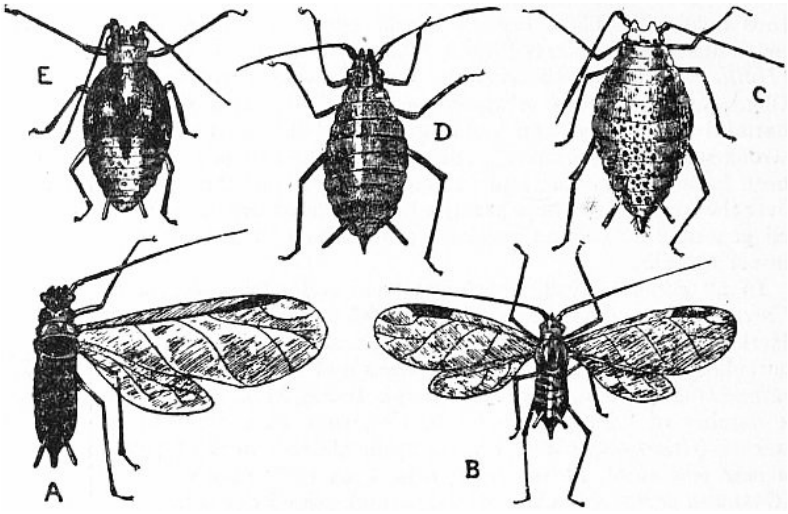


FIG. 5.—The Hop Aphis (*Phorodon humuli*). A, Winged female; B, winged male; C, ovigerous wingless female; D, viviparous wingless female from plum; E, pupal stage.

Amongst *Orthoptera* we find many noxious insects, notably the locusts, which travel in vast cloud-like armies, clearing the whole country before them of all vegetable life. The most destructive locust is the

migratory locust (*Locusta migratoria*), which causes wholesale destruction in the East. Large pits are dug across the line of advance of these great insect armies to stop them when in the larval or wingless stage, and even huge bonfires are lighted to check their flight when adult. So dense are these “locust clouds” that they sometimes quite darken the air. The commonest and most widely distributed migratory locust is *Pachytylus cinerascens*. The mole cricket (*Gryllotalpa vulgaris*) and various cockroaches (*Blattidae*) are also amongst the pests found in this order.

Of *Neuroptera* there are but few injurious species, and many, such as the lace wing flies (*Hemerobiidae*), are beneficial.

The Treatment of Insect Pests.—One of the most important ways of keeping insect pests in check is by “spraying” or “washing.” This method has made great advances in recent years. All the pioneer work has been done in America; in fact, until the South-Eastern Agricultural College undertook the elucidation of this subject, little was known of it in England except by a few growers. The results and history of this essential method of treatment are embodied in Professor Lodemann’s work on the *Spraying of Plants*, 1896. In this treatment we have to bear in mind what the entomologist teaches us, that is, the nature, habits and structure of the pest.

For insects provided with a biting mouth, which take nourishment from the whole leaf, shoot or fruit, the poisonous washes used are chiefly arsenical. The two most useful arsenical sprays are Paris green and arsenate of lead. To make the former, mix 1 oz. of the Paris green with 15 gallons of soft water, and add 2 oz. of lime and a small quantity of agricultural treacle; the latter is prepared by dissolving 3 oz. of acetate of lead in a little water, then 1 oz. of arsenate of soda in water and mixing the two well together, and adding the whole to 16 gallons of soft water; to this is added a small quantity of coarse treacle. For piercing-mouthed pests like *Aphides* no wash is of use unless it contains a basis of soft soap. This soft-soap wash kills by contact, and may be prepared in the following way:—Dissolve 6 to 8 lb. of the best soft soap in boiling soft water and while still hot (but of course taken off the fire) add 1 gallon of paraffin oil and churn well together with a force-pump; the whole may then be mixed with 100 gallons of soft water. The oil readily separates from the water, and thus a perfect emulsion is not obtained: this difficulty has been solved by Mr Cousin’s paraffin naphthalene wash, which is patented, but can be made for private use. It is prepared as follows:—Soft soap, 6 lb. dissolved in 1 quart of water; naphthalene, 10 oz. mixed with 1½ pint of paraffin; the whole is mixed together. When required for use, 1 lb. of the compound is dissolved in 5 to 10 gallons of warm water.

These two washes are essential to the well-being of every orchard in all climates. Not only can we now destroy larval and adult insects, but we can also attack them in the egg stage by the use of a caustic alkali wash during the winter; besides destroying the eggs of such pests as the *Psyllidae*, red spider, and some aphides, this also removes the vegetal encumbrances which shelter numerous other insect pests during the cold part of the year. Caustic alkali wash is prepared by dissolving 1 lb. of crude potash and 1 lb. of caustic soda in soft water, mixing the two solutions together, adding to them ¾ lb. of soft soap, and diluting with 10 gallons of soft water when required for use. Another approved insecticide for scale insects is resin wash, which acts in two ways: first, corroding the soft scales, and second, fixing the harder scales to stop the egress of the hexapod larvae. It is prepared as follows:—First crush 8 lb. of resin in a sack, and then place the resin in warm water and boil in a cauldron until thoroughly dissolved; then melt 10 lb. of caustic soda in enough warm water to keep it liquid, and mix with the dissolved resin; keep stirring until the mixture assumes a clear coffee-colour, and for ten minutes afterwards; then add enough warm water to bring the whole up to 25 gallons, and well stir. Bottle this off, and when required for use dilute with three times its bulk of warm soft water, and spray over the trees in the early spring just before the buds burst. For mites (*Acari*) sulphur is the essential ingredient of a spray. Liver of sulphur has been found to be the best form, especially when mixed with a paraffin emulsion. Bud mites (*Phytoptidae*, fig. 6) are of course not affected. Sulphur wash is made by adding to every 10 gallons of warm paraffin emulsion or paraffin-naphthalene-emulsion 7 oz. of liver of sulphur, and stirring until the sulphur is well mixed. This is applied as an ordinary spray. Nursery stock should always be treated, to kill scale, aphis and other pests which it may carry, by the gas treatment, particularly in the case of stock imported from a foreign climate. This treatment, both out of doors and under glass, is carried out as follows:—Cover the plants in bulk with a light gas-tight cloth, or put them in a special fumigating house, and then place 1 oz. of cyanide of potassium in lumps in a dish with water beneath the covering, and then pour 1 oz. of sulphuric acid over it (being careful not to inhale the poisonous fumes) for every 1000 cub. ft. of space beneath the cover. The gas generated, prussic acid, should be left to work for at least an hour before the stock is removed, when all forms of animal life will be destroyed.

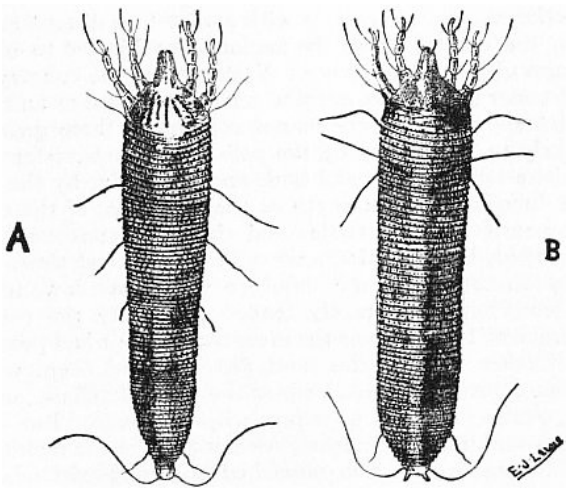


Fig. 6.—Bud Mites (*Phytoptidae*). A, Currant Bud Mite (*Phytoptus ribis*); B, Nut Bud Mite (*P. avellanae*).

For spraying, proper instruments must be used, by means of which the liquid is sent out over the plants in as fine a mist as possible. Numerous pumps and nozzles are now made by which this end is attained. Both horse and hand machines are employed, the former for hops and large orchards, the latter for bush fruit and gardens. In America, where trees in parks as well as orchards and gardens are treated, steam-power is sometimes used. Among the most important sprayers are the Strawson horse sprayers and the smaller Eclair and Notus knapsack pumps, carried on the back (fig. 7). The nozzles for "mistifying" the wash most in use are known as the Vermorel and Riley's, which can be fitted to any length of tubing, so as to reach any height, and can be turned in any direction. The pumps in the machine keep the insecticide constantly mixed, and at the same time force the wash with great strength through the nozzle, and so to the exterior, as a fine mist; every part of the plant is thus affected.

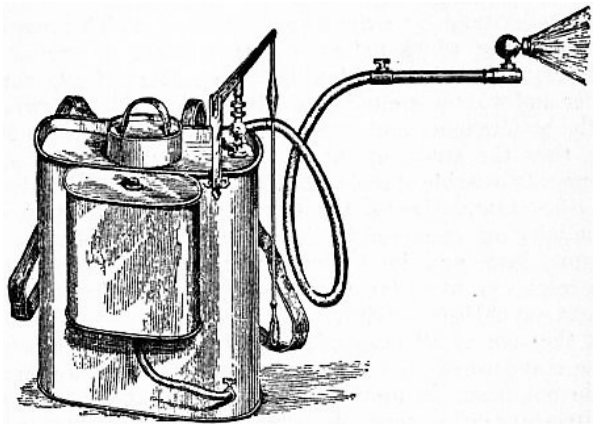


FIG. 7.—Knapsack Sprayer for Liquid Insecticides.

Beneficial Insects have also to be considered in economic entomology. They are of two kinds—(1) those that help to keep down an excess of other insects by acting either as parasites or by being insectivorous in habit; and (2) insects of economic value, such as the bee and silkworm. Amongst the most important friends to the farmer and gardener are the Hymenopterous families of ichneumon flies (*Ichneumonidae* and *Braconidae*); the Dipterous families *Syrphidae* and *Tachinidae*; the Coleopterous families *Coccinellidae* and *Carabidae*; and the Neuropterous *Hemerobiidae*, or lace-wing flies. Ichneumon flies lay their eggs either in the larvae or ova of other insects, and the parasites destroy their host. In this way the Hessian fly is doubtless kept in check in Europe, and the aphides meet with serious hindrance to their increase. If a number of plant-lice are examined, a few will be found looking like little pearls; these are the dried skins of those that have been killed by *Ichneumonidae*. The *Syrphidae*, or hover flies, are almost exclusively aphis-feeders in their larval stage. *Tachina* flies attack lepidopterous larvae. One of the most notable examples of the use of insect allies is the case of the Australian lady-bird, *Vedalia cardinalis*, which, in common with all lady-birds, feeds off *Aphidae* and *Coccidae*. The Icerya scale (*Icerya purchasi*) imported into America ruined the orange groves, but its enemy, the *Vedalia*, was also imported from Australia, and counteracted its abnormal increase with such great results that the crippled orange groves are now once more profitable.

(F. V. T.)

ECONOMICS (from the Gr. οἰκονομική, sc. τέχνη, from οἶκος, a house, and νόμος, rule,—the "art of household management"), the general term, with its synonym "political economy," for the science or study of wealth (welfare) and its production, applicable either to the individual, the family, the State, or in the widest sense, the world. How far the same considerations apply to all these spheres is one of the problems of economic thought in its widest sense. The term "economy" (*q.v.*) by itself, which should strictly mean the art of applying money (or wealth) wisely, has commonly come to mean the art of saving money, or spending as little as possible. In practice the study of "political" economy is mainly devoted to the sphere of the State; the welfare of the individual as a member of the State, and of the State in its relation to the world, being internal aspects of the prosperity of the State itself. Economics thus includes the discussion of all the numerous factors which make life profitable, whether to the nation or to the business, or to the individual man. It may be conceived either as an historical science (What principles have in fact paid?), or as an abstract science (What are the true principles which must pay, presupposing an ideal?). Economists at different times have studied both aspects, according to their lights, and influenced by historical conditions of philosophic thought. A text-book on economics necessarily deals, therefore, with the whole subject in a manner which need not here be followed, since separate articles are devoted in this work to the biographies of writers on economics, and also to the principal economic questions involved, under their own headings. In this article we propose therefore to confine ourselves to discussing the character and subject-matter of the science, indicating its relation to other sciences, and explaining the methods by which economists reach their conclusions.

We understand by economics the science which investigates the manner in which nations or other larger or smaller communities, and their individual members, obtain food, clothing, shelter and whatever else is considered desirable or necessary for the maintenance and improvement of the conditions of life. It is thus the study of the life of communities with special reference to one side of their activity. It necessarily involves the scientific examination of the structure and organization of the community or communities in question; their history, their customs, laws and institutions; and the relations between their members, in so far as they

affect or are affected by this department of their activity.

At the root of all economic investigation lies the conception of the standard of life of the community. By this expression we do not mean an ideal mode of living, but the habits and requirements of life generally current in a community or grade of society at a given period. The standard of life of the ordinary well-to-do middle class in England, for example, includes not only food, clothing and shelter of a kind different in many respects from that of a similar class in other countries and of other classes in England, but a highly complicated mechanism, both public and private, for ministering to these primary needs, habits of social intercourse, educational and sanitary organization, recreative arrangements and many other elements. Many influences operating for a long period of time on the character and the environment of a class go to determine its standard of life. In a modern industrial community it is possible to express this standard fairly accurately for the purposes of economic investigation in terms of money (*q.v.*). But it is doubtful whether the most complete investigation would ever enable us to include all the elements of the standard of life in a money estimate. The character, tastes and capacity for management of different individuals and groups differ so widely that equal incomes do not necessarily imply identity of standard. In the investigation of past times, the incommensurate elements of well-being are so numerous that merely money estimates are frequently misleading. The conception of the standard of life involves also some estimate of the efforts and sacrifices people are prepared to make to obtain it; of their ideals and character; of the relative strength of the different motives which usually determine their conduct. But no carefully devised calculus can take the place of insight, observation and experience. The economist should be a man of wide sympathies and practical sagacity, in close touch with men of different grades, and, if possible, experienced in affairs.

It is evident that no permanent classification is possible of what is or is not of economic significance. No general rules, applicable to all times, can be laid down as to what phenomena must be examined or what may be neglected in economic inquiry. The different departments of human activity are organically connected, and all facts relating to the life of a community have a near or remote economic significance. For short historical periods, indeed, many phenomena are so remotely connected with the ordinary business of life that we may ignore them. But at any moment special causes may bring into the field of economic inquiry whole departments of life which have hitherto been legitimately ignored. In times past, biblical exegesis, religious ideals, and ecclesiastical organization, the purely political aims of statesmen, chance combinations of party politics and the intrigues of diplomatists, class prejudice, social conventions, apparently sudden changes of economic policy, capricious changes of fashion—all these causes and many others have exerted a direct and immediate influence on the economic life of the community. In our own day we have had many illustrations of the manner in which special circumstances may at once bring an almost unnoticed series of scientific investigations into direct and vital relation with the business world. The economist must, therefore, not only be prepared to take account of the physical features of the world, the general structure and organization of the industry and commerce of different states, the character of their administration and other important causes of economic change. He must be in touch with the actual life of the community he is studying, and cultivate “that openness and alertness of the mind, that sensitiveness of the judgment, which can rapidly grasp the significance of at first sight unrelated discoveries or events.”

Character of subject-matter.

Some people are of opinion that the factors to be taken account of in economic investigation are so numerous that progress on these lines is impossible. It would certainly be impossible if we had to begin *de novo* to construct the whole fabric of economic science. But, as we shall see, it is no more necessary to do this in the world of science than it is in the world of business or politics. There is in existence a vast store of accumulated knowledge, and few, if any, departments of economics have been left quite unilluminated by the researches of former generations. Progress is the result of adaptation rather than reconstruction. It must be remembered also that economic work in modern times is carried on by consciously or unconsciously associated effort, and although it must always require high qualities of judgment, capacity and energy, many of the difficulties which at first sight appear so insuperable give way when they are attacked. In some ways also the study of highly developed organizations like the modern industrial state is simpler than that of earlier forms of society.

In the earliest times for which we have abundant material the economic life of England had already reached in certain directions a high degree of complexity. Even in the rural districts, manorial records reveal the existence of a great variety of classes and groups of persons engaged in the performance of economic functions. The lord of the manor with his officials and retainers, the peasantry bound to him by ties of personal dependence and mutual rights and obligations, constituted a little world, in which we can watch the play of motives and passions not so dissimilar as we are sometimes led to believe from those of the great modern world. In many a country district the gradations of social rank were more continuous, the opportunities of intercourse more frequent, and the capacity for organization greater than in modern times. The manorial accounts were kept with precision and detail, and we are told that a skilled official could estimate to the utmost farthing the value of the services due from the villein to his lord. The manor was indeed self-sufficient and independent in the sense that it could furnish everything required by the majority of the inhabitants, and that over the greater part of rural England production was not carried on with a view to a distant market. But in the earliest times the manor was subjected to external influences of great importance. Vast areas of the country were in fact under the single control of a territorial lord or an ecclesiastical foundation. Every manor composing these great fiefs was likely to be affected by the policy or the character of the administration of the feudal lord, and he, again, by the policy or the difficulties, the strength or the weakness, of the central government. Foreign trade and foreign intercourse were undeveloped, but their influence was in historical times never entirely absent, while the influence of Roman law and the Christian Church constantly tended to modify the manorial organization. In the towns the division of labour had proceeded much further than in the rural districts, and there were in existence organized bodies, such as the Gild Merchant and the crafts, whose functions were primarily economic. But one of the most striking characteristics of town life in the middle ages was the manner in which municipal and industrial privileges

Ancient and modern conditions in England.

and responsibilities were interwoven. In modern times the artisan, however well trained, efficient and painstaking he may be, does not, in virtue of these qualities, enjoy any municipal or political privileges. By means of his trade union, co-operative society or club he may gain some experience in the management of men and business, and in so far as the want of a sufficient income does not constitute an insuperable difficulty, he may share in the public life of the country. But in his character as artisan he enjoys no municipal or political privileges. In the middle ages this differentiation of the industrial, municipal and political life had not taken place, and in order to understand the working of at first sight purely economic regulations it is necessary to make a close study of the functions of local government. But this, after all, does not carry us very far. From the very nature of the records in which we study the town life of the middle ages, it follows that we obtain from them only a one-sided view. No one knows what proportion of the industrial population was included in the organized gilds, or how complete was the control exercised by these bodies over their members. Elaborate regulations were in force, but no one knows how elastic they were in practice. Medieval Englishmen were particularly apt to put their aspirations into a legal form, and then rest satisfied with their achievement. The number of regulations is scarcely to be regarded as a test of their administrative success. Further, as the country became more consolidated and the central government extended its authority over economic affairs, new regulations came into force, new organs of government appeared, which were sometimes in conflict, sometimes in harmony, with the existing system, and it becomes for a time far more difficult to obtain a clear view of the actual working of economic institutions. Thus the study of the economic life of the middle ages is one of the most complicated subjects which can engage the attention of man. It is impossible to carry the process of isolation very far. The different threads of social activity are so closely interwoven that we cannot follow any one for very long without forming wrong impressions, and it becomes necessary to turn back and study others which seemed at first sight unrelated to the subject of our investigations. Under an apparently uniform and stable system of social regulation there was much variation and movement, the significance of which it is impossible to estimate. Materials for forming such an estimate no doubt exist, but before doing so we have to study in infinite detail a vast number of separate manors, municipalities or other separate economic areas. This involves great industry on the part of many scientific workers. Meanwhile we can *illustrate* the economic life of the middle ages, describe its main features, indicate the more important measures of public policy and draw attention to some of the main lines of development.

Conditions of economic science.

It is only as we approach more modern times that the conditions of economic study are realized and economic science, as we understand it, becomes possible. Those conditions are: (i.) the life of the state or other community or communities we are studying must be so differentiated that we can isolate those functions which are wholly or predominantly economic. The “separation of employments” is not only a condition of economic efficiency; it was necessary before we could have an economic science. (ii.) We must be in a position so far to understand and estimate the character and motives of different classes and groups in these communities that we can rightly interpret their action. This condition cannot be realized without great difficulty, for “economic motives” are very different in different periods, nations and classes, and even for short periods of time in the same country are modified by the influence of other motives of an entirely different order. In studying the economic history of the 18th century, for example, it is not enough to assume with Defoe that “gain is the design of merchandise.” We have to be saturated, as it were, with 18th-century influences, so that we can realize the conditions in which industry and trade were carried on, before we can rightly explain the course of development. In our own day labour disputes, to take another example, can scarcely ever be resolved into a question of merely pecuniary gain or loss. The significance of the amount of money involved varies greatly for different trades, and can only be understood by reference to the character and habits of the people concerned. But questions of sentiment, shop-feeling and trade customs invariably play an important part. (iii.) Economics can never lead to anything but hypothetical results unless we not only realize that we must “take account of” other than the purely economic factors, but also give due weight and significance to these factors. No explanation of the industrial situation in Germany, for example, would be intelligible or satisfactory even from the economic point of view which ignored the significance of the political conditions which Germans have to deal with. So, again, it is impossible to make a useful comparative estimate of the advantages and disadvantages of the transport systems of England, the United States and Germany, unless we keep constantly in view the very different geographical, military and political conditions which these systems have to satisfy. (iv.) Sufficient information must be available to enable us to test the validity of our hypotheses and conclusions. Whatever “method” of economic investigation we employ, we must at every stage see how far our reasoning is borne out by the actual experience of life. This obvious condition of scientific inquiry is very far from being completely realized even at the present time. It implies the existence of a well-trained class engaged in the work of collecting information, and much organization both by the state and private bodies. These four conditions can be reduced to two. The community we are studying must have reached such a stage of development that its economic functions and those immediately cognate to them form a well-defined group, and adequate means must be available so that we can, as it were, watch the performance of these functions and test our hypotheses and conclusions by observation and experience.

It is easy to understand, therefore, why we trace the beginnings of economics, so far as England is concerned, in the 16th century, and why the application of strict scientific tests in this subject of human study has become possible only in comparatively recent times. Medieval economics was little more than a casuistical system of elaborate and somewhat artificial rules of conduct. From the close of the middle ages until the middle of the 18th century thousands of pamphlets and other works on economic questions were published, but the vast majority of the writers have little or no scientific importance. Their works frequently contain information given nowhere else, and throw much light on the state of opinion in the age in which they wrote. It is also possible to find in them many anticipations of the views of the economists of later times; but such statements were as a rule generated merely by the heat of controversy on some measure or event of practical importance, and when the controversy died down were seldom regarded or incorporated in a scientific system. Trade bias, personal impressions and guesswork took the place of scientific method.

This was inevitable in the absence of trustworthy information on an adequate scale, and from the immediately practical aims of the writers. But from the end of the 17th century economics has been definitely recognized as a subject of scientific study.

Necessity of economic science.

In modern times the conditions which have made economic science possible have also made it necessary. While it is impossible to give a strictly economic interpretation of the earlier history of nations, economic interests so govern the life and determine the policy of modern states that other forces, like those of religion and politics, seem to play only a subsidiary part, modifying here and there the view which is taken of particular questions, but not changing in any important degree the general course of their development. This may be, in the historical sense, merely a passing phase of human progress, due to the rapid extension of the industrial revolution to all the civilized and many of the uncivilized nations of the world, bringing in its train the consolidation of large areas, a similarity of conditions within them, and amongst peoples and governments a great increase in the strength of economic motives. When the world has settled down to the new conditions, if it ever does so, we may be confronted with problems similar to those which our forefathers had to solve. But, for the time, if we know the economic interests of nations, classes and individuals, we can tell with more accuracy than ever before how in the long run they will act. Public policy therefore requires the closest possible study of the economic forces which are moulding the destinies of the great nations of the world. In most civilized countries except England this is recognized, and adequate provision is made for the study of economic science. But the subject is not only of immediate concern to the state in its corporate and public capacity. The neglect of it in the domain of private business can now only lead to disastrous results. To quote from a useful work (*National Education: a Symposium*, 1901), “the commercial supremacy of England was due to a variety of causes, of which superior intelligence, in the ordinary business sense, was not the most important. Her insular position, continuity of political development and freedom from domestic broils played an important part in bringing about a steady and continuous growth of industry and manufactures for several generations before the modern era. The great wars of the 18th and the beginning of the 19th century, which arrested the growth of continental nations, gave England the control of the markets of the world. When peace was restored, England enjoyed something in the nature of a monopoly. The competition of France ceased for a time to be an important factor. What is now the German empire was a mere congeries of small states, waging perpetual tariff wars upon each other. In the old Prussian provinces alone there were fifty-three different customs frontiers, and German manufactures could not develop until the growth of the Zollverein brought with it commercial consolidation, internal freedom and greater homogeneity of economic conditions. The industries of the United States were in their infancy. Thus the productive power of England was unrivalled, and her manufactures and business men, under a régime rapidly approximating to complete freedom of trade, could reap the full advantages to be derived from the possession of great national resources and production by machinery. Commercial supremacy required not so much highly trained intelligence amongst manufacturers and merchants as keen business instinct and a certain rude energy. In the last generation all that has changed, and the change is of a permanent character. The struggle of the future must inevitably be between a number of great nations, more or less equally well equipped, carrying on production by the same general methods, each one trying to strengthen its industrial and commercial position by the adoption of the most highly developed machinery, and all the methods suggested by scientific research, policy or experience. Under these conditions, it is no longer possible for the individual merchant, or for small groups of merchants, to acquaint themselves, by personal experience alone, with more than a fractional part of the causes which affect the business in which they are engaged. The spread of the modern industrial system has brought with it the modern state, with its millions of consumers, its vast area, its innumerable activities, its complicated code of industrial and commercial law. At the same time, the revolution in the means of transport and communication has destroyed, or is tending to destroy, local markets, and closely interwoven all the business of the world. Events in the most distant countries, industrial and commercial movements at first sight unrelated to the concerns of the individual merchant, now exert a direct and immediate influence upon his interests. The technical training of the factory or the office, the experience of business, the discharge of practical duties, necessary as they are, do not infallibly open the mind to the large issues of the modern business world, and can never confer the detailed acquaintance with facts and principles which lie outside the daily routine of the individual, but are none the less of vital importance.” Economics, therefore, under modern conditions, is not only a subject which may usefully occupy the attention of a leisured class of scientific men. It should form part of the training of educated men of all classes, on grounds of public policy and administrative and business efficiency.

Relations between economics and other sciences.

The relations between economics and other sciences cannot be stated in a very general form. They vary for different periods, and are not the same for all branches of economics. There is no subject of human study which may not be at some time or other of economic significance, and anything which affects the character, the ideals or the environment of man may make it necessary to modify our assumptions and our reasoning with regard to his conduct in economic affairs. But if the economist, while studying one side of man’s activities, must also cultivate all other branches of human learning, it is obvious that no substantial progress can be made. The economist frankly assumes the reality of the existing world and takes men as they are, or as they have been if he is studying past times. His assumptions are based upon ordinary observation and experience, and are usually accurate in proportion to his practical shrewdness and sagacity, so that he is not interested in the speculative flights of philosophy, except in so far as they influence or have influenced conduct. In times past, and to a less extent in our own day, philosophical conceptions have formed the basis of great systems of politics and economics. The historical relations between philosophy and economics are of great importance in tracing the development of the latter, and have done much to determine its present form. But the modern conception of society or the state owes more to biology than philosophy, and actual research has destroyed more frequently than it has justified the assumptions of the older philosophical school. Experimental psychology may in course of time have an important bearing on economics, but the older science cannot be said to be of much significance except in its historical aspects. Ethics is in much the same position. That is, it is possible to conceive of an ethical science which would

extend considerably our knowledge of economic affairs, but no important new principle or original discovery, relevant to economic investigation, has come from that quarter in recent years, and at present ethics has more to learn from economics than the latter has from ethics. It is in the adaptation of biological conceptions and methods, in the positive contributions of jurisprudence, law and history, in the rigorous application, where possible, of quantitative tests, that the explanation of the present position of economics is to be found. Mathematics has influenced the form and the terminology of the science, and has sometimes been useful in analysis; but mathematical methods of reasoning, in their application to economics, while possessing a certain fascination, are of very doubtful utility.

Method of economic investigation.

There is no method of investigation which is peculiarly economic or of which economics has the monopoly. In every age economists have applied the methods ordinarily in use amongst scientific men. There would probably have been no controversy at all on this subject but for the fact that economics was elaborated into systematic form, and made the basis of practical measures of the greatest importance, long before the remarkable development in the 19th century of historical research, experimental science and biology. The application of the *a priori* method in economics was an accident, due to its association with other subjects and the general backwardness of other sciences rather than any exceptional and peculiar character in the subject-matter of the science itself. The methods applied to economics in the 18th and the early part of the 19th century were no more invented with a special view to that subject than the principles of early railway legislation, in the domain of practical policy, were devised with a special view to what was then a new means of transport. As a matter of fact, discussions of method and the criticism of hypotheses and assumptions are very rarely found in early economic works. It is only by reference to the prevailing ideas in philosophy and politics that we can discover what was in the minds of their authors. The growth of a science is much like the growth of a constitution. It proceeds by adaptation and precedent. The scientific and historical movement of the 19th century was revolutionary in character. When it began to affect economics, many people were afraid that the whole fabric of science would be destroyed and the practical gains it had achieved, jeopardized. These fears were justified, in so far as those who entertained them shut their eyes to everything new and assumed an attitude of no compromise. Where the newer methods were assimilated, the position of economics was strengthened and its practical utility increased. General discussion of method, however, is rarely profitable. In all branches of economics, even in what is called the pure theory, there is an implied reference to certain historical or existing conditions of a more or less definite character; to the established order of an organized state or other community, at a stage of development which in its main features can be recognized. In all economic investigation assumptions must be made, but we must see that they are legitimate in view of the actual life and character of the community or communities which are the subject of investigation. In common with other sciences, economics makes use of “abstractions”; but if for some problems we employ symbolic processes of reasoning, we must keep clearly in view the limits of their significance, and neither endow the symbols with attributes they can never possess, nor lose sight of the realities behind them. Every hypothesis must be tested by an appeal to the facts of life, and modified or abandoned if it will not bear examination, unless we are convinced on genuine evidence that it may for a time be employed as a useful approximation, without prejudice to the later stages of the investigation we are conducting.

An illustration of economic method.

We shall best illustrate the character and method of economic reasoning by examples, and for that purpose let us take first of all a purely historical problem, namely, the effect on the wage-earners of the wages clauses of the Statute of Apprenticeship (1563). It is at once obvious that we are dealing not with an abstract scheme of regulation in a hypothetical world, but with an act of parliament nominally in force for two hundred and fifty years, and applicable to a great variety of trades whose organization and history can be ascertained. The conclusions we reach may or may not modify any opinions we have formed as to the manner in which wages are determined under modern conditions. For the time being such opinions are irrelevant to the question we are investigating, and the less they are in our minds the better. There is no reason why we should apply to this particular act a different method of inquiry from that we should apply to any other of the numerous acts, of more or less economic importance, passed in the same session of parliament. The first step is to see whether there is a *prima facie* case for inquiry, for many acts of parliament have been passed which have never come into operation at all, or have been administered only for a short time on too limited a scale to have important or lasting results. The justices were authorized to fix wages at the Easter quarter sessions. Did they exercise their powers? To answer this question we must collect the wages assessments sanctioned by the magistrates. This is a perfectly simple and straightforward operation, involving nothing more than familiarity with records and industry in going through them. Without having recourse to any elaborate process of economic reasoning, by confining our attention to one simple question, namely, what happened, we can establish conclusions of the greatest interest to economic historians and, further, define the problem we have to investigate. We can show, for example: (1) that the Statute of Apprenticeship did not stand alone; it was one of a long series of similar measures, beginning more than two centuries before, which in their turn join on to the municipal and gild regulations of the middle ages; one of an important group of statutes, more or less closely interwoven throughout their history, administered by local authorities whose functions had grown largely in connexion with this legislation and the gradual differentiation of the trades and callings to which it related. (2) That wages were regulated with much greater frequency during the reigns of Elizabeth, James I. and Charles I. than at any later period. (3) That they were regulated in some counties and not in others. (4) That in the counties and towns where they were regulated the action of the magistrates was in general spasmodic, and rarely continuous for a long series of years. (5) That the magistrates used their powers sometimes to raise wages, sometimes to force them down. (6) That the local variations of wages and prices were what we should call excessive, so that the standard of comfort in one district was very different from that of others. (7) That the wages assessments group themselves round certain short periods, coincident in many instances with high prices, increase of poverty, and other causes of exceptional action. (8) That what we may call, with the above limitations, the effective period of the act terminates with the outbreak of the Civil War. (9) That subsequent to that period organic changes in the industries affected, coupled with the incompetence of parliament to adapt the old

legislation to new conditions, and the growing acceptance of the doctrine of *laissez faire*, brought about a general disuse of the statute, though isolated attempts to enforce it were made and new acts applicable to certain trades were passed in the 18th century. (10) For more than one hundred years before the repeal of the act, trade unions and other forms of voluntary association amongst wage-earners, combinations amongst employers, collective agreements, customary regulations, were established in many of the important trades of the country. But these conclusions, after all, suggest more difficulties than they remove, for they show that our inquiry, instead of presenting certain well-marked features which can be readily dealt with, has to be split up into a number of highly specialized studies: the investigation of rates of wages, prices and the standard of comfort in different localities, bye-industries, regularity of employment, the organization of particular trades, the economic functions of local authorities, apprenticeship and a host of other subjects. Moreover, all these subjects hang together, so that it seems impossible to come to a decision about one of them without knowing all about the others.

It is a comparatively simple thing to state the question to which we want an answer, but extremely difficult to define the exact nature of the evidence which will constitute a good answer; easy enough to say we must try hypothesis after hypothesis, and test each one by an appeal to the facts, but a man may easily spend his life in this sort of thing and still leave to his descendants nothing more than a legacy of rejected hypotheses. Every volume of records we look through contains a mass of detailed information on the economic life of England in the period we are studying. How much of it is relevant to the subject of inquiry? What is to be the principle of selection? How shall we determine the relative weight and importance of different kinds of relevant evidence? As in modern problems, so in those of past times, a man requires for success qualities quite distinct from those conferred by merely academic training and the use of scientific methods. A correct sense of proportion and the faculty of seizing upon the dominant factors in an historical problem are the result partly of the possession of certain natural gifts in which many individuals and some nations are conspicuously wanting, partly of general knowledge of the working of the economic and political institutions of the period we are studying, partly of what takes the place of practical experience in relation to modern problems, namely, detailed acquaintance with different kinds of original sources and the historical imagination by which we can realize the life and the ideals of past generations. These qualities are required all the more because, in order to make any further progress with such an inquiry as we have suggested, we have deliberately to make use of abstraction as an instrument of investigation.

The plan of a general theory.

Let us see how this will work out. Suppose we have selected one of the numerous subsidiary problems suggested by the general inquiry, and obtained such full and complete information about one particular industry that we can tabulate the wages of the workers for a long series of years. We may do the same for other industries, some of them coming under the Statute of Apprenticeship, others not. If all the industries belong to one economic area over which, so far as we can tell from general statistics of wages and prices, and other information, fairly homogeneous conditions prevailed, we may be able to reach some useful conclusions as to the operation of the act. But it would be absurd to suppose that we could reach those conclusions by simple reference to the trades themselves. We cannot assume that the fluctuations in wages were due to the action or inaction of magistrates without the most careful examination of the other influences affecting the trades. In economic affairs the argument *post hoc propter hoc* never leads to the whole truth, and is frequently quite misleading. We cannot suppose that the policy of the Merchant Adventurers' Company had nothing to do with the woollen industry; that the export trade in woollen cloth was quite independent of the foreign exchanges and international trade relations in those times; that the effect on wages of the state of the currency, the influx of new silver, the character of the harvests, and many other influences can be conveniently ignored. In studying, therefore, such an apparently simple question as the effect of an act of parliament on wages in a small group of trades we want a general theory which we can use as a kind of index of the factors we have to consider.

Difficulties due to want of evidence.

Assuming that we have in our minds this safeguard against loose thinking and neglect of important factors, the investigation of the special problems arising out of the general inquiry resolves itself into a careful definition of each problem we wish to deal with, and the collection, tabulation and interpretation of the evidence. In most cases the interpretation of the facts is far from obvious, and we have to try several hypotheses before we reach one which will bear the strain of a critical examination in the light of further evidence. But at this stage in historical investigation it is generally the want of evidence of a sufficiently complete and continuous character, rather than difficulties of method, which forces us to leave the problem unsolved. It is, for instance, practically impossible to obtain reliable evidence as to the regularity of employment in any industry in the 17th century, and the best approximations and devices we can invent are very poor substitutes for what we really want. For this reason guesswork must continue to play an important part in economic history. But every genuine attempt to overcome its difficulties brings us into closer touch with the period we are examining; and though we may not be able to throw our conclusions into the form of large generalizations, we shall get to know something of the operation of the forces which determined the economic future of England; understand more clearly than our forefathers did, for we have more information than they could command, and a fuller appreciation of the issues, the broad features of English development, and be in a position to judge fairly well of the measures they adopted in their time. By comparing England with other countries we may be able in the distant future to reach conclusions of some generality as to the laws of growth, maturity and decay of industrial nations. But like the early statisticians of the 17th century, economic historians are the "beginners of an art not yet polished, which time may bring to more perfection."

The investigation

When we come to exclusively modern questions, there is no reason or necessity for a fundamental change of method. We cannot suppose that there occurred, at or about the commencement of the 19th century, a breach of historical continuity of such a character that institutions, customs, laws and social conventions were suddenly swept away, the bonds of society loosened, and the state and people of England dissolved into an aggregate of competing individuals. The adoption of

of modern questions.

machinery gradually revolutionized the methods of production; but in the first instance only certain industries were affected, and those not at the same time or in the same degree; old laws grown obsolete were repealed, but other laws affecting wage-earners and employers took their place, more complicated and elaborate than the Elizabethan code. Trade unions, so far from disappearing, were legalized, gathered strength from the changes in industrial organization, and nowhere became so powerful as in the most progressive industries; while other forms of combination appeared, incomparably stronger, for good or evil, than those of earlier times. But while we recognize these facts, we must not suppose that we have to study the action of men as though they were all enrolled in organized associations, or covered by stringent laws which were always obeyed. There has never been in the history of English industry such licence as we find in certain directions in the earlier part of the 19th century.

The distinctive features of modern problems.

It is not in the decay of combination and monopoly or in the growth of competition that we must look for the distinctive characteristics of modern problems. A 17th-century monopoly was a very weak and ineffective instrument compared with a modern syndicate; the Statute of Apprenticeship was certainly not so widely enforced as the "common rules" of trade unions; and many of the regulations of past times, which look so complicated to modern eyes, were conditions of free enterprise rather than restraints upon it. It is due to the influence of the *laisser faire* doctrine that we regard law and regulation as a restraint on liberty. As a maxim for guidance in public affairs, *laisser faire* was genuinely relevant at the end of the 18th and the beginning of the 19th century, when the Statute Book was cumbered with vexatious and obsolete laws. As an explanation of what has taken place in later years, or of the actual economic life of the present day, it is ludicrously inadequate. Competition, in the sense in which the word is still used in many economic works, is merely a special case of the struggle for survival, and, from its limitation, does not go far towards explaining the actual working of modern institutions. To buy in the cheapest market and sell in the dearest; to secure cheapness by lowering the expenses of production; to adopt the less expensive rather than the more expensive method of obtaining a given result—these and other maxims are as old as human society. Competition, in the Darwinian sense, is characteristic not only of modern industrial states, but of all living organisms; and in the narrower sense of the "higgling of the market" is found on the Stock Exchange, in the markets of old towns, in medieval fairs and Oriental bazaars. In modern countries it takes myriads of forms, from the sweating of parasitic trades to the organization of scientific research. Economic motives, again, are as varied as the forms of competition, and their development is coeval with that of human society. They have to be interpreted in every age in relation to the state of society, the other motives or ideals with which they are associated, the kind of action they inspire, and the means through which they operate. Apparently the same economic motives have led in the same age and in the same nation to monopoly and individual enterprise, protection and free trade, law and anarchy. In our own time they have inspired both the formation of trade combinations and attempts to break them up, hostility to all forms of state interference and a belief in collectivism.

The conditions which are peculiar to the modern world are the large numbers we have to deal with, the vast and fairly homogeneous areas in which justice is administered and property secured, and the enormously increased facilities for transport and communication. These conditions are of course not independent of each other, and they have brought in their train many consequences, some good and some bad. But they supply the bases for that general theory which, as we have seen, is indispensable in economic investigation. From the standpoint of general theory economic movements assume an impersonal character and economic forces operate like the forces of nature. Although economic motives have become more complex, they have just as much and no more to do with general economic reasoning and analysis than the causes of death with the normal expectation of life, or domestic ideals with the birth-rate. So far as we have anything to do with psychology at all, it is the psychology of crowds and not of individuals which we have to consider. If we study the economy of a village, the idiosyncrasies of every individual in it are of importance. If the village is replaced by a large area, inhabited by millions, with modern facilities of communication, it is a matter of observation and experience that for the purposes of general reasoning the idiosyncrasies of individuals may be neglected. Whether such large numbers have the character of the "economic man" of the early economists matters very little. All the assumptions we require are furnished by observation of people in the mass and the larger generalizations of statistics. Thus we can construct a kind of envelope of theory, which, by careful testing as we proceed, can be made to indicate in a general manner the reactions of one part of the activities of the economic world upon the others, and the interdependence of the several parts. From its very nature this general theory can never correspond strictly to the actual life and movement of any given state. It is useful and necessary, and plays somewhat the same part in economic investigation as ton-mile statistics do in the administration of a railway. To express in any language or to illustrate by any images, from a purely objective standpoint, the infinitely complicated movements of the actual world, is a task far beyond human capacity.

Application to modern problems.

With the aid of this general theory the methods we have sketched in relation to historical problems apply with greater force to the special problems of modern times, and are rewarded with results more accurate, more fruitful, more relevant to difficulties which all civilized nations have to face, than those of historical research. To many minds the interest and usefulness of economics depend entirely on the application of these methods, for it is the actual working of economic institutions about which the statesman, the publicist, the business man and the artisan wish to know. Under the conditions we have described, many of the most interesting problems of our own time, when they are once defined, resolve themselves into statistical inquiries. But in most cases such an inquiry cannot be successfully carried out by a mere statistician. Definite economic problems can very rarely be dealt with by merely quantitative methods. In the tabulation and interpretation of statistical evidence, as in its collection, it is scarcely possible to overrate the importance of wide knowledge and experience. There is another very important instrument of investigation which can be used in our own time, but cannot be employed in historical research. Historical documents, however detailed, rarely show all the factors we have to deal with or fully explain a given situation. No sane person would suppose that the minutes of a modern legislative body explain the steps by which legislation has been

passed, or the issues really involved. The ostensible cause of a modern labour dispute is frequently not the real or the most important cause. In modern problems we can watch the economic machine actually at work, cross-examine our witnesses, see that delicate interplay of passions and interests which cannot be set down or described in a document, and acquire a certain sense of touch in relation to the questions at issue which manuscripts and records cannot impart. We can therefore substitute sound diagnosis for guesswork more frequently in modern than in historical problems.

What then, it may be asked, becomes of the "old Political Economy"? Of what possible use are the works of the so-called classical writers, except in relation to the history of economics and the practical influence of theory in past times? If we take the mere popular view of what is meant by the "old Political Economy," that is, that a generation or so ago economics was comprised in a neatly rounded set of general propositions, universally accepted, which could be set forth in a text-book and learnt like the multiplication table, it is not incumbent on the present generation to define its attitude at all. In this sense of the words, there was no faith delivered to our fathers which we are under any obligation to guard or even explain. If by the "old Political Economy" we mean the methods and conclusions of certain great writers, who stood head and shoulders above their contemporaries and determined the general character of economic science, we are still under no obligation to define the attitude of the present generation with regard to them. The fact that Adam Smith, with the meagre materials of the 18th century at his disposal, saw his way to important generalizations which later research has established on a firm basis, may enhance greatly the reputation of Adam Smith, but does not strengthen the generalizations. They stand or fall by the strength of the evidence for or against them. In the history of economics or the biography of Ricardo it is of interest to show that he anticipated later writers, or that his analysis bears the test of modern criticism; but no economist is under any obligation to defend Ricardo's reputation, nor is the fact that a doctrine is included in his works to be taken as a demonstration of its truth. The appeal to authority cannot be permitted in economics any more than in chemistry, physics or astronomy. But the cases stated above suggest more or less false issues. There has been no revolution in economic science, and is not likely to be any. The question we have really to determine is how we can make the best use of the accumulated knowledge of past generations, and to do that we must look more closely into the economic science of the 19th century.

The "old political economy."

Any one who has taken the trouble to trace the history of one of the modern schools of economists, or of any branch of economic science, knows how difficult it is to say when it began. "Anticipations" of method and doctrine can generally be found by the diligent investigator in the economic literature of his own or a foreign country. So that cross-sections of the stream of economic thought will reveal the existence, at different times, in varying proportions and at different stages of development, of most of the modern "schools." Again, the classification of an economic bibliography at once shows how varied has been the character of economic investigation, ranging from the most abstract speculation on the one hand to almost technical studies of particular trades on the other. Of the great army of writers who flourished in the first half of the 19th century some were closely identified with the utilitarian school, and the majority were influenced in a greater or less degree by the prevailing ideas of that school. Others, however, were hostile to it. In many works, such as those of a statistical or historical character, there are frequently to be found passages which could have been written in no other period, but are only of the nature of ejaculations and do not affect the argument. In stating the position of economics during this time we cannot ignore all writers, except these who belonged to one group, however eminent that group may have been, simply because they did not represent the dominant ideas of the period, and exercised no immediate and direct influence on the movement of economic thought. We must include the pioneers of the historical school, the economic historians, the socialists, the statisticians, and others whose contributions to economics are now appreciated, and without whose labours the science as we know it now would have been impossible. If we take this broadly historical view of the progress of economics, it is obvious that even in England there was no general agreement, during the 19th century, as to the methods most appropriate to economic investigation.

Suppose, now, we ignore the writers who were inaugurating new methods, investigating special problems or laboriously collecting facts, and concentrate attention on the dominant school, with its long series of writers from Adam Smith to John Stuart Mill. It is the work of these writers which people have in mind when they speak of the "old Political Economy." There are several quite distinct questions we can ask with regard to them. That they must be studied closely by every one who wishes to follow the history of economics goes without saying. That they must be studied by the economic historian is equally clear, owing to their practical influence and the fact that they furnished the theoretical bases of much of the economic policy of the 19th century. This is true whether their method is good or bad, whether their conclusions are true or false. It is not so easy to determine their relevance and usefulness in relation to distinctively modern problems, or to indicate within what limits their work is of permanent value, and we can only deal with these questions in their more general aspects.

It must be clear to every observer that the economists of the classical period, with the one exception of Adam Smith, will speedily share the fate of nearly all scientific writers. They will be forgotten, and their books will not be read. Adams Smith's *Wealth of Nations*, if it has ever been, has long ceased to be a scientific text-book. Whether a modern economist accepts his views or not is of no importance. There is probably not a single chapter in the *Wealth of Nations* which would be thoroughly endorsed by any living economist. But the reputation of the book and its author is quite independent of considerations of this kind. The *Wealth of Nations* is one of the great books of the world, many of the sayings of which are likely to be more frequently quoted in the future than they have been in the 19th century. Malthus is already an author whose name is probably more widely known than that of any other economist, but whose works are rarely read, and studied only by a small proportion of the few people who write books on the history of economic theory. Of economic students, many are unaware of the fact that he wrote any other book than the *Essay on the Principle of Population*, and what is of permanent importance in that work is contained in the generalization which it suggested to Darwin. Moreover, modern economists, while accepting in the main the

general tenor of Malthus's theory of population, would not agree with his statement of it. Like Malthus, Ricardo owes his reputation very largely to the theory associated with his name, though it has long ceased to be stated precisely in the terms he employed. But there are very few people in the world who have made a careful study of his works; and although his theory of rent has a wide and increasing application in economics, it is not comparable in general scientific importance with Malthus's theory of population. It is already impossible to take J.S. Mill's *Principles of Political Economy* as a text-book. Important as it was for thirty or forty years, it will soon be as little read as M'Culloch's *Principles*. For the rest of the economists of this period, it is difficult to see how they can escape oblivion. When the generation whose economic training was based upon J.S. Mill has died out, the relevance of the "old Political Economy" is not likely to be a question of any interest to ordinary educated men and women, or even to the great mass of economic students.

The explanation of this decay of interest does not lie upon the surface. It is frequently supposed that the influence of the "old Political Economy" has been gradually undermined by the attacks of the historical school. But great as the achievements of this school have been, it has not developed any scientific machinery which can take the place of theory in economic investigation. If our view is correct that, broadly speaking, the two ways of regarding economic questions are complementary rather than mutually exclusive, there does not seem to be any reason why the growth of the historical school should have been destructive of the "old Political Economy" if it had been well founded. The use of the historical method has, in fact, raised more reputations than it has destroyed, because by keeping carefully in view the conditions in which economic works have been written, it has shown that many theories hastily condemned as unsound by *a priori* critics had much to be said for them at the time when they were propounded. This observation is true not only of old-world writers like the Mercantilists, but also of Ricardian economics. No one is concerned to prove that the Ricardian economics applies to the manorial system, and it is generally supposed at any rate that the world has been approximating more and more nearly during the last century to the conditions assumed in most of the reasoning of that school. On the principles we have explained, therefore, the Ricardian economics should supply just that body of general theory which is required in the investigation of modern economic problems, and the reputation of at any rate the leading writers should be as great as ever. It would be of immense advantage from a scientific point of view if this could be taken for granted, if for a time the work of the classical economists could be considered final so far as it goes, and for the purposes of investigation regarded as the theoretical counterpart of the modern industrial system. This assumption, however, has been made quite impossible, not by the historical school, but by the criticism and analysis of economists in the direct line of the Ricardian succession.

Modern economic criticism and analysis has destroyed the authority of the "old Political Economy" as a scientific system. The assumptions, the definitions, the reasoning, the conclusions of the classical writers have been ruthlessly overhauled. Defects in their arguments have been exposed to view by those who are most concerned to defend their reputation. Writers with none of the prejudices of the historical school, but with the cold and remorseless regard for logic of the purely objective critic, have pointed out serious inconsistencies here, the omission of important factors there, until very little of the "old Political Economy" is left unscathed. In fact, there never was a scientific system at all. What was mistaken for it was fashioned in the heat of controversy by men whose interests were practical rather than scientific, who could not write correct English, and revealed in their reasoning the usual fallacies of the merely practical man. So the "old Political Economy" lies shattered. It is useless to suppose that this destructive criticism from within can be neutralized by generously sprinkling the pages of the classical writers with interpretation clauses. This may serve to show that the ideals of our youth were not without justification; but the younger generation, which does not care about our ideals, and looks to the future rather than the past, will not read annotated editions of old books, however eminent their authors. If the Ricardian school of economists had been merely philosophers, or even a group like the French physiocrats, this state of things might be regarded with equanimity. We might assume that criticism and analysis had separated the wheat from the chaff in their writings, that everything of permanent value had probably been preserved and incorporated in the works of later economists. But the character of much of their work makes this assumption impossible. It is, in fact, quite true that many of them were more interested in practical aims than in the advancement of economic science. We may talk of the assumptions implicitly involved in Ricardo's works. In reality we do not know what those assumptions were; we only know what assumptions we should make in order to reach the same conclusions, and they may be very different from "the mind of Ricardo." Ricardo's works, in fact, do not explain a theoretical system, but contain the matured reflections, more or less closely reasoned, of a man of great mental power looking out on the world as it appeared to a business man experienced in affairs. The conclusions of such a work are of wider significance than the assumptions we attribute to the author would warrant. They are not expressed in terms which satisfy our canons of scientific accuracy. Dissected sentence by sentence, the book may be shown to be a mass of inconsistencies. If it has the misfortune to be systematized by an enthusiastic but dull and incompetent disciple, it may appear even absurd. But after all the misinterpretation of contemporaries and the destructive criticism of later times, the book as a whole leaves upon us an impression of peculiar strength and charm, and imparts a sense of the relations of things truer, because less mechanical, than the laboured reasoning of smaller men. Such is the character of much of the work of Ricardo and some of his contemporaries. We think that the decay of interest in these writers involves a real loss, and that students of modern problems may do worse than read Ricardo and his school. Some of the criticism of their works, necessary and useful as it has been, will probably be corrected later on by that breadth of view and sense of proportion which has enabled us to appreciate justly the achievements of lesser men in more remote times. But rehabilitation in accordance with the canons of historical justice will not restore the lost influence of the Ricardian school. Their achievements in the 19th century will be fully acknowledged, but the relevance of their work to the problems of the 20th century will be admitted less than at the present time.

Ricardo's limitations.

In a subject like economics it must always be very difficult to decide how far a departure from the traditional form and expression of its main doctrines is necessary or desirable. No one who is really experienced in economic investigation cares to emphasize the originality, still less the revolutionary

Economics a conservative science.

character of his own work. It is much more likely than not that some principle which for the moment seems new, some distinction which we may flatter ourselves has not been observed before, has been pointed out over and over again by previous writers, although, owing to special circumstances, it may not have received the notice it deserved. Economics is therefore, on the whole, an intensely conservative science, in which new truths are cautiously admitted or incorporated merely as extensions or qualifications of those enunciated by previous writers. This procedure has its advantages, but it may easily become dangerous by destroying the influence of the science it is meant to preserve. It is not unlike the procedure of the canonists and casuists of the middle ages with regard to the doctrine of usury, by which the doctrine was to all appearances preserved intact while in reality it was stripped of all its original meaning by innumerable distinctions “over-curious and precise.” In the same way the doctrines of the classical economists may be adapted by interpretation clauses and qualifications the exact force of which cannot be tested or explained, so that we do not know whether the original proposition is to be considered substantially correct or not. The result will be that while the doctrines are apparently being brought into closer correspondence with the facts of life, they will in reality be made quite useless for practical purposes or economic investigation. It is easier to point out the danger than to suggest how it should be met. The position we have described is no doubt partly due to the unsettlement of economic opinion and the hostile criticism of old-established doctrines which has characterized the last generation. Or it may be the result of economic agnosticism, combined with unwillingness to cut adrift from old moorings. Whatever the cause, the complete restatement of economic theory, which some heroic persons demand, is clearly impossible, except on conditions not likely to be realized in the immediate future. The span of life is limited; the work requires an extensive knowledge of the economic literature of several countries and the general features of all the important departments of modern economic activity. In general theory special studies by other men cannot play the same part as they do in historical and statistical work. In historical and statistical investigation, or in special studies of particular subjects, it is possible, given the pecuniary means, to organize a whole army of skilled assistants, and with ordinary care to combine the results of their separate efforts. In general theory the inverse rule seems to prevail. There the unity of conception and aim, the firm grip of all the different lines of argument and their relation to each other, which are required, can only be given by a single brain. But no one individual can do original work over the whole field. He is lucky if he can throw new light on a few old propositions. For the rest, he can only, with the utmost caution, adopt the suggestions of other minds as qualifications of old doctrines, never feeling quite sure that he is right in doing so. A complete restatement could only be undertaken by a group of men, trained in much the same conditions, accustomed to think and work together, each one engaged on a special department, but all acting under the control of one master-mind. This is largely a question of the organization of economic studies, and it is of the greatest importance that, if possible, such an effort should be made to present in a connected form the best results of modern criticism and analysis.

Economics is unlike many other sciences in the fact that its claim to recognition must be based upon its practical utility, on its relevance to the actual life of the economic world, on its ability to unravel the social and economic difficulties of each generation, and to contribute to the progress of nations.

Some recent developments of economic theory.

The very effectiveness of modern criticism and analysis, which has brought great gains in almost all branches of economic theory, has made the science more difficult as a subject of ordinary study. The extensions, the changes or the qualifications, of old doctrines, which at any rate in the works of responsible writers are rarely made without good if not always sufficient reason, have modified very considerably the whole science, and weakened the confidence of ordinary educated men in its conclusions. In the case of many subjects this would matter very little, but in that of economics, which touches the ordinary life of the community at so many points, it is of great importance, especially at a time like the present, when economic questions determine the policy of great nations. The “economic man” of the earlier writers, with his aversion from labour and his desire of the present enjoyment of costly indulgences, has been abandoned by their successors, with the result that in the opinion of many good people altruistic sentiment may be allowed to run wild over the whole domain of economics. The “economic man” has, on the other hand, been succeeded by another creation almost as monstrous, if his lineaments are to be supposed to be those of the ordinary individual—a man, that is, who regulates his life in accordance with Gossen’s Law of Satiety, and whose main passion is to discover a money measure of his motives. It is extremely important to consider how far the economic conceptions based upon this view of the action of men in the ordinary business of life—such, for example, as the doctrine of marginal utility—depend for their truth and relevance on the fact that in economics we are dealing with large aggregates. The earlier writers generally assumed perfect mobility of labour and capital. No economist would deliberately make that assumption now unless he were dealing with some purely theoretical problem, for the solution of which it was legitimate at some stage in the reasoning. Many of the questions of the greatest practical importance at the present time, such as the competition between old and new methods of manufacturing commodities substantially the same in kind, and equally useful to the great body of consumers, arise largely from the immobility of capital or labour, or both of them. But it is obvious that if the assumption of perfect mobility is invalid, there is scarcely any economic doctrine identified with the earlier writers which may not require modification, in what degree it is impossible to say without very careful investigation. Much suggestive work on this subject of a general character is incorporated in economic books of the present day, but there is room for a whole series of careful monographs on a question of such fundamental importance. The same may be said of another subject, too frequently neglected by earlier writers, to which due significance has been given in the best recent work, namely, time in relation to value. It would perhaps be too much to say that the full consideration of this point has revolutionized the theory of value, but it has certainly created what seems almost a new science in close contact with the actual life of the modern world.

Some doctrines of the earlier economists, such as the Wages Fund Theory, are now practically abandoned, though it may be said that they contained a certain amount of truth. Others, which were considered of fundamental importance, owe their position in modern economics and the form in which they are stated to

the “tradition of the elders.” If they could, by some happy chance, have been left for discovery by modern economists, they would without doubt have received different treatment, to the great advantage of economic science. Such a doctrine is the so-called Law of Diminishing Returns, which Mill considered “the most important proposition in Political Economy.” “Unless this one matter,” he says, “be thoroughly understood, it is to no purpose proceeding any further in our inquiry.” “Were the law different, nearly all the phenomena of the production and distribution of wealth would be other than they are.” On the other hand, Thorold Rogers, not to speak of earlier objectors, described the law as a “dismal and absurd theorem.” The opinions of present-day economists appear to fluctuate between these two extremes. The law may apparently be “a general rule” or “a tendency” which is liable to be “checked,” or a particular case of the law of the conservation of energy. If we go to Mill to discover what it is, we find that “it is not pretended that the law of diminishing return was operative from the beginning of society; and though some political economists may have believed it to come into operation earlier than it does, it begins quite early enough to support the conclusions they founded on it.” “It comes into operation at a certain and not very advanced stage in the progress of agriculture.” But this very important stage in the history of a nation is not defined or clearly illustrated. We are told that we can see “the law at work underneath the more superficial agencies on which attention fixes itself”; it “undergoes temporary suspension,” which may last indefinitely; and “there is another agency, in habitual antagonism” to it, namely, “the progress of civilization,” which may include every kind of human improvement. Mill apparently is not content with the confusion between “law” and “agency” or “force,” but opposes the one to the other. He is constantly speaking in terms which imply the conquering of one law by another, a habit from which his successors have not freed themselves; and the theory of natural processes which appears to have satisfied him, was that when two forces come into operation there is a partial or complete suspension of one by the other. In modern economics “fertility” has no very definite meaning. It may mean what is ordinarily understood by the word—climate, rainfall, railway rates or anything else except “indestructible powers of the soil.” To speak of “additional labour and capital” without reference to the kind and quality of the labour and capital, and the manner in which they are employed, organized and directed, throws very little light on agriculture. Every improvement involves, from a quantitative point of view, more or less of capital or of labour, so that it is the “antagonizing” influences, which are nearly all qualitative, which appear to be really important. It is therefore extraordinarily difficult at present to know what happens, or rather what would happen if it were not prevented, when a country reaches “the stage of diminishing returns”; what precisely it is which comes into operation, for obviously the diminishing returns are the results, not the cause; or how commodities “obey” a law which is always “suspended.” Possibly the present generation of English industrial history will furnish many illustrations of the law of diminishing returns. We can only say that it requires investigation and restatement.

Closely related to the law of diminishing returns is the Theory of Rent. No economic doctrine so well illustrates the achievements and the defects of modern economic analysis. Ricardo’s statement of the theory left upon the world an impression, not wholly just, of singular clearness. He employed the theory with wonderful success in unravelling the problems of his time. Its importance has not been seriously, or at any rate successfully, called in question. Treated at first as a doctrine peculiarly applicable to land, with a certain controverted relevance to other natural agents, it has been so extended that there is scarcely any subject of economic study in which we may not expect to find adaptations or analogies, so that Ricardo seemed to have discovered the key of economic knowledge. But it was discovered that there were no “indestructible powers of the soil”; that the fertility of land in a country like England is almost entirely the result of improvement at some time or other; that “advantage of situation” includes very much more than the words in their literal sense imply; that both “fertility” and “advantage of situation” include many kinds of differential advantage; that in some circumstances rent does not enter into the price of agricultural and other produce, and that in others it does. Moreover, the study of the theory of rent has had a very great influence on all branches of economics by destroying the notion that it is possible to draw sharp lines of distinction, or deal with economic conceptions as though they were entirely independent categories. That modern economic analysis is incomparably more accurate than that of earlier times there can be no question. But the net result of the development of the doctrine of rent is that all problems in which this factor appears, and they embrace the whole range of economic theory, must apparently be treated on their merits. In its modern form the doctrine is far too general to be serviceable without the closest scrutiny of all the facts relating to the particular case to which it is applied. To deal adequately with the numerous extensions or qualifications of these and other doctrines in the hands of modern economists would involve us in an attempt to do what we have already said is impossible except on conditions not at present realized. It is clear that in the interests of general economic theory we require a vast number of special studies before an adequate restatement can be undertaken.

Relations between general economics and special studies.

It must be clearly recognized that the functions of economic science in the present requirements of the world cannot possibly; be discharged by treatises on economic theory. The relations between general theory and special studies conducted on the lines we have indicated have completely changed. General theory never has been, and in the nature of things never can be, the actual reflex of the life and movement of the economic world. It never has been, and never can be, more than an indication of the kind of thing which might be expected in a purely hypothetical world. When the aim of the man of affairs and the hypothesis of the economist was unrestricted competition, and measures were being adopted to realize it, general theory such as the classical economists provided was perhaps a sufficiently trustworthy guide for practical statesmen and men of business. If only people can be got to believe in them, a few abstract principles are quite enough to destroy an institution which it has taken centuries to create. But a new institution cannot be made on the same terms. The modern industrial system has brought with it an immense variety of practical problems which nations must solve on pain of industrial and commercial ruin. For these problems we want, not a few old-established general principles which no one seriously calls in question, but genuine constructive and organizing capacity, aided by scientific and detailed knowledge of particular institutions, industries and classes. Just as the historical school grew up along with the greatest constructive achievement of the 19th century, namely, the consolidation of Germany, so the application to

modern problems of the methods of that school has been called forth by the constructive needs of the present generation. We have already shown how these methods, in their turn, require the aid of general theory, but not of a general theory which tries to do their work. In fact, every attempt to make it do so must inevitably fail. How can such a huge mass of general propositions as are necessarily included in a system of economics ever be thoroughly tested by an appeal to facts? If they are not so tested, the general theory will remain a general theory, of no practical use in itself, until the end of time. It they are to be tested, an indefinitely large number of special studies must be made, for which the original materials must be collected and examined. That is, original investigation of special problems has to be carried out on a more gigantic scale than any economist of the historical school ever dreamt of or the world requires, with the certain knowledge that at the end of it all the general theory will not correspond with the facts of life. For there is all the difference in the world between using a body of general theory as an indication of the factors to be considered in the study of a special problem, and undertaking special studies with a view to testing the general theory. If the necessary limitations of general economic theory are recognized, most of the difficulties we have noticed disappear. Now that the "industrial revolution" has extended practically all over the world, so that we have several countries carrying on production by modern methods, it is easily possible to sketch the main features of industrial and commercial organization at the present time, to describe the banking and currency systems of the principal nations, their means of transport and communication, their systems of commercial law and finance, and their commercial policy. It is true that at present very little work of this kind has been done in England, but innumerable books, many of them about England, have been written by thoroughly competent economists, in French, German and other languages. So that no great amount of original work is required for a reliable account of those general features of the modern system which should form the introduction to economics. The general theory which we require should be sketched in firm and clear outline, leaving the detailed qualifications of broad principles to special studies, where they can be dealt with if it is necessary or desirable, and examined by statistical and other tests. For such a general theory there is ample material in the economic literature of all civilized countries. It is of the utmost importance that the economic terms, which are also, though in many cases with an entirely different meaning, the terms of business and commerce, should as far as possible be used in their common and ordinary English sense: that they should correspond in meaning with the same words when used in description, in law, accountancy and ordinary business. This is no doubt a difficult matter. But some change in this direction is necessary both in the interests of the science itself and of its practical utility. All the materials for investigation, all the facts and figures from which illustrations are drawn, all methods of keeping accounts in England, assume the ordinary English tongue. There are few if any conceptions in economics which cannot be expressed in it without depleting the ordinary vocabulary. At present the language of economics is for the ordinary Englishman like a foreign language of exceptional difficulty, because he is constantly meeting with words which suggest to his mind a whole world of associations quite different from those with which economic theory has clothed them. The refinements of economic analysis, as distinguished from its broader achievements, should be reserved for special studies, in which a technical scientific terminology, specially devised, can be used without danger of misconception. But in a subject like economics obscurity and an awkward terminology are not marks of scientific merit.

Economic studies should be as relevant to existing needs as those of engineering and other applied sciences. The scientific study of practical problems and difficulties is (generally speaking, and with honourable exceptions) far more advanced in almost every civilized country than it is in England, where the limited scale upon which such work is carried on, the indifference of statesmen, officials and business men, and the incapacity of the public to understand the close relation between scientific study and practical success, contrast very unfavourably with the state of affairs in Germany or the United States. The backwardness of economic science has been an index of the danger threatening the industrial and commercial supremacy of the United Kingdom. There are very few questions of public or commercial importance upon which the best and most recent investigations are to be found amongst English works. This would matter very little, perhaps, if Englishmen had a firm belief, established by actual experience, in the soundness of their policy, the present security of their position, and the sufficiency of their methods to strengthen or maintain it. But this is very far from being the case. If we take, for example, the corner-stone of the British commercial system in the 19th century, namely, the policy of "free trade" (*q.v.*), the public do not now read the economic works which supplied the theoretical basis of that policy, and, indeed, would not be convinced by them. The great men of the period, Cobden and Bright, are merely historical figures. Long before his death, Bright's references in public speeches to the achievements of the Anti-Corn Law League were received with respectful impatience, and Peel's famous speech on the repeal of the corn laws would not convince the German Reichstag or a modern House of Commons. The result is that free trade had become by the end of the 19th century in the main an old habit, for which the ordinary English manufacturer could give no very reasonable explanation, whatever may be its influence in commerce and public affairs. The doctrine of free trade only prevailed in so far as it could be restated in terms which had a direct relevance to the existing position of England and existing conditions of international trade. And it was directly challenged by the representatives of Mr Chamberlain's school of Imperialist thought (see Chamberlain, Joseph). It thus became the work of economic science ruthlessly to analyse the existing situation, explain the issues involved in the commercial policy of different countries, and point out the alternative methods of dealing with present difficulties, with their probable results.

Economic problems in Great Britain.

The commercial policy of a state is merely the reflex of its system of public finance (see *e.g.* English Finance). The absence of conviction in regard to British commercial policy naturally had its counterpart in the attitude of many men to the financial system of the country. The eulogies showered upon it in the past were no longer considered adequate. The great increase in recent years in British military and naval expenditure, made necessary by the exceptional demands of a state of war and the great development of foreign powers, was partly responsible for the new difficulties; partly it was due to the great extension of the functions of the state during the latter part of the 19th century. The former causes may be considered partly permanent, partly temporary; but those of a permanent character are likely to increase in force, and those of

Commerce and finance.

a temporary character will leave a deposit in the shape of an addition to the normal expenditure of the central government. The extension of government functions appeared much more likely to continue than to be checked. Normal expenditure might therefore be calculated to rise rather than fall. In spite of the vast increase in national wealth, it was found a matter of increasing difficulty to meet a comparatively slight strain without recourse to measures of a highly controversial character; and the search for new sources of revenue (as in 1909) at once raised, in an acute form, questions of national commercial policy and the relations between the United Kingdom and the colonies.

The development of the powers of the central government has been less than that of the functions of local governing authorities. This, again, is a movement much more likely to extend than to be checked. Local governing authorities now discharge economic functions of enormous importance and complexity, involving sums of money larger than sufficed to run important states a generation ago. The scientific study of the economics of local administration is, however, in its infancy, and requires to be taken up in earnest by economists. These questions of commercial policy and local government are closely bound up with the scientific study of the transport system. Although the British Empire contains within itself every known species of railway enterprise, the study of railways and other means of transport, and their relation to the business, the commerce and the social life of the country, is deplorably backward. It is obvious that no inquiry into commercial policy, or into such social questions as the housing of the poor, can be effective unless this deficiency is remedied.

The whole social and political fabric of the British Empire depends upon the efficiency of its industrial system. On this subject many monographs and larger works have been published in recent years, but dealing rather with such questions as trade unionism, co-operation and factory legislation, than the structure and organization of particular industries, or the causes and the results of the formation of the great combinations, peculiarly characteristic of the United States, but not wanting in England, which are amongst the most striking economic phenomena of modern times.

These are some of the questions which must absorb the energies of the rising generation of economists. The claim of economics for recognition as a science and as a subject of study must be based on its relevance to the actual life of the economic world, on its ability to unravel the practical difficulties of each generation, and so contribute to the progress of nations.

LITERATURE.—See also FREE TRADE; PROTECTION; TARIFF; COMMERCIAL TREATIES; TRUSTS; MONEY; FINANCE; &c. The bibliography of economics as a whole would include a history of all the writers on the subject, and is beyond our scope here; see the numerous articles on economic subjects throughout this work. The article by Dr J.K. Ingram in the ninth edition of the *Encyclopaedia Britannica* is still a valuable historical account. It is only possible to mention here a few of the more recent text-books. The most important general work published in English is Marshall's *Principles of Economics*, vol. i. (1st edition, 1890; 4th edition, 1898). J. Shield Nicholson's *Principles of Political Economy* (3 vols.) not only gives a survey of economic principles since Mill's time, but contains much suggestive and original work. The writer of this article is much indebted to the works of Schmoller, particularly his *Grundris der allgemeinen Volkswirtschaftslehre* (1900), and Adolph Wagner, particularly his *Grundlegung der politischen Ökonomie*. On the history of economic theory, Cannan's *History of the Theories of Production and Distribution* (1776-1848) is an admirable criticism, from a purely objective standpoint, of the works of the English classical writers. The most important English works published in recent years on general English economic history are W. Cunningham's *Growth of Industry and Commerce*, and W.J. Ashley's *Economic History*, while Vinogradoff's *Villenage in England* and *The Growth of the Manor*, as well as Maitland's *Domesday Studies*, are of great importance to the student of early economic institutions. D'Avenel's *Histoire économique de la propriété, &c.* (*1200-1800*), is a monumental work on the history of prices in France. Other books dealing with special subjects are likely to take a very high place in economic literature. We may mention particularly Charles Booth's *Life and Labour of the People in London*, B.S. Rowntree's *Poverty*, Sidney and Beatrice Webb's *History of Trade Unionism* and *Industrial Democracy*, and Dr Arthur Shadwell's *Industrial Efficiency* (1906). These books are generally regarded as typical of the best English work of recent years in economic investigation. We may also mention Schloss's *Methods of Industrial Remuneration*, a most important contribution to the study of the wages question; C.F. Bastable's works on *International Trade* and *Public Finance*; George Clare on the *Money Market* and the *Foreign Exchanges*; and A.T. Hadley's *Economics: An Account of the Relations between Private Property and Public Welfare* (1896). Studies of particular questions, both concrete and theoretical, in foreign languages are too numerous to specify, and much of the best modern work is to be found in economic periodicals.

(W. A. S. H.)

ECONOMY, a township and a village of Beaver county, Pennsylvania, U.S.A., on the E. bank of the Ohio river, 17 m. N.W. of Pittsburg. Pop. of township (1900) 1062; (1910) 860. The village is served by the Pennsylvania system. It was owned until 1904, when it was sold to a land company, by the Harmony Society (see COMMUNISM), commonly called the Economites, Harmonists or Rappists. The founder, George Rapp, after living with his would-be primitive Christian followers at Harmony, Butler county, Pennsylvania, in 1803-1814, and in 1815-1824 in New Harmony (*q.v.*), Indiana, which he then sold to Robert Owen, settled here in 1824 and rapidly built up a village, in which each family received a house and garden. The culture of silk, flax, grapes (for wine-making) and fruits and cereals in general, and the manufacture of flour and of woollen, flannel and cotton fabrics, were carried on under a rule requiring every adult to labour 12 or 14 hours each day in field or mill. Celibacy had been adopted in 1807 as the rule of the community. New members were received after a half-year's probation, and members who left received their original investment. Three hundred thus separated from Rapp in 1833, with $105,000 as their share of the

communal property, to build the millennial kingdom of New Jerusalem at Phillipsburg (now Monaca), Beaver county, Pennsylvania, under the lead of Bernhard Müller, who had come to Economy in 1831 as a fellow religionist, and was called Count Maximilian de Leon (or Proli); in 1833 Leon went, with his followers, to Louisiana, and established a religious colony 6 m. from Natchitoches. After his death his wife until 1871 was head of a similar community at Germantown in Webster parish. The Harmonists at Economy flourished under the rule of a tradesman, R.L. Baker, or Romelius Langenbacher, after the death of Rapp in 1847, and during the Civil War had about $500,000 buried away. Their numbers were for a time kept up by the addition of fresh converts, but the employés who were not Harmonists soon greatly outnumbered the members of the community, the basis of which was always religious. Baker died in 1868, and his successor, John Henrici, in 1892, when John S. Duss became first trustee. In 1907 there were only two or three members in the society. In 1851 the township of Harmony was set apart from Economy.

See Morris Hillquit, *History of Socialism in the United States* (New York, 1903); William A. Hinds, *American Communities* (revised edition, Chicago, 1902); John L. Bole, *The Harmony Society* (Philadelphia, 1904); Charles Nordhoff, *The Communistic Societies of the United States* (New York, 1875); and among several excellent monographs in German, Karl Knortz, *Die christlichkommunistische Kolonie der Rappisten* (Leipzig, 1892), and J. Hanno Deiler, *Eine vergessene deutsche Colonie: eine Stimme zur Verteidigung des Grafen de Leon* (New Orleans, 1900).

ECONOMY, a word ranging in application from the careful thrift of an individual to the systematic arrangement of an organization. It is derived from the Gr. οἰκονομία, the management (νέμειν, to control) of an οἶκος or house, extended in meaning to the administration of a state. Of its original sense, the art or science of managing a household, the expression "domestic economy" survives, but the principal use in this sense is confined to the thrifty management of the financial resources of a household or of an individual. It is thus used as equivalent to "saving," not only of money, but of time, labour or effort, and, generally, of the least expenditure of means to attain a required end. It is on the principle of "economy" that many phonetic changes occur in the development of languages, and, in aesthetics, the name has been applied to a principle or law that effects are pleasant in proportion to the smallness of the effort made, and of the means taken to produce the result. The phrase "economy of truth" is due to an invidious application of the use, in patristic theology, of the word οἰκονομία for the careful presentation of such doctrine as would be applicable to the hearer (see J.H. Newman, *History of the Arians of the 4th Century*). "Economy" is also used in theology in such expressions as "Mosaic" or "Christian economy" as a synonym of "dispensation," for the administration of the world by God at particular times or for particular races. From the meaning of organization or administration of a house or state the word is applied more widely to the ordered arrangement of any organized body, and is equivalent almost to "system"; thus the "economy" of nature or of animal or plant life may be spoken of. The most common use, however, of the word is that of "political economy," the science dealing with the production, distribution and consumption of wealth (see Economics).

ECSTASY (Gr. ἔκστασις, from ἐξίστημι, put out of its place, alter), a term applied to a morbid mental condition, in which the mind is entirely absorbed in the contemplation of one dominant idea or object, and loses for the time its normal self-control. With this there is commonly associated the prevalence of some strong emotion, which manifests itself in various ways, and with varying degrees of intensity. This state resembles in many points that of catalepsy (*q.v.*), but differs from it sufficiently to constitute it a separate affection. The patient in ecstasy may lie in a fixed position like the cataleptic, apparently quite unconscious, yet, on awaking, there is a distinct recollection of visions perceived during this period. More frequently there is violent emotional excitement which may find expression in impassioned utterances, and in extravagant bodily movements and gesticulations. Ecstasy usually presents itself as a kind of temporary religious insanity, and has frequently appeared as an epidemic. It is well illustrated in the celebrated examples of the dancing epidemics of Germany and Italy in the middle ages, and the *Convulsionnaires* of St Medard at the grave of the Abbé Paris in the early part of the 18th century, and in more recent times has been witnessed during periods of religious revivalism. (See also Insanity and Neuropathology.)

ECTOSPORA, a homogeneous and natural division of Protozoan parasites included under the Sporozoa; they comprise the three orders, Gregarines, Coccidia and Haemosporidia. The defining character of the Ectospora is that the spore-mother-cells (sporoblasts) are formed at the periphery of the parent-individual (sporont); we may, however, go further, and say that the formation of all the different reproductive elements is uniformly peripheral or exogenous. Two other very general features are (*a*) that the individual trophozoite is uninuclear, and (*b*) that growth and trophic activity are finished before the multiplicative or reproductive phase sets in.

There is now little doubt that the Ectospora possess a flagellate ancestry. The principal facts in favour of

this view are as follows: the actual ontogenetic connexion known to exist between certain Haemoflagellates and certain Haemosporidia (see Trypanosomes); the possession by many Coccidia of biflagellar microgametes (male elements), whose general structure greatly resembles that of a Heteromastigine Flagellate; the possession by various parasitic Flagellates (*e.g. Herpetomonas*) of an attached, resting phase, when the parasites become gregariniform, which strongly suggests the attached phase of many young, growing Gregarines; the typical gregarinoid and euglenoid movements of Gregarines and of the germs or other stages of Coccidia and Haemosporidia, which are quite comparable with the contractile and metabolic movements of Flagellates; and, lastly, the exogenous type of reproduction, which is easily derivable from the multiple division of certain Haemoflagellates, and this, in turn, from the typical binary longitudinal fission of a Flagellate.

ECUADOR (officially *La Republica del Ecuador*), a republic of South America, bounded N. and N.E. by Colombia, S.E. and S. by Peru, and W. by the Pacific Ocean. Its boundary lines with Colombia and Peru were

Boundaries.

in 1909 still unsettled, large areas of territory being claimed by all three republics. Under an agreement of the 15th of December 1894, the disputes were to be decided by the Spanish sovereign as arbitrator, but nothing was accomplished. On the 5th of November 1904, Colombia and Ecuador agreed to submit their dispute to the German emperor, and a convention of the 12th of September 1905 between Colombia and Peru established a *modus vivendi* for the settlement of their conflicting claims, in which Ecuador is likewise interested. The maps of Ecuador, which are very defective, usually describe its territory as extending eastward to the Brazilian frontier, but as Peru is in actual 911
occupation of the region east of Huiririma-chico, on the Napo river, 3½ degrees west of that frontier, those maps cannot be considered correct. The Trans-Andine territory occupied by Ecuador is a wedge-shaped area between the Coca and Napo, the provisional boundary line with Colombia, and a line running nearly west-south-west from Huiririma-chico (about lat. 2° 50′ S., long. 73° 20′ W.) to a point on the Santiago river in about lat. 4° 12′ S., long. 78° W., which forms the provisional boundary with Peru. The eastern part of this territory is also claimed by Peru, which would have the effect, if allowed, of restricting Ecuador to a comparatively small area covered by the Andes and western Cordillera and the narrow plain on the Pacific coast. From the Santiago river, a western affluent of the Marañon, the boundary line runs south-west and west across the Andes to the head waters of the Macara, down that stream to the Chira, or Achira, whose channel marks the frontier down to about 80° 17′ W., where a small stream (the Rio Alamo) enters from the north. The line then runs almost due north to the south shore of the Gulf of Guayaquil, following the western water parting of the lower Tumbez valley. A small district in the valley of the Chira is claimed by Peru. The northern boundary line is described elsewhere (see Colombia). A small section of this line terminating on the Pacific coast is also in dispute, Ecuador claiming the main channel of the Mira as the dividing line, and Colombia claiming a small district south of that channel, the line running due west from the mouth of the most southern outlet of the Mira opening into Panguapi Bay, to a point of intersection with that river.

Physical Geography.—The surface of Ecuador may be divided into three distinct regions: the Cis-Andine lying between the Western Cordillera and the coast; the Inter-Andine, which includes the two great mountain chains crossing the republic with the elevated plateau lying between; and the Trans-Andine, lying east of the Andes in the great Amazon valley. The first part consists of an alluvial, low-lying plain formed in

great part by the detritus brought down by the mountain streams. It is irregular in form and is broken by isolated elevations and spurs from the Cordillera. Large areas are still subject to annual inundations in the rainy season, and the lower river courses are bordered with swamps. This is the most fertile and productive part of Ecuador, especially on the higher lands near the Cordillera. The Trans-Andine region is similar to the neighbouring territories of the upper Amazon basin occupied by Colombia, Brazil and Peru—a great forest-covered plain descending gently toward the east, broken on its western margin by short spurs from the Andes enclosing highly fertile valleys, and by low, isolated ranges between the larger river courses, and traversed by large rivers flowing into the Napo and Marañon. This region has been only partially explored, and but little is known of the large areas lying between the navigable rivers.

Mountains.

The Inter-Andine or plateau region lies in and between the two great mountain chains which cross the greater part of the republic between and almost parallel with the 78th and 79th meridians. The eastern chain is known as the Andes of Ecuador, or the Cordillera Oriental, and the western as the Cordillera Occidental (Western Cordillera). Starting from the confused grouping on the southern frontier of the two great chains and some transverse ranges, they run nearly north by east to the Colombian frontier where another "knot" or junction occurs. The summits of the western range form a line of noteworthy regularity, but those of the eastern form a broken irregular line of varying distances from the first. The elevated plateau between the two great chains, which is about 300 m. long and 20 to 30 m. wide, is divided into three great shallow basins or plains by the transverse ridges or *paramos* of Tiupullo and Azuay. These are known as the Quito, Ambato and Cuenca basins. South of the latter is the irregular and deeply broken Loja basin, which can hardly be considered a part of the great Ecuador plateau. The three great basins, which are broken and subdivided by mountainous spurs and ridges, descend gradually toward the south, the Quito plain having an average elevation of 9500 ft. above the sea, Ambato 8500, and Cuenca 7800. They are also characterized by the increasing aridity of the plateau from north to south, the Quito plain being fertile and well covered with vegetation, and the Ambato and Cuenca plains being barren and desolate except in some favoured localities. The volcanic character of the region is likewise responsible for large areas of barren surfaces. Rising from this elevated plateau, along its eastern and western margins, are the Cordilleras with their principal summits culminating far above the line of perpetual snow, which in this region is about 15,750 ft. above the sea. These summits are remarkable, not only for their great height, but also for their apparent symmetrical arrangement in parallel lines, sometimes in pairs facing each other across this cyclopean passage. Nowhere in the world can there be found another such assemblage of snow-clad peaks, several of which are active volcanoes. There are 22 of them grouped around these central plains almost within sight of each other. The western chain has the distinction of having the highest summit, the eastern the greatest number of high summits and the highest average elevation. From the time of Humboldt's visit to this remarkable region down to the present time there have been many diverse calculations of the height of these peaks, but with a considerable variation. It is estimated that there was a considerable decrease in the elevation of this part of the Andes during the past century, Quito having sunk 26 ft. in 122 years, Pichincha 218 ft. in the same time, and the farm of Antisana, where Humboldt resided for a time, 165 ft. in 64 years. At the same time Cotopaxi and Sangay, the two active volcanoes, have actually increased in elevation since the measurement of La Condamine in 1742. These changes in elevation, if correct, are due to seismic disturbances, a cause that may be partially responsible for the varying computations of the heights of these well-known peaks. Among modern investigators are W. Reiss and A. Stübel (1871-1873), and Edward Whymper (1880), whose measurements of the principal summits were:—

Eastern Cordillera.			*Western Cordillera.*		
		Ft.			Ft.
Cayambe	(W.)	19,186	Cotocachi	(W.)	16,301
Sara-Urcu	"	15,502	Mojanda	(R. & S.)	14,088
Antisana	"	19,335	Pichincha	(W.)	15,918
Sincholagua	(R. & S.)	16,365	Atacatzo	(R. & S.)	14,892
Rumiñagui	"	15,607	El Corazon (Chamalari)	(W.)	15,871
Cotopaxi	(W.)	19,613	Iliniza	(R. & S.)	17,405
Tunguragua	(R. & S.)	16,690	Carahuairazo	(W.)	16,515
Altar (Capac-Urcu)	"	17,730	Chimborazo	"	20,498
Sangay	"	17,464			

The Imbabura volcano, celebrated for its destructive eruptions of mud and water, stands midway between the two ranges at the northern end of the plateau, and belongs to the transverse ridge of knot (*nudo*) which unites them. It is the most northern of the higher peaks of Ecuador, with the exception of Cotocachi, and possibly of Chiles on the Colombian frontier, and reaches the elevation of 15,033 ft. Ibarra on the northern flanks of the volcano has suffered severely from its eruptions. The name is derived from *imba*, fish, and *bura*, mother, and is said to have originated from the quantities of a fish called "preñadilla" (*Pimelodus cyclopum*) discharged from its crater during one of its eruptions—a phenomenon which, after a searching investigation, was discredited by Wagner. Cayambe, or Cayembi, the second highest peak of the Ecuadorean Andes, has the noteworthy distinction of standing very nearly on the equator. Its base covers a large area, and its square top, rising far above the snow-line, is one of the sights of Quito. Antisana is crowned with a double dome, and is described as an extinct volcano, though Humboldt saw smoke issuing from it in 1802. On its western side is the famous *hacienda* (farm) of Antisana, 13,306 ft. above the sea, where Humboldt resided for several months in 1802. Sara-Urcu stands south-east of Antisana in a densely forested region, drenched with rain and only slightly explored. Sincholagua and Rumiñagui are the next two peaks, going southward, and then the unrivalled cone of Cotopaxi (*q.v.*)—the highest active volcano in the world—from whose summit smoke curls upward unceasingly.

Llanganati or Cerro Hermoso is chiefly known through the tradition that the treasures of the Incas were buried in a lake on its slopes. It consists of a group of summits, the highest being credited with 17,843 ft. Tunguragua, or Tungurahua, has a cone-shaped summit like that of Cotopaxi, with a slope of 38°. It rises from a plain somewhat lower than the neighbouring central plateau and stands free from the surrounding elevations, except on the south, which give it an exceptionally imposing appearance. Among its characteristic features is a cataract fed by melting snows, which descends 1500 ft. in three leaps, and an

enormous basaltic lava-stream, which crosses the face of the mountain in a north-easterly direction. Its most notable eruption was in 1777. It has been sometimes classed among the extinct volcanoes, but smoke has been seen issuing from it at different dates, and a violent eruption occurred on January 12, 1886. The fertile cultivated valley of Baños, with its thermal springs, lies at the base of Tunguragua, which F. Hassaurek describes as “the most beautiful of all the snow peaks in the country.” The next in line is El Altar, which the natives call Capac-Urcu (“king mountain”), whose broken cone and impressive outlines make it one of the most attractive mountains of Ecuador. Its summit comprises a group of eight snow-clad peaks, and its crater is surrounded by a steep and jagged wall of rocks. There is a tradition that this mountain was once higher than Chimborazo, but a series of eruptions caused the cone to fall in and reduced its summit to its present altitude and broken appearance. Altar has shown no signs of activity since the discovery of America. Sangay, or Sangai, the next and last large volcano to the south, is in a state of frequent eruption, however, and is known as one of the most restless volcanoes of the world. Since the Spanish conquest it has been in a state of uninterrupted activity, but no damage has been done, because there are no civilized settlements in its immediate vicinity. Though of great interest to scientific investigators because of this unceasing activity, and of its peculiar position in the Andean system, and because of the difficult and dangerous country by which it is surrounded, Sangay has been but rarely visited by European travellers. Its eruptions are not on a grand scale, but small outbursts of lava and explosions of steam occur at frequent intervals, and at longer intervals more violent explosions in which the molten rock is thrown 2000 ft. above its summit, and ashes are carried away as far as the streets of Guayaquil.

Turning to the Cordillera Occidental and taking the principal peaks in order from south to north, the first to claim attention is Chimborazo (from *Chimpu-raza*, “mountain of snow”), the highest summit of Ecuador, and once believed to be the culminating point of the Andes. Humboldt, who unsuccessfully attempted its ascent in 1802, gives its elevation as 21,425 ft., Reiss and Stubel as 20,703, and Whymper as 20,498. It stands 76 m. north-east of Guayaquil, and, according to Spruce, rises majestically from the valley of the Guayas, on the west, without a “positive break from the summit down to the plain.” This, however, is erroneous, for Whymper located a detached range running parallel with the Cordillera on the west, for a distance of 65 m. with the Chimbo valley between them. The magnificence of its mass is imposing from almost any point of view, but it can be most fully appreciated from its western or Pacific side, where its base is covered with forest up to the snow-line, above which its pure white cone rises another 5000 ft. An unobstructed view of the great mountain is rarely obtained, however, because of the mists and clouds which cover its cone. Its summits were reached for the first time in 1880 by Edward Whymper, all previous attempts having failed. It is considered to be an extinct volcano because it makes the plumb-line deviate only 7″ to 8″, from which it is deduced that the mountain is hollow. Moreover, the calcined matter resembling white sand which covers its sides below the snow-line, extensive beds of lava, and the issue of streams of hot water from its northern side, seem to confirm the deduction that Chimborazo is an extinct volcano. Immediately north of Chimborazo, and separated from it by only a narrow valley, are the lower triple summits of Carahuairazo, or Carguairazo (which the natives call *Chimborazo-embra*, “Chimborazo’s wife”), whose hollow cone collapsed in 1698 during a great earthquake, and left the jagged rim which adds so much to its present picturesque appearance. Mr Whymper’s measurement is for the middle peak. Quirotoa, still farther north, is supposed to have suffered a similar catastrophe. Its hollow summit, 13,510 ft. above sea-level, now contains a large lake. Iliniza, which stands west by north of Cotopaxi, has two pyramidal peaks, and is one of the most interesting mountains of the Ecuadorean group. It stands at the western end of the Tiupullo ridge, and overlooks the Quito basin to the north-east. The French academician Bouger, who was chief of the scientific commission sent to Ecuador in 1736 to measure a degree of the meridian on the equator, made a trigonometrical measurement of Iliniza, and Wagner ascended to within 800 ft. of its summit in 1859. The geological structure of the mountain furnishes no evidence of volcanic activity. Chamalari, which the Spaniards called El Corazon from its heart-shaped appearance, is similarly destitute of a crater. It overlooks the Quito basin and has been ascended many times. Among the earlier explorers to reach its summit were Bouger and La Condamine, Humboldt and Bonpland, and José Cáldas, the Granadian naturalist. Atacatzo is an extinct volcano, with nothing noteworthy in its appearance and history. Pichincha, its famous neighbour, is apparently of later origin, according to Wagner, and of slightly lower elevation. Perhaps no Ecuadorean volcano is better known than Pichincha, the “boiling mountain,” because of its destructive eruptions and its proximity to the city of Quito. Its summit comprises three groups of rocky peaks, of which the most westerly, Rucu-Pichincha (Old Pichincha), contains the crater, a funnel-shaped basin 2460 ft. deep and about 1500 ft. wide at the bottom, whose walls in places rise perpendicularly and in others at an angle of 20°. The exterior of the cone has an angle of 30°. Bouger and La Condamine were the first to reach its brink in 1742, after which Humboldt made the ascent in 1802, Boussingault and Hall in 1831, Garcia Moreno and Sebastian Wisse in 1844 and 1845 (descending into the crater for the first time), Garcia Moreno and Jameson in 1857, Farrand and Hassaurek in 1862, Orton in 1867, and Whymper in 1880. Farrand spent more than a week in the crater trying to get some good photographic views, and Orton has given a graphic description of his experiences in the same place. He found that the real cone of eruption was an irregular heap 250 ft. in height and 800 ft. in diameter, containing about 70 vents. The temperature of the vapour within the fumarole was 184°, and water boiled at 189°. There have been five eruptions of Pichincha since the Spanish conquest—in 1539, 1566, 1575, 1587 and 1660. The second covered Quito 3 ft. deep with ashes and stones, but the last three were considered as the most destructive to that city. The last happily broke down the western side of the crater, which, it is believed, will ensure the city against harm in any subsequent eruption. Since the earthquake of August 1867 Pichincha has sent forth dense masses of black smoke and great quantities of fine sand. Cotocachi is a double-peaked mountain, rising from an extremely rough country. It was ascended by Whymper in 1880. All the higher summits of Ecuador have true glaciers, the largest being found on Antisana, Cayambe and Chimborazo. Whymper located and named no less than eleven on Chimborazo, and counted twelve on Cayambe.

Rivers.

There are two distinct hydrographic systems in Ecuador—the streams that flow south-eastward to the Marañon, or Amazon, and those which flow westward to the Pacific. The southern part of the great central plateau is arid and has a very light rainfall; it has no streams, therefore, except from melting snows, and the higher elevations which receive the impact of the easterly winds. Farther north the rainfall becomes heavier, the plateau is covered with vegetation, and a considerable number of small rivers flow westward through the Cordillera to the Pacific. The Eastern Cordillera, or Andes, forms the water-parting between the two systems. The largest of the eastward-flowing

rivers is the Napo, which rises in the eastern defiles of Cotopaxi and Sincholagua—the principal source being the Rio del Valle, which traverses the Valle Vicioso. It at first flows south by east, and at the village of Napo is 1450 ft. above sea-level, at the mouth of the Coca 858 ft., at the mouth of the Aguarico 586 ft., 500 at the mouth of the Curaray, and 385 at its junction with the Marañon. Orton estimates its current at Napo in the month of November as 6 m. an hour; in the next 80 m. the river falls 350 ft. and produces a fine series of rapids; and from Santa Rosa downwards the rate is not less than 4 m. an hour. Its breadth at Napo is only 120 ft., but at Coca it has widened to 1500 ft., and at its mouth to nearly 1 m. Like most of the large Amazon tributaries, its discharge into the Marañon is through several distinct channels. The Napo is navigable for steam-boats for some distance above the mouth of the Coca, and thence for canoes as far as the Cando cataract, 3332 ft. above the sea. Its total length is 920 m. The principal tributaries of the Napo are the Coca and Aguarico from the north, and the Curaray from the south. The Coca rises on the eastern slopes of the Andes near Cayambe and the Guamani range, and flows eastward near the equator to San Rafael (about 76° 30′ W. long.), where it turns sharply southward to a junction with the Napo in about lat. 1° S., long. 76° W. The Coca forms the provisional boundary line between Ecuador and Colombia from its source to the Napo. The Aguarico also rises on the eastern slopes of the Andes north of Cayambe and flows south-eastward to a junction with the Napo in about long. 75° W., its length being roughly estimated at 420 m. Little is known of its course, or of the country through which it flows, which is provisionally occupied by Colombia. The Curaray has its sources in the defiles of the Cerros de Llanganati, and flows south-eastward to the Napo, its length being estimated at 490 m. Its lower course is sluggish, where its waters are made unpalatable by a reddish slime. The Napo and its tributaries are celebrated in the early history of South America as the route by which Gonzalo Pizarro and Orellana first reached the Amazon, and it was afterwards the principal route by which the early expeditions across the continent at this point connected the Andean Plateau with the Amazon. The other rivers which flow through the Oriente territory of Ecuador into the Marañon are the Tigre, Pastaza, Morona and Santiago. The Tigre, of which little was known until a recent date, is formed by the confluence of the Cunambo and Huiviyacu, whose sources are on the eastern slopes of the Andes near those of the Curaray. Its length below this confluence is 416 m., into which are received 109 tributaries, the largest of which are the Pucacuro and Corrientes. The Tigre is navigable at all stages up to the Cunambo confluence, and promises to afford one of the most valuable river routes in Ecuador. It enters the Marañon very near the 74th meridian. The Pastaza, or Pastassa, unlike the rivers already described, has its source on the central plateau west of the principal chain of the Andes, within the shadow of Cotopaxi, and breaks through the Cordillera to the north of Tunguragua. After flowing southward along the base of the high Andes for a short distance and receiving a number of torrents from the snowclad heights, it turns south-eastward across the plain and enters the Marañon about 70 m. above the mouth of the Huallaga. The stream is known as the Patate down to its junction with the Chambo, near Baños, and is not called Pastaza until the Agoyan falls are passed. It was navigated by Don Pedro Maldonado as early as 1741, and is navigable for steamboats of 2 to 4 ft. draft up to the mouth of the Huasaga (about 124 m.) in times of high water, and for canoes nearly 200 m. farther. The Pastaza, however, is subject to irresistible floods caused by the sudden rising of the mountain torrents on its upper course, especially the Toro, which sweep down with such fury that navigation on the river is practically impossible. The shallowness of the lower stream, where the current is sluggish, is probably due to the great quantities of silt brought down by these floods. Many of the rivers of eastern Ecuador are subject to similar floods from the Andean slopes, which have cut away broad, deep channels, through the adjacent plains, leaving long, narrow ridges between their courses which the natives call *cuchillas*. The Morona is formed by the confluence of the Manhuasisa and Cangaima about 310 m. above its mouth, and is freely navigable for small steamboats to that point. The two confluents just mentioned have their sources in the Andes, and flow for some distance across the plain before uniting to form the Morona. Both are navigable for considerable distances. The Morona follows a very tortuous course before entering the Marañon, at long. 70° W., and receives a large number of affluents, one of which serves as the outlet for Lake Rimachuma, in Peruvian territory. Very little is definitely known of the affluents of the Morona, Pastaza and Tigre, as the territory through which they run has been but slightly explored. The Santiago, which enters the Marañon near the Pongo de Manseriche, is formed by the confluence of the Paute, which rises in the province of Azuay, and the Zamora, which has its source among the mountains of Loja. According to Alexander Garland (*Peru in 1906*), the rivers of eastern Ecuador are navigable at low water for steamers of 2 to 4 ft. draft for an aggregate distance of 1503 m., as follows:—

	Miles.
Napo, to the mouth of the Aguarico	559
Curaray, up to Canonaco	286
Tigre, up to Cunambo-Huiviyacu confluence	416
Pastaza	31
Morona, up to the Rarayacu	211

These same rivers are navigable at high water for steamers of 19½ ft. draft for an aggregate distance of 1330 m., including 68 m. of the Aguarico, and for steamers of 2 to 4 ft. draft for an additional 733 m. The last aggregate includes an extension of 93 m. on the Pastaza, 99 on the Morona, 186 on the Napo, and the balance on the Manhuasisa, Cangaima, Pucacuro, Corrientes, Cunambo and Huiviyacu.

On the western versant of the Andes of Ecuador there are three river systems of considerable size—the Mira, the Esmeraldas and the Guayas. The sources of the first—the Rioblanco, Pisco and Puntal—are to be found on the northern slopes of the transverse ridge which culminates in the Imbabura volcano. Its course is north and north-west to the Colombian frontier, thence westward and north-west to the Pacific, breaking through the Western Cordillera on its way. It forms the boundary line for some distance between Ecuador and Colombia, but near its mouth where the river turns northward Colombia has taken possession of the left bank and all the territory covered by its large delta. Its principal tributaries on the left are the San Pedro, Paramba, Cachiyacu, Chachavi and Canumbi, and on the right the San Juan, Caiquer and Nulpe. The delta channels of the Mira are navigable, being tributary to the Colombian port of Tumaco. The Esmeraldas drains all that part of the central plateau lying between the transverse ridge of Tiupullo on the south, and the Imbabura ridge on the north, together with the western slopes of the Cordillera between Iliniza and Cotocachi, and a considerable part of the lower plain. It is formed by the confluence of the Quininde and Toachi with the Guaillabamba between 40 and 50 m. above its mouth, and discharges into the Pacific in lat.

1° N., long. 79° 40′ W., through a narrow and precipitous gorge. The volume and current of the river is sufficient to freshen the sea 2 m. from the coast. The Guaillabamba is the larger and more important tributary, and should be considered the main stream. It rises in the Chillo valley in the vicinity of Cayambe, and flows across the northern end of the central plateau, breaking through the Western Cordillera between Cotocachi and Pichincha. One of its plateau tributaries, Rio Pedregal, rises on the slopes of Cotopaxi and is celebrated for its three beautiful cascades, the highest of which is about 220 ft. The Toachi and Quininde have their sources on the western slopes of the Cordillera. The Guayas or Guayaquil river is in part an estuary extending northward from the Gulf of Guayaquil, bordered by mangrove swamps and mud banks formed by the silt brought down from the neighbouring mountains. All the bordering country on both sides is of the same description, and for a long distance inland extensive areas of swampy country are submerged during the rainy season. Above the mouth of the Daule the river is known as the Bodegas, which in turn is formed by the confluence of the Babahoyo and the Vinces. The Guayas also receives a large tributary from the east called the Yaguachi. All these streams are navigable on their lower courses, regular steamboat communication being maintained on the Guayas and Bodegas to a river port of the latter name, 80 m. above Guayaquil, and for 40 m. on the Daule. The navigable channels of all the rivers are computed at 200 m. The drainage basin of the Guayas, according to Theodor Wolf, covers an area of 14,000 sq. m., and includes the greater part of the lower plain and the western slopes of the Cordillera Occidental as far north as Iliniza. The Babahoyo, which is the main stream, has its sources on the slopes of Chimborazo, the Daule on the Sandomo ridge in the latitude of Pichincha, the Yaguachi on the south-eastern slopes of Chimborazo, whence it flows southward for a considerable distance before breaking through the Cordillera to the western plain. The Guayas is one of the most interesting and varied of the South American river systems, and is of great economic importance to Ecuador. In addition to these three river systems, there are a large number of short streams on the coast flowing into the Pacific and Gulf of Guayaquil, only two of which have any special importance in the present undeveloped state of the country. These are the Santiago, which drains several fertile valleys in northern Esmeraldas and western Carchi, and whose outlet is connected with some navigable tide-water channels, including the Pailon basin and the Caráquez, or Caracas, on which is located the village of Bahia de Caráquez (lat. 0° 34′ S.), the nearest port to the city of Quito.

Lakes.

There are a considerable number of small lakes in Ecuador, but no large ones. These are of two classes—those of the bowl-like valleys and extinct craters of the mountainous region, and the reservoir lakes of the lowland plains caused by the annual overflow of the rivers. It is impossible to say how many of the latter there may be, for much of the territory where they are found is unexplored. They are usually shallow and malarial. Among the upland lakes, there are some of special interest because of their position and historical association. The Yaguar-cocha (“lake of blood”), in the province of Imbabura, near Ibarra, which is only 1½ m. in circumference, is celebrated for the tradition that Huayna-Capac, one of the great conquerors of the Inca dynasty, defeated an army of rebellious Carranquis on its shores, and threw so many of their bleeding corpses into it as to turn its waters to the colour of blood. On the south-east skirt of Cotocachi, 10,200 ft. above the sea, is the beautiful little Cuy-cocha, which originated, it is believed, through the falling in of the mountain’s sides. There are two others of apparently the same origin on the north-west slopes of the Mojanda volcano, but they are less attractive because of their gloomy surroundings. In the deep valley between the mountains of Imbabura and Mojanda is the lake of San Pablo, 8848 ft. above the sea. It is one of the largest of its class, being about 5 m. in circumference, and is situated in an exceptionally fertile region. It drains through the Peguchi into the Rio Blanco, a tributary of the Mira. Other well-known lakes of the plateau region are Quirotoa, about 4600 ft. in diameter; Colta, east of Riobamba, and Colay, south of the same place. Among the many thermal springs throughout the Andean districts, the best known are at Belermos and San Pedro del Tingo, north-east of Quito; at Cachillacta, in the district of Nanegal; at Timbugpoyo, near Latacunga; at Baños (5906 ft. elevation), near the foot of Tunguragua; and on the slopes of Rumiñagui and Chimborazo.

Coast.

The coast of Ecuador extends from about lat. 1° 20′ N. to the vicinity of the Boca Jambeli on the southern shore of the Gulf of Guayaquil, in lat. 3° 14′ S., and has an outward curve. Its more prominent headlands are Punta Galera, Cabo Pasado, Cabo de San Lorenzo and La Puntilla, or Santa Élena Point. The bays on this coast are commonly broad indentations, and the rivers discharging into them are generally obstructed by bars. The small ports along the coast, therefore, do not afford much protection to shipping. The most northern of these bays is the Ancon de Sardinas, lying south of the Mira delta. The head of the bay is fringed with islands and reefs, behind which is the mouth of the Santiago river, Poza Harbour, San Lorenzo Bay, Pailon basin and a network of navigable channels, all of which are difficult of access. The small ports of La Tola and Pailon are located on these waters. The port of Esmeraldas, near the mouth of the Esmeraldas river, is located near the southern entrance to this bay. As the mouth of the river is obstructed by a bar and its current is swift, the anchorage is outside in an open roadstead, only slightly protected on the south. Farther south is the broad Bay of Manta, with a small port of the same name at its southern extremity. The most frequented port on this part of the coast is that of Bahia de Caráquez, at the mouth of the Caráquez, or Caracas river, which is also obstructed by a bar. There is a fertile, productive country back of this port, and it is the objective point of a road from Quito. Immediately north of the Gulf of Guayaquil is the Bay of Santa Élena, with a small port of the same name, which has a good, well-sheltered anchorage and is the landing-place of the West Coast cable. The Gulf of Guayaquil, which lies between the Ecuadorean and Peruvian coasts, is the largest gulf on the Pacific coast of South America between Panama and Chiloe. Its mouth is 140 m. wide between La Puntilla on the north and Cabo Blanco on the south, and it penetrates the land eastward, with a slight curve northward at its head, for a distance of about 100 m., terminating in the Guayas estuary or river, on which is located the port of Guayaquil. The upper end of the bay and its northern shores are fringed with swamps through which numerous estuaries penetrate for some distance inland. Immediately west of the Guayas river the Estero Salado, which comprises a great many shallow tide-water channels, or bayous, penetrates as far inland as Guayaquil, but is used only by canoes. The upper end of the gulf is filling up with the silt brought down from the Cordillera. It is divided midway by the large island of Puna, at the eastern end of which is the anchorage for steamers too large to ascend the Guayas. The steamship channel passes between this island and the Peruvian coast, and is known as the Jambeli channel. The passage north of Puna Island is known as the Morro channel, but its entrance is obstructed by shoals and it is considered dangerous for shipping. A small port in the Jambeli channel, on the south-east shore of the gulf, is that of Puerto Bolivar, or Puerto Huaila, the shipping port for the town of Machala and the Zaruma mining region.

There are few islands off the coast of Ecuador, and only one of any considerable size—that of Puna in the Gulf of Guayaquil, which is 29 m. long from north-east to south-west and 8 to 14 m. wide. It lies in the north-east part of the gulf, and is separated from the Ecuadorean mainland by the Morro channel, and from the southern mainland by the wider and deeper Jambeli channel. There is a low, mountainous ridge, called the Zampo Palo, running through it, and its eastern shores have some moderately high bluffs; otherwise the island is low and swampy, and its shores, except the eastern end, are fringed with mud banks. The island is densely wooded (in marked contrast with the opposite Peruvian shore), and is considered unhealthy throughout the greater part. It has a population of 200, chiefly centred in the village of Puna, at its north-east extremity, which is a shipping port and health resort for the city of Guayaquil. Puna island is celebrated for its connexion with Pizarro's invasion of Peru in 1531. It is said that it had a considerable population at that time, and that the natives resisted the invaders so vigorously that it cost six months to reduce them. Midway in the outer part of the Gulf of Guayaquil is Amortajada or Santa Clara island, whose resemblance to a shrouded corpse suggested the name which it bears. It lies 12 m. south-west of Puna island and 80 m. from Guayaquil. It rises to a considerable elevation, and carries a light 256 ft. above sea-level. There are some low, swampy islands, or mud flats, covered with mangrove thickets, in the lower Guayas river, but they are uninhabited and of no importance. North of the Gulf of Guayaquil there are only two small islands on the coast of more than local interest. The first of these is Salango, in lat. 1° 25′ S., which is 2 m. in circumference and rises to a height of 524 ft. It is richly wooded, and has a well-sheltered anchorage much frequented by whalers in search of water and fresh provisions. The next is La Plata, in lat. 1° 16′ S., which rises to a height of 790 ft., and has a deep anchorage on its eastern side where Drake is said to have anchored in 1579 to divide the spoils of the Spanish treasure ship "Cacafuego." The Galapagos Islands (*q.v.*) belong to the republic of Ecuador, and form a part of the province of Guayas.

Islands.

Geology.[1]—The great longitudinal depression which lies between the eastern and the western branches of the Andes is also the boundary between the ancient rocks of the east and the Mesozoic beds which form the greater part of the west of the country. The Eastern Cordillera is composed of gneiss, mica and chlorite schist and other crystalline rocks of ancient date; the Western Cordillera, on the other hand, is formed of porphyritic eruptive rocks of Mesozoic age, together with sedimentary deposits containing Cretaceous fossils. Most of the country between the Andes and the sea is covered by Tertiary and Quaternary beds; but the range of hills which runs north-west from Guayaquil is formed of Cretaceous and porphyritic rocks similar to those of the Andes. In the intra-andine depression, between the East and West Cordilleras, recent deposits with plant remains occur near Loja, and to the north-east of Cuenca is a sandstone containing mercury ores, somewhat similar to that of Peru. Farther north nearly the whole of the depression is filled with lavas, tuffs and agglomerates, derived from the Tertiary and recent volcanoes which form the most striking feature of the Andes of Ecuador. These volcanoes are most numerous in the northern half of the country, and they stand indifferently upon the folded Mesozoic beds of the Western Cordillera (*e.g.* Chimborazo, Iliniza, Pichincha), the ancient rocks of the Eastern Cordillera (Altar, Tunguragua, Cotopaxi, Antisana), or the floor of the great depression between. The lavas and ashes are for the most part andesitic.

Climate.—Climatic conditions in Ecuador are very largely contingent on altitude, and the transition from one climate to another is a matter of only a few hours' journey. Although the equator crosses the northern part of the republic, only 15 m. north of the city Of Quito, a very considerable part of its area has the temperature of the temperate zone, and snow-crowned summits are to be seen every day in the year from its great central plateau. In addition to the climatic changes due to altitude, there are others caused by local arid conditions, by volcanic influences and by the influence of mountain ranges on the temperature and rainfall of certain districts. These influences are not general; on the contrary, they often affect very limited areas. For instance, Guayaquil has a hot humid climate and mangrove swamps line the shores of Guayas down to the gulf; at Santa Élena, about 60 m. due west, arid conditions prevail and vegetation is scanty and dwarfed; at Salango island, 50 m. north of Santa Élena, there is an abundance of moisture and vegetation is luxuriant; 33 m. farther north, at Manta, the country is a desert; and at Atacames bay, 135 m. north of Manta, the rainfall and vegetation are again favourable. On the plateau similar conditions prevail. There is no great display of arboreal vegetation anywhere except in the valleys and lower passes where the rainfall is abundant, but in general terms it may be said that the rainfall and vegetation which characterize the Quito basin soon disappear as one proceeds southward, and are substituted by arid conditions. Even here there are local modifications, as at Ambato, where a shallow depression, surrounded by barren, dust-covered ridges exposed to cold winds, is celebrated for its warm, equable climate and its fruit. It is to be noted that the Gulf of Guayaquil separates the humid, forest-covered coastal plain of Ecuador from the arid, barren coast of Peru, the two regions being widely dissimilar. The mean annual temperature, on this plain, according to an official publication, is 82.4° F., and the range is from 66° to 95°. The heat is modified at many points on the coast, however, by the cold Humboldt current which sweeps up the west coast of South America from the Antarctic seas. The year is divided into a wet and dry season—the former running from December to June, and the latter from July to December. The rainy season, or *invierno*, is broken by a short period of dry weather, called the *veranillo* (little summer), shortly after the December solstice; otherwise it rains every day, the streams overflow, land traffic is suspended, and the air is drenched with moisture and becomes oppressive and pestiferous. The dry season, which is called the *verano*, or summer, is also broken by a short rainy spell called the *inviernillo* (little winter) or "cordonazo de San Francisco," which follows the September equinox. Apart from these the two seasons are sometimes broken by cloudless skies in winter, and a drizzling mist, called the *garua*, in summer. In the inter-andine region the variations in temperature are frequent and the averages comparatively low. An official estimate gives the mean annual temperature as 64° to 68° between 6000 and 11,000 ft. In Quito the mean annual temperature is 58.8°, the diurnal variation 10°, the annual maximum 70°, and the annual minimum 45°. Other returns give the mean annual temperature at 55°. It is said that pulmonary tuberculosis is unknown in these altitudes, though it is common in the coast districts. Catarrhal complaints are common, however, and leprosy is widely prevalent, it being necessary to maintain three large hospitals for lepers. In the higher altitudes there are wide variations in the snow-fall and intensity of the cold even on the same mountain. The line of permanent snow is much higher on the plateau side in both ranges, the precipitation being greater on the outer sides—those facing the forested lowlands—and the terrestrial radiation being greater from the barren surfaces of the plateau. In some instances the difference in the elevation of the snow-line has been found to be fully 1000 ft. Moreover, no two summits seem to retain the snow permanently at the same altitude. For instance, in 1880 Whymper

found permanent snow on Cotocachi at 14,500 ft., while near by Imbabura was bare to its summit (15,033 ft.); Antisana was permanently covered at 16,000 ft., and near by Sara-Urcu, which is drenched with rains and mists from the Amazon valley all the year round, at 14,000 ft.; Sincholagua had large beds of permanent snow at 15,300 ft., Cotopaxi was permanently covered at 15,500 ft. on its western side, Corazon had daily snowstorms down to 14,500 ft., but no permanent beds of snow on its east side (elevation 15,871 ft.); and Chimborazo had deep snow at 15,600 ft. on its north-east and south sides in June—July. The eastern range was found to receive the heaviest snowfall. The elevation at which human residence is possible seems to be unusually high in Ecuador. Many of the towns and villages of central Ecuador lie at altitudes ranging from 8606 ft. (Ambato) to 9839 ft. (Machachi). The capital city of Quito is 9343 ft. above the sea, and is celebrated for its agreeable temperature, and also for its healthiness in spite of prevailing unsanitary conditions. Above these towns are a number of farms and herdsmen's habitations, where men live the whole or a part of the year with less discomfort from low temperature than is experienced in northern Europe and northern United States. According to Whymper, the *tambo* of Chuquipoquio, at the foot of Chimborazo, is 11,704 ft., and the *hacienda* of Pedregal, near Iliniza, 11,629 ft., both being permanently occupied. The *hacienda* of Antisana, 13,306 ft., and the herdsmen's hut of Cunayaco on Chimborazo, 13,396 ft., are occupied only for a part of the year. The highest elevations are generally covered with ice and snow, and glaciers, according to Whymper, are to be found upon no less than nine of the culminating peaks, and possibly upon two or three more. These serve to modify the temperatures of the plateau, which is swept by cold winds at all seasons of the year. The prevailing wind is that of the north-east and south-east trade winds, broken and modified on the plateau and western lowlands by mountain barriers. Westerly and north-west winds are sometimes experienced, but are not permanent.

Flora.—The flora of the Quito basin has been well studied by various European botanists, more especially by Dr William Jameson (1796-1873) of the university of Quito, who began the preparation of a synopsis of the Ecuadorean flora in 1864-1865 (*Synopsis plantarum Quitensium*, 2 vols., Quito, 1865). The flora of the forested lowlands on both sides of the Andes has not been studied and described so fully. From the Pacific coast upward to a height of about 3000 to 4000 ft. the vegetation is distinctively tropical, including among its economic products cacao, cotton, sugar, tobacco, rice, maize, yucca (also known as cassava and mandioca), peanuts, bananas, sweet potatoes, yams, arracacha (*Conium moschatum*, H.B.K., or *Arracacha esculenta*), indigo, rubber (*Castilloa*), ivory-nuts, cinchona and bread-fruit. Most of these become rare at 3000 ft., but a few, like sugar-cane, are cultivated as high as 8000 ft. The alluvial valley of the Guayas, above Guayaquil, is celebrated for the richness of its vegetation, which, in fruit alone, includes cacao, coffee, cocoanuts, pine-apples, oranges, lemons, guayavas (*Psidium pomiferum*), guavas (*Inga spectabilis*), shaddocks (or grape-fruit), pomegranates, apricots, chirimoyas (*Anona Chirimolia*), granadillas (*Passiflora quadrangularis*), paltas (*Persea gratissima*, otherwise known as "alligator pears"), tunas (*Cactus*), mangoes (*Mangifera Indica*), pacays (*Prosopis dulcis*), aji (Chile pepper), and many others of less importance. Besides rubber, the forests produce a great variety of cabinet and construction woods, ivory-nuts (from the "tagua" palm, *Phytelephas macrocarpa*), "toquilla" fibre (*Carludovica palmata*) for the manufacture of so-called Panama hats, cabbage palms, several species of cinchona, vanilla and dyewoods. Among the large trees which are valued for their timber are redwood (*Humiria balsamifera*), Brazil-wood, algarrobo, palo de cruz (*Jacquinea ruscifolia*), guaiacum or holy wood, rosewood, cedar and walnut. From 6000 to 10,000 ft. above the sea, the indigenous species include the potato, maize, oca (*Oxalis tuberosa*), and quinua (*Chenopodium quinoa*), and the exotic species, wheat, barley, oats, alfalfa (*Medicago sativa*), and most of the fruits and vegetables of the northern temperate zone. Wheat does not form a head below 4500 ft., nor ripen above 10,500. The larger forest trees are rarely seen above 10,000 ft., and even there only on the outer slopes of the Cordilleras. The *Escallonia myrtalloides*, however, is found at an elevation of 13,000 ft., and the shrubby *Befarias* 400 or 500 ft. higher. A characteristic growth of the open plateau and upland valleys is the cabulla, cabaya or maguey (*Agave americana*), whose fibre is much used by the natives in the manufacture of cordage, sandals (*alpargatas*) and other useful articles. In the treeless region lying between 11,600 and 13,800, or in other places between 12,000 and 14,000 ft., the similarity of the vegetation to that of the corresponding European region, according to Wagner, is especially striking. On the *paramos* of Chimborazo, Pichincha, Iliniza, &c., the relation of characteristic genera to those identical with genera in the Alpine flora of Europe is as 5 to 4; and the botanist might almost suppose himself in the Upper Engadine. Of the flora of the highest Andes, Whymper found 42 species, of various orders, above 16,000 ft., almost all of which were from Antisana and Chimborazo; 12 genera of mosses were found above 15,000 ft., and 59 species of flowering plants above 14,000 ft., of which 35 species came from above 15,000 and 20 species from above 16,000 ft. The highest specimen obtained was a lichen (*Lecanora subfusca*, L.) on the south side of Chimborazo, 18,400 ft. above sea-level. Mosses (*Grimmia*) were found on Chimborazo at 16,660 ft., ferns (*Polypodium pycnolepis*, Kze.) at 14,900, and specimens of *Gentiana rupicola*, H. B. K., *Achyrophorus quitensis*, Sz. Bip., *Culcitium nivale*, H. B. K., at 16,300; *Phyllactis inconspicua*, Wedd., at 16,600, *Astragalus geminiflorus*, H. B. K., at 14-15,000, *Geranium diffusum*, H. B. K., at 16,000, *Malvastrum phyllanthos*, Asa Gray, at 16,500, *Draba obovata*, Benth., at 16,660, and *Ranunculus praemorsus*, Kth., at 16,500—all on Chimborazo. *Fuchsia loxensis*, H. B. K., was found on the slope of Sara-Urcu at 12,779 ft., and currant bushes (*Ribes glandulosum*, R. & P.), on Chimborazo, at 14,000. On the eastern slopes of the Andes, where the rainfall is continuous throughout the year and the atmosphere is surcharged with moisture, the forest growth is phenomenal. It is similar to that of the Colombian and Peruvian *montanas*, modified, if at all, by the excessive humidity which prevails in this region.

Fauna.—The fauna of Ecuador is comparatively poor in mammalia, but the birds and still more the insects are very numerous. The Quadrumana are represented by a large number of species, the eastern forests being very much like the other parts of the great Amazonian basin in this respect. The Carnivora include the puma (*Felis concolor*), jaguar (*F. onca*), ocelot (*F. grisea*), bear (*Ursus ornatus*), fox, weasel and otter. A small deer and, in southern Ecuador, the llama (*Auchenia*) with its allied species, the alpaca, guanaco and vicuña, represent the ruminants. The rodents are numerous and include most, if not all, of the Amazonian species—the capybara (*Hydrochoerus capybara*), cavia (*C. aperea*), paca (*Coelogenys paca*) and cutia (*Dasyprocta aguti*), all amphibious and having an extensive range. Tapirs are to be found in the eastern forests, the peccary in more open woodlands, and the opossum in nearly every part of the country. Cattle, horses, asses, sheep and swine were introduced by the Spaniards, and thrive well in some of the provinces. Excellent horses are reared in the uplands, as well as mules and cattle, the pasturage on the mountain slopes being good, and alfalfa being grown in abundance in many districts. The Reptilia include countless

numbers of alligators in the Guayas and its tributaries and in the tide-water channels of many of the smaller rivers; many species of lizards, of which Mr Whymper found three in the Quito basin; snakes of every description from the huge anaconda of the Amazon region down to the beautifully marked coral snake; and a great variety of frogs and toads. Bats also are very numerous, especially in the eastern forest region, where the vampire bat is a serious obstacle to permanent settlement. The avifauna of Ecuador is distinguished for the great variety of its genera and species, among which are many peculiar to the Amazon valley, and others to the colder uplands. Among the Amazon species may be mentioned the parrot, macaw (*Macrocercus*), toucan (*Ramphastos*), curassow (*Crax*), penelope, trogon, and horned screamer (*Palamedea cornuta*). There are also herons, ibises, storks and cranes, including the great black-headed white crane, *Mycteria americana*, which ranges from northern Argentina to Colombia. One species of ibis, the *Theristicus caudatus*, is to be found, it is said, only on the slopes of Antisana. Species of the pheasant and partridge are not uncommon, and the "guácharo" (*Steatornis caripensis*), once believed to inhabit Venezuela only, is found in Ecuador also. The Raptores are well represented by a large number of genera and species, which include the condor, eagle, vulture, falcon, hawk and owl. The condor (*Sarcorhamphus gryphus*) is commonly found between the elevations of 6000 and 16,000 ft., rarely, if ever, descending to the lowland plains or rising above the lower peaks. It preys upon the smaller animals and inflicts much loss upon stock farmers through the destruction of calves, lambs, &c., but it very rarely ventures to attack man or any of the larger animals. The eagle common to Ecuador is the *Morphnus taeniatus*, and possibly the *M. guaianensis* on the eastern slopes of the Andes. The harrier-eagle (*Herpetotheres cachinnans*) is also to be found throughout this part of the continent. An eagle with buzzard-like habits, the *Leucopternis plumbea*, is likewise common in Ecuador. Among the vultures the turkey-buzzard group (*Rhinogryphus* or *Cathartes*), including the *R. aurus*, *burrovianus* and *perniger*, is common everywhere. The carrion crow, or black vulture (*Catharista atrata*), is also common to every part of the country, and is the general scavenger. The carrion hawks are represented by the *Polyborus tharus*, popularly called the "caracara," and the *Phalcobaenus carunculatus*; the falcons by the *Aesalon columbarius*; and the kites by the *Gampsonyx swainsoni*. The Ecuadorean owl is the *Bubo nigrescens*. An interesting species of the song birds is popularly known as the "flautero" (flute-bird), which inhabits the eastern forests. Its notes are marvellous imitations of "the most mellow, sweet-sounding flute," but the singer itself, according to Mr Simson, is "a very insignificant-looking little, greyish-coloured bird," which "always dies in captivity." The most interesting group of the smaller birds is that of the hummingbirds, of which the number and variety is astonishing. Some of these have a very wide range, while others are apparently limited to a small district, or to a certain altitude. The best-known fish of Ecuador is the insignificant *Pimelodus cyclopum*, the only fish found in the streams and lakes of the plateau region. Its fame rests on Humboldt's publication of the tradition that great numbers of this tiny fish had been thrown out during the eruptions of Imbabura and other volcanoes. Mr Whymper's explanation of the phenomenon is that the fish are scattered over the land by the sudden overflow during volcanic eruptions of the rivers and lakes which they inhabit. The rivers of the eastern plains are probably stocked with the fish found in the Amazon. On the coast, the Ancon de Sardinas bay is so named from the multitude of small fish (*sardinas*) which inhabit its waters. Elsewhere there are no fisheries of importance, except those of the Galapagos Islands.

The insect inhabitants of Ecuador, like the birds, include a large number of genera and species, but no complete entomological survey of the country has ever been made, and our knowledge in this respect is insufficient to warrant a detailed description. In one ascent of Pichincha in 1880, Mr Whymper collected 21 species of beetles, all new to science, between 12,000 and 15,600 ft. elevation. On Cotopaxi, at elevations of 13,000 to 15,800 ft., 18 species of the genus *Colpodes* were collected, of which 16 were new. This may be considered a fair illustration of the situation in Ecuador so far as natural history exploration is concerned. Of the Machachi basin, near Quito, which he calls a "zoologist's paradise," Mr Whymper writes (*Travels amongst the Great Andes of the Equator*): "Butterflies above, below and around; now here, now there, by many turns and twists displaying the brilliant tessellation of their under-sides.... May-flies and dragon-flies danced in the sunlight; lizards darted across the paths; and legions of spiders pervaded the grass, many very beautiful—frosted—silver backs, or curious, like the saltigrades, who took a few steps and then gave a leap. There were crickets in infinite numbers; and flies innumerable, from slim daddy-long-legs to ponderous, black, hairy fellows known to science as *Dejeaniae*; hymenopterous insects in profusion, including our old friend the bishop of Ambato (possibly *Dielis*), in company with another formidable stinger, with chrome antennae, called by the natives 'the Devil'; and occasional *Phasmas* (caballo de palo) crawling painfully about, like animated twigs." This description refers to a fertile sub-tropical oasis on the partially barren plateau; below in the forested lowlands, where tropical conditions prevail, the numbers and varieties are many times greater. The Coleoptera are especially numerous; Mr Whymper took home with him 206 species which had been identified and described up to 1892, most of them from the uplands and most of them new to science. The total number of species in Ecuador is roughly estimated to be 8000. The Hymenoptera are also numerous, but less so than the Lepidoptera, with which the mountain slopes and sunny, open spaces seem to be literally covered. Of moths alone Mr Whymper took away with him specimens representing no less than 23 genera, with a probable addition of 13 genera more among his undescribed specimens, the largest of which (an *Erebus odora*) was 7¼ in. across the wings. Among the Diptera, which includes a very wide range of genera and species, are some of a highly troublesome character, though on the whole, Mr Whymper did not find the flies and mosquitoes so. His explorations, however, did not extend to the eastern region, where the mosquitoes are usually described by travellers as extremely troublesome. Sand-flies are common, and in the eastern forests the tiny *piúm* fly (*Trombidium*, sp.?) is a veritable pest. Of the insects which infest dwellings and prey upon their human inmates, such as fleas, bed-bugs, roaches, &c., Ecuador has more than a bountiful supply. Lice-eating is a widely prevalent habit among the Indians and mestizos, and demonstrates how numerous these parasites are among the people. A good illustration of the prevalence of house-infesting animals and insects is given by Mr Whymper (*op. cit.* p. 391), who made a collection of 50 different specimens of the vermin which infested his bedroom in Guayaquil.

Population.—The indigenous population of Ecuador was originally composed of two distinct races—the Quitus and Caras, the former being the older, and the latter presumably of Quichua origin. The Caras, according to tradition, entered the country from the coast, and had thoroughly established themselves there long before the conquest by the Inca rulers Tupac-Yupanqui and his son Huayna-Capac. This conquest was comparatively easy because the Caras spoke a dialect of the same language, and were not greatly unlike their conquerors in manners and customs. The present Indian population of Ecuador, excepting those of the

trans-Andean region, may be considered as descendants of these two races. They are subjected to incredible abuses under Spanish colonial rule, their numbers being reduced to a fraction of the former population, and even yet they are subjected to a kind of debt-bondage which is slavery in all but the name. Notwithstanding all this they still represent from two-thirds to three-fourths of the actual population of Ecuador. East of the Andes the forests are inhabited by tribes of what are termed “aucas” or “infieles” (infidels)—Indians who are independent of both church and political control. Missions have been established among some of the tribes, but their influence reaches only a small part of the wild inhabitants of this extensive region.

The principal tribes are the Quijos or Canelos, who are settled about the headwaters of the Napo, on the eastern slopes of the Andes, and are in great part grouped about the missions; the Jivaros who inhabit the valley of the Pastaza; the Zaparos who occupy the forest region between the Pastaza and Napo; the Piojes of the middle Napo, and eastward to the Putumayo; and the Iquitos and Mazanes of the lower Napo and Tigre, chiefly in territory occupied by Peru. The Jivaros are the best known of these tribes because of their successful resistance to the Spanish invaders. They are still independent of political control, live in permanent settlements, till the soil (producing Indian corn, beans, yucca and plantains), and have developed some rude manufactures. The Zaparos are less homogeneous, some of their hordes living in a state of complete savagery. They are classified with the Guaranis of Brazil, whom they resemble in many particulars. The Piojes live in permanent communities and cultivate the soil. The total number of “aucas” or uncivilized Indians in the republic has been estimated at about 200,000, but this estimate covered a larger area than Ecuador actually occupies and is evidently too high. Their settlements are usually small and very much scattered, and their aggregate number is evidently much under the earlier estimates. An official estimate given to Mr Whymper in 1880, however, places the population of Oriente (the eastern territory) at 80,000, which is probably more nearly correct.

No general census has ever been taken in Ecuador, and estimates are little better than vague conjectures. One of these estimates, that published by P.F. Cevallos for 1889, which has been generally accepted, gave the total population as 1,272,161, and these figures have been used with but slight changes for various later estimates. A later official estimate appeared in 1900 in *La République de l’Équateur et sa participation à l’Exposition Universelle de 1900*, which gives for the provinces practically the same figures as those of Cevallos, and at the same time assumes the total for the whole republic to be 1,500,000. The white population is estimated at 100,000 to 120,000, which probably includes many of mixed ancestry, and the mixed bloods at 300,000 to 450,000. The tendency is for the *mestizo* who dwells in Indian communities to revert to the Indian type, and it is probable that the larger estimate is nearer the truth. On the other hand *mestizos* who live among the whites and form new alliances with them eventually class themselves as whites wherever their social condition has been improved. As a rule, the *mestizos* of Ecuador are ignorant, indolent and non-progressive. As in Colombia they are the artizans and small traders and the Indians are the farm labourers. The land is held by a few proprietors, and caste sentiment is strong among those who claim unmixed European descent; consequently the *mestizos* have limited opportunities to improve their condition.

The whites form an exclusive governing caste, as in Chile. The territory of the republic is divided among a very few of them, and its government is in their hands.

In the hot seaboard districts there are a small number of negroes, and a somewhat larger number of their crosses with the other two races. The majority of these are to be found in the northern provinces. There are comparatively few negroes and mulattoes on the colder plateaus. Villavicencio estimated their numbers at 7831 pure negroes and 36,592 mixed bloods, which is probably not far from the correct totals.

The foreign population is small, the total being estimated at about 6000, of which 5000 are natives of the neighbouring Latin republics, 700 Europeans and Americans, and 300 Chinese.

Territorial Divisions and Towns.—The republic is divided into 15 provinces and one territory. The Galapagos Islands were declared a dependency of the province of Guayas in 1885, but are practically independent and constitute a second territory under the administration of *jefe territorial* appointed by the national executive.

The official estimate (*La République de l’Équateur et sa participation à l’Exposition Universelle de 1900*) gives the data for the provinces and their capitals, which are shown on the next page.

These population figures are very nearly the same as those given by Cevállos for 1889. If the population of the Oriente be taken as 80,000, the aggretate is very nearly the same. The population of the provincial capitals is in some cases over-estimated, especially for Guayaquil and Quito, neither of which could have had 50,000 at the date of this estimate. The population of Quito in May 1906 was 50,841, of which 1365 were foreigners. As for the areas of the provinces the figures need not be questioned except those for the Oriente territory, which are much too large for the region actually occupied by Ecuador, and for the Galapagos Islands which are described by competent authorities as 2400 sq. m. The population of these islands was 400 (principally convicts) on Chatham Island in 1901, about 115 on Albemarle and 3 on Charles Island in 1903. Besides the provincial capitals already noted, there are no large and important towns in the country. The largest of the smaller towns is probably Jipijapa, in the province of Manabi, which is the centre of the Panama hat industry and had in 1900 an estimated population of 6000, nearly all Indians.

Provinces.	Area.	Population.	Capital.	Population.
	sq. m.			
Carchi	1495	40,000	Tulcan	5,000
Imbabura	2416	68,000	Ibarra	5,000
Pichincha	6219	205,000	Quito	80,000
Léon	2595	109,600	Latacunga	12,000
Tunguragua	1686	103,000	Ambato	8,000
Chimborazo	2990	122,000	Riobamba	12,000
Bolivar	1260	43,000	Guaranda	6,000
Cañar	1519	64,000	Azogues	4,000

Azuay	3874	132,400	Cuenca	30,000
Loja	3707	66,000	Loja	10,000
El Oro	2340	32,600	Machala	3,200
Guayas	8216	98,100	Guayaquil	60,000
Los Rios	2296	32,800	Babahoyo	3,000
Manabi	7893	64,100	Portoviejo	5,000
Esmeraldas	5465	14,600	Esmeraldas	6,000
Oriente (ter.)	unknown			
Galapagos Is.	2865	2,000	. .	. .

Communications.—The first railway to be completed in Ecuador was the line between Guayaquil and Quito, 290 m. in length, the last section of which was formally opened at Quito on the 25th of June 1908. It belongs to an American company, and had been under construction for many years. Lines from Puerto Bolívar to Machala, province of El Oro, and another from Bahia de Caráquez to Chone, were under construction in 1908. Several lines were also projected, two to penetrate the Ecuadorean *montana*. There is only one highway in the country on which vehicles can be used, the paved road extending southward from Quito 115 m. on the Guayaquil route, which was begun by Garcia Moreno but has been allowed to fall into neglect. Other roads have been projected to the coast and one to the eastern territory. The ordinary roads are rough mule-tracks. These are difficult at all times, and in the rainy season are quite impassable. On the Pacific lowlands the rivers Guayas, Daule, Vinces and Yaguachi have about 200 m. of navigable channels in the rainy season, and are used for the transportation of produce and merchandise. There are also several short river channels along the coast which are used by planters for the same purpose. A great part of the country, however, is still compelled to use the most primitive means of communication—mule paths, fords in the smaller streams in the dry season, and rude suspension bridges across deep gorges and swift mountain torrents. The latter are usually constructed from the tough fibre of the *Agave americana* and consist of one or more cables. When of one cable, called the *taravita*, the passenger and his luggage are drawn across in a rude kind of basket suspended from it; but when two or more cables are used, transverse sticks of bamboo and reeds are laid upon them, forming a rude prototype of the regular suspension bridge. Such a bridge is called a *chimba-chaca*, and is very hazardous for an unpractised foot. In 1907 there were 2564 m. of telegraph lines in operation, connecting Quito with all the principal towns. The national capital is connected with the submarine cable at Santa Elena (via Guayaquil) and at Tumaco, in Colombia. Guayaquil is provided with tramway and telephone lines. These public services are under the general supervision of the Minister of Public Instruction, Posts and Telegraphs.

Commerce.—Ecuador has no merchant marine beyond a few small vessels engaged in the coastwise traffic, some eighteen or twenty river steamers on the Guayas and its tributaries, and a number of steam launches, towboats and various descriptions of barges engaged in the transportation of produce and goods on the rivers. The ocean-going foreign trade of the country is carried wholly in foreign vessels, for the regular lines of which Guayaquil is a principal port of call. Less frequent calls are made at Esmeraldas and some of the other small ports on the coast, of which there are nine in all. Most of these are difficult of access and their trade is unimportant. The total trade of the republic in 1905, according to returns published by the Guayaquil Chamber of Commerce, amounted to only £3,429,955, of which £1,573,389 (15,733,891 sucrés) were credited to imports, and £1,856,566 (18,565,668 sucrés) to exports. Of these totals, all but £127,532 of the imports and £441,679 of the exports passed through the port of Guayaquil. The great poverty of the people has been a serious obstacle to the development of a larger commerce.

Agriculture.—The agricultural industries on which the export trade depends are almost wholly restricted to the western lowlands, and include cacao, coffee, cotton, sugar, tobacco, rice, yucca and sweet potatoes. The Guayas basin and the district about Machala are celebrated for their cacao, and produce about one-third of the world’s supply. It is the staple product of the country. Coffee is produced on the lower slopes of the Cordilleras and is of excellent quality. The production is small, but would be increased at remunerative prices. During the American civil war the planters of Ecuador entered largely into the production of cotton, which at that time yielded large profits, but the industry has declined to very insignificant proportions since then because of inability to compete with the lower cost of production in the United States. The output of sugar and tobacco is small, but could be largely increased, as the conditions of soil and climate are favourable. Much of the sugar-cane produced is turned into rum, which is consumed in the country. The tobacco grown is of excellent quality. Efforts have been made to promote the cultivation of indigo, but without much success. On the uplands, wheat, Indian corn, oats, barley, potatoes and vegetables of many kinds are successfully cultivated, but wholly for home consumption. The vine is successfully grown in the warm upland valleys, both for its fruit and for the production of wine. The staple foods for the common people are potatoes on the plateau (which are chiefly consumed in the form of *locro*, or potato-soup) and yucca- or cassava-meal in the warmer regions. Although cattle and horses were not known before the Spanish conquest, they have become since then important products of the country. The best grazing lands are on the lower elevations west of the Cordilleras in certain districts of the plateau and on the slopes of some of the higher Andes, as on Chimborazo and Antisana. Horses and mules are reared for export on a small scale, and sheep for their wool, which is used in home manufactures.

Forest Products.—The forest and other natural products include rubber, cinchona bark, ivory-nuts, mocora and toquilla fibre for the manufacture of hats, hammocks, &c., cabaya fibre for shoes and cordage, vegetable wool (*Bombax ceiba*), sarsaparilla, vanilla, cochineal, cabinet woods, fruit, resins, &c. The original source of the Peruvian bark of commerce, the *Cinchona calisaya*, is completely exhausted, and the “red bark” derived from *C. succirubra*, is now the principal source of supply from Ecuador. Guaranda is the centre of the industry, but bark gatherers are to be found everywhere in the forest regions. The rubber-gathering industry is comparatively new. The product is derived from the *Castilloa elastica*, the *Heveas* not being found west of the Andes.

Minerals.—The mineral resources are much inferior to those of Colombia and Peru. Gold is found in the province of El Oro, where the great Zaruma and other companies have opened a number of mines. It is also found in the provinces of Loja, Esmeraldas, and in the river-beds along the eastern slopes of the Andes. Quicksilver has been mined at Azogues, in the province of Cañar, and is also to be found in Azuay. Iron ores

and lead are credited to several provinces, and platinum has been found in Esmeraldas, where emerald mines have been worked ever since the Spanish conquest. Coal of good quality has been found in Azuay and at other points, and petroleum is known to exist in several localities. Salt springs near Riobamba and at Salinas, in Imbabura, have long been used by the natives in the manufacture of salt.

Manufactures.—The manufacturing industries are chiefly of a primitive character and have been developed to meet local necessities. There are some cotton factories and sugar mills provided with modern machinery, but the cotton and woollen cloths of the country are commonly coarse and manufactured in the most primitive manner. Some of these goods are sent into southern Colombia, but they are chiefly made for the local market. Hats and hammocks are made from the fibres of the mocora and toquilla palms, and sandals from the fibre of the *Agave americana*. The hats are an article of export, and are known abroad as Panama hats. Hand-made laces of admirable workmanship are made in some localities, especially on the plateau about Quito. Among other manufactories, all for the home market, may be mentioned: flour-mills, sugar refineries, rum distilleries, breweries, chocolate factories, a candle factory, saw-mills and tanneries.

Government.—Constitutionally, the government of Ecuador is that of a centralized republic, whose powers are defined by a written constitution and whose chief organs are an executive consisting of a president and vice-president, and a national congress consisting of two houses, a senate and a chamber of deputies. Revolutionary changes, however, have been very frequent in Ecuador, and no less than eleven constitutions were adopted between 1830 and 1909.

The constitution adopted in 1906 succeeded that of 1884 (amended in 1887 and 1897), and its terms may be given here, subject to what may be regarded as the extra-constitutional powers vested in the executive. Executive power is vested in a president and vice-president elected for periods of four years by a direct vote of the people. (Under the constitution of 1884 the official terms of these two officers were not wholly synchronous, the vice-president's term beginning with the president's third year.) These officials cannot be re-elected to succeed themselves. The president, whose salary is 12,000 sucrés per annum, has a limited veto power, and may convene extraordinary sessions of Congress for a specified purpose, but he has no further authority over that body. He appoints the diplomatic and consular representatives of the republic and the governors of the provinces, exercises a limited control over the administration of justice and public instruction through the appointment of officials, and is chief of the small military force maintained by the republic. The construction of railways with public funds and under government supervision also places him at the head of a very important public service. The president is assisted by a cabinet of five ministers:—foreign relations and justice; interior and public works; finance; war; public instruction, posts and telegraphs—all of whom may be impeached by congress. The executive authority is also partially exercised by a council of state composed of 15 members, including the five cabinet ministers, of which the vice-president is *ex-officio* president. The council has important advisory functions, and must be consulted by the president on every important measure or appointment. The provinces are administered by governors chosen by the national executive; the departments by *jefes politicos* (political chiefs); and the municipalities by *tenientes politicos* (political lieutenants). The Galapagos Islands are under a *jefe territorial* (territorial chief), Chatham Island being a penal colony and governed by special laws.

The congressional organization is similar to that of the majority of South American states. The senate is composed of 32 members (2 from each province) elected for two years, one-half the number being renewed each two years. The chamber is composed of 42 deputies, who are elected by the provinces for a period of two years, on a basis of one representative for each 30,000 inhabitants and one supplementary representative for an additional 15,000. A senator must be at least 35 years of age, and a deputy 25. The elections are direct, and members of both houses may be re-elected. The immunities of legislators begin 30 days before the opening session of congress, and terminate 30 days after its dissolution. Congress meets at Quito on the 10th of August, and remains in session for a period of 60 days, but its sessions may be extended or extraordinary sessions called for specified purposes. The right of suffrage is restricted to literate male adults.

The judicial branch of the government is composed of a supreme court, located at Quito, consisting of 5 judges and a fiscal (public prosecutor) appointed by the executive; six superior courts (in Quito, Guayaquil, Cuenca, Riobamba, Loja and Portoviejo) with a total of 9 judges; *a Tribunal de Cuentas* of seven members at Quito; and various municipal courts, or *alcaldes*, in the chief towns of the departments. There are civil courts of first and second instance in the larger towns, and consular courts in Quito, Guayaquil and Cuenca with jurisdiction in commercial cases. There are also police commissaries in the departments and justices of the peace in the municipalities, the latter having jurisdiction in civil cases where the amount involved does not exceed 200 sucrés. The laws of Ecuador are based on the old Spanish laws and procedure, and include civil, criminal and commercial codes.

Army.—The army, according to an official report of 1900, consisted of 4 battalions of infantry (about 3690 strong), 3 brigades of artillery (1362), and 2 regiments of cavalry (468), in all, about 5520 men, rank and file. In 1908 this force was reported to comprise 4350 men. The national guard is composed of three classes: actives—all enrolled citizens of 20 to 38 years; auxiliaries—enrolled citizens of 38 to 44 years; and passives—enrolled citizens of 44 to 50 years. These were estimated at 95,329 men. There is a military school at Quito and a naval school at Guayaquil.

Education.—Although primary instruction is free, and is obligatory for children of 6 to 12 years, a considerable part Of the population is unprovided with schools and is indifferent in regard to them. An official report for 1900 gives the number of primary schools as 1297, and the number of pupils in attendance as about 80,000. The secondary schools numbered 37, with 371 teachers and about 4500 pupils. Higher instruction includes the technical and professional schools with the three universities of Quito, Guayaquil and Cuenca, and 6 schools of "trades and professions" (*artes y oficios*) in as many provinces. The old University of Quito has a staff of 32 professors divided into 5 faculties: Philosophy and Belles-Lettres, Law, Medicine, Physical and Natural Sciences and Mathematics. There are also in Quito a school of agriculture, astronomical observatory, botanical garden, museum and national printing office, all apparently under the supervision of the University.

Church.—According to the constitution of 1884, "the religion of the Republic is the Roman Catholic

Apostolic, and all others are excluded." The only opposition which the Church has ever had to encounter has been from the "liberal" element within itself, and thus has arisen, seemingly from political motives, a desire to restrict clerical influence in political affairs. This influence has been exercised to an extreme in Ecuador, so much so, in fact, that its government at times was more nearly a theocracy than a republic. The growth of liberalism finally began to produce results. In 1889 the tithes from which the Church revenues had been derived were abolished, and a tax of 3 per mil. on real estate was substituted. In 1902 a signal victory was won in a law permitting civil marriage, but in 1904 a social revolution was effected by legislation, which placed the Church under State control, forbade the foundation of new religious orders and admission into the country of new religious communities, and provided that the members of the episcopate must be citizens of Ecuador. The higher dignitaries of the Church are an archbishop at Quito, and six suffragan bishops at Cuenca, Loja, Ibarra, Riobamba, Guayaquil and Manabi.

Finance.—The revenues of the republic are derived from import and export duties, liquor, tobacco and stamp taxes, inheritance tax, salt, gunpowder and playing cards monopolies, consular charges, and sundry miscellaneous receipts, including those from posts, telegraphs and railways. Up to 1907 the customs duties were increased by surtaxes amounting at that time to 100%. The minister of finance proposed to abolish these surtaxes and double all the rates of duties involved. On exports, however, all the duties were to be abolished except those on cacao, coffee, hides, rubber, tagua (ivory nuts), hat fibre, hammock fibre and tobacco. For 1907 the revenues were £1,424,770 and the expenditures £1,383,122.

On the 10th of October 1906, when the report of the provisional government created by the revolution of the preceding January presented its financial report to a national assembly, the total obligations of the country were stated to be:—

	Sucrés.
Railway bonds, 12,282,000 sucrés gold at 107% premium	25,423,740
Banco del Ecuador, advances	3,000,000
Banco Comercial y Agrocola, idem	2,400,000
Internal debt	739,575
Condor bonds	757,000
French Finance Corporation	887,000
Total	33,207,315
In £ sterling at 10 sucrés per £	3,320,731

The foreign debt of the republic, which in 1898 stood at £693,160 in bonds, was assumed by the Guayaquil & Quito Railway Co. under contracts of 1897, 1898, 1899 and 1900, the government guaranteeing interest on the sum of £2,520,000 railway mortgage bonds for 33 years and recognizing the external debt at 35% of its face value. This debt originated in 1830, when Ecuador seceded from the Colombian confederacy and was charged with 21½% of the indebtedness of the three states. In 1855 the amount was fixed at £1,824,000, and in 1892 it was converted into a new consolidated debt of £750,000. Payments of interest and amortization had been very irregular, and its transfer to a foreign company as the price of a railway concession put an end to a transaction which had been a serious discredit to the country. The amount outstanding on the 31st of December 1907 was 10,808,000 sucrés (£1,080,800). It should be said that the difficulties in regard to this debt arose from a feeling in Ecuador that the part assigned to it in 1830 was much too large, and that it was contracted almost wholly for the benefit of the two northern republics, Colombia and Venezuela.

Money and Measures.—Under the law of 1898, which came into effect on the 4th of June 1900, gold is made the monetary standard in Ecuador, the legal tender of silver being limited to 10 sucrés, and banks of issue being required to hold at least one-half their metallic reserves in gold coin. Previously there had been much confusion in the circulating medium because of the depreciated value of the Quito currency in comparison with that of Guayaquil, but the new law has corrected the anomaly and has given a simple and uniform medium for the whole country. The coinage under the law of 1898 consists of the gold *condor*, of 10 *sucrés*, which weighs 8.136 grams, contains 7.3224 grams of fine gold, and is equal to the English pound sterling in value; the silver *sucré*, of 100 centavos, equivalent to 24d. in value; and smaller coins of silver, nickel and copper, the denominations being decimal parts of the sucré. The sucré received its name from the portrait of General Sucré engraved on the coin, and is legal tender up to 10 sucrés. The paper money circulation consists of the issues of two Guayaquil banks—the Banco del Ecuador, and the Banco Comercial y Agricola, whose united issues on June 30th, 1906, amounted to 7,414,140 sucrés (£741,414). The Bank of Quito at one time issued notes which, according to Whymper, were not current at and south of Riobamba, but it does not appear that this bank is authorized to issue its notes under the new law. The metallic money nominally in circulation on the 30th of June 1906, amounted to 2,587,667 sucrés gold and 2,522,802 sucrés silver. Although the metric system was adopted in 1856, the old Spanish weights and measures—the quintal, libra, vara and fanega—are still in use, the quintal being equivalent to about 101 lb.

Antiquities.—Throughout Ecuador there are still considerable remains of the architectural and artistic skill of the ante-European period. At Cañar, to the north-east of Cuenca, stands the Incapirca, a circular rampart of finely hewn stone, enclosing an open area with a roofless but well-preserved building in the centre; not far off is the Inca-chungana, a very much smaller enclosure, probably the remains of a pavilion; and in the same neighbourhood the image of the sun and a small cabinet are carved on the face of a rock called Intihuaicu. On one of the hills running from Pichincha to the Esmeraldas there are remains at Paltatamba of a temple and a conical tower, the buttresses of a bridge composed of stone and bitumen, portions of a great causeway, and numerous tombs from which mummies and plates of silver have been obtained. At Hantuntaqui similar sepulchral mounds, called *tolas*, may be seen, as well as traces of military structures. On the plain of Callo, near Cotopaxi, at a height of 8658 ft., the ruins of an Incarial palace, Pachusala, are utilized by the *hacienda*; and a conical hill at its side is supposed to be of artificial construction. The remains of another fortress and palace are preserved at Pomallacta, and in the neighbouring pueblo of Achupallas an ancient temple of the sun now serves as parish church. In many localities, especially in Imbabura, pottery and various objects are found belonging to the pre-Colombian period, among which five and six rayed stars

(*casse-têtes*) are very numerous.

(A. J. L.)

History.—The territory of the republic of Ecuador, when first it becomes dimly visible in the grey dawn of American history, appears to be inhabited by upwards of fifty independent tribes, among which the Quitus seem to hold the most important position. About A.D. 280 a foreign tribe is said to have forced their way inland up the valley of the Esmeraldas; and the kingdom which they founded at Quito lasted for about 1200 years, and was gradually extended, both by war and alliance, over many of the neighbouring dominions. In 1460, during the reign of the fourteenth *Caran Shyri*, or king of the Cara nation, Hualcopo Duchisela, the conquest of Quito was undertaken by Tupac Yupanqui, the Inca of Peru; and his ambitious schemes were, not long after his death, successfully carried out by his son Huayna-Capac, who inflicted a decisive defeat on the Quitonians in the battle of Hatuntaqui, and secured his position by marrying Pacha, the daughter of the late Shyri. By his will the conqueror left the kingdom of Quito to Atahuallpa, his son by this alliance; while the Peruvian throne was assigned to Huascar, an elder son by his Peruvian consort. War soon broke out between the two kingdoms, owing to Huascar's pretensions to supremacy over his brother; but it ended in the defeat and imprisonment of the usurper, and the establishment of Atahuallpa as master both of Quito and Cuzco. The fortunate monarch, however, had not long to enjoy his success; for Pizarro and his Spaniards were already at the door, and by 1533 the fate of the country was sealed. As soon as the confusions and rivalries of the first occupation were suppressed, the recent kingdom of Quito was made a presidency of the Spanish viceroyalty of Peru, and no change of importance took place till 1710. In that year it was attached to the viceroyalty of Santa Fé; but it was restored to Peru in 1722. When, towards the close of the century, the desire for independence began to manifest itself throughout the Spanish colonies of South America, Quito did not remain altogether indifferent. The Quitonian doctor Eugenio Espejo, and his fellow-citizen Don Juan Pio Montufar, entered into hearty co-operation with Nariño and Zea, the leaders of the revolutionary movement at Santa Fé; and it was at Espejo's suggestion that the political association called the *Escuela de Concordia* was instituted at Quito. It was not till 1809, however, that the Quitonians made a real attempt to throw off the Spanish yoke; and both on that occasion and in 1812 the royal general succeeded in crushing the insurrection. In 1820 the people of Guayaquil took up the cry of liberty; and in spite of several defeats they continued the contest, till at length, under Antonio José de Sucré, who had been sent to their assistance by Bolivar, and reinforced by a Peruvian contingent under Andres de Santa Cruz, they gained a complete victory on May 22, 1822, in a battle fought on the side of Mount Pichincha, at a height of 10,200 ft. above the sea. Two days after, the Spanish president of Quito, Don Melchor de Aymeric, capitulated, and the independence of the country was secured. A political union was at once effected with New Granada and Venezuela on the basis of the republican constitution instituted at Cucuta in July 1821—the triple confederation taking the name of Colombia.

A disagreement with Peru in 1828 resulted in the invasion of Ecuador and the temporary occupation of Cuenca and Guayaquil by Peruvian forces; but peace was restored in the following year after the Ecuadorian victory at Tarqui. In the early part of 1830 a separation was effected from the Colombian federation, and the country was proclaimed an independent republic. General Juan José Flores was the first president, and in spite of many difficulties, both domestic and foreign, he managed to maintain a powerful position in the state for about 15 years. Succeeded in 1835 by Vicente Rocafuerte, he regained the presidency in 1839, and was elected for the third time in 1843; but shortly afterwards he accepted the title of generalissimo and a sum of 20,000 pesos, and left the country to his rivals. One of the most important measures of his second presidency was the establishment of peace and friendship with Spain. Roca, who next attained to power, effected a temporary settlement with Colombia, concluded a convention with England against the slave trade, and made a commercial treaty with Belgium. Diego Noboa, elected in 1850 after a period of great confusion, recalled the Jesuits, produced a rupture with New Granada by receiving conservative refugees, and thus brought about his own deposition and exile. The democratic Urbina now became practically dictator, and as the attempt of Flores to reinstate Noboa proved a total failure, he was quickly succeeded in 1856 by General Francisco Robles, who, among other progressive measures, secured the adoption of the French system of coinage, weights and measures. He abdicated in 1859 and left the country, after refusing to ratify the treaty with Peru, by which the defender of Guayaquil had obtained the raising of the siege. Dr Gabriel Garcia Moreno, professor of chemistry, the recognized leader of the conservative party at Quito, was ultimately elected by the national convention of 1861. Distrust in his policy, however, was excited by the publication of some of his private correspondence, in which he spoke favourably of a French protectorate, and the army which he sent under Flores to resist the encroachments of Mosquera, the president of New Granada, was completely routed. His first resignation in 1864 was refused; but the despotic acts by which he sought to establish a dictatorship only embittered his opponents, and in September 1865 he retired from office. While he had endeavoured to develop the material resources of the country, he had at the same time introduced retrograde measures in regard to religion and education. The principal event in the short presidency of his successor, Gerónimo Carrion (May 1865-Nov. 1867), was the alliance with Chile and Peru against Spain, and the banishment of all Spanish subjects. Several important changes were made by congress in the period between his resignation and the election of Xavier Espinosa, January 1868: the power of the president to imprison persons regarded as dangerous to public order was annulled; and the immediate naturalization of Bolivians, Chilians, Peruvians and Colombians was authorized. Espinosa had hardly entered on his office when, in August 1868, the country was visited by an earthquake, in which 30,000 people are said to have perished throughout South America. The public buildings of Quito were laid in ruins; and Ibarra, Otavalo, Cotacachi and several other towns were completely destroyed. Next year a revolution at Quito, under Moreno, brought Espinosa's presidency to a close; and though the national convention appointed Carvajal to the vacant office, Moreno succeeded in securing his own election in 1870 for a term of six years. His policy had undergone no alteration since 1865: the same persistent endeavour was made to establish a religious despotism, in which the supremacy of the president should be subordinate only to the higher supremacy of the clergy.

President Moreno was eventually assassinated at Quito, in August 1875, and Dr Borrero was elected to the presidency, but his tenure of power was short. A revolution headed by General Veintemilla, the Radical

leader, then military commandant at Guayaquil, broke out in 1876, and on the 14th of December of that year the government forces under General Aparicio were completely routed at Galte. Veintemilla was proclaimed president, and in 1877 was duly elected by the cortes. He altered the constitution in a more Liberal direction, and struck various blows at the Clerical party, among other things abolishing the concordat with Rome. In 1878 Veintemilla caused himself to be declared elected as president for a term of four years. At the expiration of this period the president assumed dictatorial powers and remained in office as chief of the executive. This action on the part of General Veintemilla led to a union between the Clericals and Moderate Liberals, and resulted in a popular rising throughout the republic, ending in his defeat and overthrow. His power was first restricted to Guayaquil and Esmeraldas, and finally General Rinaldo Flores drove him from Guayaquil, and Veintemilla fled (July 1883) to Peru. Dr Placido Caamaño was then called upon to take charge temporarily, and on the 17th of February 1884 was definitely elected for the presidential period terminating in 1888. Several revolutionary outbreaks occurred during the Caamaño administration, but were successfully suppressed. In 1888 Dr Antonio Flores succeeded Caamaño, the four years following being passed in peaceful conditions. In 1892 Dr Luis Cordero was elected, his administration again plunging the country into an epoch of internal disturbance.

The cause of the troubles under President Cordero was the assistance lent by Ecuador to Chile in the matter of the sale of the cruiser *Esmeralda* to the Japanese government in 1894, in the middle of the Japanese-Chinese War. The government of Chile arranged the sale of the *Esmeralda*, but wished to be free from all danger of international complications in the affair. To this end the transfer of the vessel was made to Ecuador, and she proceeded to Ecuadorian waters. On arriving at the Galapagos Islands the flag of Ecuador was replaced by that of Japan and the vessel handed over to the representatives of that nation sent for the purpose. When the part played by President Cordero in this transaction became known, an outburst of popular indignation occurred. An insurrection, headed by General Eloy Alfaro, followed; and after desultory skirmishing extending over a period of nearly a year the government forces were finally routed, President Cordero abandoning his office and escaping from the country.

General Alfaro then assumed dictatorial powers as supreme chief of the nation, continuing in this capacity until the 6th of February 1897, on which date he was declared to be elected president of the republic. A series of revolutionary movements against the administration of President Alfaro occurred in the course of the next few years. Many of these risings were due to the intrigues of the Church party, and in view of these circumstances President Alfaro curtailed the influence of the clergy in several directions. On the 31st of August 1901 General Alfaro peacefully handed over the presidency to his elected successor, General Leonidas Plaza.

General Plaza continued the anticlerical policy of his predecessor. Civil marriage and divorce were introduced, and in 1904 all religions were placed on a position of equality in the eye of the law, and the foundation of new monasteries and convents was forbidden. The final year of Plaza's tenure of office was marked by a still stronger measure, all the property of the church being declared to be national property, and let to the highest bidders. In 1905 the Opposition made an effort to effect a change of policy, and were successful in obtaining the election of Lizaro Garcia, a well-to-do merchant and a director of the Banco commercial y Agricola. General Alfaro, however, appealed to arms, ejected Garcia from office, and made himself ruler with practically dictatorial powers.

The more recent history of Ecuador would not be complete without a reference to the work of Mr Archer Harman (b. 1860), an American railway builder and financier whose connexion with the construction of the Guayaquil and Quito railway began in 1897. To his personal energy and enterprise, as manager of the railway company, was largely due the continued prosecution of this difficult engineering undertaking, in connexion with which he was responsible for a thorough reconstruction of Ecuador finance. He thus came to exercise a powerful influence on the internal progress of the country.

See C.E. Akers, *History of South America, 1854-1904* (London, 1904); H.W. Bates, *Central and South America* (London, 1882); Pedro F. Cevallos, *Resumen de la historia del Ecuador* (Guayaquil, 1886); Hans Meyer, *In den Hoch-Anden von Ecuador* (Berlin 1907); A.H. Keane, *Stanford's Compendium*, vol. i. (1904); W. Reiss and A. Stübel, *Das Hochgebirge der Republik Ecuador* (Berlin, 1892-1898); Edward Whymper, *Travels amongst the Great Andes of the Equator* (London, 1892); T. Wolf, *Geografia y geologia del Ecuador* (Leipzig, 1892); A. Stübel, *Skizzen aus Ecuador* (Berlin, 1886); *Die Vulkanberge von Ecuador* (Berlin, 1897); *Handbook of Ecuador* (Bureau of the American Republics, Washington, 1892); *The World's Work*, vol. ii. pp. 1271-1277; *Engineering News* (New York), vol. 52, pp. 117-119; *Bulletin of Internat. Bureau of American Republics* for July 1900, p. 26, and for August 1908, pp. 280-282; *Thirty-fifth Annual Report of the Council of Foreign Bondholders*, pp. 115, 117.

1 See J. Siemiradzki, "Geologische Reisenotizen aus Ecuador," *Neues Jahrb. f. Min.*, Beil. Band iv. (1886, pp. 195-227, pl. vii.); Th. Wolf, *Geografia y geologia del Ecuador, publicada por orden del Supremo Gobierno de la Republica* (Leipzig, 1892); W. Reiss and A. Stübel, *Reisen in Sud-America. Das Hochgebirge der Republik Ecuador* (Berlin, 1892-1902).

ECZEMA (Gr. ἔκζεμα, a cutaneous eruption), one of the most common and important of all skin diseases, consisting of a catarrhal inflammation of the skin originating without visible external irritation, and characterized in some stage of its evolution by a serous exudation. This definition excludes all those forms of inflammation of the skin (dermatitis), which though they may be identical in course and manifestation are yet caused by chemical or mechanical irritants. For an attack of eczema two conditions are necessary: a predisposition or special irritability of the skin, and a directly exciting cause. The first of these conditions is

usually inherited or depends on some underlying constitutional state. Thus any organic lesion which may produce oedema and malnutrition of the cutis and epidermis as in kidney diseases, any condition of imperfect metabolism as in dyspepsia or malnutrition, or seborrhoea, may be the predisposing cause. Another influence that has received increasing attention from skin specialists is that of any nervous shock or prolonged mental strain. A “chill” is followed in most people by an ordinary cold, but in some by an attack of eczema. Again, it may be caused by reflex nervous irritation from the uterus, stomach, &c. In some women it always accompanies menstruation, and in others pregnancy. It is of common occurrence in infancy, being attributed by some specialists to dentition, but by others to seborrhoea. Also there is an undoubted relationship between eczema and certain forms of functional neurosis, of which perhaps asthma is the most striking illustration, some physicians considering the latter trouble to be eczema of the bronchial tubes. Sufferers from rheumatism and gout are also specially prone to eczema, though the exact relationship is a much disputed point. There are yet other cases that are undoubtedly microbic, but the micro-organism cannot produce the lesion unless the soil is suitable. As a rule it is not contagious, though when complicated by micro-organisms it may be auto-inoculable, or more rarely inoculable from one patient to another. Except between the ages of ten and twenty years when menstruation is becoming established, and again at the menopause, males are more liable to be attacked than females. In old age the sex influence is lost.

An attack of eczema is usually described as acute or chronic, but the only distinction lies in the greater or less intensity of the inflammation at the time of description: it has nothing to do with the length of time that the disease has lasted. The illness usually begins with a feeling of itching and burning at the site of the lesion. The skin becomes covered with an erythematous blush, on which numerous tiny vesicles form. Swelling, heat, redness and tension are all present. The vesicles grow larger, run together, and either burst or are broken by the patient’s scratching, a clear fluid exuding which stiffens linen. The discharge does not dry up at once, but continues to exude—hence the name of “weeping eczema” when this is a prominent symptom. In mild cases the symptoms begin to subside in a few days, the exudation growing less and scales and scabs forming, under which new skin is formed. But where the attack is more acute fresh crops of vesicles spring up and the process repeats itself. In some cases papules are the predominant lesions, but in others, especially when the face is attacked, the erythematous condition is more marked. A severe attack of eczema is usually accompanied by some slight constitutional disturbance, but the general health seldom suffers appreciably, unless, as occasionally, the itching is so bad as to make sleep impossible. The irritation and local heat may be out of all proportion to visible changes in the skin, and in neurotic patients the nervous excitement may be extreme. The attack may centre itself on any part of the body, but there are certain places where it more usually begins, such as the bends of the elbows, the backs of the knees and the groins; the groove behind the ears, the scalp, the palms or the soles, and the breasts of women. According to its position the form of the eczema is somewhat modified. On the front of the legs and arms, from the uniform redness it exhibits in these positions, it is known as eczema rubrum. On the scalp it is generally of the seborrhoeic type, and in children, especially when pediculi are present, it will become pustular from microbic infection. On the palms and soles it brings about a thickening of the epidermis which leads to the formation of cracks, and is hence called eczema rimosum.

The disease can best be treated by a combination of internal and external remedies. Internally, when the inflammation is acute, nothing is so good as antimony, since this relieves the arterial tension and thus reduces the local inflammation. But this must never be given when the patient is suffering from depression. In other cases, especially for babies and children, small doses of calomel are very beneficial; strychnine, phosphorus and ergot are all useful at times. When nervous excitement is marked it must be treated with sedatives. Arsenic and iron are both contra-indicated in this disease, since they increase blood formation and hence stimulate the eczematous process. Internal treatment is always best when combined with local treatment, but as a preliminary to this all crusts and scales must first be removed to allow the remedy free access to the disease. Locally the aim is (1) to overcome any source of irritation, (2) to protect the inflamed surface from the air and from microbic infection, and (3) to relieve the itching. The diet should be simple but nourishing, and all hygienic precautions must be taken.

EDAM, a town of Holland in the province of North Holland, close to the Zuider Zee, about 13 m. N.N.E. of Amsterdam by steam tramway. It is connected with the Zuider Zee by a fine canal protected by a large sea-lock (1828), and has regular steam-boat communication in various directions. Pop. (1900) 6444. The many quaint old brick houses form the chief feature of interest in the town. The façades are frequently adorned with carvings and inscriptions, one of which records the legend of the capture of a siren in 1403, who lived for some time among the people of Edam, but escaped again to the sea. The Great Church of St Nicholas, probably founded in the 14th century, was largely rebuilt after a fire in 1602, which, originating in the church, destroyed nearly the whole town. It contains some fine stained glass and carved woodwork of this period. The Little Church (15th century) was demolished in 1883, except for a portion of the nave and the old tower and steeple, from which the bells curiously project. The town hall dates from 1737, and there is a museum founded in 1895. Edam has some trade in timber, while shipbuilding, rope-spinning and salt-boiling are also carried on. It gives its name to the description of “sweet-milk cheese” (*zoetemelks kaas*) made throughout North Holland, which is familiar on account of its round shape and red rind.

Edam took its name and origin from the dam built on the little river Ye which joined the great Purmer lake close by. Free access to the Zuider Zee was obtained by the construction of a new dock in 1357, in which year the town also received civic rights from William V. of Bavaria, count of Holland. Owing to the danger of the extension of the Purmer and Beemster lakes, Philip II. of Spain caused a sluice to be built into the dock in 1567. In the next century Edam was a great shipbuilding centre, and nearly the whole of Admiral de Ruyter’s fleet was built here; but in the same century the harbour began to get blocked up, and the

importance and industrial activity of the city slowly waned.

EDDA, the title given to two very remarkable collections of old Icelandic literature. Of these only one bears that title from antiquity; the other is called *Edda* by a comparatively modern misnomer. The word is unknown to any ancient northern language, and is first met with in *Rigspula*, a fragmentary poem at the end of Codex Wormianus, dated about 1200, where it is introduced as the name or title of a great-grandmother. From the 14th to the 17th century, this word—but no one has formed a reasonable conjecture why—was used to signify the technical laws of Icelandic court metre, *Eddu regla*, and "Never to have seen Edda" was a modest apology for ignorance of the highest poetic art. The only work known by this name to the ancients was the miscellaneous group of writings put together by Snorri Sturlason (*q.v.*; 1178-1241), the greatest name in old Scandinavian literature. It is believed that the *Edda*, as he left it, was completed about 1222. Whether he gave this name to the work is doubtful; the title first occurs in the Upsala Codex, transcribed about fifty years after his death. The collection of Snorri is now known as the *Prose or Younger Edda*, the title of the *Elder Edda* being given to a book of ancient mythological poems, discovered by the Icelandic bishop of Skálaholt, Brynjulf Sveinsson, in 1643, and erroneously named by him the *Edda of Saemund*.

1. The Prose *Edda*, properly known as *Edda Snorra Sturlusonar*, was arranged and modified by Snorri, but actually composed, as has been conjectured, between the years 1140 and 1160. It is divided into five parts, the Preface or *Formáli*, *Gylfaginning*, *Bragaraeður*, *Skáldskaparmál* and *Háttatal*. The preface bears a very modern character, and simply gives a history of the world from Adam and Eve, in accordance with the Christian tradition. *Gylfaginning*, or the Delusion of Gylfi, on the other hand, is the most precious compendium which we possess of the mythological system of the ancient inhabitants of Scandinavia. Commencing with the adventures of a mythical king Gylfi and the giantess Gefion, and the miraculous formation of the island of Zealand, it tells us that the Aesir, led by Odin, invaded Svithjod or Sweden, the land of Gylfi, and settled there. It is from the *Ynglingasaga* and from the *Gylfaginning* that we gain all the information we possess about the conquering deities or heroes who set their stamp upon the religion of the North. Advancing from the Black Sea northwards through Russia, and westward through Esthonia, the Aesir seem to have overrun the south lands of Scandinavia, not as a horde but as an immigrant aristocracy. The Eddaic version, however, of the history of the gods is not so circumstantial as that in the *Ynglingasaga*; it is, on the other hand, distinguished by an exquisite simplicity and archaic force of style, which give an entirely classical character to its mythical legends of Odin and of Loki. The *Gylfaginning* is written in prose, with brief poetic insertions. The *Bragaraeður*, or sayings of Bragi, are further legends of the deities, attributed to Bragi, the god of poetry, or to a poet of the same name. The *Skáldskaparmál*, or Art of Poetry, commonly called *Skálda*, contains the instructions given by Bragi to Aegir, and consists of the rules and theories of ancient verse, exemplified in copious extracts from Eyvindr Skáldaspillir and other eminent Icelandic poets. The word *Skáldskapr* refers to the form rather than the substance of verse, and this treatise is almost solely technical in character. It is by far the largest of the sections of the *Edda* of Snorri, and comprises not only extracts but some long poems, notably the *Thorsdrapa* of Eilifr Guðrúnarson and the *Haustlaung* of Thjóðólfr. The fifth section of the *Edda*, the *Háttatal*, or Number of Metres, is a running technical commentary on the text of Snorri's three poems written in honour of Haakon, king of Norway. Affixed to some MS. of the *Younger Edda* are a list of poets, and a number of philological treatises and grammatical studies. These belong, however, to a later period than the life of Snorri Sturlason.

> The three oldest MSS. of the prose *Edda* all belong to the beginning of the 14th century. The Wurm MS. was sent to Ole Wurm in 1628; the Codex Regius was discovered by the indefatigable bishop Brynjulf Sveinsson in 1640. The most important, however, of these MSS. is the Upsala Codex, an octavo volume written probably about the year 1300. There have been several good editions of the *Edda Snorra Sturlusonar*, of which perhaps the best is that published by the Arne-Magnaean Society in Copenhagen in 1848-1852, in two vols., edited by a group of scholars under the direction of Jón Sigurdsson. There are English translations by T. Percy, *Northern Antiquities*, from the French by P.H. Mallet (1770); by G. Webbe Dasent (Stockholm, 1842); by R.B. Anderson (Chicago, 1880).

2. The Elder *Edda*, Poetic *Edda* or *Saemundar Edda hins froða* was entirely unknown until about 1643, when it came into the hands of Brynjulf Sveinsson, who, puzzled to classify it, gave it the title of *Edda Saemundi multiscii*. Saemund Sigfusson, who was thus credited with the collection of these poems, was a scion of the royal house of Norway, and lived from about 1055 to 1132 in Iceland. The poems themselves date in all probability from the 10th and 11th centuries, and are many of them only fragments of longer heroic chants now otherwise entirely lost. They treat of mythical and religious legends of an early Scandinavian civilization, and are composed in the simplest and most archaic forms of Icelandic verse. The author of no one of them is mentioned. It is evident that they were collected from oral tradition; and the fact that the same story is occasionally repeated, in varied form, and that some of the poems themselves bear internal evidence of being more ancient than others, proves that the present collection is only a gathering made early in the middle ages, long after the composition of the pieces, and in no critical spirit. Sophus Bugge, indeed, one of the greatest authorities, absolutely rejects the name of Saemund, and is of opinion that the poetic *Edda*, as we at present hold it, dates from about 1240. There is no doubt that it was collected in Iceland, and by an Icelander.

The most remarkable and the most ancient of the poems in this priceless collection is that with which it commences, the *Völuspá*, or prophecy of the Völva or Sibyl. In this chant we listen to an inspired prophetess, "seated on her high seat, and addressing Odin, while the gods listen to her words."

She sings of the world before the gods were made, of the coming and the meeting of the Aesir, of the origin of the giants, dwarfs and men, of the happy beginning of all things, and the sad ending that shall be in

the chaos of Ragnarök. The latter part of the poem is understood to be a kind of necromancy—according to Vigfusson, “the raising of a dead völva”; but the mystical language of the whole, its abrupt transitions and terse condensations, and above all the extinct and mysterious cosmology, an acquaintance with which it presupposes, make the exact interpretation of the *Völuspá* extremely difficult. The charm and solemn beauty of the style, however, are irresistible, and we are constrained to listen and revere as if we were the auditors of some fugual music devised in honour of a primal and long-buried deity. The melodies of this earliest Icelandic verse, elaborate in their extreme and severe simplicity, are wholly rhythmical and alliterative, and return upon themselves like a solemn incantation. *Hávamál*, the Lesson of the High One, or Odin, follows next; this contains proverbs and wise saws, and a series of stories, some of them comical, told by Odin against himself. The *Vafprúðnismál*, or Lesson of Vafprúðnir, is written in the same mystical vein as *Völuspá*; in it the giant who gives his name to the poem is visited by Odin in disguise, and is questioned by him about the cosmogony and chronology of the Norse religion. *Grimnismál*, or the Sayings of The Hooded One, which is partly in prose, is a story of Odin’s imprisonment and torture by King Geirrōd. *För Skirnis*, or the Journey of Skirnir, *Harbarðslióð*, or the Lay of Hoarbeard, *Hymiskviða*, or the Song of Hymir, and *Aegisdrekka*, or the Brewing of Aegir, are poems, frequently composed as dialogue, containing legends of the gods, some of which are so ludicrous that it has been suggested that they were intentionally burlesque. *Thrymskviða*, or the Song of Thrym, possesses far more poetic interest; it recounts in language of singular force and directness how Thor lost his hammer, stolen by Thrym the giant, how the latter refused to give it up unless the goddess Freyia was given him in marriage, and how Thor, dressed in women’s raiment, personated Freyia, and, slaying Thrym, recovered his hammer. *Alvíssmál*, or the Wisdom of Allwise, is actually a philological exercise under the semblance of a dialogue between Thor and Alvis the dwarf. In *Vegtamskviða*, or the Song of Vegtam, Odin questions a völva with regard to the meaning of the sinister dreams of Balder. *Rígsmál*, or more properly *Rígspula*, records how the god Heimdall, disguised as a man called Rig, wandered by the sea-shore, where he met the original dwarf pair, Ai and Edda, to whom he gave the power of child-bearing, and thence sprung the whole race of thralls; then he went on and met with Afi and Amma, and made them the parents of the race of churls; then he proceeded until he came to Faðir and Moðir, to whom he gave Jarl, the first of free men, whom he himself brought up, teaching him to shoot and snare, and to use the sword and runes. It is much to be lamented that of this most characteristic and picturesque poem we possess only a fragment. In *Hyndluljóð*, the Lay of Hyndla, the goddess Freyia rides to question the völva Hyndla with regard to the ancestry of her young paramour Ottar; a very fine quarrel ensues between the prophetess and her visitor. With this poem, the first or wholly mythological portion of the collection closes. What follows is heroic and pseudo-historic. The *Völundarkviða*, or Song of Völundr, is engaged with the adventures of Völundr, the smith-king, during his stay with Nidud, king of Sweden. Völundr, identical with the Anglo-Saxon Wêland and the German Wieland (O.H.G. *Wiolant*), is sometimes confused with Odin, the master-smith. This poem contains the beautiful figure of Svanhvít, the swan-maiden, who stays seven winters with Völundr, and then, yearning for her fatherland, flies away home through the dark forest. *Helgakviða, Hiörvarðs sonar*, the Song of Helgi, the Son of Hiörvarð, which is largely in prose, celebrates the wooing by Helgi of Svava, who, like Atalanta, ends by loving the man with whom she has fought in battle. Two Songs of Helgi the Hunding’s Bane, *Helgakviða Hundingsbana*, open the long and very important series of lays relating to the two heroic families of the Völsungs and the Niblungs. Including the poems just mentioned, there are about twenty distinct pieces in the poetic *Edda* which deal more or less directly with this chain of stories. It is hardly necessary to give the titles of these poems here in detail, especially as they are, in their present form, manifestly only fragments of a great poetic saga, possibly the earliest coherent form of the story so universal among the Teutonic peoples. We happily possess a somewhat later prose version of this lost poem in the *Völsungasaga*, where the story is completely worked out. In many places the prose of the *Völsungasaga* follows the verse of the Eddaic fragments with the greatest precision, often making use of the very same expressions. At the same time there are poems in the *Edda* which the author of the saga does not seem to have seen. But if we compare the central portions of the myth, namely Sigurd’s conversation with Fafnir, the death of Regin, the speech of the birds and the meeting with the Valkyrje, we are struck with the extreme fidelity of the prose romancer to his poetic precursors in the *Sigurðarkviða Fafnisbana*; in passing on to the death of Sigurd, we perceive that the version in the *Völsungasaga* must be based upon a poem now entirely lost. Of the origin of the myth and its independent development in medieval Germany, this is not the place for discussion (see Nibelungenlied). Suffice to say that in no modernized or Germanized form does the legend attain such an exquisite colouring of heroic poetry as in these earliest fragments of Icelandic song. A very curious poem, in some MSS. attributed directly to Saemund, is the Song of the Sun, *Sólarlióð*, which forms a kind of appendix to the poetic *Edda*. In this the spirit of a dead father addresses his living son, and exhorts him, with maxims that resemble those of *Hávamál*, to righteousness of life. The tone of the poem is strangely confused between Christianity and Paganism, and it has been assumed to be the composition of a writer in the act of transition between the old creed and the new. It may, however, not impossibly, be altogether spurious as a poem of great antiquity, and may merely be the production of some Icelandic monk, anxious to imitate the Eddaic form and spirit. Finally *Forspjallsljóð*, or the Preamble, formerly known as the Song of Odin’s Raven, is an extremely obscure fragment, of which little is understood, although infinite scholarship has been expended on it. With this the poetic *Edda* closes.

The principal MS. of this *Edda* is the Codex Regius in the royal library at Copenhagen, written continuously, without regard to prose or verse, on 45 vellum leaves. This is that found by Bishop Brynjulf. Another valuable fragment exists in the Arne-Magnaean collection in the University of Copenhagen, consisting of four sheets, 22 leaves in all. These are the only MSS. older than the 17th century which contain a collection of the ancient mythico-heroic lays, but fragments occur in various other works, and especially in the *Edda* of Snorri. It is believed to have been written between 1260 and 1280. The poetic *Edda* was translated into English verse by Amos Cottle in 1797; the poet Gray produced a version of the *Vegtamskviða*; but the first good translation of the whole was that published by Benjamin Thorpe in 1866. An excellent edition of the Icelandic text has been prepared by Th. Möbius, but the standard of the original orthography will be found in the admirable edition of Sophus Bugge, *Norroen Fornkvaeði*, published at Christiania in 1867.

The Eddaic poems were rearranged, on a system of their own which differs entirely from that of the early MSS., by Gudbrand Vigfusson and F. York Powell, in their *Corpus poeticum boreale* (Oxford, 1883). This is a collection, not of *Edda* only but of all existing fragments of the vast lyrical literature of ancient Iceland. It supplies a prose translation.

(E. G.)

EDDIUS (Aeddi), a Kentish choirmaster, summoned by Wilfrid (*c.* 634-709), bishop of York, to help in organizing church services in Northumbria. He wrote the *Life* of his patron, and this biography of St Wilfrid is the earliest extant historical work compiled by an Anglo-Saxon author. He is a strong partisan and very credulous, but the *Vita Wilfridi* is nevertheless invaluable for the period it treats. Its date is little after the first decade of the 8th century, and it was used by Bede in compiling his *Historia*.

See Eddius, *Vita Wilfridi* (Raine, *Historians of Church of York*, London, 1879-1894), 14; Bede, *Hist. Eccl.* (Plummer, Oxford, 1896), iii. 2.

EDELINCK, GERARD (1649-1707), Flemish copper-plate engraver, was born at Antwerp. The rudiments of the art, which he was to carry to a higher pitch of excellence than it had previously reached, he acquired in his native town under the engraver Cornelisz Galle. But he was not long in reaching the limits of his master’s attainments; and then he went to Paris to improve himself under the teaching of De Poilly. This master likewise had soon done all he could to help him onwards, and Edelinck ultimately took the first rank among line engravers. His excellence was generally acknowledged; and having become known to Louis XIV. he was appointed, on the recommendation of Le Brun, teacher at the academy established at the Gobelins for the training of workers in tapestry. He was also entrusted with the execution of several important works. In 1677 he was admitted member of the Paris Academy of Painting and Sculpture. The work of this great engraver constitutes an epoch in the art. His prints number more than four hundred.

Edelinck stands above and apart from his predecessors and contemporaries in that he excelled, not in some one respect, but in all respects,—that while one engraver attained excellence in correct form, and another in rendering light and shade, and others in giving colour to their prints and the texture of surfaces, he, as supreme master of the burin, possessed and displayed all these separate qualities, in so complete a harmony that the eye is not attracted by any one of them in particular, but rests in the satisfying whole. Edelinck was the first to break through the custom of making prints square, and to execute them in the lozenge shape. Among his most famous works are a “Holy Family,” after Raphael; a “Penitent Magdalene,” after Charles le Brun; “Alexander at the Tent of Darius,” after Le Brun; a “Combat of Four Knights,” after Leonardo da Vinci; “Christ surrounded with Angels”; “St Louis praying”; and “St Charles Borromeo before a crucifix,”—the last three after Le Brun. Edelinck was especially good as an engraver of portraits, and executed prints of many of the most eminent persons of his time. Among these are those of Le Brun, Rigaud, Philippe de Champagne (which the engraver thought his best), Santeuil, La Fontaine, Colbert, John Dryden, Descartes, &c. He died at Paris in 1707. His younger brother John, and his son Nicholas, were also engravers, but did not attain to his excellence.

EDELWEISS, known botanically as *Leontopodium alpinum*, a member of the family *Compositae*, a native of the Alps of Central Europe. It is a small herb reaching about 6 in. high, with narrow white woolly leaves, and terminal flower-heads enveloped in woolly bracts. The woolly covering enables the plant to thrive in the exposed situations in which it is found, by protecting it from cold and from drying up through excessive loss of moisture. It is grown in Britain as a rock-plant.

EDEN, SIR ASHLEY (1831-1887), Anglo-Indian official and diplomatist, third son of Robert John Eden, third Lord Auckland and bishop of Bath and Wells, was born on the 13th of November 1831, and was educated at Rugby, Winchester and the East India Company’s college at Haileybury, entering the Indian civil service in 1852. In 1855 he gained distinction as assistant to the special commissioner for the suppression of the Santal rising, and in 1860 was appointed secretary to the Bengal government with an *ex officio* seat on the legislative council, a position he held for eleven years. In 1861 he negotiated, as political agent, a treaty with the raja of Sikkim. His success led to his being sent on a similar mission to Bhutan in 1863; but, being unaccompanied by any armed force, his demands were rejected and he was forced under circumstances of personal insult to come to an arrangement highly favourable to the Bhutias. The result was the repudiation of the treaty by the Indian government and the declaration of war against Bhutan. In 1871 Eden became the

first civilian governor of British Burma, which post he held until his appointment in 1877 as lieutenant-governor of Bengal. In 1878 he was made a K.C.S.I., and in 1882 resigned the lieutenant-governorship and returned to England on his appointment to the council of the secretary of state for India, of which he remained a member till his death on the 8th of July 1887. The success of his administration of Bengal was attested by the statue erected in his honour at Calcutta after his retirement.

EDEN, the name of the region in which, according to the Hebrew paradise-tradition in its present form, God planted a garden (or park), wherein he put the man whom he had formed (Gen. ii. 8). Research into primitive beliefs, guided by the comparative method, leads to the view that the "garden" was originally a celestial locality (see Paradise), and we cannot therefore be surprised if, now that paradise has been brought down to earth, the geographical details given in the Bible are rather difficult to work into a consistent picture. The fantastic geography of the (Indian) *Vishnu Purana* and the (Iranian) *Bundahish* will, in this case, be a striking parallel.

Let us now take the details of Eden as they occur. In Gen. ii. 8 we read that the garden lay "in Eden eastward," where "eastward" is generally taken to mean "in the east of the earth." This, however, seems inconsistent with Isa. xiv. 13, where the "mountain of God," which corresponds (see Ezek. xxviii. 13, 14 and the article Adam) to the "garden in Eden," is said to have been "in the uttermost parts of the north" (so R.V.). The former statement ("eastward") suits Babylonia, where Friedrich Delitzsch[1] places Eden; the latter does not. We are further told (v. 10) that "a river went out from Eden to water the garden," and that "from thence it parted itself (?), and became four heads (?)," which is commonly understood to mean that the river was so large that, soon after leaving the garden ("from thence" is all that the text says), it could still supply four considerable streams (the text says, not "streams," but "heads," *i.e.* perhaps "beginnings" or "starting-points"). In *vv.* 11-14 the names of four rivers are given, but in spite of the descriptive supplements attached to three of them, only that one which has no supplement can be identified with much probability. In fact, Pĕrāth may without any obvious difficulty be "Euphrates," except in Jer. xiii., where a more southerly stream seems indicated, but to the identification of "Hiddekel" with "Tigris" (Babylonian Diglat) the presence of the initial *Hi* in the Hebrew is an objection. Now as to "Pishon" and "Gihon." If a moderately early tradition may be trusted, the "Gihon" is another name for the "Shihor," which was either in or beside "Mizraim" (= Egypt) or Mizrim (= the North Arabian Muṣri), and indeed according to most scholars means the Nile in Jer. ii. 18, where the Septuagint substitutes for it Gēōn, *i.e.* Gihon. For "Pishon" few plausible suggestions have been made; it is not, however, a hopeless problem from the point of view which recognizes Eden in Arabia.

For details of the interesting descriptive supplements of the names Pishon, Giḥon, and Ḥiddeḳel, on which there is much difference of opinion, it must suffice to refer to the *Encyclopaedia Biblica* and Hasting's *Dictionary of the Bible*. We must, however, mention a widely held explanation of the name *Eden*. Plausible as it is to interpret this name as "delight"—indeed, the Septuagint translates in Gen. iii. 23 f. ὁ παράδεισος τῆς τρυφῆς—this cannot have been the original meaning. Hence Delitzsch (*Wo lag das Paradies?* p. 79) suggested that "Eden" might be a Hebraized form of the Babylonian *ēdinu*, "field, plain, desert." But whereas Delitzsch takes "Eden" to be the entire plain of Babylonia, Hommel thinks that it is rather the plain 924
about the sacred city of Eridu. It is the latter scholar to whom the "Arabian theory" of Paradise in its best-known form is due. The rivers (apart from Pĕrāth, "Euphrates") he locates in northern and central Arabia, the "Cush" and "Asshur" of Genesis being, according to him, central Arabia and Edom respectively (*Ancient Hebrew Traditions*, pp. 314-316; *Aufsätze u. Abhandlungen*, iii. 281-284, 335-339). These rivers, in short, become Arabian wadis, on which see Hast. *D.B.* i. 132a (foot). Cheyne, on the other hand, rejects the Babylonian explanation of Eden as = "field, plain," on the ground that "Eden" was originally regarded as a mountainous tract.

See further Driver, *Book of Genesis* (1904), pp. 57-60; *Ency. Bib.* "Paradise"; and the commentaries of Gunkel (2nd ed., 1902), and Cheyne (1907).

(T. K. C.)

1 *Wo lag das Paradies?* p. 66. A Sumerian name of Babylon was Tin-ter, "dwelling of life." Cf. Bābīlu, Bābīli, "gate of God."

EDENBRIDGE, a market town in the south-western parliamentary division of Kent, England, 26 m. S.S.E. of London, on the South-Eastern & Chatham, and the London, Brighton & South Coast railways. Pop. (1901) 2546. It is pleasantly situated on the river Eden, an affluent of the Medway, in a valley between the Ragstone Hills and the Forest Ridges. The church of St Peter and St Paul is principally Perpendicular. The town, which has considerable agricultural trade, possesses a chalybeate spring, but this is little used. Two miles from the town is Hever Castle, a beautiful moated mansion dating from the 15th and 16th centuries, but occupying the site of an earlier structure. This was rebuilt by Sir Geoffrey Boleyn, whose grandson, Sir Thomas, was father of Anne, second wife of Henry VIII., who here spent much of her life before her marriage, and was visited several times by the king. There is a chapel of her family in the fine parish church of Hever. Not far distant is the modern Chiddingstone Castle, on an ancient site. A block of sandstone in the park is called the "chiding stone," tradition asserting it to be a prehistoric seat of judgment.

EDEN HALL, LUCK OF, an old painted drinking goblet preserved at Eden Hall, Cumberland, the seat of the Musgrave family. It is of enamelled or painted glass and is believed to date from the 10th century. It is of fair size and has the letters I.H.S. on the top. Round the vase is the famous verse given below. A legend involving the fortunes of the Musgraves attaches to this cup. In the grounds of Eden Hall is a spring called St Cuthbert's Well, and the story is that one of the earliest of the Musgraves surprised the fairies feasting and making merry round the well. He snatched at the goblet from which the Fairy King was drinking and made off with it. The fairies pursued him to his castle, but failed to catch him. The Fairy King acknowledged his defeat and gave the cup as a prize to Musgrave, but warned him that the gift carried with it a condition: —

"When this cup shall break or fall.
Farewell the luck of Eden Hall."

There are variants of this legend, but substantially they agree. Possessed of the lucky cup the knight of Musgrave is said to have at once prospered in a love-suit which had till then gone against him. There is a curious poem on the cup called "The Drinking Match at Eden Hall," by Philip, duke of Wharton, a parody on the ballad of Chevy Chase. This is reprinted in full in Edward Walford's *Tales of Great Families* (1877, vol. 11), under the heading, "The witty Duke of Wharton." In Longfellow's famous poem the goblet is represented as having been broken.

EDENKOBEN, a town of Germany, in the Bavarian Palatinate, 6 m. N. from Landau, on the railway to Weissenburg. Pop. 5300. It has a Roman Catholic and a Protestant church, several high-grade schools and a sulphur-spring. Its industries comprise linen- and damask-weaving, ironworks, and the manufacture of machinery, furniture and cigars. It has also a considerable trade in wine.

EDENTATA, the name assigned by Cuvier to an order of placental mammals apparently typified by the South American anteater, but likewise including the sloths and armadillos of the same country, and the Old World aard-varks and pangolins. Only the anteaters and pangolins are absolutely without teeth (Lat. *e*, out, *dens*, tooth), and the name is strictly applicable only to those two groups; but in all the existing representatives of the order teeth are absent from the front of the jaws, while the cheek-teeth are devoid of roots and of enamel, and only very exceptionally have deciduous predecessors. Practically this is all the definition that can be given to the assemblage, which is possibly an artificial one. It may be mentioned, however, that there is not unfrequently a separate coracoid bone.

Edentates may be divided into three distinct sections or suborders, firstly the Xenarthra, or Edentata Vera, of America, secondly the Tubulidenta, represented by the African aard-varks, and thirdly the Pholidota, which includes only the pangolins common to Africa and Asia. The Xenarthra are essentially a South and Central American group, some of the members of which have effected an entrance into North America. The three families by which they are now represented are widely sundered, both as regards habits and structure; but two of them—the sloths and the anteaters—are intimately connected by means of the extinct ground-sloths. As regards the presumed relationship of the Old World to the New World types, it is noteworthy that in the early Tertiary deposits of France and Germany are found certain fossil remains apparently referable to armadillos, aard-varks and pangolins, some of the armadillos coming very close to South American forms. This assemblage of three groups of edentates in the countries fringing northern Africa is suggestive that the latter continent may have been the original home of the group, which reached South America by means of a direct land connexion.

Xenarthra.—The typical American edentates, or Xenarthra, are characterized by the circumstance that the last dorsal and all the lumbar vertebrae carry additional articular facets, or abnormal articulations (xenarthral). Teeth may be absent or present, and when developed either all similar (homaeodont) or to some extent differentiated. The bodily covering may take the form either of coarse hairs, or of bony plates, with a larger or smaller intermixture of hairs.

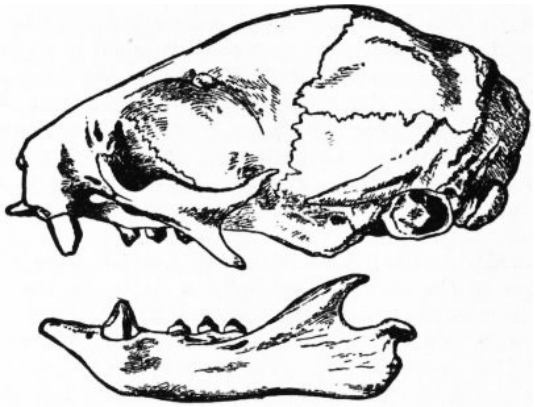


Fig. 1.—Skull of Unau or Two-toed Sloth (*Choloepus didactylus*).

Of the three existing families of this group, the first is that of the *Bradypodidae*, or sloths, characterized by the presence of five pairs of upper and four of lower teeth, the normally-formed tongue and the rudimentary tail. The species are arboreal and feed on leaves; all being confined to the forests of tropical America. Externally sloths are clothed with long coarse, crisp hair; the head is short and rounded, and the external ears inconspicuous. The teeth are subcylindrical, of persistent growth, consisting of a central axis of vasodentine, with a thin investment of hard dentine, and a thick outer coating of cement; without any succession. Fore-limbs greatly longer than the hind-limbs; the extremities terminating in narrow, curved feet; with the digits never exceeding three in number, and encased for nearly their whole length in a common integument, and armed with long, strong claws. Stomach complex. No caecum. Placenta deciduate and dome-like, composed of an aggregation of numerous discoidal lobes.

A remarkable feature connected with sloths is the development of a green colour in their hair, due to the growth of an alga. According to Dr W.G. Ridewood, in the three-toed sloth the hair is invested with a thick extra-cortical layer. “The hair has a tendency to crack in a transverse direction, and in the cracks there come to lodge unicellular algae, to which Kühn has given the name *Pleurococcus bradypi*. The moisture of the climate in which *Bradypus* lives enables the alga to live and propagate in this curious position, and the sloth acquires a general green tint which must render it very difficult to distinguish as it hangs among the green foliage.” In the two-toed sloth, on the other hand, the bulk of the hair is composed of an outer coat, or cortex, which is longitudinally fluted or grooved, the grooves being filled with strands of extra-cortex in which flourishes an alga (*Pleurococcus choloepi*) distinct from the one infesting the hairs of the three-toed species. Of quite a different type are the hairs of the extinct ground-sloths (see Mylodon), which are smooth and solid, Dr Ridewood rejecting the idea that they were originally coated with a cortex that has disappeared.

The typical genus *Bradypus* is represented by the various species of ai, or three-toed sloth, in which none of the teeth project greatly beyond the others; the first in the upper jaw is much smaller than any of the others, while the first in the lower jaw is broad and compressed, and the grinding surfaces of all are much cupped. Vertebrae: C 9, D and L 20 (of which 15 to 17 bear ribs), S 6, Ca 11. All the species present the peculiarity of possessing nine cervical vertebrae; but the ninth, and sometimes the eighth, bears a pair of short movable ribs. The fore-limbs are considerably longer than the hind-legs, and the bones of the fore-arm are complete, free and capable of pronation and supination. The fore-feet are long, very narrow, habitually curved and terminate in three pointed curved claws, in close apposition to each other; they are, in fact, incapable of being divaricated, so that the foot is reduced to the condition of a triple hook, fit only for the function of suspension from the boughs of trees. The hind-foot closely resembles the fore-foot in general structure and mode of use, and has the sole habitually turned inwards so that it cannot be applied to the ground in walking. The tongue is short and soft, and the stomach large and complex, bearing some resemblance to that of ruminants. The windpipe or trachea has the remarkable peculiarity—not unfrequent among birds and reptiles—of being folded on itself before it reaches the lungs. The two teats are pectoral in position. The premaxilla is rudimentary and loosely attached to the maxilla. Except in *B. torquatus*, there is no perforation in the lower end of the humerus. Some of the species are covered uniformly with a grey or greyish-brown coat; others have a dark collar of elongated hairs around the shoulders (*B. torquatus*); some have the hair of the face shorter than that of the rest of the head and neck; and others have a remarkable-looking patch of soft, short hair on the back between the shoulders, consisting, when best marked, of a median stripe of glossy black, bordered on each side by bright orange, yellow or white. There are also structural differences in the skulls, as in the amount of inflation of the pterygoid bones. The habits of all are apparently alike. They are natives of Guiana, Brazil and Peru, and two species (*B. infuscatus* and *B. castaneiceps*) extend north of the Isthmus of Panama as far as Nicaragua. Of the former of these a specimen in captivity uttered a shrill sound like a monkey when forcibly pulled away from the tree to which it was holding.

In the species of unau, or two-toed sloths, *Choloepus*, the front tooth in both jaws is separated by an interval from the others, and is large and caniniform, wearing to a sharp bevelled edge against the opposing tooth, the upper shutting in front of the lower when the mouth is closed, unlike true canines. Vertebrae: C 6 or 7, D 23-24, L 3, S 7-8, Ca 4-6. One species (*C. didactylus*) has the ordinary number of vertebrae in the neck; but an otherwise closely allied form (*C. hoffmanni*) has but six. The tail is very rudimentary. The fore-feet generally resemble those of *Bradypus*, but there are only two functional digits, with claws; these answering to the second and third of the typical five-toed limb. The structure of the hind-limb generally resembles that of *Bradypus*, the appellation “two-toed” referring only to the anterior limb, for in the foot the three middle toes are functionally developed and of nearly equal size. The premaxilla is well developed, and firmly attached to the maxilla; and there is always a perforation, or foramen, on the inner side of the lower end of the humerus. *C. didactylus*, which has been longest known, and is commonly called by the native

name of unau, inhabits the forests of Brazil. *C. hoffmanni* has a more northern geographical range, extending from Ecuador through Panama to Costa Rica. Its voice, which is seldom heard, is like the bleat of a sheep, and if the animal is seized it snorts violently. Both species are very variable in external coloration (see SLOTH).

The second family is that of the anteaters, *Myrmecophagidae*, distinguished from the last by the absence of teeth, the elongated tongue and the long tail. The long and slender head has a tubular mouth, with a small terminal aperture through which the worm-like tongue, covered with the sticky secretion of the enormous submaxillary salivary glands, is rapidly protruded in feeding, and withdrawn again with the adhering particles of food which are then sucked into the gullet. In the foot the third toe is greatly developed, and has a long sickle-like claw; the others are reduced or suppressed. The hind-foot has four or five subequal digits with claws. The long tail is sometimes prehensile. Placenta dome-like or discoidal. Externally the body is covered with hair. Anteaters feed exclusively on animal substances, mostly insects. One species is terrestrial, the others arboreal; none burrow in the ground. They are all inhabitants of tropical America. In the typical genus *Myrmecophaga* the skull is remarkably elongated and narrow, with its upper surface smooth and cylindriform. Anteriorly the face is produced into a long tubular rostrum, rounded above and flattened below, with terminal nostrils, and composed of the mesethmoid (ossified for more than half its length), the vomer, the maxillae, and the long and narrow nasal bones, the premaxillae being extremely short and confined to the margin of the nostrils. The zygomatic arch is incomplete, the rod-like jugal only articulating with the maxilla in front, and not reaching the short zygomatic process of the squamosal. The lachrymal foramen is in front of the margin of the orbit. There are no post-orbital processes to the frontals or any other demarcation between the orbits and the temporal fossae. Palate extremely elongated, and produced backwards as far as the level of the external auditory meatus by the meeting in the middle line of the largely developed pterygoids. The glenoid fossa for the lower jaw, a shallow oval facet, with its long diameter from before backwards. Lower jaw long and slender, with an exceedingly short symphysis, no distinct coronoid process, and a slightly elevated, elongated, flattened, condylar articular surface. Vertebrae: C 7, D 15-16, L 3-2, S 6, Ca 31. Clavicles rudimentary. In the fore-foot the first digit is very slender, the second also slender, with compressed phalanges of nearly equal length, but the third is immensely developed, though its first phalanx is extremely short, while the terminal one is so long that the entire length of the digit exceeds that of the second. The fourth has a long and rather slender metacarpal, and three phalanges diminishing in size, the terminal phalange being very small. The fifth has the metacarpal nearly as long, but not so stout as the fourth, and followed by two small phalanges, the last rudimentary and conical. Claws are developed upon all but the fifth. In walking the toes are kept bent, with their points turned upwards and inwards, the weight being supported on a pad over the end of the fifth digit, and the upper surfaces of the third and fourth digits. The hind feet are short and rather broad, with five subequal claws, the fourth rather longest, the first shortest; the whole sole is placed on the ground in walking. Body rather compressed, clothed with long, coarse hair. Tail about as long as the body, and covered with very long hair; not prehensile. Ears small, oval, erect. Eyes very small. Stomach consisting of a sub-globular, thin-walled, cardiac portion, and a muscular pyloric gizzard with dense epithelial lining. No ileocolic valve; but a short, wide, ill-defined caecum. The two teats are pectoral.

The tamandua anteaters (*Tamandua*, or *Uroleptes*), of which several species (or races) are now recognized, are smaller animals than the last, in which the head is much less elongated, the fur short and bristly, and the tail, tapering, prehensile, with the under side throughout, and the whole of the terminal portion naked and scaly. The stomach is similar to that of *Myrmecophaga*, but with the muscular pyloric gizzard less strongly developed. There is a distinct ileocolic valve and short globular caecum. The fore-foot has a very large claw on the third toe, moderate-sized claws on the second and fourth, a minute one on the first, and none on the fifth, which is entirely concealed within the skin. The hind-foot has five subequal claws. Vertebrae: C 7, D 17, L 2, S 5, Ca 37. There are very rudimentary clavicles.

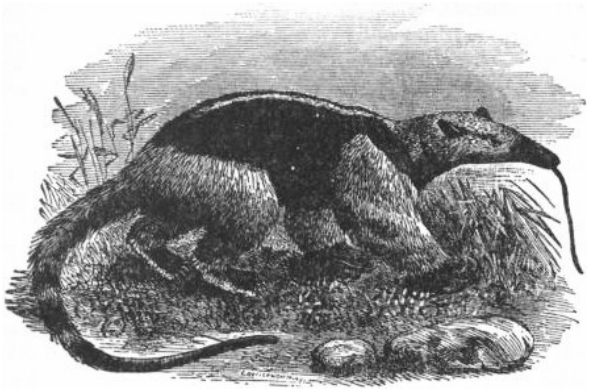


FIG. 2.—Tamandua Anteater (*Tamandua tetradactyla*).

The last representative of the family is the tiny golden-haired pigmy or two-toed anteater, *Cyclopes* (or *Cycloturus*) *didactylus*, in which the skull is much shorter even than in the preceding genus, and arched considerably in the longitudinal direction. It differs from that of the other members of the family mainly in the long canal for the posterior nostrils not being closed by bone below, as the greater part of the palatines and the pterygoids do not meet in the middle line. The lower jaw has a prominent, narrow, recurved coronoid, and a well-developed angular process, and is strongly decurved in front. Vertebrae: C 7, D 16, L 2, S 4, Ca 40. Ribs remarkably broad and flat. Clavicles well developed. Fore-foot remarkably modified, having the third digit greatly developed at the expense of all the others; it has a short stout metacarpal and but two phalanges, of which the terminal one is large, compressed, pointed and much curved, with a strong hook-like claw. The second digit has the same number of phalanges, and bears a claw, but is much more slender

than the third. The fourth is represented only by the metacarpal, and one nailless phalange, the first and fifth only by rudimentary metacarpals. The hind-foot is also modified into a climbing organ, the first toe being rudimentary and consisting of a metatarsal and one phalange concealed beneath the skin, but the other four toes subequal and much curved, with long, pointed, compressed claws. The tuberosity of the heel-bone or calcaneum is directed towards the sole, and parallel with it and extending to about double its length is a greatly elongated sesamoid ossicle. These together support a prominent cushion to which the nails are opposed in climbing. Stomach pyriform, with muscular walls, but no distinct gizzard-like portion. The commencement of the colon provided with two small caeca, narrow at the base, but rather dilated at their terminal blind ends, and communicating with the general cavity by very minute apertures. Tail longer than the body, tapering, bare on the under surface and prehensile. Fur soft and silky.

The third and last existing family of the Xenarthra is that of the armadillos, or *Dasypodidae*, in which there are at least seven pairs of teeth in each jaw, while the tongue is normal, the tail generally long, and the body covered with an armour of bony plates overlain by horny scales. All the species are terrestrial, and insectivorous or more or less omnivorous.

The union of the numerous polygonal bony shields on the back and sides forms a hard shield, usually consisting of an anterior (scapular) and posterior (pelvic) solid portion (which overhang on each side the parts of the body they respectively cover, forming chambers into which the limbs are withdrawn), and a variable number of rings between, connected by soft flexible skin so as to allow of curvature of the body. The top of the head has also a similar shield, and the tail is usually encased in bony rings or plates. The outer or exposed surfaces of the limbs are protected by irregular bony plates, not united at their margins; but the skin of the inner surface of the limbs and under side of the body is soft and more or less clothed with hair. Hairs also in many species project through apertures between the bony plates of the back. The bony plates are covered by a layer of horny epidermis. Teeth numerous, simple, of persistent growth and usually without milk predecessors. Zygomatic arch of skull complete. Cervical vertebrae with extremely short, broad and depressed bodies; the first free, but the second and third, and often several of the others united together both by their bodies and arches. Clavicles well developed. A third trochanter on the femur. Tibia and fibula united at their lower extremities. Fore-feet with strongly developed, curved claws, adapted for digging and scratching, three, four or five in number. Hind-feet plantigrade, with five toes, all provided with nails. Tongue long, pointed and extensile, though to a less degree than in the anteaters. Submaxillary glands largely developed. Stomach simple. Placenta discoidal and deciduate.

The typical genus *Dasypus*, with several others, represents the subfamily *Dasypodinae*, which usually have all five toes developed and with nails, though the first and fifth may be suppressed. The first and second are long and slender, with the normal number and relative length of phalanges, the others stout, with short broad metacarpals, and the phalanges reduced in length and generally in number by coalescence; the terminal phalange of the third being large, that of the others gradually diminishing to the fifth. *Dasypus* has the most normal form of fore-foot, but the modifications developed in all the others (culminating in *Tolypeutes*) are foreshadowed. Ears wide apart. Teats, one pair, pectoral. In *Dasypus* the teeth are $^{9}/_{10}$ or $^{8}/_{9}$, of which the first in the upper jaw is usually implanted in the premaxillary bone. The series extends posteriorly some distance behind the anterior root of the zygoma, almost level with the hind edge of the palate. The teeth are large, subcylindrical, slightly compressed, diminishing in size towards each end of the series; the anterior two in the lower jaw smaller and more compressed than the others. Cranial portion of the skull broad and depressed, facial portion triangular, broad in front and depressed. Auditory bulla completely ossified, perforated on the inner side by the carotid canal, and continued externally into an elongated bony meatus auditorius, with its aperture directed upwards and backwards. (In all the other genera of *Dasypodinae* the tympanic bone is a mere half-ring, loosely attached to the cranium.) Lower jaw with a high ascending branch, broad transversely placed condyle, and high slender coronoid process. Vertebrae: C 7, D 11-12, L 3, S 8, Ca 17-18. Head broad and flat above, with the muzzle obtusely pointed. Ears of moderate size or rather small, placed laterally far apart. Body broad and depressed. Armour with six or seven movable bands between the scapular and pelvic shields. Tail shorter than the body, tapering, covered with plates forming distinct rings near the base. Fore-feet with five toes; the first much more slender than the others, and with a smaller ungual phalange and nail; the second, though the longest, also slender. The third, fourth and fifth gradually diminishing in length, all armed with strong, slightly curved compressed claws, sloping from an elevated, rounded inner border to a sharp, outer and inferior edge. The hind-foot is rather short, and has all five toes armed with stout, compressed, slightly curved, obtusely pointed claws—the third the longest, the second nearly equal to it, the fourth the next, the first and fifth shorter and nearly equal.

To this genus belongs one of the best-known species of the group, the six-banded armadillo or encoubert (*D. sexcinctus*) of Brazil and Paraguay; a very similar species, *D. villosus*, the hairy armadillo, replacing it south of the Rio Plata. There are also two small species, *D. vellerosus* and *D. minutus*, from the Argentine Republic and North Patagonia; the latter, which differs from the other three in having no tooth implanted in the premaxillary bone and is often referred to a genus apart, as *Zäedius*.

In *Tatoua* (*Cabassous* or *Lysiurus*) the teeth are $^{9}/_{9}$ or $^{8}/_{8}$, of moderate size and subcylindrical: the most posterior placed a little way behind the anterior root of the zygoma, but far from the hinder margin of the palate. Skull somewhat elongated, much constricted behind the orbits, and immediately in front of the constriction considerably dilated. Lower jaw slender, with the coronoid process small and sharp pointed, sometimes obsolete. Vertebrae: C 7, D 12-13, L 5, S 10, Ca 18. Head broad behind. Ears rather large and rounded, wide apart. Movable bands of armour 12-13. Tail considerably shorter than the body, and slender, covered with nearly naked skin, with a few small, scattered, bony plates, chiefly on the under surface and near the apex. On the fore-feet the first and second toes are long and slender, with small claws and the normal number of phalanges. The other toes have but two phalanges; the third has an immense sickle-like claw; the fourth and fifth similar but smaller claws. The hind-feet are comparatively small, with five toes, and small, triangular, blunt nails; the third longest, the first shortest. The best-known species of this genus, the tatouay or cabassou, *T. unicinctus*, is, after *Priodon gigas*, the largest of the group. It is found, though

not abundantly, in Surinam, Brazil and Paraguay. Others, such as *T. hispidus* and *T. lugubris*, have been described.

In the giant armadillo (*Priodon gigas*) the teeth are variable in number, and generally differ on the two sides of each jaw, being usually from 20 to 25 on each side above and below, so that as many as a hundred may be present altogether; but as life advances the anterior teeth fall out, and all traces of their sockets disappear. The series extends as far back as the hinder edge of the anterior root of the zygoma. They are all very small, in the anterior half of each series strongly compressed, with flat sides and a straight free edge, but posteriorly more cylindrical, with flat, truncated, free surfaces. Vertebrae: C 7, D 12, L 3, S 10, Ca 23. Head small, elongated, conical. Ears moderate, ovate. Armour with 12-13 movable bands. Tail nearly equal to the body in length, gradually tapering, closely covered with quadrangular scales, arranged in a quincunx pattern. Fore-feet with five toes, formed on the same plan as those of *Tatoua*, but with the claw of the third of still greater size, and that of the others, especially the fifth, proportionally reduced. Hind-foot short and rounded, with five very short toes, and short, broad, flat obtuse nails. The giant armadillo is by far the largest existing member of the family, measuring rather more than 3 ft. from the tip of the nose to the root of the tail, the tail being about 20 in. long. It inhabits the forest of Surinam and Brazil. The powerful claws of its fore-feet enable it to dig with great facility; and its food consists chiefly of termites and other insects, although it is said to attack and uproot newly-made graves for the purpose of devouring the flesh of the bodies contained in them.

The apar (*Tolypeutes tricinctus*) typifies a genus in which the teeth are $\frac{0}{9}$ or $\frac{0}{8}$, and are rather large in proportion to the size of the skull, with the hinder end of the series reaching nearly to the posterior margin of the palate. Vertebrae: C 7, D 11, L 3, S 12, Ca 13. Ears placed low on the sides of the head, rather large, broadly ovate. Armour with its scapular and pelvic shields very free at the sides of the body, forming large chambers into which the limbs can be readily withdrawn, and only three movable bands. Tail short, conical, covered with large bony tubercles. The fore-feet formed on the same type as in the last genus, but the peculiarities carried to a still greater extent. The claw of the third toe is very long, while those of the first and fifth are greatly reduced and sometimes wanting. On the hind-foot the three middle toes have broad, flat, subequal nails, forming together a kind of tripartite hoof; the first and fifth much shorter, with more compressed nails.

The armadillos of this genus have the power of rolling themselves up into a ball, the shield on the top of the head and the tuberculated dorsal surface of the tail exactly fitting into and filling up the apertures left by the notches at either end of the body-armour. This appears to be their usual means of defence when frightened or surprised, as they do not burrow like the other species. They run very quickly, with a very peculiar gait, only the tips of the claws of the fore-feet touching the ground. In addition to the apar, there are the Argentine and Bolivian *T. conurus*, and *T. muriei* from Argentina or Patagonia.

The last group of existing armadillos forms the genus *Tatusia* and the subfamily *Tatusiinae*; the subfamily rank being based on the fact that of the seven or eight pairs of small subcylindrical teeth, all but the last, which is considerably smaller than the rest, are preceded by milk-teeth not changed until the animal has nearly attained full size. Vertebrae: C 7, D 9-11, L 5, S 8, Ca 20-27. Head narrow, with a long, narrow, subcylindrical obliquely truncated snout. Ears rather large, ovate and erect, placed close together on the occiput. Armour with seven to nine distinct movable bands. Body generally elongated and narrow. Tail moderate, or long, gradually tapering; its plates forming distinct rings for the greater part of its length. Fore-feet with four visible toes, and a concealed clawless rudiment of the fifth; the claws long, slightly curved, and slender, the third and fourth subequal and alike, the first and fourth much shorter. Hind-feet with five toes, armed with strong, slightly curved, conical, obtusely pointed nails, and the third longest, then the second and fourth, and the first and fifth much shorter than the others. This genus differs from all the other armadillos in having a pair of inguinal teats in addition to the usual pectoral pair, and in producing a large number (4 to 10) of young at a birth, all the others having usually but one or two. The peba armadillo, *T. septemcincta*, is a well-known species, having an extensive range from Texas to Paraguay. It is replaced in the more southern regions of South America by a smaller species, with shorter tail, the mulita (*T. hybrida*) so called from the resemblance of its head and ears to those of a mule. *T. kappleri* is a large species from Guiana.

Finally we have the pichiciago, or fairy armadillo, *Chlamydophorus truncatus*, typifying the subfamily *Chlamydophorinae*. In most anatomical characters, especially the structure of the fore-foot, this group resembles the *Dasypodinae*, but it differs remarkably from all other known armadillos, living or extinct, in the peculiar modification of the armour.

The teeth, which number $\frac{0}{8\text{-}9}$, are subcylindrical, somewhat compressed, moderate in size, and smaller at each end (especially in front) than at the middle of the series. Skull broad and rounded behind, pointed in front. Muzzle subcylindrical and depressed. A conspicuous rounded rough prominence on the frontal bone, just before each orbit. Tympanic prolonged into a tubular auditory meatus, curving upwards round the base of the zygoma. Vertebrae: C 7, D 11, L 3, S 10, Ca 15. Upper part of head and trunk covered with four-sided horny plates (with small thin ossifications beneath), forming a shield, free and overhanging the sides of the trunk, and attached only along the middle line of the back. The plates are arranged in a series of distinct transverse bands, about twenty in number between the occiput and the posterior truncated end, and not divided into solid scapular and pelvic shields with movable bands between. The hinder end of the body is abruptly truncated and covered by a vertically placed, strong, solid, bony shield, of an oval (transversely extended) form, covered by thin horny plates. This shield is firmly welded by five bony processes to the hinder part of the pelvis. Through a notch in the middle of its lower border the tail passes out. The latter is rather short, cylindrical in its proximal half, and expanded and depressed or spatulate in its terminal portion, and covered with horny plates. The dorsal surfaces of the fore and hind-feet are also covered with horny plates. The remainder of the limbs and under surface and sides of the body beneath the overlapping lateral parts of the back shield are clothed with rather long, soft silky hair. Eyes and ears very small, and concealed by the hair. Extremities short. Feet large, each with five well-developed claws, those on the fore-

feet very long, stout and subcompressed, the structure of the digits being essentially the same as those of *Tatoua* and *Priodon*. Teats two, pectoral. Visceral anatomy closely resembling that of *Dasypus*, the caecum being broad, short and bifid. The pichiciago, a burrowing animal, about 5 in. long, inhabits the sandy plains of western Argentina, especially the vicinity of Mendoza. Its horny covering is pinkish, and its silky hair white. A second species, *C. retusus*, from Bolivia is rather larger and has the dorsal shield attached to the skin of the back as far as its edge, instead of only along the median line. (See Armadillo.)

Tubulidentata.—The second suborder of edentates, namely the Tubulidentata, is represented at the present day only by the aard-varks, or ant-bears, of Africa, constituting the family *Orycteropodidae* and the genus *Orycteropus*. Together with the following group, they differ from the Xenarthra in the absence of additional articular facets to the lumbar vertebrae; for which reason the term Nomarthra has been proposed for the Tubulidentata and Pholidota as collectively distinct from the Xenarthra. In the present group the external surface is scantily covered with bristle-like hairs. The teeth are numerous, and traversed by a number of parallel vertical pulp-canals. Femur with a third trochanter. Fore-feet without the first toe, but all the other digits well developed, with strong moderate-sized nails, suited to digging, the plantar surfaces of which rest on the ground in walking. Hind-feet with five subequal toes. Placenta broadly zonular. The brain is very like that of the Ungulata; and there are two pairs of teats, one abdominal, and the other inguinal. Aard-varks feed on animal substances; and are terrestrial and fossorial in habits. The total number of teeth is from eight to ten in each side of the upper, and eight in the lower jaw; but they are never all in place at one time, as the small anterior ones are shed before the series is completed behind. In the adult they number usually five on each side above and below, of which the first two are simple and compressed, the next two larger and longitudinally grooved at the sides, the most posterior simple and cylindrical. Their summits are rounded before they are worn; their bases do not taper to a root, but are evenly truncated and continually growing. Each tooth is made up of an aggregation of parallel dental systems, having a slender pulp cavity in the centre, from which the dentinal tubes radiate outwards, and being closely packed together each system assumes a polygonal outline as seen in transverse section. A series of milk-teeth is developed. Skull moderately elongated with the facial portion subcylindrical and slightly tapering, and the zygoma complete and slender. The palate ends posteriorly in the thickened transverse border of the palatines, and is not continued back by the pterygoids. The tympanic is annular, and not welded to the surrounding bones. The lower jaw is slender anteriorly, but rises high posteriorly, with a slender recurved coronoid, and an ascending pointed process on the hinder edge below the condyle, which is small, oval, and looks forward as much as upwards. Vertebrae: C 7, D 13, L 8, S 6, Ca 25. The large number of lumbar vertebrae is peculiar among Edentates. The tongue is less worm-like than in *Myrmecophaga*, being thick and fleshy at the base and gradually tapering to the apex. The salivary apparatus is developed much in the same manner as in that genus, but the duct of the submaxillary gland has no reservoir. The stomach consists of a large subglobular cardaic portion, with a thick, soft, and corrugated lining membrane, and a smaller muscular, pyloric part, with a comparatively thin and smooth lining. There is a distinct ileocaecal valve and a considerable sized caecum; also a gall-bladder. Head elongated, with a tubular snout, terminal nostrils and small mouth-opening. Ears large, pointed, erect. Tall nearly as long as the body, cylindrical, thick at the base, tapering to the extremity.

According to the researches of Dr E. Lönnberg, the teeth of the aard-varks correspond only to the roots of those of other mammals, the crowns being unrepresented, except to a very small degree when the teeth first cut the gum. This explanation renders the peculiar internal structure of these teeth much less difficult to understand than if they represented both crown and root. In Dr Lönnberg’s opinion, the teeth indicate the descent of the aard-vark from an ungulate stock,—a view in harmony with the evidence of the brain. If this idea prove well founded, and if the aard-varks are rightly classed with the Edentata, the whole order must apparently be regarded as an offshoot from primitive Ungulata. The fact of the frequent distinctness of the coracoid bone requires, however, explanation in connexion with such a descent (see Aard-Vark).

Pholidota.—The Pholidota, constituting the third and last group of the Edentata, are represented by the pangolins, or scaly anteaters, of Asia and Africa, all of which are included in the family *Manidae* and the genus *Manis*. Pangolins differ from all other mammals by the armour of overlapping horny scales (often with hairs growing between them) which invests the whole animal, with the exception of the under surface of the body, and sometimes a small patch near the tip of the under side of the tail. There are no teeth; and although the tongue is long and worm-like, it is not extensile. The scaphoid and lunar bones of the carpus are united. The uterus is bicornuate, and the placenta diffused and non-deciduate. The skull has somewhat the form of an elongated cone, with the small end turned forwards, and is smooth and free from crests and ridges. No distinction between the orbits and temporal fossae. The zygomatic arch usually incomplete, owing to the absence of the jugal bone; no distinct lacrymal bone; and the palate long and narrow. The pterygoids extend backwards as far as the tympanics, but do not meet in the middle line below. Tympanic welded to the surrounding bones, and more or less bladder-like, but not produced into a tubular auditory meatus. Two halves of lower jaw very slender and straight, without any angle or coronoid process, on the anterior extremity of the upper edge a sharp, conical, tooth-like process projecting upwards and outwards. No clavicles. No third trochanter to the femur. Terminal phalanges cleft at the tip. Caudal vertebrae with very long transverse processes and numerous chevron-bones. Stomach with thick muscular walls and lining membrane, and a special gland near the middle of the great curvature, consisting of a mass of complex secreting follicles, the ducts of which terminate in a common orifice. No caecum, but a gall-bladder. Head small, depressed, narrow, and pointed in front, with a very small mouth-opening. Eyes and ears very small. Body elongated, narrow. Tail more or less elongated, convex above, flat underneath. Limbs short, and in walking the surface and outer sides of the phalanges of the two outer digits of the front feet alone rest on the ground, with the points of the nails turning upwards and inwards. The third toe the longest, with a powerful compressed curved claw, the second and fourth with similar but smaller claws, but that of the first toe often almost rudimentary. Hind-feet plantigrade with the first toe very short, and the four other toes subequal, and carrying moderate, curved, compressed nails. Pangolins are of small or moderate size, terrestrial and burrowing, and feed mainly on termites or white ants; some of the species being more or less arboreal. They can roll themselves up in a ball when in danger. Their peculiar elongated form, short limbs,

long tapering tail, and scaly covering give them on a superficial inspection more the appearance of reptiles than of mammals. The species are not numerous and may be divided into two sections, one comprising the Asiatic species, such as *M. javanica*, *M. aurita* of China, and the Indian *M. pentadactyla*, and the other the African, as represented by the large *M. gigantea*, *M. temminchi*, the long-tailed *M. macrura*, and the small arboreal *M. tricuspis*. In the Asiatic group the middle series of scales continues to the tip of the tail; but in the African forms this row splits into two a few inches from the tail-tip. The latter have also no hairs between the scales and no external ears. The climbing species have a small bare patch on the under side of the tail near the tip (see Pangolin).

Extinct Edentates.

Beyond remains of species closely allied to or identical with the existing forms, the sloths and anteaters appear to be unknown in a fossil state. On the other hand the extinct family of ground sloths, or *Megatheriidae*, which includes the largest of all edentates, is an exceedingly large one, and extends in South America from the Miocene to the Pleistocene, and was also represented during the latter epoch in North America. It serves to connect the *Bradypodidae* with *Myrmecophagidae*. The alleged occurrence of an allied form in Madagascar is somewhat doubtful (see Megatherium and Mylodon).

Of *Dasypodidae* numerous representatives occur in the South American Tertiaries. From the higher beds many of the species are referable to existing genera, such as *Dasypus* and *Tatusia*, although some are much larger than any living forms, the skull in one case being nearly a foot in length. In other instances, when lower formations are reached, the genera are also distinct, *Eutatus* having the whole armour divided into movable bands, and the allied *Stegotherium* representing the group in the Santa Cruz formation of Patagonia. Even in the Argentine Pleistocene there is an extinct genus, *Chlamydotherium*, represented by a species of the size of a rhinoceros, with grooved teeth approximating to those of the glyptodonts. The latter represent a family (*Glyptodontidae*) by themselves, and typically may be described as giant solid-shelled armadillos, although some of their smaller Santa Cruz representatives (*Propalaeohoplophorus*) approximate in some degree to true armadillos (see Glyptodon).

A very remarkable Santa Cruz armadillo, *Peltephilus*, has an altogether peculiar type of head-shield, developed into horns in front of the eyes; and, what is still more noteworthy, teeth in the front of the jaws, thereby rendering the ordinary definition of the order Edentata incorrect. It has been made the type of a distinct family, *Peltephilidae*.

The past history of the armadillo group does not, however, by any means end here. True armadillos, it should be observed, are known in North America as far north as Texas, from the Pleistocene onwards; but in formations of middle Tertiary age are unrepresented. Recent discoveries apparently indicate, however, the occurrence of armadillos of a primitive type in the lower Tertiary or Eocene formations of Wyoming. The first evidence of these Eocene armadillos was afforded by portions of the jaws, which, together with a leg-bone of a totally different animal, were believed to indicate creatures nearly allied to the aye-aye (*Chiromys*) of Madagascar, and for which the name *Metachiromys* was consequently proposed. According to modern usage, this name, in spite of its inappropriate nature, is retained for the armadillos, although in the writer's opinion it ought to be replaced. According to Professor H.F. Osborn, by whom their remains have been described, the North American fossil armadillos were closely related to the existing members of the group, from which they differ chiefly by the armour, or shield, having probably been formed of tough leathery skin instead of bony plates, by the presence of a single pair of large enamel-capped tusk-like teeth in each jaw, and by the degeneration of the other teeth. If these determinations are trustworthy, the question arises whether we should regard the armadillos of South America as the descendants of North American forms which migrated southwards before that separation of the two continents was established, which lasted for a large portion of the Tertiary period, or whether a migration took place at the same early epoch in the opposite direction.

More interesting still is the occurrence of remains of reputed armadillos (*Necrodasypus*) from the Oligocene of France and Germany. In the opinion of Dr F. Ameghino these Oligocene armadillos, which had bony shields on both the head and body, were near akin to some of the modern South American forms.

Passing on to the aard-varks (*Orycteropodidae*), we find these represented by a species closely allied to the existing ones in the Lower Pliocene formations of Spain, France, Hungary, Samos and Asia Minor. A single tibia from the French Oligocene is identified by Dr Ameghino with the present family, and the genus *Archaeorycteropus* established for its reception; this genus, in its founder's opinion, being also represented in the Santa Cruz beds of Patagonia. As regards the pangolins, the only fossils referred to this group (apart from a few discovered in a cave in India) appear to be certain limb-bones from the Oligocene of France and Germany, for which the names *Necromanis* and *Teutomanis* have been proposed. The occurrence of the characteristic cleft terminal toe-bones among these remains seems to leave little doubt as to the correctness of the determination.

The alleged occurrence of remains of giant pangolins in the upper Tertiary of Europe is due to misidentification (see Ancylopoda). By some authorities the Eocene group of Ganodonta has been affiliated to the Edentata, but this reference is not accepted by Prof. W.B. Scott.

Authorities.—The above article is to some extent based on the articles by Sir W.H. Flower in the 9th edition of this work. See also O. Thomas, "A Milk-dentition in *Orycteropus*," *Proc. Royal Soc.* vol. xlvii. (1890); R. Lydekker, "The Extinct Edentates of Argentina," *Palaeont. Argentina*, vol. iii., An. Mus. (La Plata, 1894); C.W. Andrews, "On a Skull of *Orycteropus gaudryi* from Samos," *Proc. Zool. Soc. London* (1896); G.E. Smith, "The Brain in the Edentata," *Trans. Linn. Soc. London*, vol. vii. (1899); W.B. Scott, "Mammalia of the Santa Cruz Beds—*Dasypoda*," *Rep. Princeton Exped. to Patagonia*, vol. v. (1903); H.F. Osborn, "An Armadillo from the Middle Eocene of North America," *Bull. Amer. Mus.* vol. xx. art. 12 (1904); J.A. Allen, "The Tamandua Anteaters," *T.C.*, art. 33 (1904); F. Ameghino, "Les Édentes fossiles de France et d'Allemagne," *Ann. Mus. Buenos Aires*, vol. xiii. (1905); E. Lönnberg, "On a new *Orycteropus*," and "Remarks on the

dentition of the Tubulidentata," *Archiv für Zoologie*, vol. iii. No. 3 (1906).

(R. L.*)

EDENTON, a town and the county-seat of Chowan county, North Carolina, U.S.A., on Edenton Bay, an estuary of Albemarle sound, near the mouth of Chowan river, in the N.E. part of the state. Pop. (1890) 2205; (1900) 3046 (2090 negroes); (1910) 2789. It is served by the Norfolk & Southern railway, and by the Albemarle Steam Navigation Co. In 1907 the former projected a great bridge across Albemarle sound near the city. Edenton is an old and interesting town, has a number of fine old homesteads, and has broad and well-shaded streets. Lumbering and the shad and herring fisheries are the most important industrial interests, and the town is a shipping point for fish, truck and other farm products, cotton and peanuts. There is a Fish Cultural Station here, established by the Federal government. The court-house was built about 1750.

Edenton was settled about 1658, and was for some time known as the "Towne on Queen Anne's Creek" or the "Port of Roanoke"; in 1722 the present name was adopted in honour of Governor Charles Eden (1673-1722), whose grave is in St Paul's churchyard here. Throughout the 18th century Edenton was a place of considerable social and political importance; the legislative assembly of North Carolina met here occasionally, and here lived the royal governors and various well-known citizens of the province, among them: Joseph Hewes (1730-1779), a signer of the Declaration of Independence; James Iredell, Sr. (1750-1799), a Federalist leader and after 1790 a justice of the United States Supreme Court, and his son James Iredell, Jr. (1788-1853), a prominent lawyer, for many years a member of the state legislature, governor of North Carolina in 1827-1828, and a member of the United States Senate in 1828-1831. Near Edenton lived Samuel Johnston (1733-1816), a prominent leader of the American Whigs preceding and during the War of American Independence, a member of the Continental Congress in 1780-1782, governor of North Carolina in 1787-1789, and a Federalist member of the United States Senate in 1790-1793. In 1907 the Hewes, Iredell and Johnston homesteads were still standing. In a house facing the court-house green the famous "Edenton Tea Party" of fifty-one ladies met on the 24th of October 1774 and signed resolutions that they would not conform "to that Pernicious Custom of Drinking Tea" and would not "promote the wear of any manufacture from England" until the tax on tea should be repealed. Near Edenton the Confederate ram "Albemarle," on emerging from the Roanoke river, was met by the Union "double-enders," "Sassacus," "Mattabesett," and "Miami," on the 5th of May 1864; the battle, which resulted in favour of the Confederates, was a duel between the Confederate ironclad and the Union wooden side-wheeler, the "Sassacus," which rammed the "Albemarle" and had her bows, fitted with a three-ton bronze beak, twisted off and carried away.

EDESSA (mod. *Vodena*), the ancient capital of Macedonia, previously known as Aegae, situated 46 m. W. of Thessalonica on the banks of a beautiful stream in the very centre of the kingdom, and at the head of a defile commanding the approaches from the coast to the interior. It was the original residence of the Macedonian kings; and even after the seat of government was removed by Philip II. to the more accessible Pella, it continued to be the burial-place of the royal family. At the celebration of his daughter's marriage here, Philip II. was murdered by Pausanias in 336 B.C. His son Alexander was buried at Memphis through the contrivance of Ptolemy; but the bodies of his granddaughter Eurydice and her husband Arrhidaeus were removed by Cassander to the ancestral sepulchre. On the occupation of the town by Pyrrhus the royal tombs were plundered by the Gallic mercenaries. Owing to its position commanding the Via Egnatia, the town retained its importance during the Roman and Byzantine periods. For its present condition, see VODENA.

EDESSA, the Greek name of an ancient city of N.W. Mesopotamia (in 37° 21′ N. lat. and 39° 6′ E. long.), suggested perhaps by a comparison of its site, or its water supply,[1] with that of its Macedonian namesake. It still bears its earlier name, modified since the 15th century (by the Turks?) to Urfa.

The oldest certain form is the Aramaic *Urhāi* ("Western" pronunciation *Urhōi*), which appears in Greek as an adjective as Ὀρροηνή[2], -νοί[3] (perhaps also as a fortress with spring, as Ὄρρά),[4] and in Latin as Orr(*h*)ei,[5] and (in the inscription on Abgar's grave) *Orrhenoru*(*m*).[6] The Syriac Chronicle ascribed to Dionysius of Tell-maḥrē derives the name from a first king Urhāi, son of Hewyā, whom Procopius (*De bello persico*, i. 17) calls Osroes (cf. below), connected by Bayer[7] with Chosroes,[8] from which G. Hoffmann would also derive the Syriac Urhāi (*Z.D.M.G.* xxxii. 742). The Syriac town name has, however, the form of an ethnic, and we may therefore with Duval leave it unexplained (*Hist.* 22). The fact that the Arabic name is Ruhä supports the hint of the Graeco-Latin forms that there was a vowel between the R and the H. There is little plausibility in the suggestion of Assemani and others that Ruhā comes from ροη of Callirrhoe. A gentilic of the form Ru-u-ai occurs in a letter (of an Assyrian king?) to chiefs in a (Babylonian?) town as the designation of three captives (Harper, *Ass. and Bab. Letters*, No. 287 [= K 94], line 6; cf. Bezold, *Die Achämenideninschriften*, p. xii.), who have Semitic names; and Ru-'-u-a is the name of an Aramaic people mentioned with other Aramaeans by Tiglath-pileser IV., Sargon and Sennacherib. It is not impossible that some such people may have settled at

Urhāi and given it their name, although the Ru-'-u-a are always mentioned in connexions that imply seats near the Persian Gulf.[9] The district name Osroēnē for Ὀρροηνή, is Greek, perhaps due to analogy of Chosroes. It occurs but rarely in Syriac (Uzroina); *e.g.* Chronicle of Edessa. § 35;[10] elsewhere Bēth-Urhāyē (*e.g.* Cureton, *Spicileg. Syr.* 20). In the time of Tiglath-pileser I. (*c.* 1100 B.C.) the name seems to have been "District of (not Edessa, but) Ḥarrān" (Annals, vi. 71). The Arabs pronounced the name er-Ruhā (see above), and that form prevailed till it gave place to Urfa in the 15th century.

The Greek name Edessa appears in the Jerusalem Targum to Gen. x. 10 as Hădas (הדס, myrtle); it has been proposed (cf. Duval, *Hist. d'Édesse*, 23) to derive Edessa from Aram. הדת, as though = Carthage, New Town; but Syriac writers, when they occasionally [11] use the name (Edessa, אדסא; so Yāqūt, Adāsā), show no suspicion of its being Semitic. According to Pliny, v. 86, Edessa was also called Antioch, and coins of Antiochus IV. Epiphanes with the legend "Antioch on the Callirrhoe" may imply that he rebuilt and renamed the place (so Ed. Meyer in Pauly-Wissowa, *Realencyclopädie*, col. 1933, 66; otherwise Duval, *Hist.* 23; cf. art. Osroene). Pliny indeed seems to call the city itself Callirrhoe, and S. Funk finds it so named in the Talmud (*Bab. Mez.*, 18a רעל רכם נהרא שויר מתא: *Die Juden in Babylonien 200-500*, ii. 148; 1908); but K. Regling (*Klio*, i. 459 n. 1) may be right in his emendation which applies the title in Pliny to the sacred spring.

History: Pre-Hellenistic.—Until excavation gives us more definite data we can only infer from its position on one of the main thoroughfares between the Mediterranean and the East (see Mesopotamia) that Urhāi-Edessa, possibly bearing some other name, was already a town of some importance in the early Babylonian-Assyrian age. Whatever may have been the ethnographical type of the early inhabitants, it must by the beginning of the second last millennium B.C. have included Hittites in the large sense of the term, probably Aryans, and certainly Semites of some of the types characteristic of early Assyrian history. Most probably its people belonged to the domain of the then more famous Ḥarrān-Carrhae, between which and Samosata (on the Euphrates) Urhāi lies midway (some 25-30 m. distant from each) in the district watered by the Balīh. Although at Edessa itself no cuneiform documents have yet been found, a little more than four hours journey eastwards, at Anaz (= Gullāb?) = Dūr of Tiglath-pileser IV. was found in 1901 a slab with a bas-relief and an inscription; and 15-20 min. W. of Eski-Ḥarrān, in 1906 a very interesting 6th-century Assyrian inscription (see Mesopotamia).

In the later Assyrian empire the population was largely Aramaic-speaking; but S. Schiffer's theory (Beiheft I. zur *Orientalistischen Litteratur-Zeitung*) finds contemporary evidence of Israelites settled in the neighbourhood of Edessa in the second half of the 7th century B.C. At the fall of Nineveh many towns in Mesopotamia suffered severely at the hands of the Medes. The period remains dark, notwithstanding the obscure light that has been thrown on it lately (Pognon, *Inscriptions*). When Aramaic began to take the place of Assyrian in written documents is not known; but just across the Euphrates the change had occurred as early as the 8th century B.C. (Zengīrli, Hamath; see also Pognon). Certain it is that the earliest documents that have survived in Syriac, or Edessene Aramaic, do not represent an experimental stage. Moreover, although the Syriac of the Story of Aḥīqār is of a late type, the sources of the story, traces of which are to be found in the Hebrew Tobit (*q.v.*), go back to the pre-Hellenistic period.

Graeco-Roman Times.—According to a credible tradition found in Eusebius (*Excerpta*, 179), the Syriac Chronicle ascribed to Dionysius of Tell-maḥrē (Tullberg, 61), and elsewhere, Urhāi was renovated, like other Mesopotamian sites, in 304 B.C. by Seleucus I. Nicator, who gave it its Greek name.[12] It would share in the Hellenistic culture of Syria, although the language of the common people would continue to be Aramaic (E.R. Bevan, *House of Seleucus*, i. 227 f. with reff.). With the decay of the Seleucid power, weakened by Rome and Parthia, the old influx from the desert would recommence, and an Arabic element begin to show. Von Gutschmid (*Untersuch.*, cf. Duval, ch. iii. end) argues plausibly that it was in 132 B.C., in the reign of Antiochus VII. Sidetes, that Edessa became the seat of a dynasty of some thirty local kings, whose succession has been preserved in native sources. The name of the first king, however, appears in different forms (cf. above), and one (Osroës-Orhai) is so like that of the town that Ed. Meyer suspects the historicity of the first reign, of five years. The names of the other kings—Abgar, Ma'nu, Bekr, &c.—are for the most part Arabic, as the people (in whose inscriptions the same mixture of names occurs) are called by classical authors; but the rulers, among whom an occasional Iranian name betrays the influence of the dominant Parthians,[13] would hardly maintain their distinctness from the Aramaic populace. This state which lasted for three centuries and a half, naturally varied in extent.[14] Bounded on the W. and the N. by the Euphrates, it reached at its widest as far as the Tigris. At such times, therefore, it included such towns as Ḥarrān (Carrhae), Nisibis, Sarūg, Zeugma-Birejik, Resaena, Singara, Tigranocerta, Samosāta, Melitene. Its position "on the dangerous verge of two contending empires," Parthia and Rome, determined its changeful fortunes. 931
Parthian predominance yielded for a time to Armenian (Tigranes, 88-86 B.C.). Then, at the time of the expeditions of Lucullus, Pompey and Crassus, Edessa was an ally of Rome, though Abgar II. Ariamnes (68-53) played an ambiguous part. In A.D. 114 Abgar VII. entertained Trajan on his way back to Syria (Dio Cass. xviii. 21); but in 116, in consequence of a general rising, his consul L. Quietus sacked the city, Abgar perhaps dying in the flames, and made the state tributary. Hadrian, however, abandoning Trajan's forward policy in favour of a Euphrates boundary, restored it as a dependency of Rome. When L. Verus (163-165) recovered Mesopotamia from Parthia, it was not Edessa but Ḥarrān that was chosen as the site of a Roman colony, and made the metropolis by Marcus Aurelius (172).

To one of the native kings doubtless is to be ascribed the Syriac inscription[15] on one of the pair of pillars, 50 ft. high, which stood, no doubt, in front of a temple connected with some local cult. Trustworthy data for determining its nature are lacking. One or both of the pools below the citadel containing sacred fish may have been sacred to Atargatis (*q.v.*), an Ishtar-Venus deity; and according to the *Doctrine of Addai*, alongside of Venus were worshipped the sun and the moon.[16] Nergal and Sin were known as "twins," and connected with the sign Gemini, under the name *ellamme*, "the youths" (cf. Zimmern, *K.A.T.* 363). This makes more plausible than it otherwise would be the suggestion of J. Rendel Harris that the great twin pillars were connected with the cult of the Dioscuri, and that in the Acts of Thomas is to be seen a later attempt to substitute other "twins," viz. Jesus and Judas-Thomas (Addai), whom legend buried "in Britio Edessenorum" (explained by Harnack as the Edessan citadel: Aram. *birtha*).[17]

Whether it was at Edessa that a Jewish translation of the Old Testament into Syriac was made,[18] under the encouragement perhaps of the favour of the royal house of Adiabene (Josephus, *Bell. Jud.* ii. 19. 4), or whether that work was done *in* Adiabene,[19] cannot be discussed here. That the translation did not share the fate of the other non-Christian Syriac writings, which did not survive the 13th century (see Syriac Literature), is due to the fact that it was adopted (after being revised) by the Christians, and thus rescued. Although the beginnings of Christianity at Edessa are enshrouded in the mists of legend, and the first mention of Christian communities in Osrhoëne and the towns there is connected with the part they played in the paschal controversy (*c.* A.D. 192), it has been reasonably urged that the legends imply a fact, namely that Christianity began in the Jewish colony, perhaps by the middle of the 2nd century, although the earliest seat of the Syrian church may have been farther east, in Adiabene.[20] Parts of the New Testament were certainly translated into Syriac in the 2nd century, although whether the "Old Syriac" (so *e.g.* Hjelt) or the Diatessaron (so Burkitt) came first is uncertain. About the end of the 2nd century Edessene Christianity seems to have made a fresh beginning: the ordination of Palūṭ by Serapion of Antioch may mean that things ecclesiastical took a westward trend, and it is possible (so Burkitt) that the "Old Syriac" New Testament version was now introduced. A strong man offered himself in Bardaiṣān (*q.v.*; Bardesanes), to whom perhaps we owe the finest Syriac poem extant, the "Hymn of the Soul," though orthodoxy rejected him. He was a contemporary of Abgar IX., at whose court Julius Africanus stayed for a while. A Syrian official record from this reign, preserved in the *Edessene Chronicle*, gives a somewhat detailed account of a violent flood (autumn, 201) of the Daiṣān river which did much damage, destroying amongst other things "the palace of Abgar the Great," rebuilt as a summer palace by Abgar IX., and "the temple of the church of the Christians." The form of this last statement shows that at the time of writing (206) the rulers had not adopted Christianity themselves. Abgar IX. is now commonly supposed to be the ruler to whom the famous legend was first attached (see Abgar); but though he visited Rome there is no proof that he ever became a Christian (Gomperz, in *Archäologisch-epigraphische Mitteilungen aus Österreich-Ungarn*, xix. 154-157). It was at Edessa that Caracalla, who made it a military colony under the style of Colonia Marcia Edessenorum, spent the winter of 216-217, and near there that he was murdered. The religious philosophical treatise preserved under the title of *Book of the Laws of the Lands* was probably produced at this time by a pupil of Bardesanes, and the *Acts of Thomas* in its original form may have followed not long after.

Sassanian Period.—In 226 the Parthian empire gave place to the new kingdom of the Sassanidae, whose claim to the ancient Achaemenian empire led to constant struggle with Rome in which Edessa naturally suffered. The native state was restored by Gordian in 242; but in 244 it became again directly subject to Rome. The Edessan martyrs Sharbēl and Barsamyā, whose "Acts" in legendary form have come down to us, may have perished in the Decian persecution. In 260 the city was besieged by the Persians under Shapur I., and Valerian was defeated and made prisoner by its gates. Odaenathus of Palmyra (d. 267), however, wrested Mesopotamia from the Persians; but Aurelian defeated his successor Zenobia at Emesa (273), and Carus, who died in 283 in an expedition against the Persians, and Galerius (297) carried the frontier again to the Tigris. Diocletian's persecution secured the martyr's crown for the Edessenes Shamōna, Guria (297), and Ḥabbīb (309), and shortly thereafter Lucian "the martyr," who though born at Samosata received his training at Edessa; but the bishop Qōna, who laid the foundations of "the great church" by the sacred pool, somehow escaped. Edessa can claim no share in "the Persian Sage" Aphrahaṭ or Afrahaṭ (Aphraates); but Ephraem, after bewailing in Nisibis the sufferings of the great Persian war under Constantius and Julian, when Jovian in 363 ceded most of Mesopotamia to Shapur II., the persecutor of the Christians, settled in Edessa, which as the seat of his famous school (called "the Persian") grew greatly in importance, and attracted scholars from all directions. He taught and wrote vigorously against the Arians and other heretics, and although just after his death (373) the emperor Valens banished the orthodox from Edessa, they returned on the emperor's death in 378. Under Zenobius, disciple of Ephraem, studied the voluminous writer, Isaac of Antioch (d. circ. 460). Rabbūla perhaps owed his elevation to the see of Edessa (411-435), in the year which produced the oldest dated Syriac MS., to his asceticism, and it was to his time that the sojourn there of the "Man of God" (Alexis) was assigned; but he won from the Nestorians the title of the Tyrant of Edessa. In particular he exerted himself to stamp out the use of the Diatessaron in favour of the four Gospels, the Syriac version of which probably now took the form known as the Peshitta. When the popular Nestorianism of the Syrians was condemned at Ephesus (431) it began to gravitate eastwards, Nisibis becoming its eventual headquarters; but Edessa and the western Syrians refused to bow to the Council of Chalcedon (451) when it condemned Monophysitism. In and around Edessa the theological strife raged hotly.[21] When, however, Zeno's edict (489) ordered the closing of the school of the Persians at Edessa, East and West drifted apart more and more; the ecclesiastical writer Narsai, "the Harp of the Holy Spirit," fled to Nisibis about 489. Till about this time Syriac influence was strong in Armenia, and some Syriac works have survived only in Armenian translations. In the opening years of the 6th century the Persian-Roman War (502-506) found a chronicler in the anonymous Edessene history known till recently as the Chronicle of Joshua Stylites. Whether Edessa received from the emperor Justin I. the additional name of Justinopolis may be uncertain (see Hallier, *op. cit.* p. 128); but it seems to have been renewed and fortified after the "fourth" flood in 525 (Procop. *Pers.* ii. 27; *De aedific.* ii. 7). About this time, according to Nöldeke, an anonymous Edessene wrote the Romance of Julian the Apostate, which so many Arab writers use as a history. Chosroes I. Anushirwān succeeded in 540, according to the last entry in the Edessene Chronicle, in exacting a large tribute from Edessa; but in 544 he besieged it in vain. A few years later Jacob Baradaeus, with Edessa as centre of his bishopric, was carrying on the propaganda of Monophysitism which won for the adherents of that creed the name of Jacobites (*q.v.*). The valuable Syriac Chronicle just referred to probably was compiled in the latter half of this century.

Islam.—In the first decade of the next century Edessa was taken by Chosroes II., and a large part of the population transported to eastern Persia. Within a score of years it was recovered by the emperor Heraclius, who reviewed a large army under its walls. The prophet of Islam was now, however, building up his power in Arabia, and although Heraclius paid no heed to the letter demanding his adhesion which he received from Medina (628), and the deputation of fifteen Rahāwiyīn who paid homage in 630 were not Edessenes but South Arabians, a few years later (636?) Heraclius's attempts, from Edessa as a centre, to effect an

organized opposition to the victorious Arabs were defeated by Sa'd, and he fell back on Samosāta. The terms on which Edessa definitely passed into the hands of the Moslems (638) under Riyād are not certain (Balādhurī). As it now ceased to be a frontier city it lost in importance. In 668 occurred another destructive flood (Theophanes, p. 537), and in 678 an earthquake which destroyed part of the "old church," which the caliph Mo'āwiya I. is said to have repaired. To the latter part of the century belongs the activity of Edessa's bishop Jacob, whose chronicle is unfortunately lost. It may have been the impulse given by the final supremacy of the caliphate to the long process which eventually substituted a new branch of Semitic speech for the Aramaic (which had now prevailed for a millennium and a half), that led Jacob to adopt the Greek vowel signs for use in Syriac. A century later Theophilus of Edessa (d. 785), author of a lost history, translated into Syriac "the two books of the poet Homer on the Conquest of the city of Ilion." When the Bagdād caliphs lost control of their dominions, Edessa shared the fortunes of western Mesopotamia, changing with the rise and fall of Egyptian dynasties and Arab chieftains. In the 10th century al-Mas'ūdī, writing in the very year in which it happened, tells how the Mahommedan ruler of Edessa, with the permission of the caliph, purchased peace of the emperor Romanus Lecapenus by surrendering to him the napkin of Jesus of Nazareth, wherewith he had dried himself after his baptism. The translation of the Holy Icon of Christ from Edessa is commemorated on the 16th of August (Cal. Byzant). A few years later Ibn Ḥauḳal (978) estimates the number of churches in the city at more than 300, and al-Moḳaddasī (985) describes its cathedral, with vaulted ceiling covered with mosaics, as one of the four wonders of the world. In 1031 the emperor recovered Edessa; but in 1040 it fell into the hands of the Seljuks, whose progress had added a large element of Armenian refugees to the population of Osrhoëne. There is no reason, therefore, to discredit Maqrīzī's statement that it was three brother architects from Edessa that the Armenian minister Badr al-Gamāli employed to build three of the fine city gates of Cairo (1087-1091). The empire soon recovered Edessa, but the resident made himself independent. Thoros applied for help to Baldwin, brother and successor of Godfrey of Bouillon in the First Crusade, who in 1098 took possession of the town and made it the capital of a Burgundian countship, which included Samosata and Sarūg', and was for half a century the eastern bulwark of the kingdom of Jerusalem.[22] The local Armenian historian, however, Matthew of Edessa, tells of oppression, decrease of population, ruin of churches, neglect of agriculture. With the campaign of Maudud in 1110 fortune began to favour the Moslems. Edessa had to endure siege after siege. Finally, in 1144 it was stormed, Matthew being among the slain, by 'Imād ud-Dīn Zengī, ruler of Mosul, under Joscelin II., an achievement celebrated as "the conquest of conquests," for laying the responsibility of which not on God but on the absence of the Frankish troops, an Edessan monk, John, bishop of Ḥarrān (d. 1165), brought down upon himself the whole bench of bishops. Edessa suffered still more in 1146 after an attempt to recover it. Churches were now turned into mosques. The consternation produced in Europe by the news of its fate led to "the Second Crusade." In 1182 it fell to Saladin, whose nephew recovered it when it had temporarily passed (1234) to the sultan of Rūm; but the "Eye of Mesopotamia" never recovered the brilliance of earlier days. The names it contributed to Arabic literature are unimportant. By timely surrender (1268) it escaped the sufferings inflicted by Hūlākū and his Monguls on Sarū'g (Barhebraeus, *Chron. Arab.*, Beirūt ed., 486). Mostaufī describes a great cupola of finely worked stone still standing by a court over a hundred yards square (1340). Ali b. Yazd in his account of the campaigns of Tīmūr, who reduced Mesopotamia in 1393, still calls the city (1425) Ruhā. In 1637, when Amurath IV. conquered Bagdād and annexed Mesopotamia, it passed finally into the hands of the Turks, by whom it is called Urfa.

The Modern Town.—Urfa lies north-east of the Nimrud Dagh. It is surrounded by a wall, strengthened by square towers at distances of 18-20 steps, probably dating in its present condition from medieval Mahommedan times. On a height in a corner towards the west, overtopping the town by 100-200 ft., are the remains of the old citadel, and the two famous Corinthian columns[23] known as "the Throne of Nimrūd." In the hollow between this height and the town rise two springs which form ponds, the farther removed of which from the citadel is known as Birket al-Khalīl, doubtless the Callirrhoe of the classical writers, and contains the sacred fish, estimated by J.S. Buckingham at 20,000, and the nearer as 'Ain Zalkha (*i.e.* Zuleikha, the wife of Potiphar). On the north edge of the Birket al-Khalīl (see plan in Sachau, p. 197) is the great mosque of Abraham, the interior of which is described by J.S. Buckingham (*Travels*, pp. 108-110). Diagonally opposite the mosque is a house with a square tower, which is locally believed to occupy the place of the famous ancient school. The waters of the two pools make their way in a single stream southwards out of the town. The once dangerous stream Daiṣān (Σκιρτός) no longer flows southwards through the town, but encircles it on the north and east in the channel of the old moat. This stream, now called Kara Kuyun, and the other are exhausted in the irrigation of the gardens lying south-east of the town, except when fuller than usual, when they reach the Balīh. Not far east of the sacred pool is the largest building in the town, the recent Armenian Gregorian cathedral, whose American bells were first heard during Sachau's visit in 1879. About the middle of the town is the largest mosque, Ulu 'Gamī (parts of it probably pre-Islamic), which probably occupies the site of the Christian church reckoned by the early Mahommedan writers as one of the wonders of the world. In the bazaar, which lies between the chief mosque and the sacred pool, and contains several streets, are displayed not only the native woollen stuffs, pottery and silver work, but also a considerable variety of European goods, especially cloth stuffs. The principal manufactures are fine cotton stuffs and yellow leather. The streets are of course narrow and winding; but the houses are well built of stone. The outskirts are occupied by melon gardens, vineyards and mulberry plantations. The fertile plain south of the town is noted for its wheat and fine pasture. The climate is healthy except in summer; the "Aleppo button" (see Bagdad, vilayet), a painful boil, is common. The rocky heights south and west of the town, whence the building material is largely obtained, are full of natural and artificial caverns, once used as dwellings, cloisters and graves, where are most of the inscriptions published by Sachau, who also visited and describes (pp. 204-206) the Dēr Ya'qūb, nearly two hours distant.

Urfa is the capital of a sanjak of the same name, in the vilāyet of Aleppo. The population was estimated by Olivier in 1796 at 20,000 to 24,000, by Buckingham at 50,000, by Chernik in 1873 at 40,000, by Sachau in 1879 at 50,000, in Baedeker's Handbook in 1906 at 30,000. Vice-Consul Fitzmaurice said that before December 1895 it was close on 65,000, of whom about 20,000 were Armenian, 3000 or 4000 Jacobites, Syrian-Catholic, Greek-Catholic, Maronites and Jews, and the remaining 40,000 Turkish, Kurdian and Arab

Mahommedans. Two barbarous massacres occurred on the 28th and 29th of October and the 28th and 29th of December 1895; 126 Armenian families were absolutely wiped out. He believes that 8000 Armenians perished in the second massacre. The Deutsche Orient-Mission has its chief seat in Urfa, and there have for years been American and French missions. The Germans have an orphanage with 300 Armenian children, a carpet factory and a medical station. The American school had some years ago 250 pupils.

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(H. W. H.)

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1 So Appian, *Syr.* 57; cp. Steph. Byz., s.v. Εδεσσα: διὰ τὴν τῶν ὑδάτων ῥύμην.

2 Steph. Byz., s.v. Βατναι.

3 Dio, *passim.*

4 Isidore Charac. 1 (Müller, *Geog. Gr. Min.*, i. 246).

5 Several times in Pliny, *Nat. Hist.*

6 *CIL.* vi. 1797.

7 *Hist. Osrhoena et Edessena*, p. 33.

8 Written Ὀσρόης in Dio Cassius, *Excerpta*, lxviii. 22.

9 See the reff. collected by M. Streck, *M.V.G.*, 1906. The name occurs in the same company in the fragmentary tablet K. 1904. The mountain Ru-u-[a], mentioned thrice by Tiglath-pileser IV., is placed by Billerbeck near Hamadān (*Sandschak Suleimania*, 82, 86, and map, 1898).

10 See further Payne Smith, *Thesaurus* 110 *b*.

11 In translating from the Greek; also in Ephraim (Duval, *Hist.* 22, n. 4) and the Acts of Sharbīl (Cureton, *Anc. Syr. Doc.* 41).

12 On a possible restoration under the name of "Antioch on the Callirrhoë" see above.

13 The Edessans used to call their town "the city," or "the daughter," "of the Parthians" (Cureton, *Anc. Syr. Doc.*, 41 ult., 97 l. 7; 106 l. 12).

14 The portion of the Mesopotamian steppe under Osrhoënic influence was, according to Nöldeke (*Zeitsch. Ass.* xxi. 153, 1908), called 'Arābh in Syriac.

15 The inscription, which is difficult to read, connects the structure with Shalmat the queen, daughter of Ma'nu, who cannot be identified with certainty, and refers to some image(*s*), which probably excited the pious vandalism of the Arabs.

16 Nebo and Bel (*Doctr. Addai*, 31) may come from the Old Testament (Burkitt).

17 *S.B.A.W.*, 1904, 910 ff.

18 So, *e.g.* F.C. Burkitt, *Early Eastern Christianity*, 72.

19 Marquart, *Ostasiat. und osteurop. Streitzüge*, 292 ff.

20 Marquart, *op. cit.*

21 Some one found time, however, to produce the oldest *dated* MS. of a portion of the Bible in any language.

22 The counts were: Baldwin I. (1098), Baldwin II. (1100), Joscelin I. (1119), Joscelin II. (1131-1147).

23 Pictures in Burkitt, *Early East. Christ.*, frontispiece; *P.S.B.A.* xxviii. 151 f.; J.R. Harris, *The Heavenly Twins*.

EDFU, in Coptic *Atbō*, a town of Upper Egypt, 484 m. S.S.E. of Cairo by rail, on the W. bank of the Nile, the railway station being on the opposite side of the river. Pop. (1907) 19,262. The inhabitants manufacture

earthenware, which finds ready sale all through Egypt. The ancient Atbō (*Apollinopolis Magna*) was capital of the second nome of Upper Egypt. The great sandstone temple is practically complete (see ARCHITECTURE: *Egypt*). It was built on the site of an earlier structure entirely in the time of the Ptolemies. The central part of the building, begun by Ptolemy III. Euergetes in 237 B.C., was finished by his successor in 212; the portico, court, pylons and surrounding wall were added by Ptolemy Euergetes II., Soter II. and Alexander I.; but the decoration was not finished till 57 B.C. in the reign of Ptolemy XIII. Neos Dionysus. The god of Atbō was a form of Horus (Apollo) as the sun-god; his most characteristic representation is as the disk of the sun with outspread wings, so often seen over the doors of shrines, at the top of stelae, &c. In the temple, where he is often figured as a falcon-headed man, he is associated with Hathor of Dendera and the child Harsemteus.

See Baedeker's *Egypt*; Ed. Naville, *Textes relatifs au mythe d'Horus recueillis dans le temple d'Edfou*.

(F. Ll. G.)

EDGAR (EADGAR), king of the English (944-975), was the younger son of Edmund the Magnificent and Ælfgifu. As early as 955 he signed a charter of his uncle Eadred, and in 957 the Mercian nobles, discontented with the rule of his elder brother Eadwig, made him king of England north of the Thames. On the death of his brother in October 959 Edgar became king of a united England. Immediately on his accession to the throne of Mercia Edgar recalled St Dunstan from exile and bestowed on him first the bishopric of Worcester, and then that of London. In 961 Dunstan was translated to Canterbury, and throughout Edgar's reign he was his chief adviser, and to him must be attributed much of the peace and prosperity of this time.

The reign of Edgar was somewhat uneventful, but two things stand out clearly: his ecclesiastical policy and his imperial position in Britain. Edgar and Dunstan were alike determined to reform the great monastic houses, and to secure that they should be restored once more to their true owners and not remain in the hands of the secular priests or *canonici*, whose life and discipline alike seem to have been extremely lax. In this reform Edgar was helped not only by St Dunstan but also by Oswald of Worcester and Æthelwold of Winchester. The priests of the old and new monasteries at Winchester, at Chertsey and at Milton Abbas were replaced by monks, and in monastic discipline the old rule of St Benedict was restored in all its strictness.

The coronation of Edgar was, for some unexplained reason, delayed till the Whitsunday of 973. It took place with much ceremony at Bath, and was followed shortly after by a general submission to Edgar at Chester. Six, or (according to later chroniclers) eight kings, including the kings of Scotland and Strathclyde, plighted their faith that they would be the king's fellow-workers on sea and land. The historical truth of this story has been much questioned; there seems to be little doubt that it is true in its main outlines, though we need not accept the details about Edgar's having been rowed on the Dee by eight kings.

Two isolated and unexplained incidents are also recorded in the chronicle: first, the ravaging of Westmorland by the Scandinavian Thored, son of Gunnere, in 967; and second, the ravaging of Thanet by Edgar's own command in 970.

Edgar's death took place in the year 975, and he was buried at Glastonbury. By his vigorous rule and his statesmanlike policy Edgar won the approval of his people, and in the Saxon chronicle we have poems commemorating his coronation and death, and describing his general character. The only fault ascribed to him is a too great love for foreigners and for foreign customs. Edgar strengthened the hands of the provincial administration, and to him has been attributed the reorganization of the English fleet. The characteristic feature of his rule was his love of peace, and by efficient administration he secured it.

Edgar formed an irregular union in 961 with Wulfthryth, an inmate of the convent at Wilton, who bore him a daughter Eadgyth. He next married Æthelflæd, "the white duck," daughter of Earl Ordmær, who bore him a son, afterwards known as Edward the Martyr. Finally he was united to Ælfthryth, daughter of Earl Ordgar, who became the mother of the Ætheling Edmund (d. 971) and of Æthelred the Unready.

AUTHORITIES.—*Saxon Chronicle* (ed. Plummer and Earle, Oxford), *sub. ann.*; *Vita Sancti Oswaldi* (*Historians of the Church of York*, ed. Raine, Rolls Series); William of Malmesbury, *Gesta regum* (ed. Stubbs, Rolls Series); Birch, *Cartularium Saxonicum*, vol. iii. Nos. 1047-1319; F. Liebermann, *A.-S. Laws*, i. 192-216; "Florence of Worcester" (*Mon. Hist. Brit.*); E.W. Robertson, *Historical Essays*, pp. 189-215.

(A. Mw.)

EDGAR, or EADGAR (*c.* 1050-*c.* 1130), called the Ætheling, was the son of Edward, a son of the English king Edmund Ironside, by his wife Agatha, a kinswoman of the emperor Henry II., and was born probably in Hungary some time before 1057, the year of his father's death. After the death of Harold in 1066, Archbishop Aldred and the citizens of London desired to make him king, but on the advance of William, Edgar and his supporters made their submission. In 1068, after the failure of the first rising of the north, Edgar retired to Scotland, when his sister Margaret married the Scottish king, Malcolm Canmore. Next year he returned to take part in the second rising, but, this proving no more successful than the first, he again took refuge in Scotland. In 1074 he went to Normandy and made peace with William. In the struggle

between Henry I. and Robert of Normandy, Edgar sided with the latter. He was taken prisoner at the battle of Tinchebrai in 1106, but was subsequently released. The date of his death is uncertain, but he was certainly alive about 1125.

EDGECUMBE, or EDGECOMBE, the name of a celebrated west of England family, taken from the manor of Edgecumbe in Cornwall. One of its earlier members was Sir Richard Edgecumbe (d. 1489), who was descended from a Richard Edgecumbe who flourished during the reign of Edward I. Richard was a member of parliament in 1467; afterwards he joined Henry, earl of Richmond, in Brittany, returned with the earl to England, and fought at Bosworth, where he was knighted. He received rich rewards from Henry, now King Henry VII., who also sent him on errands to Scotland, to Ireland and to Brittany, and he died at Morlaix on the 8th of September 1489. His son and successor, Sir Piers Edgecumbe, went to France with Henry VIII. in 1513, and when he died on the 14th of August 1539 he left with other issue a son, Sir Richard Edgecumbe (1499-1562), a cultured and hospitable man, who is celebrated through Richard Carew's *Friendly Remembrance of Sir Richard Edgecumbe*. Sir Richard's eldest son, Piers or Peter Edgecumbe (1536-1607), was a member of parliament under Elizabeth for about thirty years.

Another famous member of this family was Richard, 1st baron Edgecumbe (1680-1758), a son of Sir Richard Edgecumbe. Educated at Trinity College, Cambridge, he was successively member of parliament for St Germans, Plympton and Lostwithiel from 1701 to 1742; on two occasions he served as a lord of the treasury; and from 1724 to 1742 he was paymaster-general for Ireland, becoming chancellor of the duchy of Lancaster in 1743. Edgecumbe was a faithful follower of Sir Robert Walpole, in whose interests he managed the elections for the Cornish boroughs, and his elevation to the peerage, which took place in 1742, was designed to prevent him from giving evidence about Walpole's expenditure of the secret service money. He died on the 22nd of November 1758. His son and successor, Richard, the 2nd baron (1716-1761), was comptroller of the royal household, a member of parliament, and a major-general in the army. A wit, a writer of verse, a gambler and an intimate friend of Horace Walpole, "Dick Edgecumbe" died unmarried on the 10th of May 1761.

Edgecumbe's brother, George, 1st earl of Mount Edgecumbe (1721-1795), was a naval officer who saw a great deal of service during the Seven Years' War. Succeeding to the barony on the 1st baron's death in 1761 he became an admiral and treasurer of the royal household; he was created Viscount Mount-Edgecumbe in 1781 and earl of Mount-Edgecumbe in 1789. He died on the 4th of February 1795, his only son being his successor, Richard, the 2nd earl (1764-1839), the ancestor of the present earl and the author of *Musical Reminiscences of an Old Amateur*. He died on the 26th of September 1839. His son, Ernest Augustus, the 3rd earl (1797-1861), wrote *Extracts from Journals kept during the Revolutions at Rome and Palermo*.

EDGE HILL, an elevated ridge in Warwickshire, England, near the border of Oxfordshire. The north-western face is an abrupt escarpment of the lias, and the summit of the ridge is almost level for nearly 2 m., at a height somewhat exceeding 700 ft. The escarpment overlooks a rich lowland watered by streams tributary to the Avon; the gentle eastern slope sends its waters to the Cherwell, and the ridge thus forms part of the divide between the basins of the Severn and the Thames. Edge Hill gave name to the first battle of the Great Rebellion (*q.v.*), fought on the 23rd of October 1642. Charles I., marching on London from the north-west, was here met by the parliamentary forces under Robert Devereux, earl of Essex. The royalists were posted on the hill while the enemy was in the plain before Kineton. But the rash advice of Prince Rupert determined the king to give up the advantage of position; he descended to the attack, and though Rupert himself was successful against the opposing cavalry, he was checked by the arrival of a regiment with artillery under Hampden, and, in the meantime, the royalist infantry was driven back. The parliamentarians, however, lost the more heavily, and though both sides claimed the advantage, the king was able to advance and occupy Banbury.

EDGEWORTH, MARIA (1767-1849), Irish novelist, second child and eldest daughter of Richard Lovell Edgeworth (*q.v.*) and his first wife, Anna Maria Elers, was born in the house of her maternal grandparents at Black Bourton, Oxfordshire, on the 1st of January 1767. Her early efforts in fiction were of a sufficiently melodramatic character; for she recollected one of her schoolgirl compositions, in which the hero wore a mask made of the dried skin taken from a dead man's face. Her holidays were often spent in the house of the eccentric Thomas Day, for whom she entertained a genuine respect. She had ample opportunities for society among her father's neighbours in Ireland, among whom were the second Lord Longford, whose daughter, "Kitty" Pakenham, became later duchess of Wellington, Lady Moira at Castle Forbes, and Maria's aunt, Margaret Ruxton, at Black Castle. She gained a first-hand experience of the Irish peasantry by acting as her father's assistant in the management of the estate. The Edgeworths were in Ireland from 1793 onwards

through that dangerous period, and Maria's letters, always gay and natural, make very light of their anxieties and their real perils.

Mr Edgeworth encouraged his daughter's literary instincts. It has been the fashion to regard his influence over Maria's work as altogether deplorable, but against the disadvantages arising from his interference must be weighed the stimulus she undoubtedly derived from his powerful mind. Her first publication was a plea for female education, *Letters to Literary Ladies* (1795), and in 1796 appeared the collection of stories known as *The Parent's Assistant* (2nd ed., 6 vols., 1800), an unpromising title which was not chosen by the author. The stories had been submitted as they were written to the juvenile critics of the Edgeworth nursery. They were therefore children's stories for children, even though the morals were Mr Edgeworth's. In 1798 Mr Edgeworth's fourth marriage threatened the family harmony, but Maria soon became a close friend of her stepmother. *Practical Education* (2 vols., 1798) was written in conjunction with her father, who also collaborated with her in the *Essay on Irish Bulls* (1802). Miss Edgeworth's first novel, *Castle Rackrent, an Hibernian Tale taken from Facts, and from the Manners of the Irish Squires before the year 1782*, was written without her father's supervision, and appeared anonymously in 1800. It is the story of an Irish estate and its owners, the Rackrents, as told by Thady, the steward. Its success was immediate, and a second edition soon appeared with the author's name. Perhaps because of the absence of Richard Lovell Edgeworth's co-operation, the book is the most natural and vigorous of her novels. The course of the story is not altered to suit any moral, and the personages appear to be drawn immediately from the natives of Edgeworthstown, though Miss Edgeworth asserts that only Thady himself was an actual portrait. In her realistic pictures of Irish peasant life she opened up a new vein in fiction, and even if the unquestionable excellences of *Castle Rackrent* were less, it would still be a noteworthy book. In the "General Preface" to the 1829 edition of his novels Sir Walter Scott, writing of the publication of *Waverley*, says: "I felt that something might be attempted for my own country, of the same kind with that which Miss Edgeworth so fortunately achieved for Ireland," and in the "Postscript, which should have been a preface," in the original edition of *Waverley*, he describes his aim as being "in some distant degree to emulate the admirable Irish portraits of Miss Edgeworth, so different from the 'Teagues' and 'dear joys' who so long, with the most perfect family resemblance to each other, occupied the drama and the novel." *Belinda* (1801) is a society novel, and one of her best books. Mr Saintsbury thinks that Miss Austen's heroines owe something of their naturalness to Belinda, who was one of the earliest to break with the tradition of fainting and blushing. *Moral Tales for Young People* (5 vols.) and *Early Lessons*, which included "Harry and Lucy," "Rosamond" and "Frank," appeared in 1801.

In 1802 the Edgeworths went abroad, first to Brussels and then to Paris. They had already connexions in Paris through their kinsman, the abbé Henri Allen Edgeworth de Firmont, who was, however, then in exile. They met all the notabilities in Paris, and Maria refused an offer of marriage from a Swedish count named Edelcrantz. Although *Leonora*, not published until four years later, is said to have been written to meet his taste, she apparently remained then and always heart-whole; but her stepmother thought otherwise, and maintained that she suffered severely for her decision (*Memoir*, i. 144). Returning to Edgeworthstown, Miss Edgeworth resumed her writing, which was always done in the rooms commonly used by the whole family. *Popular Tales* was published in 1804, and *The Modern Griselda* in the same year; *Leonora* in 1806; and in 1809 the first series of *Tales of Fashionable Life*, three volumes containing "Ennui," "Madame de Fleury," "Almeria," "The Dun" and "Manœuvring"; the second series (3 vols., 1812) included "The Absentee," one of her best tales, which was originally designed as a play, "Vivian" and "Émilie de Coulanges." In 1813 Maria and her parents spent a considerable time in London, and her society was much sought after. When *Waverley* was published, Miss Edgeworth received a copy from the publishers, and at once recognized the authorship. She wrote a long letter of appreciation (23rd of October 1814) to "the author of *Waverley*," which she began with the phrase *aut Scotus, aut diabolus*, but the letter was merely acknowledged by the publishers. *Patronage* (4 vols., 1814), the longest of her novels, and *Harrington, a tale*, and *Ormond, a tale* (3 vols., 1817) complete the list of the works which received what her father called his *imprimatur*.

After his death in 1817 Miss Edgeworth occupied herself with completing his *Memoirs*, which were published in 1820. The book was the excuse for an attack on Mr Edgeworth's reputation in the July number of the *Quarterly Review*, which Miss Edgeworth had the courage to leave unread. Her life at Edgeworthstown was varied by visits to London, to Lord Lansdowne at Bowood, Wiltshire, to the Misses Sneyd in Staffordshire, and to many other friends. In 1820 she was again in Paris, and in 1823 she spent a happy fortnight with the Scotts at Abbotsford. In 1825 Scott went to Edgeworthstown, and their relations were always cordial.

Miss Edgeworth's production was less after her father's death. Sequels to "Rosamond," "Frank," "Harry and Lucy" in the *Early Lessons* were published in 1822-1825. *Comic Dramas* appeared in 1817, and *Helen* in 1834. She worked to the last, and in 1846 laboured strenuously for the relief of the famine-stricken Irish peasants. She died on the 22nd of May 1849.

Miss Edgeworth's novels are distinguished by good sense, humour and an easy flowing style. As the construction of a plot is not her strong point, she is generally more successful in tales than in lengthy novels. The vivacity of her dialogues is extraordinary; and in them her characters reveal themselves in the most natural way possible. Her books are character-studies rather than intensely interesting narratives. Sobriety of judgment is seen throughout; and passion, romance and poetry rarely, if ever, shed their lustre on her pages. Three of her aims were to paint national manners, to enforce morality, and to teach fashionable society by satirizing the lives of the idle and worldly. She expressly calls some of her stories "Moral Tales"; but they all fall under this category. In her pages the heroic virtues give place to prudence, industry, kindness and sweetness of temper. There are few instances of overwhelming emotions or tumultuous passions in her works; and it is remarkable how little the love of nature appears. She never uses material which does not yield some direct moral lesson. But the freshness of her stories, her insight into character, lively dialogues, originality of invention, and delightfully clear style render it quite possible to read her works in succession without any sense of weariness. Among the many sweet memories her unsullied pages have bequeathed to the world, not the least precious is her own noble character, which ever responded to all

that is best and most enduring in human nature.

See *A Memoir of Maria Edgeworth, with a Selection from her Letters* (1867), by her stepmother, F.A. Edgeworth, privately printed. A selection from this was made by Augustus J.C. Hare, and printed under the title of *The Life and Letters of Maria Edgeworth* (2 vols., 1894). See also *Maria Edgeworth* (1883), by Helen Zimmern, in the "Eminent Women" series; Grace A. Oliver, *A Study of Maria Edgeworth* ... (3rd ed., Boston, U.S.A., 1882); and *Maria Edgeworth* (1904), by the Hon. Emily Lawless in the "English Men of Letters" series. Among the numerous shorter articles dealing with Maria Edgeworth and the family circle at Edgeworthstown may be mentioned a friendly appreciation of Miss Edgeworth's novels by George Saintsbury in *Macmillan's Magazine* (July 1895), and a charming description of her family circle and surroundings in the preface supplied by Lady Thackeray Ritchie to Macmillan's edition of the novels (1895).

EDGEWORTH, RICHARD LOVELL (1744-1817), British writer, was born at Bath on the 31st of May 1744. The greater part of his life, however, was spent at Edgeworthtown, or Edgeworthstown, in the county of Longford, Ireland, where the Edgeworth family had been settled for upwards of 150 years. He was of gentle blood—his father being the son of Colonel Francis Edgeworth, and his mother, Jane Lovell, being the daughter of Samuel Lovell, a Welsh judge. Richard's mother taught him to read at a very early age; and from childhood he had a strong love for mechanical science. The Rev. Patrick Hughes initiated him in Lilye's *Latin Grammar*—an office he also performed for Goldsmith, who was born on the property of the Edgeworths—and his public education began, in August 1752, in a school at Warwick. He subsequently attended Drogheda school, then reputed the best in Ireland; and, after spending two years at a school in Longford, entered Trinity College, Dublin, in April 1761, but was transferred to Corpus Christi College, Oxford, in October of the same year. While still at college, he made a runaway match, marrying at Gretna Green, Anna Maria, one of the daughters of Paul Elers of Black Bourton, Oxfordshire, an old friend of his father. His eldest son was born before Edgeworth reached his twentieth birthday, and his daughter Maria in 1767.

Shortly after the birth of his son, he and his wife went to Edgeworthstown, but in 1765 they took a house at Hare Hatch, near Maidenhead. Edgeworth devoted much time to scientific reading and experiments; and he made an attempt to establish telegraphic communication (*Memoirs*, 2nd edition, i. 144). He also invented a turnip-cutter, a one-wheeled chaise and other contrivances. In the pursuit of his mechanical inventions he visited Erasmus Darwin at Lichfield, where he met Anna Seward, and her cousin, Honora Sneyd. His home was now at Hare Hatch, in Berkshire, where he endeavoured to educate his son according to the method explained in Rousseau's *Émile*. In later life, however, the ill-success of this experiment led him to doubt many of Rousseau's views (*Memoirs*, ii. 374). At the same time he kept terms at the Temple, and formed the greatest friendship of his life with Thomas Day, the author of *Sandford and Merton*, which was written at Edgeworth's suggestion. In 1769, on the death of his father, he gave up the idea of being a barrister; but, instead of immediately settling on his Irish estate, he spent a considerable time in England and France, mainly in Day's company. In Lyons, where he resided for about two years, he took an active part in the management of public works intended to turn the course of the Rhone. He was summoned to England by the death of his wife (March 1773), with whom he was far from happy. Edgeworth hurried to Lichfield, to Dr Erasmus Darwin's, and at once declared his passion for Honora Sneyd, which had been the cause of his flight to France two years before. Miss Sneyd had been the object of attention from Thomas Day, but her views on marriage were not submissive enough to please him. She had other suitors, among them the unfortunate Major André. She married Edgeworth (July 1773), and after residing at Edgeworthstown for three years, they settled at Northchurch, in Hertfordshire. After six years of domestic happiness, Honora Edgeworth died (April 1780), recommending her husband to marry her sister Elizabeth; and they were actually married on Christmas Day, 1780.

In 1782 Edgeworth returned to Ireland, determined to improve his estate, educate his seven children, and ameliorate the condition of the tenants. Up to this point Edgeworth has told his own story in his *Memoirs*. The rest of his life is written by his daughter, who opens with a lengthy panegyric on her father as a model landlord (*Memoirs*, ii. 12-36). In 1785 he was associated with others in founding the Royal Irish Academy; and, during the two succeeding years, mechanics and agriculture occupied most of his time. In October 1789 his friend Day was killed by a fall from his horse, and this trial was soon followed by the loss of his daughter Honora, who had just reached her fifteenth year. In 1792 the health of one of Edgeworth's sons took him to Clifton, where he remained with his family for about two years, returning in 1794 to Edgeworthstown. Ireland was, at that time, harassed by internal disturbances, and threats of a French invasion, and Edgeworth offered to establish telegraphic communication of his own invention throughout the country. This offer was declined. A full account of the matter is given in Edgeworth's *Letter to Lord Charlemont on the Telegraph*; and his apparatus is explained in an "Essay on the art of Conveying Swift and Secret Intelligence," published in the sixth volume of the *Transactions of the Royal Irish Academy*. In the autumn of 1797 the third Mrs Edgeworth died.

Practical Education (1798) was written in collaboration with his daughter Maria, and embodied the experience of the authors in dealing with children. "So commenced," says Miss Edgeworth, "that literary partnership which, for so many years, was the pride and joy of my life" (*Memoirs*, ii. 170). This book, generally regarded as old-fashioned, has a real value in the history of education. Mr Edgeworth's interest in the subject had been inspired by the study of Rousseau and by his friendship with Thomas Day. But he went beyond Rousseau, who developed his theories from his own ingenious mind and related an imaginary process. The Edgeworths brought a scientific method to their work. The second Mrs Edgeworth (Honora Sneyd) began the collection of actual examples of conversations between the children and their elders. This was continued patiently by the writers of the book; and their reasonings were thus founded on an accurate record of childish methods of thought. They deprecated especially any measures that interrupted the child's

own chain of reasoning. The chapters on special subjects of study, chronology, geometry, &c., were written by Richard Lovell Edgeworth; those on toys, on rewards and punishments, on temper, &c., by his daughter.[1]

In 1798 Edgeworth married Miss Beaufort, and was elected M.P. for the borough of St John's Town, Longford. The same year, too, saw a hostile landing of the French and a formidable rebellion; and for a short time the Edgeworths took refuge in Longford. The winter of 1802 they spent in Paris. In 1804 the government accepted his telegraphic apparatus, but the installation was left incomplete when the fear of invasion was past. In 1802 appeared the *Essay on Irish Bulls* by Mr and Miss Edgeworth; and in 1806 Edgeworth was elected a member of the board of commissioners to inquire into Irish education. From 1807 till 1809 much of his time was spent on mechanical experiments and in writing the story of his life. In 1808 appeared *Professional Education*, and in 1813 his *Essay on the Construction of Roads and Carriages*. He died on the 13th of June 1817, and was buried in the family vault in Edgeworthstown churchyard.

Many of Edgeworth's works were suggested by his zeal for the education of his own children. Such were *Poetry Explained for Young People* (1802), *Readings in Poetry* (1816), *A Rational Primer* (unpublished), and the parts of *Early Lessons* contributed by him. His speeches in the Irish parliament have also been published; and numerous essays, mostly on scientific subjects, have appeared in the *Philosophical Transactions*, the *Transactions of the Royal Irish Academy*, the *Monthly Magazine* and *Nicholson's Journal*. The story of his early life, told by himself, is fully as entertaining as the continuation by Maria, as it contains less dissertation and more incident. One of his daughters by his first marriage, Anna Maria, married Dr Beddoes and became the mother of T.L. Beddoes, the poet.

See *Memoirs of Richard Lovell Edgeworth, Esq.*, begun by himself and concluded by his daughter, Maria Edgeworth (2 vols., 1820, 3rd and revised ed. 1844). A selection from this, giving an optimistic view of him, *Richard Lovell Edgeworth* (1896), was edited by Mrs Lionel Tollemache.

1 For an appreciation of the two Edgeworths from the teacher's point of view, see Prof. L.C. Miall in the *Journal of Education* (August 1, 1894).

EDGEWORTH DE FIRMONT, HENRY ESSEX (1745-1807), last confessor to Louis XVI., was the son of Robert Edgeworth, rector of Edgeworthstown in Ireland, his mother being a granddaughter of Archbishop Ussher. When he was three years old his father became a Roman Catholic, resigned his living and emigrated to Toulouse, where the boy was brought up by the Jesuits. In 1769, after his father's death, he went to Paris to be trained for the priesthood. On taking orders he assumed the additional surname of de Firmont, from the family estate of Firmount near Edgeworthstown. Though originally studying with a view to becoming a missionary, he decided to remain in Paris, devoting himself especially to the Irish and English Roman Catholics. In 1791 he became confessor to the princess Elizabeth, sister of Louis XVI., and earned the respect even of the *sans-culottes* by his courage and devotion. By Madame Elizabeth he was recommended to the king when his trial was impending; and after Louis' condemnation to death he was able to obtain permission to celebrate mass for him and attend him on the scaffold, where he recommended the king to allow his hands to be tied, with the words: "Sire, in this new outrage I see only the last trait of resemblance between your Majesty and the God who will be your reward." It is said that at the moment of the execution, the confessor uttered the celebrated words: "Son of St Louis, ascend to heaven." But it is certain that the phrase was never spoken. The abbé himself does not quote it, either in his memoirs or in a letter written in 1796 to his brother, in which he describes the death of the king. Moreover, Edgeworth declared to several persons who asked him about it, that the words were not his. In spite of the danger he now ran, Edgeworth refused to leave France so long as he could be of any service to Madame Elizabeth, with whom he still managed to correspond. At length, in 1795, his mother having meanwhile died in prison, where his sister was also confined, he succeeded in escaping to England, carrying with him Elizabeth's last message to her brother, the future King Charles X. whom he found in Edinburgh. He afterwards went with some papers to Monsieur (Louis XVIII.) at Blankenburg in Brunswick, by whom he was induced to accompany him to Mittau, where, on the 22nd of May 1807, he died of a fever contracted while attending some French prisoners.

Edgeworth's *Memories*, edited by C.S. Edgeworth, were first published in English (London, 1815), and a French translation (really the letters and some miscellaneous notes, &c.) was published in Paris in 1816. A translation of the *Lettres de l'abbé Edgeworth avec des mémoires sur sa vie* was published by Madame Elizabeth de Bow in Paris in 1818, and *Letters from the Abbé Edgeworth to his Friends, with Memoirs of his Life*, edited by T.B. England, in London in 1818. See J.B.A. Hanet-Cléry, *Journal de ce qui s'est passé, &c.* (Paris, 1825); A.H. du D. de Beauchesne, *Vie de Madame Elisabeth* (Paris, 1869); J.C.D. de Lacretelle, *Précis historique de la Révolution française* (Paris, 1801-1806).

EDGREN-LEFFLER, ANNE CHARLOTTE, duchess of Cajanello (1849-1892), Swedish author, daughter of the mathematician Prof. C.O. Leffler, was born on the 1st of October 1849. Her first volume of stories appeared in 1869, but the first to which she attached her name was *Ur Lifvet* ("From Life," 1882), a series of realistic sketches of the upper circles of Swedish society, followed by three other collections with the same title. Her earliest plays, *Skådespelerskan* ("The Actress," 1873), and its successors, were produced anonymously in Stockholm, but in 1883 her reputation was established by the success of *Sanna Kvinnor*

("True Women"), and *En Räddande engel* ("An Angel of Deliverance"). *Sanna Kvinnor* is directed against false femininity, and was well received in Germany as well as in Sweden. Anne Leffler had married in 1872 G. Edgren, but about 1884 she was separated from her husband, who did not share her advanced views. She spent some time in England, and in 1885 produced her *Hur man gör godt* ("How men do good"), followed in 1888 by *Kampen för lyckan* ("The Struggle for Happiness"), in which she had the help of Sophie Kovalevsky. Another volume of the *Ur Lisvet* series appeared in 1889; and *Familjelycka* ("Domestic Happiness," 1891) was produced in the year after her second marriage, with the Italian mathematician, Pasquale del Pezzo, duca di Cajanello. She died at Naples on the 21st of October 1892. Her dramatic method forms a connecting link between Ibsen and Strindberg, and its masculine directness, freedom from prejudice, and frankness gave her work a high estimation in Sweden. Her last book was a biography (1892) of her friend Sophie (Sonya) Kovalevsky, by way of introduction to Sonya's autobiography. An English translation (1895) by A. de Furnhjelm and A.M. Clive Bayley contains a biographical note on Fru Edgren-Leffler by Lily Wolffsohn, based on private sources.

See also Ellen Key, *Anne Charlotte Leffler* (Stockholm, 1893).

EDHEM PASHA (*c.* 1815-1893), Turkish statesman, was of Greek origin, and is said to have been taken into a Turkish household at the time of the Chio massacre in 1822, and to have been brought up as a Mussulman. He entered the Turkish government service and rose to high office, being successively minister of public works, grand vizier for eleven months (1878), ambassador at Vienna (1879) and minister of the interior. He was quick-tempered, but of kindly disposition, intelligent and patriotic, and he left a reputation of unblemished honesty and uprightness.

EDICT (Lat. *edictum*, from *e*, out, and *dicere*, to say, speak), an order or proclamation issued under authority and having the force of law. The word is especially used of the promulgations of the Roman praetor (*q.v.*), of the Roman emperors, and also of the kings of France (see also Roman Law).

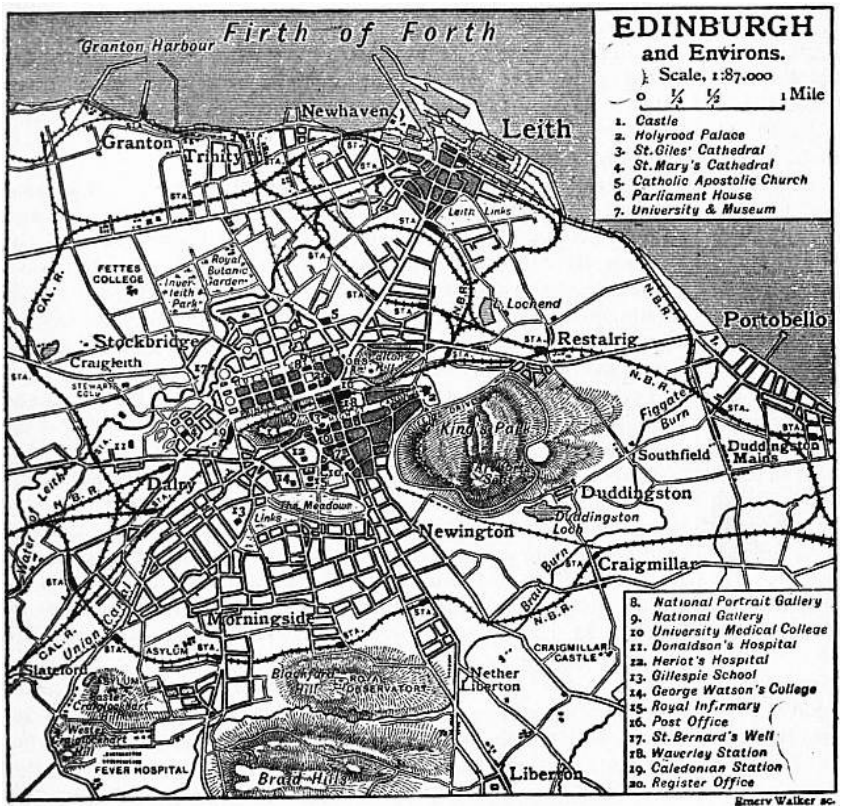
EDINBURGH, a city and royal burgh, and county of itself, the capital of Scotland, and county town of Edinburghshire or Midlothian, situated to the south of the Firth of Forth, 396 m. by rail N. of London. The old Royal Observatory on Calton Hill stands in 55° 57′ 23″ N. and 12° 43′ 05″ W. Edinburgh occupies a group of hills of moderate height and the valleys between. In the centre is a bold rock, crowned by the castle, between which and the new town lies a ravine that once contained the Nor' Loch, but is now covered with the gardens of Princes Street. To the east rises Calton Hill (355 ft.) with several conspicuous monuments, the city prison and the Calton cemetery. On the south-east, beyond the Canongate limits, stands the hill of Arthur's Seat (822 ft.). Towards the north the site of the city slopes gently to the Firth of Forth and the port of Leith; while to the south, Liberton Hill, Blackford Hill, Braid Hills and Craiglockhart Hills roughly mark the city bounds, as Corstorphine Hill and the Water of Leith do the western limits. The views of the city and environs from the castle or any of the hills are very beautiful, and it is undoubtedly one of the most picturesque capitals in the world. Its situation, general plan and literary associations suggested a comparison that gave Edinburgh the name of "the modern Athens"; but it has a homelier nickname of "Auld Reekie," from the cloud of smoke (reek) which often hangs over the low-lying quarters.

Chief Buildings.—Of the castle, the oldest building is St Margaret's chapel, believed to be the chapel where Queen Margaret, wife of Malcolm Canmore, worshipped, and belonging at latest to the reign of her youngest son, David I. (1124-1153). Near it is the parliament and banqueting hall, restored (1889-1892) by the generosity of William Nelson (1817-1887) the publisher, which contains a fine collection of Scottish armour, weapons and regimental colours, while, emblazoned on the windows, are the heraldic bearings of royal and other figures distinguished in national history. Other buildings in the Palace Yard include the apartments occupied by the regent, Mary of Guise, and her daughter Mary, queen of Scots, and the room in which James VI. was born. Here also are deposited the Scottish regalia ("The Honours of Scotland"), with the sword of state presented to James IV. by Pope Julius II., and the jewels restored to Scotland on the death (1807) of Cardinal York, the last of the Stuarts. The arsenal, a modern building on the west side of the rock, is capable of storing 30,000 stand of arms. In the armoury is a collection of arms of various dates; and on the Argyll battery stands a huge piece of ancient artillery, called Mons Meg, of which repeated mention is made in Scottish history. Argyll Tower, in which Archibald, 9th earl of Argyll, spent his last days (1685), was also restored in 1892 by Mr William Nelson.

Holyrood Palace was originally an abbey of canons regular of the rule of St Augustine, founded by David I. in 1128, and the ruined nave of the abbey church still shows parts of the original structure. Connected with this is a part of the royal palace erected by James IV. and James V., including the apartments occupied by Queen Mary, the scene of the murder of Rizzio in 1566. The abbey suffered repeatedly in invasions. It was sacked and burnt by the English under the earl of Hertford in 1544, and again in 1547. In a map of 1544,

preserved among the Cotton MSS. in the British Museum, the present north-west tower of the palace is shown standing apart, and only joined to the abbey by a low cloister. Beyond this is an irregular group of buildings, which were replaced at a later date by additions more in accordance with a royal residence. But the whole of this latter structure was destroyed by fire in 1650 while in occupation by the soldiers of Cromwell; and the more modern parts were begun during the Protectorate, and completed in the reign of Charles II. by Robert Milne, after the designs of Sir William Bruce of Kinross. They include the picture gallery, 150 ft. in length, with 106 mythical portraits of Scottish kings, and a triptych (*c.* 1484) containing portraits of James III. and his queen, which is believed to have formed the altar-piece of the collegiate church of the Holy Trinity, founded by the widowed queen of James II. in 1462, demolished in 1848, and afterwards rebuilt, stone for stone, in Jeffrey Street. The picture gallery is associated with the festive scenes that occurred during the short residence of Prince Charles in 1745; and in it the election of representative peers for Scotland takes place. Escaping from France at the revolution of 1789, the comte d'Artois, afterwards Charles X. of France, had apartments granted for the use of himself and the emigrant nobles of his suite, who continued to reside in the palace till August 1799. When driven from the French throne by the revolution of 1830, Charles once more found a home in the ancient palace of the Stuarts. George IV. was received there in 1822, and Queen Victoria and the prince consort occupied the palace for brief periods on several occasions, and in 1903 Edward VII., during residence at Dalkeith Palace, held his court within its walls. A fountain, after the original design of that in the quadrangle of Linlithgow Palace, was erected in front of the entrance by the prince consort. The royal vault in the Chapel Royal, which had fallen into a dilapidated condition, has been put in order; Clockmill House and grounds have been added to the area of the parade ground, and the abbey precincts generally and the approaches to the King's Park have been improved. With the abolition of imprisonment for debt in 1881 the privileges of sanctuary came to an end.

Parliament House, begun in 1632 and completed in 1640, in which the later assemblies of the Scottish estates took place until the dissolution of the parliament by the Act of Union of 1707, has since been set apart as the meeting-place of the supreme courts of law. The great hall, with its fine open-timbered oak roof, is adorned with a splendid stained-glass window and several statues of notable men, including one (by Louis François Roubiliac) of Duncan Forbes of Culloden, lord president of the court of session (1685-1747), and now forms the ante-room for lawyers and their clients. The surrounding buildings, including the courtrooms, the Advocates' and the Signet libraries, are all modern additions. The Advocates' library is the finest in Scotland. Founded in 1682, at the instance of Sir George Mackenzie, king's advocate under Charles II., and then dean of the faculty, it is regarded as the national library, and is one of the five entitled by the Copyright Act to receive a copy of every work published in Great Britain.



The General Register House for Scotland, begun in 1774 from designs by Robert Adam, stands at the east end of Princes Street. It contains, in addition to the ancient national records, adequate accommodation, in fireproof chambers, for all Scottish title-deeds, entails, contracts and mortgages, and for general statistics, including those of births, deaths and marriages.

The Royal Institution, in the Doric style, surmounted by a colossal stone statue Of Queen Victoria by Sir John Steell, formerly furnished official accommodation for the Board of Trustees for Manufactures and the Board of Fishery, and also for the school of art, and the libraries and public meetings of the Royal Society (founded in 1783), and the Society of Antiquaries of Scotland (founded in 1780). In 1910 it was renamed and appropriated to the uses of the Royal Scottish Academy of Painting, Sculpture and Architecture, which was instituted in 1826, and incorporated by royal charter in 1838, on the model of the Royal Academy in London. It is situated on the Mound close to the National Gallery, of which the prince consort laid the foundation

stone in 1850. These collections, especially rich in Raeburn's works, include also Alexander Nasmyth's portrait of Robert Burns, Gainsborough's "The Hon. Mrs. Graham" (see PAINTING, Plate VI. fig. 20), Sir Noel Paton's "Quarrel" and "Reconciliation of Oberon and Titania," several works by William Etty, Robert Scott Lauder and Sam Bough, Sir Edwin Landseer's "Rent Day in the Wilderness," and the diploma pictures of the academicians, besides many specimens of the modern Scottish school. The National Portrait Gallery and Antiquarian Museum are housed in Queen Street, in a building designed by Sir Rowand Anderson and constructed at the expense of J.R. Findlay of Aberlour (1824-1898), the government providing the site.

Churches.—In conformity with the motto of the city, *Nisi Dominus frustra*, there are numerous handsome places of public worship. St Giles's church, which was effectively restored (1879-1883) by the liberality of Dr William Chambers the publisher, has interesting historical and literary associations. The regent Moray, the marquess of Montrose, and Napier of Merchiston were buried within its walls and are commemorated by monuments, and among the memorial tablets is one to R.L. Stevenson by Augustus St Gaudens. The choir (restored in 1873 by public subscription) is a fine example of 15th-century architecture, and the Gothic crown surmounting the central tower forms one of the most characteristic features in every view of the city. Just outside the church in Parliament Square, the supposed grave of John Knox is indicated by a stone set in the pavement bearing his initials, and in the pavement to the west a heart indicates the site of the old Tolbooth,[1] which figures prominently in Scott's *Heart of Midlothian*. Other churches having historical associations are the two Greyfriars churches, which occupy the two halves of one building; Tron church, the scene of midnight hilarity at the new year; St Cuthbert's church; St Andrew's church in George Street, whence set out, on a memorable day in 1843, that long procession of ministers and elders to Tanfield Hall which ended in the founding of the Free Church; St George's church in Charlotte Square, a good example of the work of Robert Adam. The United Free Church claims no buildings of much historic interest, but St George's Free was the scene of the ministrations of Dr Robert S. Candlish (1806-1873), Dr Oswald Dykes (b. 1835), Dr Alexander Whyte (b. 1837), a man of great mark and influence in the city, and his successor Hugh Black (b. 1868). Preachers like Robert Candlish, Thomas Guthrie (1803-1873), Marcus Dods (b. 1834), occupied many pulpits, besides those of the particular congregations whom each served. The most imposing structure belonging to the Scottish Episcopal Church is St Mary's cathedral, built on ground and chiefly from funds left by the Misses Walker of Coates, and opened for worship in 1879. It is in the Early Pointed style, by Sir Gilbert Scott, is 278 ft. long, and is surmounted by a spire 275 ft. high. The old-fashioned mansion of East Coates, dating from the 17th century, still stands in the close, and is occupied by functionaries of the cathedral. St John's Episcopal church at the west end of Princes Street was the scene of the ministrations of Dean Ramsay, and St Paul's Episcopal church of the Rev. Archibald Alison, father of the historian. The Catholic Apostolic church at the foot of Broughton Street is architecturally noticeable, and one of its features is a set of mural paintings executed by Mrs Traquair. The Central Hall at Tollcross testifies to Methodist energy. John Knox's house at the east end of High Street is kept in excellent repair, and contains several articles of furniture that belonged to the reformer. The Canongate Tolbooth adjoins the parish church, in the burial-ground of which is the tombstone raised by Burns to the memory of Robert Fergusson, and where Dugald Stewart, Adam Smith and other men of note were buried. Almost opposite to it stands Moray House, from the balcony of which the 8th earl of Argyll watched Montrose led to execution (1650). The city gaol, a castellated structure on the black rock of Calton Hill, forms one of the most striking groups of buildings in the town. In the Music Hall in George Street, Carlyle, as lord rector of the university, delivered his stimulating address on books to the students, and Gladstone addressed the electors in his Midlothian campaigns. St Bernard's Well, on the Water of Leith, was embellished and restored (1888) at the cost of Mr William Nelson. A sum of £100,000 was bequeathed by Mr Andrew Usher (1826-1898) for a hall to be called the Usher Hall and to supplement the municipal buildings. The library of the solicitors to the supreme courts presents to the Cowgate a lofty elevation in red sandstone. The Sheriff Court Buildings stand on George IV. Bridge, and facing them is Mr Andrew Carnegie's free library (1887-1889). At the corner of High Street and George IV. Bridge stand the County buildings. The *Scotsman* newspaper is housed in an ornate structure in North Bridge Street, the building of which necessitated the demolition of many old alleys and wynds, such as Fleshmarket Close and Milne Square. Ramsay Gardens, a students' quarter fostered by Prof. Patrick Geddes (b. 1854), grew out of the "goose-pie" house where Allan Ramsay lived, and with its red-tiled roof and effective lines adds warmth to the view of the Old Town from Princes Street. Not the least interesting structure is the old City Cross (restored at the cost of W.E. Gladstone), which stands in High Street, adjoining St Giles's. Several of the quaint groups of buildings of Auld Reekie have been carefully restored, such as the White Horse Close in the Canongate; the mass of alleys on the north side of the Lawnmarket, from Paterson's Close to James's Court have been connected, and here Lord Rosebery acquired and restored the 17th-century dwelling which figures in the legend of *My Aunt Margaret's Mirror*. Another model restoration of a historic close is found in Riddle's Close, which contains a students' settlement. If these and other improvements have led to the disappearance of such old-world picturesque buildings as Allan Ramsay's shop "at the sign of the Mercury, opposite Niddry Wynd," Cardinal Beaton's palace, the old Cunzie House, or mint, the beautiful timber-fronted "land" that stood at the head of the West Bow, and even such "howffs" as Clerihugh's tavern, where Mr Counsellor Pleydell and the rest played the "high jinks" described in *Guy Mannering*, it must be conceded that the changes in the Old Town (many of a drastic nature) have been carried out with due regard to the character of their environment.

Monuments.—Edinburgh is particularly rich in monuments of every description and quality. Of these by far the most remarkable is the Scott monument in East Princes Street Gardens, designed by George Meikle Kemp (1795-1844); it is in the form of a spiral Gothic cross with a central canopy beneath which is a seated statue of Scott with his dog "Maida" at his side, by Sir John Steell, the niches being occupied by characters in Sir Walter's writings. A column, 136 ft. high, surmounted by a colossal figure of Viscount Melville, Pitt's first lord of the Admiralty, rises from the centre of St Andrew Square. At the west end of George Street, in the centre of Charlotte Square, stands the Albert Memorial, an equestrian statue of the prince consort, with groups at each of the four angles of the base. Burns's monument, in the style of a Greek temple, occupies a prominent position on the Regent Road, on the southern brow of the lower terrace of Calton Hill. It was originally intended to form a shrine for Flaxman's marble statue of the poet (now in the National Portrait

Gallery), but it proved to be too confined to afford a satisfactory view of the sculptor's work and was at length converted into a museum of Burnsiana (afterwards removed to the municipal buildings). On Calton Hill are a number of finely placed monuments. The stateliest is the national monument to commemorate the victory of Waterloo, originally intended to be a reproduction of the Parthenon. The plan was abandoned for lack of funds, after twelve out of the twenty-four Greek pillars had been erected, but it is perhaps more effective in its unfinished state than if it had been completed. The Nelson monument, an elongated turreted structure, stands on the highest cliff of the hill. Close by is the monument to Dugald Stewart, a copy of the choragic monument of Lysicrates. Sir John Steell's equestrian statue of the duke of Wellington stands in front of the Register House, and in Princes Street Gardens are statues of Livingstone, Christopher North, Allan Ramsay, Adam Black and Sir J.Y. Simpson. In George Street are Chantrey's figures of Pitt and George IV., and a statue of Dr Chalmers; the 5th duke of Buccleuch stands beside St Giles's. Charles II. surveys the spot where Knox was buried; the reformer himself is in the quadrangle of New College: Sir David Brewster adorns the quadrangle of the university; Dr William Chambers is in Chambers Street, and Frederick, duke of York (1763-1827), and the 4th earl of Hopetoun are also commemorated.

Cemeteries.—Obviously the churchyards surrounding the older and more important parish churches—such as Greyfriars', St Cuthbert's and the Canongate, contain the greatest number of memorials of the illustrious dead. In Greyfriars' churchyard the Solemn League and Covenant was signed, and among its many monuments are the Martyrs' monument, recording the merits of the murdered covenanters, and the tomb of "Bluidy" Mackenzie. To the three named should be added the Calton burying-ground, with its Roman tomb of David Hume, and the obelisk raised in 1844 to the memory of Maurice Margarot, Thomas Muir (1765-1798), Thomas Fyshe Palmer (1747-1802), William Skirving and Joseph Gerrald (1765-1796), the political martyrs transported towards the end of the 18th century for advocating parliamentary reform. The Scottish dead in the American Civil War are commemorated in a monument bearing a life-sized figure of Abraham Lincoln and a freed slave. The cemeteries are all modern. In Warriston cemetery (opened in 1843) in the New Town, were buried Sir James Young Simpson, Alexander Smith the poet, Horatio McCulloch, R.S.A., the landscape painter, the Rev. James Millar, the last Presbyterian chaplain of the castle, and the Rev. James Peddie, the pastor of Bristo Street church. In Dean cemetery, partly laid out on the banks of the Water of Leith, and considered the most beautiful in the city (opened 1845), were interred Lords Cockburn, Jeffrey and Rutherford; "Christopher North," Professor Aytoun, Edward Forbes the naturalist, John Goodsir the anatomist; Sir William Allan, Sam Bough, George Paul Chalmers, the painters; George Combe, the phrenologist; Playfair, the architect; Alexander Russel, editor of the *Scotsman*; Sir Archibald Alison, the historian; Captain John Grant, the last survivor of the old Peninsular Gordon Highlanders; Captain Charles Gray, of the Royal Marines, writer of Scottish songs; Lieutenant John Irving, of the Franklin expedition, whose remains were sent home many years after his death by Lieut. Frederick Schwatka, U.S. navy; and Sir Hector Macdonald, "Fighting Mac" of Omdurman. In the south side are the Grange, Newington or Echobank, and Morningside cemeteries. In the Grange repose the ashes of Chalmers, Guthrie and Lee, Sir Thomas Dick Lauder, Sir Hope Grant, Hugh Miller and the 2nd Lord Dunfermline.

Parks and Open Spaces.—Edinburgh is exceptionally well provided with parks and open spaces. The older are Princes Street Gardens, covering the old Nor' Loch, Calton Hill, the Meadows and the Bruntsfield Links. The municipal golf links are on the Braid Hills. On the southern side Blackford Hill has been set apart for public use. Here stands the Royal Observatory, in which the great Dunecht telescope was erected in 1896. Harrison Park is a breathing spot for the congested district of Fountainbridge, and the park at Saughton Hall, opened in 1905, for the western district of the city. To the north of the Water of Leith lie Inverleith Park, the Arboretum and the Royal Botanical Garden. This institution has undergone four changes of site since its foundation in 1670 by Sir Andrew Balfour and Sir Robert Sibbald, and now occupies an area of 34 acres in Inverleith Row. It includes a herbarium and palm house, with an extensive range of hot-houses, a museum of economic botany, a lecture-room and other requisites for the study of botany. The most important open spaces, however, surround Arthur's Seat (822 ft.). This basaltic hill, the name of which is believed to commemorate the British king Arthur, who from its height is said to have watched the defeat of the Picts by his followers, is shaped like a lion *couchant*, with head towards the north. It is separated from the narrow valley, in which lie the Canongate and Holyrood Palace, by Salisbury Crags, named after Edward III.'s general William Montacute, 1st earl of Salisbury (1301-1344). At their base is the Queen's Drive (3½ m. long), named by Queen Victoria. Adjoining Holyrood Palace is the King's Park, used as a parade ground. Facing the crags on the south-west are the spots familiar to readers of *The Heart of Midlothian*, where stood Jeanie Deans's cottage, and between the crags and Arthur's Seat lies Hunter's Bog, used as a shooting range. Near here too are three small lakes, Duddingston, Dunsappie and St Margaret's, the last overlooked by the ruins of St Anthony's chapel.

Environs.—In several directions many places once to be described among the environs have practically become suburbs of Edinburgh. Newhaven (population of parish, 7636), so called from the harbour constructed in the reign of James IV., had a shipbuilding yard of some repute in former times. The village has always been a fishing-place of importance, the "fishwives" in their picturesque garb being, till recently, conspicuous figures in the streets of the capital. It used to be a popular resort for fish dinners, and it plays a prominent part in Charles Reade's novel of *Christie Johnstone*. To the west lies Granton (pop. 1728), where the 5th duke of Buccleuch constructed a magnificent harbour. Before the building of the Forth Bridge the customary approach to Fifeshire and the north-east of Scotland was by means of a steam ferry from Granton to Burntisland, which is still used to some extent. There is regular communication with Iceland, the continental ports and London. A marine station here was established by Sir John Murray, but has been discontinued. Still farther west lies the village of Cramond (pop. of parish, 3815), at the mouth of the river Almond, where Roman remains have often been found. It was the birthplace of several well-known persons, among others of John Law (1671-1729), originator of the Mississippi scheme, Lauriston Castle being situated in the parish. Cramond Brig was the scene of one of the "roving" adventures of James V., when the life of the "Gudeman of Ballengeich" was saved by Jock Howieson of the Braehead. Corstorphine (pop. 2725), once noted for its cream and also as a spa, is now to all intents and purposes a western suburb of the capital. The parish church contains the tombs of the Forresters, of old the leading family of the district, with full-length

sculptured figures, and at the base of Corstorphine Hill—from one point of which (“Rest and be Thankful”) is to be had one of the best views of Edinburgh—are the seats of several well-known families. Among these are Craigcrook Castle (where Lord Jeffrey spent many happy years, and the gardens of which are said to have given Scott a hint for Tullyveolan in *Waverley*), and Ravelston House, the home of the Keiths. To the south of the metropolis are Colinton (pop. 5499), on the Water of Leith, with several mansions that once belonged to famous men, such as Dreghorn Castle and Bonally Tower; and Currie (pop. 2513), which was a Roman station and near which are Curriehill Castle (held by the rebels against Queen Mary), the ruins of Lennox Tower, and Riccarton, the seat of the Gibson-Craigs, one of the best-known Midlothian families. At Dalmahoy Castle, near Ratho (pop. 1946), the seat of the earl of Morton, are preserved the only extant copy of the bible of the Scottish parliament and the original warrant for committing Queen Mary to Lochleven Castle in Kinross-shire. Craigmillar, though situated in the parish of Liberton, is really a part of Edinburgh. Its picturesque castle, at least the oldest portion of it, probably dates from the 12th century. Its principal owners were first the Prestons and latterly the Gilmours. After playing a varied rôle in local and national story, now as banqueting-house and now as prison, it fell gradually into disrepair. It was advertised as to let in 1761, and early in the 19th century, along with the chapel adjoining, was in ruins, but has been restored by Colonel Gordon-Gilmour. It was a favourite residence of Mary Stuart, and its associations with the hapless queen give it a romantic interest. Duddingston (pop. 2023), once a quiet village, has become a centre of the distilling and brewing industries. The parish church, effectively situated on an eminence by the side of the lake, was the scene of the ministration of the Rev. John Thomson (1778-1840), the landscape painter, who numbered Sir Walter Scott among his elders. Duddingston House is a seat of the duke of Abercorn. Liberton (pop. of parish, 7233), a name that recalls the previous existence of a leper’s hospital, is prominently situated on the rising ground to the south of Edinburgh, the parish church being a conspicuous landmark. Adjoining is the village of Gilmerton (pop. 1482), which used to supply Edinburgh with yellow sand, when sanded floors were a feature in the humbler class of houses. Portobello (pop. 9180), being within 3 m. of the capital, must always enjoy a large share of public patronage, though it is not in such favour as a watering-place as it once was. Its beautiful stretch of sands is flanked by a promenade extending all the way to Joppa. The beach was at one time used for the purpose of reviews of the yeomanry. The town dates from the middle of the 18th century, when a cottage was built by a sailor and named Portobello in commemoration of Admiral Vernon’s victory in 1739. The place does a considerable trade in the making of bricks, bottles, earthenware, pottery, tiles and paper. Joppa, which adjoins it, has salt works, but is chiefly a residential neighbourhood. Inveresk (pop. 2939), finely situated on the Esk some 6 m. from Edinburgh, is a quaint village with several old-fashioned mansions and beautiful gardens. Alexander Carlyle, the famous divine (1772-1805), whose *Memorials of his Times* still affords fascinating reading, ministered for fifty-five years in the parish church, in the graveyard of which lies David Macbeth Moir (1798-1851), who under the pen-name of “Delta” wrote *Mansie Wauch*, a masterpiece of Scots humour and pathos. Lasswade (pop. of parish, 9708), partly in the Pentlands, famous for its oatmeal, was often the summer resort of Edinburgh worthies. Here Sir Walter Scott lived for six years and De Quincey for nineteen, and William Tennant (1784-1848), author of *Anster Fair*, was the parish dominie. Many interesting mansions were and are in the vicinity, amongst them Melville Castle, the seat of the Dundas Melvilles, and Auchendinny, where Henry Mackenzie, author of *The Man of Feeling*, resided. The two most celebrated resorts, however, amongst the environs of Edinburgh are Roslin (pop. 1805) and Hawthornden. Roslin Castle is romantically situated on the beautifully wooded precipitous banks of the Esk. It dates from the 12th century and is a plain, massive ruin, architecturally insignificant. Partially destroyed by fire in 1447 and afterwards rebuilt, it was sacked in 1650 and again in 1688, and then gradually fell into decay. The chapel, higher up the bank, a relic of great beauty, was founded in 1446 by William St Clair, 3rd earl of Orkney. It is believed to be the chancel of what was intended to be a large church. Although it suffered at the hands of revolutionary fanatics in 1688, the damage was confined mainly to the external ornament, and the chapel, owing to restoration in judicious taste, is now in perfect condition. The Gothic details are wonderful examples of the carver’s skill, the wreathed “Prentice’s pillar” being the subject of a well-known legend. The walk to Hawthornden, about 1½ m. distant, through the lovely glen by the river-side, leads to the mansion of the Drummonds, perched high on a lofty cliff falling sheer to the stream. The caverns in the sides of the precipice are said to have afforded Wallace and other heroes (or outlaws) refuge in time of trouble, but the old house is most memorable as the home of the poet William Drummond, who here welcomed Ben Jonson; the tree beneath which the two poets sat still stands. Near Swanston, on the slopes of the Pentlands, where R.L. Stevenson when a boy used to make holiday occasionally, is a golf-course which was laid out by the Lothianburn Club. The Pentland range contains many points of interest and beauty, but these are mostly accessible only to the pedestrian, although the hills are crossed by roads, of which the chief are those by Glencorse burn and the Cauld Stane Slap. Habbie’s Howe, the scene of Allan Ramsay’s pastoral *The Gentle Shepherd*, is some 2 m. from Carlops, and Rullion Green is noted as the field on which the Covenanters were defeated in 1666. At Penicuik (pop. 5097), where the Clerks were long the ruling family, S.R. Crockett was minister until he formally devoted himself to fiction. The town is, industrially, remarkable for its paper mills and mines of coal and other minerals.

Communications.—The two trunk railways serving Edinburgh are the North British and the Caledonian. The North British station is Waverley, to which the trains of the Great Northern, North Eastern and the Midland systems run from England. The Caledonian station is Princes Street, where the through trains from the London & North-Western system of England arrive. Leith, Granton and Grangemouth serve as the chief passenger seaports for Edinburgh. Tramways connect the different parts of the city with Leith, Newhaven, Portobello and Joppa; and the Suburban railway, starting from Waverley station, returns by way of Restalrig, Portobello, Duddingston, Morningside and Haymarket. In summer, steamers ply between Leith and Aberdour and other pleasure resorts; and there is also a service to Alloa and Stirling. In the season brakes constantly run to Queensferry (for the Forth Bridge) and to Roslin, and coaches to Dalkeith, Loanhead and some Pentland villages.

Population.—In 1801 the number of inhabitants was 66,544; in 1851 it was 160,302; in 1881 it was 234,402; and in 1901 it was 316,479. In 1900 the birth-rate was 26.90 per thousand, 7.8% of the births

being illegitimate; the death-rate was 19.40 per thousand, and the marriage-rate 10 per thousand.

The area of the city has been enlarged by successive extensions of its municipal boundaries, especially towards the west and south. An important accession of territory was gained in 1896, when portions of the parishes of Liberton and Duddingston and the police burgh of Portobello were incorporated. Under the Edinburgh Corporation Act 1900, a further addition of nearly 1800 acres was made. This embraced portions of South Leith parish (landward) and of Duddingston parish, including the village of Restalrig and the ground lying on both sides of the main road from Edinburgh to Portobello; and also part of Cramond parish, in which is contained the village and harbour of Granton. The total area of the city is 10,597½ acres. The increase in wealth may best be measured by the rise in assessed valuation. In 1880 the city rental was £1,727,740, in 1890 it was £2,106,395, and in 1900-1901 £2,807,122.

Government.—By the Redistribution Act of 1885 the city was divided for parliamentary purposes into East, West, Central and South Edinburgh, each returning one member; the parliamentary and municipal boundaries are almost identical. The town council, which has its headquarters in the Municipal Buildings in the Royal Exchange, consists of fifty members, a lord provost, seven bailies, a dean of guild, a treasurer, a convener of trades, seven judges of police, and thirty-two councillors. The corporation has acquired the gas-works, the cable tramways (leased to a company), the electric lighting of the streets, and the water-supply from the Pentlands (reinforced by additional sources in the Moorfoot Hills and Talla Water). Among other duties, the corporation has a share in the management of the university, and maintains the Calton Hill observatory.

May Meetings.—During the establishment of Episcopacy in Scotland, Edinburgh was the seat of a bishop, and the ancient collegiate church of St Giles rose to the dignity of a cathedral. But the annual meeting of the General Assembly of the Church of Scotland at Edinburgh is now the public manifestation of the predominance of Presbyterianism as the national church. In May each year the sovereign appoints a representative as lord high commissioner to the General Assembly of the Established Church, who takes up his abode usually in the palace of Holyrood, and thence proceeds to the High Church, and so to the assembly hall on the Castle Hill. The lord provost and magistrates offer to him the keys of the city, and levees, receptions and state dinners revive in some degree the ancient glories of Holyrood. The General Assembly of the United Free Church is usually held at the same time.

University.—The university of Edinburgh, the youngest of the Scottish universities, was founded in 1583 by a royal charter granted by James IV., and its rights, immunities and privileges have been remodelled, ratified and extended at various periods. In 1621 an act of the Scottish parliament accorded to the university all rights and privileges enjoyed by other universities in the kingdom, and these were renewed under fresh guarantees in the treaty of union between England and Scotland, and in the Act of Security. Important changes were made in the constitution by acts passed in 1858 and 1889. It was one of the first universities to admit women students to its classes and degrees, and its *alumni* are brought into close bonds of sympathy and activity by a students' union. The number of students averages nearly three thousand a year. As a corporation it consists of a chancellor, vice-chancellor, lord rector (elected by the students every three years), principal, professors, registered graduates and matriculated students. The chancellor is elected for life by the general council, of which he is head; and the rights of the city as the original founder have been recognized by giving to the town council the election of four of the seven curators, with whom rest the appointment of the principal, the patronage of seventeen of the chairs, and a share in other appointments. Along with that of St Andrews, the university sends one member to parliament. While the college, as such, bears the name of the College of King James, or King's college, and James VI. is spoken of as its founder, it really originated in the liberality of the citizens of Edinburgh. William Little of Craigmillar, and his brother Clement Little, advocate, along with James Lawson, the colleague and successor of John Knox, may justly be regarded as true founders. In 1580 Clement Little gave all his books, three hundred volumes, for the beginning of a library, and this was augmented by other valuable benefactions, one of the most interesting of which was the library of Drummond of Hawthornden. The library now contains upwards of 220,000 volumes, and more than 7000 MSS. The buildings of the university occupy the site of the ancient collegiate church of St. Mary in the Field (the "Kirk of Field"), the scene of the murder of Darnley. The present structure, the foundation-stone of which was laid in 1789, is a classical building, enclosing an extensive quadrangle. The older parts of it, including the east front, are from the design of Robert Adam, his plans being revised and modified by W.H. Playfair (1789-1857), but it was not till 1883 that the building was completed by the dome, crowned by the bronze figure of Youth bearing the torch of Knowledge, on the façade in South Bridge Street. This edifice affords accommodation for the lecture rooms in the faculties of arts, law and theology, and for the museums and library. The opening up of the wide thoroughfare of Chambers Street, on the site of College Wynd and Brown and Argyll Squares, cleared the precincts of unsightly obstructions and unsavoury neighbours. The Royal Scottish Museum, structurally united to the university, contains collections illustrative of industry, art, science and natural history; and Minto House college and Heriot-Watt college are practically adjuncts of the university. The library hall was restored and decorated, largely through the generosity of Sir William Priestley (1829-1900), formerly M.P. for the university; while munificent additions to the academic funds and resources were made by the 15th earl of Moray (1840-1901), Sir William Fraser (1816-1898), and others. The university benefits also, like the other Scottish universities, from Mr Andrew Carnegie's endowment fund. The medical school stands in Teviot Row, adjoining George Square and the Meadows. To this spacious and well-equipped group of buildings the faculty of medicine was removed from the college. The medical school is in the Italian Renaissance style from the designs of Sir Rowand Anderson. The magnificent hall used for academic and public functions was the gift of William M'Ewan, some time M.P. for the Central division of Edinburgh. Closely associated with the medical school, and separated from it by the Middle Meadow Walk, is the Royal Infirmary, designed by David Bryce, R.S.A. (1803-1876), removed hither from Infirmary Street. Its wards, in which nearly ten thousand patients receive treatment annually, are lodged in a series of turreted pavilions, and cover a large space of ground on the margin of the Meadows, from which, to make room for it, George Watson's College—the most important of the Merchant Company schools—was removed to a site farther west, while the Sick

Children's hospital was moved to the southern side of the Meadows.

Scientific Institutions.—The old Observatory is a quaint structure on Calton Hill, overlooking the district at the head of Leith Walk. The City Observatory stands close by, and on Blackford Hill is the newer building of the Royal Observatory. The Astronomer-Royal for Scotland also holds the chair of practical astronomy.

The museum and lecture-rooms of the Royal College of Surgeons occupy a handsome classical building in Nicolson Street. The college is an ancient corporate body, with a charter of the year 1505, and exercises the powers of instructing in surgery and of giving degrees. Its graduates also give lectures on the various branches of medicine and science requisite for the degree of doctor of medicine, and those extra-academical courses are recognized, under certain restrictions, by the University Court, as qualifying for the degree. The museum contains a valuable collection of anatomical and surgical preparations.

The Royal College of Physicians is another learned body organized, with special privileges, by a charter of incorporation granted by Charles II. in 1681. In their hall in Queen Street are a valuable library and a museum of materia medica. But the college as such takes no part in the educational work of the university.

Educational Institutions.—After the Disruption in 1843, and the formation of the Free Church, New College was founded in connexion with it for training students in theology. Since the amalgamation of the United Presbyterian and the Free Churches, under the designation of the United Free Church of Scotland, New College is utilized by both bodies. New College buildings, designed in the Pointed style of the 16th century, and erected on the site of the palace of Mary of Guise, occupy a prominent position at the head of the Mound.

Edinburgh has always possessed exceptional educational facilities. The Royal high school, the burgh school *par excellence*, dates from the 16th century, but the beautiful Grecian buildings on the southern face of Calton Hill, opened in 1829, are its third habitation. It was not until 1825, when the Edinburgh Academy was opened, that it encountered serious rivalry. Fettes College, an imposing structure in a 16th-century semi-Gothic style, designed by David Bryce and called after its founder Sir William Fettes (1750-1836), is organized on the model of the great English public schools. Merchiston Academy, housed in the old castle of Napier, the inventor of logarithms, is another institution conducted on English public school lines. For many generations the charitable foundations for the teaching and training of youth were a conspicuous feature in the economy of the city. Foremost among them was the hospital founded by George Heriot—the "Jingling Geordie" of Scott's *Fortunes of Nigel*—the goldsmith and banker of James VI. At his death in 1624 Heriot left his estate in trust to the magistrates and ministers of Edinburgh for the maintenance and teaching of poor fatherless sons of freemen. The quadrangular edifice in Lauriston, sometimes ascribed to Inigo Jones, is one of the noblest buildings in the city. Even earlier than Heriot's hospital was the Merchant Maiden hospital, dating from 1605, which gave to the daughters of merchants similar advantages to those which Heriot's secured for burgesses' sons. In 1738 George Watson's hospital for boys was founded; then followed the Trades' Maiden hospital for burgesses' daughters, John Watson's, Daniel Stewart's, the Orphans', Gillespie's,[2] Donaldson's[3] hospitals, and other institutions founded by successful merchants of the city, in which poor children of various classes were lodged, boarded and educated. Nearly all these buildings are characterized by remarkable distinction and beauty of design. This is especially true of Donaldson's hospital at the Haymarket, which has accommodation for three hundred children. As the New Town expanded, the Heriot Trust—whose revenues were greatly benefited thereby—erected day-schools in different districts, in which thousands of infants and older children received a free education, and, in cases of extreme poverty, a money grant towards maintenance. Public opinion as to the "hospital" system of board and education, however, underwent a revolutionary change after the Education Act of 1872 introduced school boards, and the Merchant Company—acting as governors for most of the institutions—determined to board out the children on the foundation with families in the town, and convert the buildings into adequately equipped primary and secondary day-schools. This root-and-branch policy proved enormously successful, and George Watson's college, Stewart's college, Queen Street ladies' college, George Square ladies' college, Gillespie's school, and others, rapidly took a high place among the educational institutions of the city. Nor did the Heriot Trust neglect the claims of technical and higher education. The Heriot-Watt college is subsidized by the Trust, and Heriot's hospital is occupied as a technical school. Concurrently with this activity in higher branches, the school board provided a large number of handsome buildings in healthy surroundings. The Church of Scotland and the United Free Church have training colleges.

Charities.—Besides the Royal Infirmary there are a considerable number of more or less specialized institutions, two of the most important being situated at Craiglockhart. On the Easter Hill stands the Royal Edinburgh asylum for the insane, which formerly occupied a site in Morningside, while the City infectious diseases hospital is situated at Colinton Mains. The Royal blind asylum at Powburn in its earlier days tenanted humbler quarters in Nicolson Street. Chalmers's hospital in Lauriston was founded in 1836 by George Chalmers for the reception of the sick and injured. The home for incurables is situated in Salisbury Place. The infirmary convalescents are sent to the convalescent house in Corstorphine. Other institutions are the Royal hospital for sick children, the home for crippled children, the Royal maternity hospital, and the deaf and dumb asylum. Though Trinity hospital no longer exists as a hospital with resident pensioners, the trustees disburse annually pensions to certain poor burgesses and their wives and children; and the trust controlling the benevolent branch of the Gillespie hospital endowment is similarly administered.

Industries.—Although Edinburgh is a residential rather than a manufacturing or commercial centre, the industries which it has are important and flourishing. From 1507, when Walter Chapman, the Scottish Caxton, set up the first press, to the present day, printing has enjoyed a career of almost continuous vitality, and the great houses of R. & R. Clark, T. & A. Constable, the Ballantyne Press, Morrison & Gibb, Turnbull & Spears, and others, admirably maintain the traditional reputation of the Edinburgh press. Publishing, on the other hand, has drifted away, only a few leading houses—such as those of Blackwood, Chambers and Nelson—still making the Scottish capital their headquarters. Mapmakers, typefounders, bookbinders and lithographers all contribute their share to the prosperity of the city. Brewing is an industry of exceptional vigour, Edinburgh ale being proverbially good. The brewers and distillers, such as M'Ewan, Usher and Ure,

have been amongst the most generous benefactors of the city. The arts and crafts associated with furniture work, paper-making and coach-building may also be specified, whilst tanneries, glassworks, india-rubber and vulcanite factories, brass-founding, machinery works, the making of biscuits, tea-bread and confectionery are all prominent. In consequence of the large influx of tourists every year the North British and Caledonian railway companies give employment to an enormous staff. Building and the allied trades are chronically brisk, owing to the constant development of the city. Fine white freestone abounds in the immediate vicinity (as at Craigleith, from the vast quarry of which, now passing into disuse, the stone for much of the New Town was obtained) and furnishes excellent building material; while the hard trap rock, with which the stratified sandstones of the Coal formation have been extensively broken up and overlaid, supplies good materials for paving and road-making. On this account quarrying is another industry which is seldom dormant. Owing to the great changes effected during the latter part of the 19th century, some of the old markets were demolished and the system of centralizing trade was not wholly revived. The Waverley Market for vegetables and fruit presents a busy scene in the early morning, and is used for monster meetings and promenade and popular concerts. Slaughter-houses, cattle markets and grain markets have been erected at Gorgie, thus obviating the driving of flocks and herds through the streets, which was constantly objected to. An infantry regiment is always stationed in the castle, and there are in addition the barracks at Piers-hill (or “Jock’s Lodge”), half-way between Edinburgh and Portobello.

Social Life.—Edinburgh society still retains a certain old-fashioned Scottish exclusiveness. It has been said that the city is “east-windy” and the folk “west-endy.” But this criticism needs judicious qualification. The local patriotism and good taste of the citizens have regulated recreation and have also preserved in pristine vigour many peculiarly Scottish customs and pastimes. Classical concerts and concerts of the better sort, chiefly held in the M’Ewan and Music Halls, are well attended, and lectures are patronized to a degree unknown in most towns. In theatrical matters in the old days of stock companies the verdict of an Edinburgh audience was held to make or mar an actor or a play. This is no longer the case, but the Lyceum theatre in Grindlay Street and the Theatre Royal at the head of Leith Walk give good performances. Variety entertainments are also in vogue, and in Nicolson Street and elsewhere there are good music halls. Outdoor recreations have always been pursued with zest. The public golf-course on Braid Hills and the private courses of the Lothianburn club at Swanston and the Barnton club at Barnton are usually full on Saturdays and holidays. The numerous bowling-greens are regularly frequented and are among the best in Scotland—the first Australian team of bowlers that visited the mother country (in 1901) pronouncing the green in Lutton Place the finest on which they had played. Cricket is played by the university students, at the schools, and by private clubs, of which the Grange is the oldest and best. In winter the game of curling is played on Duddingston Loch, and Dunsappie, St Margaret’s Loch, Lochend and other sheets of water are covered with skaters. Rugby football is in high favour, Edinburgh being commonly the scene of the international matches when the *venue* falls to Scotland. Hockey claims many votaries, there usually being on New Year’s day a match at shinty, or *camanachd*, between opposing teams of Highlanders resident in the city. The central public baths in Infirmary Street, with branch establishments in other parts of the town, including Portobello, are largely resorted to, and the proximity of the Firth of Forth induces the keener swimmers to visit Granton every morning. Facilities for boating are limited (excepting on the Forth), but rowing clubs find opportunity for practice and races on the Union Canal, where, however, sailing is scarcely possible. Edinburgh maintains few newspapers, but the *Scotsman*, which may be said to reign alone, has enjoyed a career of almost uninterrupted prosperity, largely in consequence of a succession of able editors, like Charles Maclaren, Alexander Russel, Robert Wallace and Charles Cooper. The *Edinburgh Evening News* and the *Evening Dispatch* are popular sheets. In the past the *Edinburgh Evening Courant*, the chief organ of the Tory party, of which James Hannay was editor for a few years, had a high reputation. *The Witness*, edited by Hugh Miller, the *Daily Review*, edited first by J.B. Manson and afterwards by Henry Kingsley, and the *Scottish Leader*, were conducted more or less as Liberal organs with a distinct bias in favour of the then Free Church, but none of these was long-lived. Volunteering has always attracted the younger men, and the highest awards at Wimbledon and Bisley have been won by the Queen’s Edinburgh.

History.—In remote times the seaboard from the Tyne to the Forth was occupied by the Ottadeni, a Welsh tribe of the Brigantes, the territory immediately to the west of it being peopled by the Gadeni. It is probable that the Ottadeni built a fort or camp on the rock on which Edinburgh Castle now stands, which was thus the nucleus around which, in course of time, grew a considerable village. Under the protection of the hill-fort, a native settlement was established on the ridge running down to the valley at the foot of Salisbury Crags, and another hamlet, according to William Maitland (1693-1757), the earliest historian of Edinburgh, was founded in the area at the north-western base of the rock, a district that afterwards became the parish of St Cuthbert, the oldest in the city. The Romans occupied the country for more than three hundred years, as is evidenced by various remains; but James Grant (1822-1887), in *Old and New Edinburgh*, doubts whether they ever built on the castle rock. When they withdrew, the British tribes reasserted their sway, and some authorities go so far as to suggest that Arthur was one of their kings. The southern Picts ultimately subdued the Britons, and the castle became their chief stronghold until they were overthrown in 617 (or 629) by the Saxons under Edwin, king of Northumbria, from whom the name of Edinburgh is derived. Symeon of Durham (854) calls it Edwinesburch, and includes the church of St Cuthbert within the bishopric of Lindisfarne. Its Gaelic name was Dunedin. This name is probably a translation of the Saxon name. James Grant’s view that it may have been the earlier name of the castle, from *dun* (“the fort”), and *edin* (“on the slope”), conflicts with the more generally received opinion that the Britons knew the fortress as *Castelh Mynedh Agnedh* (“the hill of the plain”), a designation once wrongly interpreted as the “castle of the maidens” (*castrum puellarum*), in allusion to the supposed fact that the Pictish princesses were lodged within it during their education. In the 16th century the latinized form Edina was invented and has been used chiefly by poets, once notably by Burns, whose “Address” begins “Edina! Scotia’s darling seat.” Long after Edwin’s conquest the lowland continued to be debatable territory held by uncertain tenure, but at length it was to a large extent settled anew by Anglo-Saxon and Norman colonists under Malcolm Canmore and his sons.

In the reign of Malcolm Canmore the castle included the king’s palace. There his pious queen, Margaret,

the grand-niece of Edward the Confessor, died in 1093. It continued to be a royal residence during the reigns of her three sons, and hence the first rapid growth of the upper town may be referred to the 12th century. The parish church of St Giles is believed to have been erected in the reign of Alexander I., about 1110, and the huge Norman keep of the castle, built by his younger brother, David I., continued to be known as David's Tower till its destruction in the siege of 1572. Soon after his accession to the Scottish throne David I. founded the abbey of Holyrood (1128), which from an early date received the court as its guests. But notwithstanding the attractions of the abbey and the neighbouring chase, the royal palace continued for centuries to be within the fortress, and there both the Celtic and Stuart kings frequently resided. Edinburgh was long an exposed frontier town within a territory only ceded to Malcolm II. about 1020; and even under the earlier Stuart kings it was still regarded as a border stronghold. Hence, though the village of Canongate grew up beside the abbey of David I., and Edinburgh was a place of sufficient importance to be reckoned one of the four principal burghs as a judicatory for all commercial matters, nevertheless, even so late as 1450, when it became for the first time a walled town, it did not extend beyond the upper part of the ridge which slopes eastwards from the castle. So long, however, as its walls formed the boundary, and space therefore was limited, the citizens had to provide house-room by building dwellings of many storeys. These tall tenements on both sides of what is now High Street and Canongate are still a prominent characteristic of the Old Town. The streets were mostly very narrow, the main street from the castle to Holyrood Palace and the Cowgate alone permitting the passage of wheeled carriages. In the narrow "wynds" the nobility and gentry paid their visits in sedan chairs, and proceeded in full dress to the assemblies and balls, which were conducted with aristocratic exclusiveness in an alley on the south side of High Street, called the Assembly Close, and in the assembly rooms in the West Bow. Beyond the walls lay the burghs of Calton, Easter and Wester Portsburgh, the villages of St Cuthbert's, Moutrie's Hill, Broughton, Canonmills, Silvermills and Deanhaugh—all successively swallowed up in the extension of the modern city. The seaport of Leith, though a distinct burgh, governed by its own magistrates, and electing its own representative to parliament, has also on its southern side become practically united to its great neighbour.

The other three royal burghs associated with Edinburgh were Stirling, Roxburgh and Berwick; and their enactments form the earliest existing collected body of Scots law. The determination of Edinburgh as the national capital, and as the most frequent scene of parliamentary assemblies, dates from the death of James I. in 1436. Of the thirteen parliaments summoned by that sovereign, only one, the last, was held at Edinburgh, but his assassination in the Blackfriars' monastery at Perth led to the abrupt transfer of the court and capital from the Tay to the Forth. The coronation of James II. was celebrated in Holyrood Abbey instead of at Scone, and the widowed queen took up her residence, with the young king, in the castle. Of fourteen parliaments summoned during this reign, only one was held at Perth, five met at Stirling and the rest at Edinburgh; and, notwithstanding the favour shown for Stirling as a royal residence in the following reign, every one of the parliaments of James III. was held at Edinburgh. James II. conferred on the city various privileges relating to the holding of fairs and markets, and the levying of customs; and by a royal charter of 1452 he gave it pre-eminence over the other burghs. Further immunities and privileges were granted by James III.; and by a precept of 1482, known as the Golden Charter, he bestowed on the provost and magistrates the hereditary office of sheriff, with power to hold courts, to levy fines, and to impose duties on all merchandise landed at the port of Leith. Those privileges were renewed and extended by various sovereigns, and especially by a general charter granted by James VI. in 1603.

James III. was a great builder, and, in the prosperous era which followed his son's accession to the throne, the town reached the open valley to the south, with the Cowgate as its chief thoroughfare. But the death of James IV. in 1513, along with other disastrous results of the battle of Flodden, brought this era of prosperity to an abrupt close. The citizens hastened to construct a second line of wall, enclosing the Cowgate and the heights beyond, since occupied by Greyfriars churches and Heriot's hospital, but still excluding the Canongate, as pertaining to the abbey of Holyrood. In the 16th century the movements connected with John Knox and Mary, queen of Scots, made Edinburgh a castle of much activity. With the departure, however, of the sixth James to fill the English throne in 1603, the town lost for a long period its influence and prestige. Matters were not bettered by the Act of Union signed in a cellar in High Street in 1707, amidst the execrations of the people, and it was not till the hopes of the Jacobites were blasted at Culloden (1746) that the townsfolk began to accept the inevitable. This epoch, when grass grew even in High Street, long lingered in the popular memory as the "dark age."

By the accession of George III. (1760), Edinburgh showed signs of revived enterprise. In 1763 the first North Bridge, connecting the Old Town with the sloping ground on which afterwards stood the Register House and the theatre in Shakespeare Square, was opened; a little later the Nor' Loch was partially drained, and the bridging of the Cowgate in 1785 encouraged expansion southwards. Towards the end of the 18th century the New Town began to take shape on the grand, if formal, lines which had been planned by James Craig (d. 1795), the architect, nephew of the poet Thomson, and the erection of Regent Bridge in Waterloo Place (formally opened in 1819 on the occasion of the visit of Prince Leopold, afterwards king of the Belgians) gave access to Calton Hill. The creation of Princes Street, one of the most beautiful thoroughfares in the world, led to further improvement. The earth and débris from the excavation of the sites for the houses in this and adjoining streets had been "dumped" in the centre of the drained Nor' Loch. This unsightly mass of rubbish lay for a while as an eye-sore, until the happy thought arose of converting it into a broad way joining the new road at Hanover Street with the Old Town at the Lawnmarket. Upon this street, which divides Princes Street and its gardens into east and west, and which received the title of the Mound, were erected the National Gallery and the Royal Institution. Speaking generally, the New Town was resorted to by professional men—lawyers, doctors and artists,—and in its principal streets will be found the head offices of the leading banks and insurance offices, all lodged in buildings of remarkable architectural pretensions. The Commercial, the Union and the Clydesdale banks are in George Street, the National Bank of Scotland, the Royal Bank of Scotland, and the British Linen Company's Bank are in St Andrew Square, the Bank of Scotland is at the head of the Mound. The extensive building operations engaged in by the town council in the early part of the 19th century resulted in the insolvency of the city in 1833. The property of the corporation was valued at £271,658 against a debt of £425,195, which was compounded for by the issue

of 3% annuity bonds—the loss to the creditors amounting to 25% of their claims.

Meanwhile the progress of letters, science and learning manifested the recovery of the city. The names of Knox (d. 1572), Buchanan (1582), Alexander Montgomery (1605), Drummond of Hawthornden (1649), Allan Ramsay (1757), Smollett (1771), Fergusson (1774), and Burns (1796), carried on the literary associations of the Scottish capital nearly to the close of the 18th century, when various causes combined to give them new significance and value. The university was served by a body of teachers and investigators who won for it a prominent position among European schools. Then succeeded the era of Scott's *Marmion* and *The Lady of the Lake*, followed by the Waverley novels and the foundation of *Blackwood's Magazine* and the *Edinburgh Review*.

Modern conditions have changed the character of Edinburgh society. In Scott's early days a journey to London was beset with difficulties and even dangers; but railways have now brought it within a few hours' distance, and Scottish artists and literary men are tempted to seek a wider field. Nevertheless, the influence of the past survives in many ways. Edinburgh is not markedly a manufacturing city, but preserves its character as the Scottish capital.

AUTHORITIES.—James Grant, *Old and New Edinburgh* (London, 1880 et seq.); W. Maitland, *History of Edinburgh* (1753); Hugo Arnot, *History of Edinburgh* (1789); B. Chambers, *Traditions of Edinburgh* (1824); D. Wilson, *Memorials of Edinburgh in the Olden Time* (1846-1848); O. Smeaton, *Edinburgh and its Story* (1904). *The Municipal Buildings of Edinburgh*, by Robert Miller, Lord Dean of Guild, printed by order of the town council (Edinburgh, 1895); *Royal Edinburgh*, by Mrs Oliphant, illustrations by Sir George Reid, R.S.A. (London, 1890).

1 The original Tolbooth was completed in 1501, but a new one took its place in 1563-1564, and was subsequently altered. At first occupied by the parliament and courts of justice, it served later as a prison, and was removed in 1817.

2 James Gillespie (1726-1797) was a tobacco and snuff manufacturer, and when he set up his carriage Henry Erskine suggested as a motto the homely couplet:—

"Wha wad hae thocht it,
That noses wad bocht it?"

3 James Donaldson (1751-1830) was a printer who bequeathed nearly the whole of his large fortune for the purposes of a hospital for poor boys and girls, and the trustees have usually selected half of the children admitted from the ranks of the deaf and dumb.

EDINBURGHSHIRE, or MIDLOTHIAN, a county of Scotland, bounded N. by the Firth of Forth, E. by the shires of Haddington, or East Lothian, and Berwick, S.E. by Roxburghshire, S. by Selkirkshire, Peeblesshire and Lanarkshire, S.W. by Lanarkshire, and W. by Linlithgowshire or West Lothian. Its area is 234,339 acres or 3662 sq. m. The island of Cramond belongs to the county. There are no mountains, but the Pentland Hills advance boldly from the south-west to within 5 m. of the sea. The loftiest summits are Scald Law (1898 ft.), Carnethy (1881), West and East Cairn Hill (1844 and 1839), and West Kip (1806). They are generally of rounded form, and covered with heath or grass. The Moorfoot Hills, in the south-east, are a continuation of the Lammermuirs, and attain in Blackhope Scar a height of 2136 ft. Of more or less isolated eminences there are the Braid Hills (698 ft.), Blackford Hill (500), Arthur's Seat (822), Corstorphine Hill (500)—all practically within Edinburgh—and Dalmahoy Craig (800), 7 m. south-west of the city. Of the rivers the Gala rises on the south-east of the Moorfoot Hills and flows south to join the Tweed, and the Tyne after a course of 7 m. passes into Haddingtonshire. All the others flow into the Firth of Forth. Of these the Esk, which is the longest, drains the district between the Pentlands and the Moorfoot Hills, and empties into the sea at Musselburgh. The southern branch has its source near Blackhope Scar, receives on its right Gore Water and, on its left, Dalhousie Burn, and flows past Newbattle Abbey; the northern rises in the Pentlands, and proceeds through much picturesque scenery past Penicuik, Roslin, Hawthornden and Lasswade; the two streams uniting within the grounds of Dalkeith Palace. Braid Burn from Capelaw Hill passes between the Braid Hills and Blackford Hill, and reaches the sea at Portobello. The Water of Leith, with its head streams on the western slope of the Pentlands, flows past Balerno, Currie, Juniper Green, Colinton, Edinburgh and Leith. The Almond, rising in Lanarkshire, and its right-hand tributary, Breich Water, form the boundary between Midlothian and Linlithgowshire. Several of these streams, especially the Esk and the Water of Leith, furnish much water power. The only loch is that at Duddingston, but there are several large reservoirs connected with the water supply of Edinburgh. Cobbinshaw reservoir, situated at the head of Bog Burn, a tributary of the Almond, is used for the supply of the Union Canal connecting the Forth with the Clyde.

Geology.—The southern portion of the county, embracing the Moorfoot Hills and a large part of the catchment basin of the Gala Water, lies within the Silurian tableland of the south of Scotland. From Bowland northwards to Crookston in the Gala valley the Silurian strata are mainly of Tarannon age and consist of greywackes, grits, flags and shales, with thin dark seams which yield graptolites sparingly. To the north of this area, older sediments, comprising Arenig cherts, black shales, greywackes and grits of Llandeilo and Caradoc age, rise from underneath the Tarannon strata and spread over the hills north to the margin of the tableland. In some of the folds of Arenig cherts diabase lavas appear, which occupy small lenticular areas. All the Silurian strata are repeated by folds striking north-east and south-west and frequently dipping in one direction, to the north-west as in the Gala valley. North of the Silurian tableland and within the area occupied by the younger palaeozoic rocks of the Pentland Hills, there are various inliers of Upper Silurian strata. These isolated patches occur (1) in the North Esk section, (2) at Loganlee reservoir, (3) near Bavelaw

Castle, and (4) in Bavelaw Burn. The section in the North Esk is by far the most complete, as the strata embrace Wenlock, Ludlow and Downtonian rocks with a north-east strike similar to that of the beds in the Silurian tableland. The Wenlock rocks have yielded a rich suite of organic remains. In the Pentland Hills the folded and denuded Silurian strata are covered unconformably by Lower Old Red Sandstone rocks, comprising conglomerates and red sandstones, which are succeeded by a great volcanic series, the latter extending from the West Kip Hill to the Braid Hills. The pebbles of the basal conglomerates are derived chiefly from the underlying platform of greywackes and shales and from the Radiolarian cherts and volcanic rocks in the tableland to the south. The contemporaneous igneous rocks include olivine basalts, andesites, trachytes, rhyolites and tuffs, which are pierced by the microgranite of the Black Hill and by several vents filled with agglomerate, as near Swanston.

The Upper Old Red Sandstone rests unconformably on all older formations. The red sandstones and cornstones of this division form the Cairn Hills, and are traceable north-eastwards along the north-west slope of the Pentland Hills towards the Clubbiedean reservoir, where they are overlapped by Carboniferous strata. They occupy the south part of the city of Edinburgh, they occur in the lower slope of Salisbury Crags, and south by Craigmillar and Liberton towards Mortonhall. Recently the horizon of these beds has been proved by the discovery of fish remains (*Holoptychius*), a zonal form of the Upper Old Red Sandstone. The remainder of the county embracing the fertile low ground west of the city of Edinburgh and along the basin of the Esk is occupied by Carboniferous strata and various igneous rocks associated with that formation. The Pentland Hills, formed of older Palaeozoic deposits, appear as a prominent ridge, throwing off the Carboniferous beds to the north-west and south-east. In the former direction only the Calciferous Sandstone series is represented, and in the latter all the Carboniferous divisions are well developed. The lowest subdivision of the Calciferous Sandstone series, consisting of sandstones, red and green shales, marls and cement-stones, appears in the ridge of the old part of the city between the Castle and Holyrood, in the Hunter’s Bog and on the north-west side of the Pentland Hills. Intercalated in this series near the top, there are interbedded volcanic rocks, comprising olivine basalts, mugearites, tuffs and agglomerates, which form conspicuous features on Arthur’s Seat, on Calton Hill, at Craiglockhart and Corston Hill south of Mid Calder. Next in order come the Granton sandstones and Wardie shales, which are best seen on the shore at Granton, and extend up the Water of Leith in the direction of Colinton, where they are succeeded by the Hailes sandstone. The upper portion of the Calciferous Sandstone series, overlying the Hailes sandstone, embraces the valuable oil-shales, which give rise to one of the chief industries of the Lothians. Recently, however, it has been proved that some of the bands in the Wardie shales give a low yield of oil and sulphate of ammonia. The oil-shale-fields in the county lie partly along its west margin from Mid Calder south to Breich and also on the south-east side of the Pentland Hills between Straiton and Carlops along the west side of the Midlothian basin. From an economic point of view the Midlothian coalfield is of special importance, the strata being arranged in a syncline, the long axis of which trends north-north-east and south-south-west. In the centre of the basin lie the Coal-Measures covered by the barren red sandstone of Dalkeith, probably on the same horizon as the red sandstones of Wemyss in Fife (Middle Coal-Measures). The underlying Millstone Grit and Carboniferous Limestone series with its middle-coal-bearing group rise from underneath the Coal-Measures, forming parallel bands curving round the basin. Along the west side of the syncline, the strata dip at high angles to the south-east, are sometimes vertical and even in some cases inverted, while in the centre they become flat and rise at gentle angles towards the east. The Coal Measures and the coal-bearing group of the Carboniferous Limestone series contain numerous valuable coals and ironstones, and there still remains a large field for development. The intrusive igneous rocks forming prominent features in the county are divisible into two main groups, which are separated from each other by a considerable interval of time. The coarse agglomerate filling the old volcano on the top of Arthur’s Seat is associated with the eruption of the volcanic rocks of Calciferous Sandstone age near Edinburgh. The fine grained basalt appearing as a plug on the Castle Rock closely resembles the basalt on the top of Arthur’s Seat, and is likewise of the same age. The intrusive sheets of Salisbury Crags and Corstorphine Hill composed of olivine-dolerite belong to the same general period. But the quartz-dolerites represented by the Ratho sill are in all probability of late Carboniferous age.

Climate and Agriculture.—In the hill country the average rainfall is 37.4 in., but on the coast only 28.4 in. The average temperature ranges from 38° F. in January to 59°.5 in July, the mean for the year being 47.7. The north-east and easterly winds prevailing in spring are, especially in Edinburgh and its vicinity, remarkable for their cold and blighting character. Excepting in the uplands, snow seldom lies long, but frosts sometimes occur at night as late as the beginning of June, and severe enough to destroy the young shoots of seedling trees in nurseries. But the winter is often astonishingly mild. The common snowdrop (*Galanthus nivalis*) blossoms as early as the 25th of January, the kidney liverleaf (*Hepatica triloba*) by the 31st of January and the rhododendron (*R. nobleanum*) by the 25th of February. On the shores of the Forth along the Almond and the Esk, and on some of the richer flats, grain crops ripen early; 2 m. nearer the hills and 200 ft. higher the harvest is ten days later; and at 600 ft. still another week later. High farming is the rule in the three Lothians. All the area on which wheat can be profitably grown is so occupied; oats, however, is the predominant grain crop, though barley is also raised. Turnips and potatoes are the chief roots, and beans are grown to a limited extent. A large area is occupied by pasture and sown grasses, fallow land having practically disappeared. Near Edinburgh sewage farming has been largely developed. There are 200 acres at Craigentinny between Restalrig and the Forth, besides smaller tracts under similar treatment at Lochend, Dalry and the Grange. The produce consists principally of natural grasses. Sheep and cattle raising is an important pursuit. In the neighbourhood of the capital dairy farming is conducted on an extensive scale. Horse breeding flourishes, several of the studs being of excellent character, Clydesdales predominating. Pig-keeping has grown considerably and poultry-farming is carried on near Edinburgh. The nursery gardens are extensive, and, besides market gardening, which prospers near the capital, there are many orchards.

Other Industries.—Though as a whole not a mining county, Midlothian possesses some mineral wealth. Coal is extensively mined at various points on the North Esk, like Penicuik, Loanhead, Bonnyrigg, Eskbank and at Gorebridge, Newbattle, Newbigging, Niddrie, Gilmerton, Mid and West Calder. Ironstone is obtained chiefly at Lasswade and Penicuik and fire-clay occurs at various points. In the vicinity of West Calder there is a large amount of valuable oil-bearing shale. Limestone is of frequent occurrence—at Esperston,

Cousland, Crichton near Dalkeith, Burdiehouse, Gilmerton near Edinburgh, the Camps in Kirknewton parish, and at Muirieston and Leven Seat in the south-west. Freestone is quarried at Craigleith, Hailes, Redhall and Craigmillar. It is used for pavements and stairs, and for the great docks at Leith. Barnton Mount supplies large blocks of whinstone, also used for docks and for fortifications; the causeway stones for the streets of Edinburgh are mainly procured from the quarries at Ratho; and a number of smaller quarries for the supply of road-material are scattered throughout the county. Owing no doubt to the growth of printing and publishing in the metropolis, the chief manufacturing industry in Midlothian is paper-making. Most of the mills are extensive and equipped with the most modern processes and have an enormous yearly output. The most important mills, some of them dating from the beginning of the 18th century, are situated on the North Esk between Penicuik and Musselburgh, and on the South Esk at Newbattle. At Balerno, Currie, Colinton and elsewhere on the Water of Leith there are several mills, as well as near Mid Calder and at Portobello. The ancient vat-mill called Peggy's Mill, at Cramond, produces handmade papers. There are carpet factories on the Esk at Roslin and at Lasswade. The manufacture of gunpowder is also carried on at Roslin, the works being distributed in recesses on the Esk. Iron foundries exist at Dalkeith, Westfield, Loanhead, Penicuik, Millerhill and in the suburbs of Edinburgh; brick and tile works at Portobello, Millerhill, Newbattle, Bonnyrigg and Rosewell; and candle works at Dalkeith and Loanhead. Leather also is tanned at Edinburgh and Dalkeith. The shipping trade is concentrated at Leith and Granton, and Newhaven is still an important fishery centre, while there are also fleets at Fisherrow and Granton.

Population and Government.—The population in 1891 was 434,276, and in 1901 488,796, of whom 5765 spoke both Gaelic and English, and 75 Gaelic only. The chief towns, besides Edinburgh, the capital (pop. in 1901, 316,837), are Bonnyrigg (1924), Dalkeith (6812), Leith (77,439), Loanhead (3071), Musselburgh (11,711), Newton Grange (2406), Penicuik (3574), and West Calder (2652). The county forms a single parliamentary constituency, exclusive of Edinburgh city and Leith burghs. It has been divided by the county council into four county districts (Calder, Gala Water, Lasswade, Suburban) for the purposes of the Roads and Bridges Act 1878, and the Public Health Acts. The management of special districts formed for water supply, drainage and other sanitary purposes is entrusted to sub committees appointed by the respective district committees. The grant under the Local Taxation (Customs and Excise) Act is administered by the Technical Education Committee appointed by the Council; and, subject to the same authority, the Secondary Education Committee provides for the distribution of the grant under the Local Taxation (Scotland) Act. In respect of education the shire is under school-board jurisdiction.

History and Antiquities.—Cramond was once a Roman seaport, and various objects of Roman art and workmanship have been discovered in its vicinity and along the banks of the Almond. On several heights are remains of early military works—the most important being that on Dalmahoy Hill, Braidwood Castle in the parish of Penicuik, and Castle Greg on the Harburn estate in Mid Calder parish. Picts' houses are found at Crichton Mains, at Borthwick Castle, near Middleton House and elsewhere, the first being especially interesting from the fact that some of the stones bear marks of Roman masonry. There are hut-circles and a fort on Kaimes Hill, near Ratho; a large tumulus, with three upright stones, at Old Liston; a smaller tumulus at Newbattle; a cistvaen or stone burial chest at Carlowrie; and standing stones at Lochend, at Comiston (the Caiy stone), and the "Cat Stane" near Kirkliston. Temple, on the South Esk, was at one time the chief seat of the Knights Templars in Scotland for whom David I. here built a church, now in ruins.

The history of the county is almost identical with that of the capital. Traces of Celtic occupation are obvious in such names as Inveresk, Almond, Leith, Dalry, Dalmahoy, Dalkeith and others; though most of the villages, hamlets and castles received their present designation from Saxon possessors. The termination *ton* is very frequent. Following upon the withdrawal of the Romans the land was the scene of intertribal strife, but it was in a measure subdued by the Saxons and passed under the rule of the Northumbrian kings, who held it till 1020, when the Lothians were handed over to the Scottish king, Malcolm II. The people of the Lothians, however, stipulated that they were to retain their manners and customs, and in this way the south-eastern lowlands became the centre from which Anglo-Saxon and Norman civilization gradually spread throughout Scotland, and hence, too, was assured the pre-eminence of Edinburgh. Within the county lie the battlefields of Roslin, where (in 1303) the English suffered three reverses in one day; Burghmuir, where the English were defeated by the earl of Moray in 1334; Pinkie near Inveresk, where (in 1547) the duke of Somerset inflicted heavy loss upon the Scots; and Rullion Green, on the eastern slopes of the Pentlands, where (in 1666) the Covenanters were routed by the royal troops under General Dalziel.

See James Grant, *Old and New Edinburgh* (London, 1880 et seq.); Miss Warrender, *Walks near Edinburgh* (Edinburgh, 1890); J.C. Oliphant, *Rambles round Edinburgh* (Edinburgh, 1892); J.M. Bell, *Castles of the Lothians* (Edinburgh, 1893); W. Baird, *Annals of Duddingston and Portobello* (Edinburgh, 1898); J. Geddie, *The Water of Leith* (Edinburgh, 1896); Rev. J. Dickson, *Ruined Castles of Midlothian* (Edinburgh, 1895); *The Islands of the Forth* (Edinburgh 1899).

EDISON, THOMAS ALVA (1847-), American inventor, was born on the 11th of February 1847, at Milan, Erie county, Ohio, of mixed Dutch and Scottish descent; but his parents moved to Port Huron, Michigan, when he was seven years old. At the age of twelve he became a train news-boy on the railway to Detroit, and managed to gratify his youthful interest in chemistry by performing experiments while travelling. At fifteen he became a telegraph operator, and was employed in many cities in the United States and Canada, but frequently neglected his duties in order to carry on studies and experiments in electrical science. Before he was twenty-one he had constructed an automatic repeater, by means of which a message could be transferred from one wire to another without the aid of an operator; and he had also directed his attention to the problem of duplex telegraphy, of which he later invented a successful system. In 1869

Edison came to New York city, and soon afterwards became connected with the Gold & Stock Company. He invented an improved printing telegraph for stock quotations, for which he received $40,000. He then established a laboratory and factory in Newark, N.J., for further experiments and for the manufacture of his inventions. In 1876 he removed to Menlo Park, and later to West Orange, N.J., where he continued his experiments. Since then his name has been prominently associated with all kinds of novelties in practical electricity. Among his principal inventions are his system of duplex telegraphy, which he later developed into quadruplex and sextuplex transmission; his carbon telephone transmitter; the microtasimeter, for the detection of small variations in temperature; the phonograph, which records and reproduces all manner of sounds; the cinematograph, which his improvements made practicable; and his method of preparing carbon filaments for the incandescent electric lamp. In 1878 Edison was made a chevalier of the Legion of Honour by the French government.

EDMONTON, the capital city of the province of Alberta, Canada, which was constituted in 1905. Pop. (1901) 2652; (1906) 11,167. It is picturesquely situated on the north bank of the North Saskatchewan river in 113° 37′ W. and 53° 32′ N. It is on a high tableland which rises 200 ft. above the river, and overlooks the thickly wooded valley of the North Saskatchewan river—at this point a mile in width, the river itself being one-eighth of a mile wide. Directly opposite Edmonton on the south bank of the river stands Strathcona, a town with a population of 2927. The streets of Edmonton are wide and laid out in rectangular form. Its excellent drainage makes street grading an easy matter. In 1896 it was scarcely a village; in 1901 it assumed some importance, but three-quarters of the city were built between 1901 and 1906. Its choice as capital in 1905 gave it a great impetus. The buildings, largely of brick, give a substantial appearance to the place. The public school buildings, high school and Alberta College are attractive. The church buildings, many in number, include several architecturally beautiful. Three well planned and commodious hospital buildings represent the benevolent work of the community. The banks and the wholesale warehouses are well built, and many beautiful private residences are worthy of note. Its growth may be realized from the fact that during a part of 1906, $806,015 worth of building permits were granted; the customs receipts, $57,994 in 1905, grew to $104,416 in 1906; the mail parcels handled increased from 6800 to 12,079; and the express parcels handled from 1277 to 2347. Edmonton is the depot of the fur traders for the great region on the north and west. The Hudson’s Bay Company has great interest in Edmonton, but is vigorously opposed by a strong French firm, Revillon Frères of Paris. These two companies have their posts wide spread over the north country. The city, being incorporated, is governed by a mayor and a board of aldermen. It operates its own water service, electric light plant, and telephone system. Its schools are managed by an elected public school board.

Edmonton was begun as a post of the North West Company about the year 1778. Early in the 19th century the Hudson’s Bay Company also established a fort at this point. On the union of the two companies under the name of the latter, Fort Edmonton sprang into new importance. It became a north-western centre, and in its neighbourhood many employees of the fur company, both Scottish and French, took up land as settlers. As freighters for the Hudson’s Bay Company many of these settlers made, with their ox or pony carts, the long journey over the natural prairie roads to Fort Garry, fording or swimming the streams, carrying furs for a thousand miles or more on the eastern trip, and returning brought loads of merchandise for the company. Its inaccessibility made the Edmonton settlement grow very slowly, so that its great increase in population belongs to the period subsequent to 1896.

EDMONTON, an urban district in the Enfield parliamentary division of Middlesex, England, suburban to London, 7½ m. N. of London Bridge, on the Old North Road, on the west side of the Lea Valley. Pop. (1891) 25,381; (1901) 46,899. There are numerous factories in the valley, and Edmonton consists largely of the cottages of artisans. The church of All Saints has been extensively restored, but retains part of the ancient fabric of Perpendicular and earlier date. It contains brasses of interest, and in the churchyard is the memorial of Charles Lamb, who lived and died (1834) at Edmonton, and his sister. Cowper and Keats were also residents, and the Bell Inn is famed through Cowper’s poem *John Gilpin*.

EDMUND, SAINT [Edmund Rich] (d. 1240), English saint and archbishop of Canterbury, was born at Abingdon, near Oxford, about 1175. His father was a merchant of that town who retired, with his wife’s consent, to the monastery of Eynsham, leaving in her hands the education of their family. Her name was Mabel; she was a devout woman who lived an ascetic life and encouraged her children to do the same. Both her daughters took the veil; three of her sons served the church in different capacities. Edmund, her first-born, began his education in a grammar school at Oxford. Of weak health and a contemplative disposition, he showed, from his earliest years, a remarkable taste for learning and religious exercises. He saw visions while still at school, and at the age of twelve took a vow of perpetual chastity in the Virgin’s church at Oxford. Later he was sent, with his brother Robert, to study the liberal arts at Paris. His mother’s death and

family affairs recalled him for a time to England; but he afterwards graduated at Paris. For six years he lectured in the liberal arts, partly in Paris and partly in Oxford; his career as an Oxford teacher commenced before 1205, and is noteworthy for the fact that he was the first who lectured there on Aristotle. He then returned to Paris for a course of theological studies, and rapidly made himself proficient in that branch of learning.

After spending a year in retirement with the Augustinian canons of Merton (Surrey) he became a theological lecturer in Oxford. In this capacity he gained some reputation, and it is related that his audience were often moved to tears by his eloquence. He spent the fees which he received in charity, and refused to spend upon himself the revenues which he derived from several benefices. He not infrequently retired for solitude to Reading Abbey; it is probable that he would have become a monk if that profession had afforded more scope for his gifts as a preacher and expositor. As his fame increased he became alarmed by the temptations which it threw in his way. He ceased to lecture in Oxford, and about 1222 accepted, at the invitation of Bishop Richard Poore, the treasurership of Salisbury cathedral. Little is known of his life for the next ten years. But he attracted the notice of the Roman court, and was appointed in 1227 to preach the Crusade in England; he formed a friendship with Ella, countess of Salisbury, and her husband, William Longsword, and he won general admiration by his works of charity and the austerity of his life.

In 1233 he was elected archbishop of Canterbury at the express suggestion of Gregory IX., after the monks of Canterbury had in vain suggested three other candidates for the pope's approval. Edmund at once leaped into prominence by the outspoken manner in which he rebuked the king for following the advice of foreign favourites. In common with the baronial opposition he treated Henry III. as responsible for the tragic fate of Richard Marshal, earl of Pembroke, and threatened the king with excommunication. The king bowed before the storm, dismissed the foreign counsellors, made peace with Marshal's adherents, and was publicly reconciled with the barons. But the new ministers were as unpopular as the old; nor was the archbishop allowed that political influence which he claimed in virtue of his office. It was with the object of emancipating himself from Edmund's control that the king asked the pope to send him a legate (1236). On the arrival of Cardinal Otho (1237) the archbishop found himself thwarted and insulted at every point. The marriage between Simon de Montfort and the Princess Eleanor, which Edmund had pronounced invalid, was ratified at Rome upon appeal. The king and legate upheld the monks of Canterbury in their opposition to the archbishop's authority. On all public occasions the legate took precedence of the archbishop. By the advice of his suffragans Edmund laid a protest before the king, and excommunicated in general terms all who had infringed the liberties of Canterbury. These measures led to no result; nor could the pope be moved to reverse the legate's decisions. Edmund complained that the discipline of the national church was ruined by this conflict of powers, and began to meditate retiring. He was confirmed in this intention by the papal encroachments of the year 1240, when the English clergy were required to pay a subsidy of a fifth for the war against Frederick II., and simultaneously three hundred Romans were "provided" with English benefices in return for their political services to the Holy See. Edmund withdrew to Pontigny in the summer of 1240. A little later the state of his health compelled him to seek the cooler air of Soissy (near Provins). Here he died on the 16th of November 1240.

His canonization was at once demanded by his admirers, and only delayed (till 1247) through the opposition of Henry III. The honour was well deserved. He is one of the most saintly and attractive figures in the history of the English church. It was his misfortune to be placed at the head of the national hierarchy in a crisis for which he had not been prepared by practical training or experience. As archbishop he showed no great capacity or force of character; but the purity of his motives and the loftiness of his ideals commanded universal respect.

See the Life printed by Martène and Durand in the *Thesaurus novus anecdotorum* (1717). Other lives of importance exist in manuscript at the British Museum, in the Cambridge University library and in that of St John's College, Cambridge. The last-named is printed by W. Wallace in the appendix to his *Life of St Edmund* (1893). An account of the manuscript lives and many extracts (translated) will be found in the Rev. B. Ward's *St Edmund* (1903). See also *St Edmund of Abingdon* (1898), by the Baroness Paravicini; and the *English Historical Review*, xxii. pp. 84 ff.

(H. W. C. D.)

EDMUND, king of East Anglia (*c.* 840-870), succeeded to the East Anglian throne in 855 while he was yet but a boy. According to Abbo, followed by Florence of Worcester, he was "*ex antiquorum Saxonum prosapia*," which would seem to mean that he was of foreign origin and that he belonged to the Old Saxons of the continent. This very doubtful tradition was expanded later into a fuller legend which spoke of his Old Saxon parentage, his birth at Nuremberg, his nomination as successor to Offa, king of East Anglia, and his landing at Hunstanton to claim his kingdom. His coronation took place in the next year at "Burna" (*i.e.* probably Bures St Mary, Suffolk), which was then the royal capital.

Of the life of St Edmund during the next fourteen years we know nothing. In the year 870 the Danes, who had been wintering at York, marched through Mercia into East Anglia and took up their quarters at Thetford. Edward engaged them fiercely in battle, but the Danes under their leaders Ubba and Inguar were victorious and remained in possession of the field of battle. The king himself was slain, whether on the actual field of battle or in later martyrdom is not certain, but the widely current version of the story which makes him fall a martyr to the Danish arrows when he had refused to renounce his faith or hold his kingdom as a vassal from the heathen overlords, may very probably be true. The story is a very old one, and according to Abbo of Fleury (945-1004), St Edmund's earliest biographer, it was told him by Dunstan, who heard it from the lips of Edmund's own standard-bearer. This is chronologically just possible, but that is all.

The battle was fought at Hoxne, some 20 m. south-east of Thetford, and the king's body was ultimately interred at Beadoricesworth, the modern Bury St Edmunds. The shrine of Edmund soon became one of the most famous in England and the reputation of the saint was European. The date of his canonization is unknown, but churches dedicated to his memory are found all over England.

See *Asser's Life of Alfred*, ed. W.H. Stevenson; *Annals of St Neots*; *Saxon Chronicle*; *Memorials of St Edmund's Abbey* (Rolls Series), including the *Passio Sancti Edmundi* of Abbo of Fleury; and the *Corolla Sancti Eadmundi*, edited by Lord Francis Hervey (1907).

(A. Mw.)

EDMUND I., king of the English (d. 946), was the son of Eadgifu, third wife of Edward the Elder, and half-brother to his predecessor Æthelstan. He succeeded to the throne in 940, but had already played an active part in the previous reign, especially when he fought by the side of his half-brother in the great battle of Brunanburh.

In the first year of his reign Edmund had trouble with Olaf or Anlaf Sihtricsson, called Cuaran. The latter had just crossed from Ireland and had been chosen king by the Northumbrians, who threw off their allegiance to Edmund. Anlaf took York, besieged Northampton and destroyed Tamworth, but was met by Edmund at Leicester. The enemy escaped, but a peaceful settlement was made by the good offices of Odo of Canterbury and Wulfstan of York. Simeon of Durham states that a division of the kingdom was now made, whereby Edmund took England south of Watling Street and Anlaf the rest. This division seems incredible, especially in face of the poem inserted in the chronicle (*sub anno* 942). There can be little doubt that the story told there of the reconquest of Northern Mercia by Edmund refers to the compact with Anlaf, made as a result of the campaign, and it is probable that Simeon's statement is a wide exaggeration, due in part at least to a confused reminiscence of the earlier pact between Alfred and Guthrum. All Mercia south of a line from Dore (near Sheffield), through Whitwell to the Humber, was now in Edmund's hands, and the five Danish boroughs, which had for some time been exposed to raids from the Norwegian kings of Northumbria, were now freed from that fear. The peace was confirmed by the baptism of Kings Anlaf and Rægenald, Edmund standing as sponsor, but in 944 or 945 the peace was broken and Edmund expelled Anlaf and Rægenald from Northumbria.

In 945 Edmund ravaged Strathclyde, and entrusted it all to Malcolm, king of Scotland, "on condition that he should be his fellow-worker by sea and land," the object of this policy being apparently to detach the king of Scots from any possible confederacy such as had been formed in 937.

On the 26th of May 946 Edmund's brief but energetic reign came to a tragic conclusion when he was stabbed at the royal villa of Pucklechurch, in Gloucestershire, by an exiled robber named Liofa, who had returned to the court unbidden. Edmund, the "deed-doer" as the chronicle calls him, "Edmundus magnificus" as Florence of Worcester describes him, perhaps translating the Saxon epithet, was buried at Glastonbury, an abbey which he had entrusted in 943 to the famous Dunstan.

Edmund was twice married; first to Ælfgifu, the mother of Eadwig and Edgar; second to Æthelflæd "æt Damerhame" (*i.e.* of Damerham, Co. Wilts). Ælfgifu died in 944, according to Ethelwerd.

Authorities.—*Anglo-Saxon Chronicle* (ed. Earle and Plummer, Oxford); *Simeon of Durham* (Rolls Series); *A.S. Laws*, ed. Liebermann, pp. 184-191; Birch, *Cartularium Saxonicum*, Nos. 745-817; *Dictionary of National Biography*, s.v.

(A. Mw.)

EDMUND, or Eadmund (*c.* 980-1016), called Ironside, king of the English, was the son of Æthelred II. by his first wife Ælfgifu. When Canute invaded England in 1015, Edmund sought to resist him, but, paralysed by the treachery and desertion of the ealdorman Edric, he could do nothing, and Wessex submitted to the Danish king. Next year Canute and Edric together harried Mercia, while Edmund with infinite difficulty gathered an army. Returning into Northumbria, he in his turn harried the districts which had submitted to the invader, but a march northward by Canute brought about the speedy submission of Northumbria and the return of Edmund to London. The death of Æthelred on the 23rd of April 1016 was followed by a double election to the English crown. The citizens of London and those members of the Witan who were present in the city chose Edmund, the rest of the Witan meeting at Southampton elected Canute. In the warfare which ensued Edmund fought at the severest disadvantage, for his armies dispersed after every engagement, whatever its issue. Canute at once fiercely besieged London, but the citizens successfully resisted all attacks. Edmund meanwhile marched through Wessex and received its submission. At Pen in Somersetshire he engaged the Danes and defeated them. Canute now raised the siege of London and soon afterwards encountered Edmund at Sherston in Wiltshire. The battle was indecisive, but Canute marched back to London and left Edmund in possession of Wessex. Edmund hastened after him and relieved London, which he had again besieged. He defeated the Danes at Brentford and again at Otford, and drove them into Sheppey. He was now joined by Edric, in conjunction with whom he followed the Danes into Essex, overtaking them at Assandun (or Ashington). In the battle which ensued Edric again played the traitor, and the English were routed with terrible slaughter. Edmund retired into Gloucestershire, whither he was followed by Canute. He himself was anxious to continue the struggle, but Edric and the Witan persuaded

him to accept a reconciliation. At Olney the two rivals swore friendship, and a division of the kingdom was effected—Canute taking the north, Edmund the south. Soon afterwards Edmund died (30th of November 1016), probably from natural causes, though later historians hint at foul play.

(C. S. P.*)

EDMUND, king of Sicily and earl of Lancaster (1245-1296), was the second son of Henry III. of England by Eleanor of Provence. At ten years of age Edmund was invested by Pope Alexander IV. with the kingdom of Sicily (April 1255); the pecuniary obligations which Henry III. undertook on his son's behalf were not the least among the causes which led to the Provisions of Oxford and the Barons' War. Alexander annulled his grant in 1258, but still pressed Henry for the discharge of unpaid arrears of subsidies. In 1265, after Montfort's fall, Edmund received the earldom of Leicester, and two years later was created earl of Lancaster. He joined the crusade of his elder brother, the Lord Edward (1271-1272); and Edward, on his accession, found in Edmund a loyal supporter. In 1275, two years after the death of his first wife, Aveline de Fortibus, Edmund married Blanche of Artois, the widow of Henry III. of Navarre and Champagne. Although the county of Champagne had descended to his wife's infant daughter, Joan, Edmund assumed the title "Count Palatine of Champagne and Brie," and is described in the English patent rolls as earl of Lancaster and Champagne. Until 1284 he held, in his wife's right, the custody of Champagne. This he was compelled to renounce upon the marriage of Joan to Philip the Fair, the heir to the crown of France. But he retained the possession of his wife's dowerlands in Champagne, and is described in an official document of Champagne so late as the year 1287, as "the Count Edmund." He was employed by his brother as a mediator with Philip the Fair in 1293-1294. When Philip's court pronounced that the king of England had forfeited Gascony, Edmund renounced his homage to Philip and withdrew with his wife to England. He was appointed lieutenant of Gascony in 1296, but died in the same year, leaving a son Thomas to succeed him in his English possessions.

See "Edmund, Earl of Lancaster," by W.E. Rhodes, in the *English Historical Review*, vol. x. pp. 19, 209.

EDMUNDS, GEORGE FRANKLIN (1828-), American lawyer and political leader, was born in Richmond, Vermont, on the 1st of February 1828. He began the practice of law in 1849. He was a member of the Vermont House of Representatives in 1854, 1855, 1857, 1858 and 1859, acting for the last two years as speaker, and was a member and president *pro tem.* of the state Senate in 1861-1862. In 1866 he became a member, as a Republican, of the United States Senate, where he remained until 1891, when he resigned in order to have more time for the practice of his profession. He took an active part in the attempt to impeach President Johnson. He was influential in providing for the electoral commission to decide the disputed presidential election of 1876, and became one of the commissioners. In the national Republican nominating conventions of 1880 and 1884 he was a candidate for the presidential nomination. From 1882 to 1885 he was president *pro tem.* of the Senate. As senator he was conspicuous on account of his legal and parliamentary attainments, his industry and his liberal opinions. He was the author of the so-called Edmunds Act (22nd of March 1882) for the suppression of polygamy in Utah, and of the anti-trust law of 1890, popularly known as the Sherman Act.

EDOM, the district situated to the south of Palestine, between the Dead Sea and the Gulf of 'Akaba (Aelanitic Gulf), the inhabitants of which were regarded by the Israelites as a "brother" people (see Esau). On the E. it touched Moab, the tribes of the great desert and the northern part of Arabia; on the W. its boundaries were determined by the Sinaitic peninsula, Egypt and Israel. Both Kadesh and Mt. Hor (perhaps Jebel Mādera) are represented as lying on its border (Num. xx. 16, 22), and the modern Wadi el-Fikreh, in which the "Scorpion pass" was probably situated (Judg. i. 36; Num. xxxiv. 4), may have marked its limits from Jebel Mādera north-west towards the southern extremity of the Dead Sea. Kadesh (*'Ain Ḳadis*), however, lies about 50 m. south of Beersheba (the southern end of Israel as opposed to Dan in the north), and the precise borders must always have been determined by political conditions: by the relations between Edom and its neighbours, Judah, the Philistine states, Moab, and the restless desert tribes with which Edom was always very closely allied.

The northern part of Edom became known by a separate name as Gebalene (Gebal in Ps. lxxxiii. 7), the modern Jibāl, "mountain country." Seir or Mt. Seir, a synonym for Edom, not to be confused with the Judaean locality (Josh. xv. 10), has been identified with the modern *eš-šarah*, the hilly region to the south of Petra; though its use probably varied in ancient times as much as that of Edom certainly did. Mt. Ḥalaḳ, apparently one of its offshoots (Josh. xi. 17, xii. 7), is of uncertain identification, nor can the exact position of Paran (probably desert of *et-Tih*) or Zin (Sin) be precisely determined. The chief Edomite cities extended from north to south on or adjoining an important trade-route (see below); they include Bozrah (Buseire), Shōbek, Petra (the capital), and Ma'ān; farther to the south lay the important seaports Ezion-Geber (mod. 'Ain el-Ghudyān, now 15 m. north of the head of the Aelanitic Gulf) and Elath (whence the gulf derives its

name). Petra (*q.v.*) is usually identified with the biblical Sela, unless this latter is to be placed at the south end of the Dead Sea (Judg. i. 36). The sites of Teman and Dedan, which also were closely associated with Edom (Jer. xlix. 7 seq.; Ez. xxv. 13), are uncertain. No doubt, as a general rule, the relations between Edomites and the "sons of the east" (Ezek. xxv. 10; Job i. 3) and the "kingdoms of Hazor" (nomad states; Jer. xlix. 28, 30, 33) varied considerably throughout the period of O.T. history.

The land of Edom is unfruitful and forbidding, with the notable exception of fertile districts immediately south of the Dead Sea and along its eastern border. It was traversed by an important trade-route from Elath (the junction for routes to Egypt and Arabia) which ran northwards by Ma'ān and Moab; but cross-routes turned from Ma'ān and Petra to Gaza or up the Ghor (south end of Dead Sea) to Hebron and Jerusalem.[1] Thus Edom formed a prominent centre for traffic from Arabia and its seats of culture to Egypt, the Philistine towns, Palestine and the Syrian states, and it enjoyed a commercial importance which made it a significant factor in Palestinian history.

The earliest history of Edom is that of the "sand-dwellers," "archers" or *Shasu* (perhaps "marauders"), whose conflicts with ancient Egypt are not infrequently mentioned. The first clear reference is in the eighth year of Mineptah II. (close of 13th century B.C.), when a tribe of Shasu from Aduma received permission to enter Egypt and feed their flocks.[2] A little more than a century later Rameses III. claims to have overthrown the Saaru among the tribes of the Shasu, and the identification of this name with Seir is usually recognized, although it is naturally uncertain whether the Edomites of Old Testament tradition are meant. According to the latter, the Edomites were a new race who drove out the Horites from Mt. Seir. The designation suggests that these were "cave-dwellers," but although many caves and hollows have been found about Petra (and also in Palestine), this tradition probably "serves only to express the idea entertained by later generations concerning their predecessors" (Nöldeke).

Not only is Edom as a nation recognized as older than Israel, but a list of eight kings, who reigned before the Israelite monarchy, is preserved in Gen. xxxvi.

> The first Bela, son of Beor, is often identified with Balaam, but the traditions of the Exodus are not precise enough to warrant the assumption that the seer was the king of a hostile land in Num. xx. 14 sqq., which in Deut. ii. 1-8 appears to have been peaceful; see Balaam; Exodus. In Husham, the third king, several scholars (Grätz, Klostermann, Marquart, &c.) have recognized the true adversary of Othniel (*q.v.*; Judg. iii.). The defeat of Midian in the land of Moab by his successor Hadad has been associated with the Midianite invasion in the time of Gideon (*q.v.*; Judg. vi. sqq.). The sixth is Shaul, whose name happens to be identical with Saul, king of Israel, whilst the last Hadad (so 1 Chron. i. 50) of Pau (or Peor in Moab, so the Septuagint) should belong to the time of David. The list, whatever its value, together with the other evidence in Gen. xxxvi., implies that the Edomites consisted of a number of local groups with chieftains, with a monarchy which, however, was not hereditary but due to the supremacy of stronger leaders. The tradition thus finds an analogy in the Israelite "judges" before the time of Saul and David.

Saul, the first king of Israel, conquered Edom (1 Sam. xiv. 47).[3] Of the conquest of Edom by David, the first king of the united Judah and Israel, several details are given (2 Sam. viii. 13 seq.; 1 Kings xi. 14 sqq.; 1 Chron. xviii. 11 seq.; cf. Ps. lx. title and ver. 8 seq.), although the account of the slaughter is certainly exaggerated. The scene was the valley of Salt, probably to the south of the Dead Sea. Of the escape of the Edomite prince Hadad, and of his residence in Egypt, a twofold account is preserved.[4] After the death of David he returned to Edom; if, as the narrative implies, he became a troublesome adversary to Solomon, nothing is known of his achievements, and if the royal trading-journeys from Ezion-geber were maintained, Edom could have done little. However, in the first half of the 9th century Edom was under the rule of Jehoshaphat of Judah, and this king together with Israel held Ezion-geber (1 Kings xxii. 47 sqq.; 2 Chron. xx. 35 sqq.). But some catastrophe befell the fleet, and shortly afterwards Jehoshaphat's son Jehoram had to face a revolt in which Edom and the men of Libnah (the Philistines) were concerned. It was about this period that Israel had conquered Moab, thrusting it farther south towards Edom, and the subsequent success of Moab in throwing off the yoke, and the unsuccessful attempt of Jehoram of Israel to regain the position, may show that Edom was also in alliance with Moab.[5] In the time of Adad-nirari of Assyria (812-783 B.C.) Edom is mentioned as an independent tributary with Beth-Omri (Israel) and Palashtu (Philistia); the absence of Judah is perplexing. Amaziah of Judah had gained a signal victory over Edom in the valley of Salt (2 Kings xiv. 7), but after his defeat by Jehoash of Israel there is a gap and the situation is obscure. Consequently it is uncertain whether Edom was the vassal of the next great Israelite king Jeroboam II., or whether the Assyrian evidence for its independent position belongs to this later time. However, Uzziah, a contemporary of Jeroboam II., and one of the most successful of Judaean kings, overcame Edom and its natural allies (2 Chron. xxvi. 6 sqq.), and at this stage Edomite history becomes more prominent. It joined the great coalition in which Philistia and Israel were leagued against Assyria, and drove out the Judaeans who had been in possession of Elath.[6] On the events that followed see Ahaz; Hezekiah; Philistines. The Assyrian inscriptions name as tributary kings of Edom, Kauš-melek (time of Tiglath-Pileser IV.), Malik (?)-ram (701 B.C.), and Kauš-gabri (7th century). In the middle of the 7th century both Edom and Moab suffered from the restlessness of the desert tribes, and after another period of obscurity, they joined in the attempt made by Zedekiah of Judah to revolt against Nebuchadrezzar (Jer. xxvii. 3). In the last years before the fall of Jerusalem many of the Jews found a refuge in Edom (Jer. xl. 11), although other traditions throw another light upon the attitude of Edom during these disasters.

> That Edomites burned the temple after the destruction of Jerusalem (1 Esd. iv. 45, cf. *v.* 50) is on a line with the repeated denunciation of their "unbrotherly" conduct in later writings. Certainly the weak state of Palestine invited attacks from the outlying tribes, but the tone of certain late writings implies a preliminary period of, at least, neutrality (cf. Deut. ii. 4 sqq., xxiii. 7 seq.; the omission of Edom in xxiii. 3; Neh. xiii. 1; and in Ezra ix. 1—contrast 1 Esd. viii. 69). Subsequently Edom is execrated for revengeful attacks upon the Jews, and its speedy destruction is foretold; but the passages appear to be much later than the disaster of 587 B.C., and may even imply conditions after the restoration (Ob. 10 sqq.; Ezek. xxv. 12-14; Jer. xlix. 7; Ps. cxxxvii. 7; Lam. iv. 21 seq., v. 2 sqq.). But at length the day of reckoning came (cf. Is. xxxiv. 5; lxiii. 1-6), and the fate of Edom is still fresh in the mind of Malachi (i. 1-5).

The problem is complicated by the possibility that during the ages over which the references can range many changes of fortune could have occurred. The pressure of the Nabataeans (*q.v.*) forced Edom to leave its former seats and advance into the south of Judah with Hebron as the capital. This had been fully accomplished by 312 B.C., but the date of the first occupation cannot be ascertained from the literary evidence alone. Thus the district in question is Jewish in the time of Nehemiah (Neh. xi. 25-30), but it is uncertain whether the Edomite occupation was earlier (a fusion being assumed) or later, or whether the passage may be untrustworthy. Henceforth, the new home of the Edomites is consequently known as Idumaea. See, for further history, HEROD; JEWS.[7]

Although but little is known of the inhabitants of Edom, their close relationship to Judah and their kinship with the surrounding tribes invest them with particular interest. The ties which united Lot (the "father" of Ammon and Moab), Ishmael, Midian and Edom (Esau) with the southern tribes Judah and Simeon, as manifested in the genealogical lists, are intelligible enough on geographical grounds alone, and the significance of this for the history of Judah and Palestine cannot be ignored. The traditions recording the separation of Lot from Abraham, of Hagar and Ishmael from Isaac, and of Esau from Jacob, although at present arranged in a descending scheme of family relationship, are the result of systematic grouping and cannot express any chronological order of events (see GENESIS). Many motives have worked to bring these legends into their present form, and while they depict the character of Israel's wilder neighbours, they represent the recurrent alternating periods of hostility and fellowship between it and Edom which mark the history. Esau (Edom) although the older, loses his superiority, and if the oracles declare that the elder shall serve the younger (Jacob, *i.e.* Israel), the final independence of Esau (Gen. xxv. 23, xxvii. 39 seq.), as foretold, obviously alludes to some successful Edomite revolt. As an enemy, Edom in alliance with the tribes along the trade-routes (Philistines, Moabites, &c.) was responsible for many injuries, and in frequent forays carried away Judaeans as slaves for Gaza and Tyre (Am. i. 6 seq., 9). As an ally or vassal, it was in touch with the wealth of Arabia (Ezek. xxvii. 16, read "Edom" for "Aram"), and Judah and Israel as well as Gaza and Damascus enjoyed the fruits of its commerce. In view of the evidence for the advanced culture of early Arabia, the question of Edom is extremely suggestive, and although speculation at this stage would be premature, it is interesting to observe that Edomite and allied tribes were famed for their wisdom,[8] and that apart from the *possibility* of Arabian influence upon Israelite culture, the influence of Midian and related tribes is *certain* from the traditions of Moses and of his work (see JETHRO; KENITES; MOSES), and the Edomite district was a traditional home of Yahweh himself (Deut. xxxiii. 2; Judg. v. 4; Hab. iii. 3); see HEBREW RELIGION. It should be added, however, that the Edomite names and other evidence point to the cult of other gods, viz. Baal, Hadad, Malik (cf. MOLOCH), Kauš, or Kuš, and Kozeh (Jos. *Ant.* xv. 7, 9), who was probably a sky or lightning deity.

The names Esau and Edom are possibly old divine names; see ESAU and *Ency. Bib. s.v.* "Obed edom" (the name appears to mean "servant of Edom"). For Kauš, see Baethgen, *Beitr. z. semit. Religionsgeschichte*, p. 11 seq.; G.A. Cooke, *N. Sem. Inscr.* p. 234; *Ency. Bib.* col. 2682, n. 2 and 2688 (*s.v.* "Kushaiah"); and Zimmern, *Keilinschr. u. d. alte Test.*[3], pp. 472 seq. On the question of early Arabian civilization see YEMEN. That the name Mizraim (Miṣraim), "Egypt," was extended eastwards of the Delta is in itself probable, but it is still uncertain whether the term (also Ass. Muṣri) was applied to Edom. The evidence (which is of mixed value) makes the view a plausible one, but the theory has often been exaggerated (see MIZRAIM). For Edom see, generally, Buhl, *Gesch. d. Edomiter* (1893); Nöldeke's article in *Ency. Bib.*; W. Libbey and F.E. Hoskins, *The Jordan Valley and Petra* (1905); the conjectural sketch by I. Levy in *Rev. d'études juives* (Jan. 1906). For the history and culture of the latest period, see J.P. Peters and Thiersch, *Painted Tombs in the Necropolis of Marissa* (1905), ch. i.

(S. A. C.)

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1 See further, E. Robinson, *Biblical Researches*, vol. ii.; E. Hull, *Mt. Seir*; E.H. Palmer, *Desert of the Exodus*; Baedeker's *Palestine and Syria*; C.W. Wilson, "Quart. Stat." (*Pal. Explor. Fund*), 1899, p. 307, and G.A. Smith, *Ency. Bib.* col. 5162 seq.

2 In the old story of Sinuhit (ascribed to the 12th dyn.) the hero visits the land of *Kedem*, which, it was suggested, lay to the south-east or south of the Dead Sea; see, however, now A.H. Gardiner, *Sitz.-Ber.* of the Berlin Academy, 1907, pp. 142 sqq. The suggestion that the city Udumu, in the land of Gar, mentioned in the 15th century (*Amarna Tablets*, ed. Winckler, No. 237), is Edom, Gar being the Eg. *Kharu* (Palestine) and the O.T. Horites (see above), is extremely hazardous. That the name Aduma (above) refers to Etham (so Naville, &c.) is improbable.

3 That the Edomites preserved this tradition of Saul's sovereignty and (from their standpoint) enrolled him among their kings (Gen. xxxvi. 37) cannot of course be proved. The account of the ferocious slaughter of the priests of Nob at Saul's command by Doeg the Edomite is a secondary tradition and probably of late origin (1 Sam. xxi. 1-9, xxii. 6-23); cf. the hostility of Edom in exilic and post-exilic times (p. 878, col. 1).

4 1 Kings l.c., see the Septuagint and, especially, H. Winckler, *Alttest. Untersuch.*, pp. 1-15; C.F. Burney, *Kings*, pp. 158 sqq.; J. Skinner, *Kings*, pp. 443 sqq.; Ed. Meyer, *Israeliten*, pp. 358 sqq.

5 On 2 Kings iii. see JEHORAM; JEHOSHAPHAT; MOAB; and for the biblical traditions relating to this period see KINGS (Book) and JEWS: *History*. The chronicler's account of Judaean successes (2 Chron. xvii. 10 seq.; xx.) and reverses (xxi. 16, xxii. 1) may rest originally upon the source from which 1 Kings xxii. 47 seq.; 2 Kings viii. 20, 22, have been abbreviated. It is hardly probable that there was enmity between Edom and Moab as 2 Kings iii. now implies, although hostile relations at other periods are likely (cf. Am. ii. 1); for Edom in Moabite territory see above on Gen. xxxvi. and "Quart. Stat." (*Pal. Explor. Fund*), 1902, pp. 10 sqq.

6 2 Kings xvi. 6; on the text see the commentaries.

7 For the Jewish hatred of Edom in later times see the book of Enoch lxxxix. 11-12; Jubilees, xxxvii. 22 seq., and on the Talmudic custom of applying to the Romans the references to Edom or Esau, see *Jewish Ency.* vol. v. p. 41.

8 Ob. 8; Jer. xlix. 7 sqq.; Baruch iii. 22, cf. 1 Kings iv. 30; see also JOB.

EDRED (Eadred), king of the English (d. 955), was the youngest son of Edward the Elder and his wife Eadgifu. He succeeded his brother Edmund in the year 946 and at this time received the formal submission both of the Northumbrians and Scots. In the next year Edred himself went to Tanshelf, near Pontefract, in Yorkshire, where he received from Wulfstan, archbishop of York, and the Northumbrian "witan" confirmation of their submission. Shortly after they threw their pledges to the winds and took the Norwegian Eric Bloodaxe, son of Harold Fairhair (Harald Harfagar), as their king. Edred recklessly ravaged all Northumbria in revenge, burning Ripon during his march. On his return home Edred's rearguard was attacked at Castleford, and the infuriated king once more turned to ravage Northumbria, which was only saved by its abandonment of Eric and by compensation made to Edred. Archbishop Wulfstan seems to have been a centre of disaffection in the north, and in 952 Edred caused him to be imprisoned in the castle of "Judanburh," while in the same year the king, in revenge for the slaying of Abbot Eadelm, slew many of the citizens of Thetford. After the brief rule of Anlaf Cuaran in Northumbria, Eric was once more restored, probably in 950, only to be expelled again in 953 or 954, when Edred took the Northumbrian kingdom into his own hands. In the same year Wulfstan was liberated and appointed to the Mercian bishopric of Dorchester. Edred died on the 23rd of November 955 at Frome, in Somersetshire, and was buried in the old minster at Winchester. During the whole of his life Edred was troubled by ill-health, a fact which may help to explain some of the more passionate acts of violence attributed to him. The king was throughout his life on terms of personal intimacy with St Dunstan, and his public policy was largely guided by that prelate and by his own mother Eadgifu. So far as we know, Edred was never married.

Authorities.—The *Saxon Chronicle* (ed. Earle and Plummer, Oxford), *sub ann.*; *Memorials of St Dunstan* (Rolls Series, ed. Stubbs); Florence of Worcester; Birch, *Cartularium Saxonicum*, vol. iii., Nos. 815-834 and 860-931; *D.N.B.*, art. *sub voce*.

(A. Mw.)

EDRIC, or Eadric, **STREONA** (d. 1017), ealdorman of the Mercians, was a man of ignoble birth who was advanced to high dignity through the favour of the English king Æthelred II. In 1007 he became ealdorman of the Mercians, and subsequently married Æthelred's daughter Eadgyth. In the struggle between the English and the Danes he appears in the character of an arch-traitor. When Æthelred in 1009 proposed a great attack on the Danes, Edric dissuaded him from carrying it into effect. Again, on the invasion of England by Canute in 1015 Edric deserted Edmund Ironside and joined him. After the battle of Otford he returned to Edmund, but only by his treachery at the battle of Assandun to secure the utter defeat of the national cause. When peace was at length made, Canute restored to Edric the earldom of Mercia; but at Christmas 1017, fearing further treachery, he had him slain—"very rightly" says the *Saxon Chronicle*.

EDUCATION. In the following treatment of this subject, the theory and early history of education is first dealt with, and secondly the modern organization of education as a national concern. Many definitions have been given of the word "education," but underlying them all is the conception that it denotes an attempt on the part of the adult members of a human society to shape the development of the coming generation in accordance with its own ideals of life. It is true that the word has not infrequently been used in wider senses than this. For example, J.S. Mill included under it everything which "helps to shape the human being"; and, with some poetic licence, we speak of the education of a people or even of the whole human race. But all such usages are rhetorical extensions of the commonly accepted sense of the term, which includes, as an essential element, the idea of deliberate direction and training (Lat. *educare*, to bring up; *educere*, to draw out, lead forth). No doubt, all education is effected through the experiences of the educated, and much of it is indirect, consisting mainly in the determination of the form of experiences other than those of direct precept, compulsion and instruction. But it does not follow that all experiences are educative. Whether an experience is part of an individual's education or not is determined by its origin. Whatever be its effect, it is educative in so far as its form has been arranged with greater or less deliberation by those who are concerned with the training of him whose experience it is. It follows that an education may be good or bad, and that its goodness or badness will be relative to the virtue, wisdom and intelligence of the educator. It is good only when it aims at the right kind of product, and when the means it adopts are well adapted to secure the intended result and are applied intelligently, consistently and persistently.

Education is, thus, a definitely personal work, and will vary between wide extremes of effectiveness and worth in any given society. For in all times and places there are wide differences in virtue, wisdom and capacity among those who have in their hands the care and nurture of the young. But the inference that, therefore, no comparative estimate of the education of different times and places can be made would be fallacious. For, despite all differences in conception and efficiency among individual educators, each expresses, more or less perfectly and clearly, the common conception and energy of his age and country. As these rise or fall the general level of the actual educative practice rises or sinks with them. The first essential for successful educative effort is, then, that the community as a whole should have a true estimate of the nature and value of education.

I. Educational Theory

In any comparative estimate of different places and times, as tested by the standard just given, it must be borne in mind that, except in the most general and abstract form, we cannot speak of an ideally best education. Looking at the individual to be educated, we may say with Plato that the aim of education is "to develop in the body and in the soul all the beauty and all the perfection of which they are capable," but this leaves quite undecided the nature and form of that beauty and perfection, and on such points there has never been universal agreement at any one time, while successive ages have shown marked differences of estimate. We get nearer to the point when we reflect that individual beauty and perfection are shown, and only shown, in actual life, and that such life has to be lived under definite conditions of time, place, culture, religion, national aspirations and mastery over material conditions. Perfection of life, then, in the Athens of the age of Plato would show a very different form from that which it would take in the London or Paris of to-day. So an individualistic statement of the purpose of education leads on analysis to considerations that are not, in themselves, individualistic. The personal life is throughout a relation between individual promptings to activity and the environment in which alone such promptings can, by being actualized, become part of life. And the perfection of the life is to be sought in the perfection of the relations thus established. So far, then, as any conception of education can give guidance to the actual process it must be relative in every way to the state of development of the society in which it is given. Indeed, looked at in the mass, education may be said to be the efforts made by the community to impose its culture upon the growing generation. Here again is room for difference. The culture in question may be accepted as absolute at least in its essentials, and then the ideal of education will be to secure its stability and perpetuation, or it may be regarded as a stage in a process of development, and then the ideal will be to facilitate the advance of the next generation beyond the point reached by the present. So some ages will show a relatively fixed conception of the educative process, others will be times of unrest and change in this as in other modes of social and intellectual life.

It is in these latter times that the actual work of education is apt to lose touch with the culture of the community. For schools (*q.v.*) and universities (*q.v.*), which are the ordinary channels through which adult culture reaches the young, are naturally conservative and bound by tradition. They are slow to leave the old paths which have hitherto led to the desired goal, and to enter on new and untried ways. If the opposition to change is absolute, there must come a time when the instruments of education are out of true relation to the desired end. For change in culture ideals means change in the specific form of the goal of education, and consequently the paths of educative effort need readjustment. When the goal of the past is no longer the goal of the present, to follow the ways which led to the former is to fail to reach the latter. Continuous readjustment, by small and almost imperceptible degrees, is the ideal at which the educator should aim. When this is not secured, the educational domain is liable to sudden and violent revolutions which are destructive of successful educative effort at the time they occur, however beneficial their results may be in the future.

But the relation of adjustment is not entirely one-sided. The tone of thought and feeling and the direction of will induced by education necessarily affect the common ideals of the next generation, and may make them better or worse than those of the present. Hence, the educator must not blindly accept all current views of life, but rather select the highest. For the average thought of every community is obviously below its best thought; and may, in some points at any rate, be lower than the best thought of a past age. While, then, all true education must be in direct relation with the culture of its age and country, yet, especially on the ethical side, it should aim at transcending the average thought and tone.

Still more does this imply that education strives to transcend the present condition of the educated by making their life more rational, more volitional, and more attracted by goodness and beauty than it would otherwise be. It can never be a passive watching of the child's development. No more fundamental error can be made than the assumption that education can be determined wholly, or even mainly, by the tendencies and impulses with which a child is endowed. Its real guiding principle must be a conception of the nature to which the child may attain, not a knowledge of that with which it starts. The educator studies the original endowment of the child and the early stages in the development of that innate nature in order that he may, wisely and successfully, employ appropriate means to direct further development and to accelerate its progress towards a more rational, complete and worthy life; not that he may the more skilfully give facilities to the child to drift about on the unregulated currents of caprice.

Such considerations show the importance of an insight into the theory of education on the part of all who are practically concerned with its direction. But the theory required is no system of abstract ideas ignoring the real concrete conditions of the life for which the actual education it is to guide is a preparation. To approach the subject only from the standpoint of the mental sciences which underlie it is to run the risk of setting up such a body of abstractions, whose relation to real life is neither very close nor very direct. The most profitable way of developing an educational theory for the present is to trace how in the past education has consciously adapted itself, more or less truly and fully, to the conditions of culture and social life; and by analysis to discover the reasons for comparative success or failure in the degree of clearness with which the end to be sought was apprehended and the nature of the children to be trained was understood.

In all ages the claims of the individual and those of the community have struggled for the mastery as the ultimate principles of life. As one or the other has prevailed the conception of education has emphasized social service or individual success as the primary end. The true harmony of human life will only be attained when these two impulses, contradictory on their own level, are united in a higher synthesis which sees each as the complement of the other in a life whose purpose is neither simple egoism nor pure altruism. Until that conception of life is attained and held generally there can be no sure and universally accepted conception of the aim and function of education. Much of the interest of the history of education[1] turns on the relation of these two principles as determinants of its aim.

In ancient Greece the supremacy of the state was generally unquestioned, and, especially in the earlier times, the good man was identified with the good citizen. No doubt, in later days philosophers, such as Plato and Aristotle, saw clearly that the round of the duties of citizenship did not exhaust the life of the individual.

Old Greek education. With them the highest life was one of cultured leisure in which the energies were mainly concentrated on the pursuit of knowledge for its own sake. But this "diagogic" life was only for the select few; for the undistinguished many the fulfilment by each of the duties of his station remained the measure of worthy life, though such duties were regarded as affecting the individual and private relations of the citizens in a much more intimate way than in former and ruder ages. And for those who devoted their lives to the highest culture, the essential preliminary condition was the existence of such a state as would form the most favourable environment for their pursuits and the most stable foundation for their leisured life. Thus Greek thought was saturated with the conception of life as essentially a set of relations between the individual and the city-state of which he formed an integral part. The first aim of education was therefore to train the young as citizens.

This training must, of necessity, be of a specific kind; for, like other small communities, the Greek city-states showed a life fundamentally one in conception, under various specific forms. Each state had its special character, and to this character the education given in it must conform if it were to be an effective instrument for training the citizens. From these fundamental conceptions flowed the demands of Plato and Aristotle that education should be regulated in all its details by the state authority, should be compulsory on all free citizens, and should be uniform—at any rate in its earlier stages—for all. In the *Republic* and the *Laws*, Plato shows to what extreme lengths theory may go when it neglects to take account of some of the most pertinent facts of life. For the guardian-citizens of the ideal state family life and family ties are abolished; no lower community is to be allowed to enter into competition with the state. Aristotle, indeed, did not go to these extreme lengths; he allowed the family to remain, but he seems to have regarded it as likely to affect children more for evil than for good.

In the essential principles laid down by both philosophers as to the relation of the state to education, and in the corollaries they drew from that relation, they were not at variance with the accepted Greek theory on the subject. It is true that the actual practice of Greek states departed, and often widely, from this ideal, for, especially in later centuries, the Greek always tended to live his own life. The nearest approach to the theory was found in Sparta, where the end of the state as a military organization was kept steadily in view, and where, after early childhood, the young citizens were trained directly by the state in a kind of barrack life—the boys to become warriors, the girls the mothers of warriors. It was this feature of Spartan education, together with the rude simplicity of life it enforced, which attracted Plato, and, to a less extent, Aristotle. In Athens there had of old been state laws insisting on the attendance of the children of the free citizens at school, and, in some degree, regulating the schools themselves. But at the time of Plato these had fallen into desuetude, and the state directly concerned itself only with the training of the ephebi, for which, we learn from Aristotle's *Constitution of Athens*, somewhat elaborate provisions were made by the appointment of officers, and the regulation of both intellectual and physical pursuits. For children and youths under the ephebic age there was no practical regulation of schools or palaestra by the state. Yet there is no doubt that the education really given was in conformity with Athenian ideals of culture and life, and that it was generally received by the children of free citizens, though of course the sons of the wealthy, then as now, could and did continue their attendance at school to a later age than their poorer brethren. The education of girls was essentially a domestic training. What Plato and Aristotle, with the theorist's love of official systematic regulation, regarded as the greatest defect of Athenian education was in reality its strongest point. In practice, the harmony between individual liberty and social claims was much more nearly attained under a system of free working out of common thoughts and ideals than would have been the case under one of the irresistible imposition from without of a rigid mould.

The instruments of education everywhere found to be in harmony with the Greek conception of life and culture were essentially twofold,—"music" (μουσική), or literary and artistic culture, for the mind, and systematic gymnastic (γυμναστική) for the body. Plato, in the *Republic*, shows that the latter, as well as the former, affects the character, and doubtless, though not formulated, this was generally more or less vaguely felt. But Greek gymnastic was really an individual training, and therefore made only indirectly for the aim of cultivating the social bonds of citizenship. Ancient Greece had nothing corresponding in value in this respect to the organized games which form so important a feature in the school life of modern England. The "musical" training was essentially in the national literature and music of Greece, and this could obviously be carried to very different lengths. The elements of mathematical science were also commonly taught. The essential purpose throughout was the development of the character of a loyal citizen of Athens. As Athenian culture advanced, increasing attention was paid to diagogic studies, especially in the ephebic age, with a corresponding decrease of attention to merely physical pursuits; hence the complaints of such satirists as Aristophanes of a growing luxury, effeminacy and corruption of youths: complaints apparently based on a comparison of the worst features of the actual present with an idealized and imaginative picture of the virtues of the past. Such comparison is, indeed, implicit in much of Plato and Aristotle as well as in Aristophanes.

But a disintegrating force was already at work in the educational system of Greece which Plato and Aristotle vainly opposed. This was the rhetorical training of the Sophists, the narrowly practical and individualistic aim of which was entirely out of harmony with the older Greek ideals of life and culture. In a democratic city-state the orator easily became a demagogue, and generally oratory was the readiest path to influence and power. Thus oratory opened the way to personal ambition, and young men who were moved by that passion eagerly attended the Sophist schools where their dominant motive was strengthened.

Further, the closer relations between the Greek states, both in nearer and farther Hellas, led naturally to the diminution of differences between civic ideals, and, as a consequence, to a more cosmopolitan conception of higher education. This process was completed by the loss of political independence of the city-states under the Macedonian domination. Henceforth, higher education became purely intellectual, and its relation to political and social life increasingly remote. This, combined with the growing rhetorical tendency already noticed, accounts for the sterility of Greek thought during the succeeding centuries. The means of higher education were, indeed, more fully organized. The university of Athens was the outcome of a fusion of the private philosophical schools with the state organization for the training of the ephebi, and there were

other such centres of higher culture, especially in after years at Alexandria, where the contact of Greek thought with the religions and philosophies of Egypt and the East gave birth in time to the more or less mystical philosophies which culminated in Neo-platonism. But at Athens itself thought became more and more sterile, and education more and more a mere training in unreal rhetoric, till the dissolution of the university by Justinian in A.D. 529.

Thus when Rome conquered Greece, Greek education had lost that reality which is drawn from intimate relation to civic life, and the fashionable individualistic schools of philosophy could do nothing to replace the loss. It was, then, an education which had largely lost its life-springs that was transferred to Rome. In the earlier centuries of the republic, Roman education was given entirely in family and public life. The father had unlimited power over his son's life, and was open to public censure if he failed to train him in the ordinary moral, civic and religious duties. But it is doubtful if there were any schools (*q.v.*), and it is certain there was no national literature to furnish an instrument of culture. A Roman boy learnt to reverence the gods, to read, to bear himself well in manly exercises, and to know enough of the laws of his country to regulate his conduct. This last he acquired directly by hearing his father decide the cases of his clients every morning in his hall. The rules of courtesy he learnt similarly by accompanying his father to the social gatherings to which he was invited. Thus early Roman education was essentially practical, civic and moral, but its intellectual outlook was extremely narrow.

Old Roman education.

When a wider culture was imported from Greece it was, however, the form rather than the spirit of true Hellenic education that was transferred. This was, indeed, to some extent inevitable from the decadent state of Greek education at the time, but it was accentuated by the essentially practical character of the Roman mind. The instrument of education first introduced was Greek literature, much of which was soon translated into Latin. In time the schools of the *grammatici*, teaching grammar and literature, were supplemented by schools of rhetoric and philosophy, though the philosophy taught in them was itself little more than rhetorical declamation. These furnished the means of higher culture for those youths who did not study at Alexandria or Athens, and were also preparatory to studies at those universities. Under the Empire the rhetorical schools were gradually organized into a state system, the general principles of administration being laid down by imperial decree, and even such details as the appointment and rate of payment of the professors, at first left to the municipalities, being in time assumed by the central government. There is no evidence of any state regulation or support of the lower schools. This widening of culture affected both boys and girls, the domestic education of the latter being supplemented by a study of literature. But it is the higher training in rhetoric which is especially characteristic of Hellenized Roman education.

Hellenized Roman education.

The conception of a rhetorical culture is seen at its best in Quintilian's *Institutio oratoria*, the most systematic treatise on education produced by the ancient world. With Quintilian the ideal of an orator was a widely cultured, wise and honourable man. And at first the teaching of rhetoric undoubtedly made for higher and true culture. But with the autocracy, soon passing into tyranny, of the empire, rhetoric ceased to be a preparation for real life. The true function of oratory is to persuade a free people. When it cannot be applied to this purpose it becomes little more than a means of intellectual frivolity, or, at the best, an exhibition of cultured ingenuity. Under the empire a rhetorical training was, indeed, turned in not a few instances to practical but most unworthy uses by the delators; a result made possible by the legal system which rewarded delation with a considerable portion of the estate of the condemned. Even apart from this, the education in rhetoric had an increasingly evil effect both on the culture and on the character of the higher classes in the Roman empire. Out of real connexion with life as it was, it sought its subjects in the realms of the fanciful and the trivial, and with unreality of topic went of necessity deterioration of style. The vivid presentment of living thought gave way to that inflated and bombastic abuse of meretricious ornament and far-fetched metaphor in which human speech is always involved when it sets forth ideas, or shadows of ideas, which grow out of no conviction in the speaker and are expected to carry no conviction to the hearer. Imitation of the form of great models, without the substance of thought which underlay them, led to a general unreality and essential falseness of mental life. Further, the continual gazing with admiration on the productions of the past, and the conception of excellence as consisting in closeness of imitation, induced a servile attitude of mind towards authority in all too close agreement with the political servility which marked the Roman court. Such an attitude was essentially hostile to mental initiative, and thus rhetoric became not merely an art of expression but a type of character.

Nor was there anything in the general conditions of society to counterbalance the ill effects of school and university education. Quintilian lamented that, even in his time, the old Roman family education by example was corrupted; and the moral degradation of later times, though it has doubtless been exaggerated, was certainly real and widespread. Nor does the religious revival of Paganism which synchronized with the early centuries of Christianity appear to have effected any reform in life. Alexandria, the birthplace of Neo-platonism and the intellectual centre of the later empire, was also a very sink of moral obliquity.

It was into such a decaying civilization, which by its want of vitality sterilized education, oppressing it under the weight of a dead tradition, that Christianity brought new life. Of course, careful instruction in the Faith was given in catechetical schools, of which that at Alexandria was the most famous. But the question as to the attitude of Christians towards the ordinary classical culture was important. On the one hand, literature was saturated with Paganism, and the Pagan festivals formed a regular part of school life. On the other hand, the Pagan education offered the only means of higher culture, and thus furnished the only weapon with which Christians could successfully meet their controversial antagonists. Quite at first, no doubt, when the converts to the new faith were few and obscure, the question scarcely arose; but as men of culture and position were attracted to the Church it became urgent. The answers given by the Christian leaders were various, and largely the outcome of temperament and previous training. The Greek Fathers, especially Clement of Alexandria (150-217) and Origen (185-253), regarded Christianity as essentially the culmination of philosophy, to which the way must be found through liberal culture. Without a liberal education the

Christianity and Pagan education.

Christian could live a life of faith and obedience but could not attain an intellectual understanding of the mysteries of the Faith. On the other hand, Tertullian (160-240) was very suspicious of Pagan culture; though he granted the necessity of employing it as a means of education, yet he did so with regret, and would forbid Christians to teach it in the public schools, where some recognition of Paganism would be implied. The general practice of the Christians, however, did not conform to Tertullian's exhortations. Indeed, many of the cultivated Christians of the 3rd and 4th centuries were little more than nominal adherents to the Faith, and the intercourse between Christian and Pagan was often close and friendly. The general attitude of Christians towards the traditional education is evidenced by the protest raised against the edict of Julian, which forbade them to teach in the public schools. The ultimate outcome seems to be fairly expressed in the writings of St Augustine (354-430) and St Jerome (346-420), who held that literary and rhetorical culture is good so long as it is kept subservient to the Christian life.

In another way Greek philosophy exercised an abiding influence over the culture of future ages. The early centuries of Christianity felt the need of formulating the Faith to preserve it from disintegration into a mass of fluid opinions, and such formulation was of necessity made under the influence of the philosophy in which the early Fathers had been trained—that Neo-platonism which was the last effort of Paganism to attain a conception of life and of God. In the West, this formulation had to be translated into Latin, for Greek was no longer generally understood in Italy, and thus the juristic trend of Roman thought also became a factor in the exposition of Christian doctrine. This formulation of the Faith was one of the chief legacies the transition centuries passed on to the middle ages.

Had classical culture been less formal than it was during the early centuries of Christianity, the innate antagonism of the Pagan and Christian views of life and character must have been so apparent that the education which prepared for the one could not have been accepted by the other. It was only because rhetorical culture was so emphatically intellectual, and so little, if at all, moral in its aims, that its inherent opposition to the Christian conception of character was not obvious. That its antagonistic influence was not inoperative is shown by the not infrequent perversions of cultured Christians to Paganism. But generally the opposition was so obscured that the ethical writings of St Ambrose (340-397) are largely Stoic in conception and reasoning. Yet the Pagan ideal of life, especially as it had been developed in the individualistic ethics which had prevailed for more than six centuries, was antithetical in essence to that of the Christian Church. The former was essentially an ethics of self-reliance and self-control showing itself in moderation and proportion in all expressions of life. An essential feature in such a character was high-mindedness and a self-respect which was of the nature of pride. On the contrary, Christian teaching exalted humility as one of the highest virtues, and regarded pride and self-confidence as the deadliest of sins. It recognized no doctrine of limitation; what was to be condemned could not be abhorred too violently, nor could what was good be too strongly desired or too ardently sought. The highest state attainable by man was absorption in loving ecstasy in the mystic contemplation of God. The practical attempt to realize this gave rise to monasticism, with its minutely regulated life expressing unlimited obedience and the renunciation of private will at every moment. The monastic life was regarded as the nearest approach to the ideal which a Christian could make on earth. Naturally, as this conception gathered strength in generations nurtured in it, the value of classical culture became less and less apparent, and by the time of St Gregory the Great (d. 604) the use of classical literature except as means of an education having quite another end than classical culture was discouraged.

Effect of barbarian inroads.

Of course, during these centuries, the gradual subjugation of the western empire by the barbarians had been powerfully operative in the obscuring of culture. Most of the public schools disappeared, and generally the light of learning was kept burning only in monasteries, and in them more and more faintly as they became more or less isolated units exposed to attack by ruthless foes or living in continual dread of such attack. Though the barbarians absorbed the old culture in various degrees of imperfection, yet the four centuries following the death of St Augustine were plunged in intellectual darkness, relieved by transitory gleams of light in Britain and by a more enduring flame in Ireland. The utmost that could be done was to preserve to some extent the heritage of the past. This, indeed, was essentially the work of men like Boethius, Cassiodorus, Isidore and Bede.

Modification of Latin.

During these same centuries another process had been advancing with accelerating steps. This was the modification of the Latin language. In the early centuries of Christianity literary Latin was already very different from colloquial Latin, especially in the provinces; and, as has been said, the literary output of the last age of Paganism was marked by sterility of thought and meretricious redundancy of expression. On the other hand, the writings of Christianity show a real living force seeking to find appropriate expression in new forms. Thus, with Christian writers, slavish imitation of the past gradually gave way to the evolution of a new and living Latin, which showed itself more and more regardless of classical models. To express the new ideas to which Christianity gave birth fresh words were coined, or borrowed from colloquial speech or from the Hebrew and Greek Scriptures. This Christian Latin was a real living instrument of expression, which conformed itself in its structure much more closely to the mode of thought and expression of actual life than did the artificial imitation of antiquity in which the literary productions of Paganism were clothed. It is the Latin in which St Jerome wrote the Vulgate. But with the obscuring of culture during the barbarian invasions this current Latin became more and more oblivious of even such elements of form as grammatical inflexions and concords.

The Carolingian revival.

It was to the reformation of this corrupt Latin by a return to classical models, and to the more general spread of culture, especially among clergy and nobles, that the Carolingian revival addressed itself. The movement was essentially practical and conservative. Alcuin (735-804), who was Charlemagne's educational adviser and chief executive officer in scholastic matters, was probably the best scholar of his time, and himself loved the classical writings with which he was acquainted; but the text-books he wrote were but imperfect summaries of existing compendia, and the intellectual condition of his pupils forbade a very generous literary diet even had he thought it desirable, of which there is some doubt. The most valuable outcome of the movement

was the establishment of the palace school, and of bishops' schools and monastic schools throughout the empire. Of these the latter were the most important, and each of the chief monasteries had from the time of Charlemagne an external school for pupils not proposing to enter the order as well as an internal school for novices. Thus, the educational system north of the Alps was pre-eminently ecclesiastical in its organization and profoundly religious in its aims. For two centuries the new intellectual life was obscured by the troubled times which followed the death of Charlemagne, but the learning which the Carolingian revival had restored was preserved here and there in cathedral and monastic schools, and the sequence of well-educated ecclesiastics was never altogether interrupted.

The medieval curriculum.

The scope of that learning was comprised within the seven liberal arts and philosophy, on the secular side, together with some dogmatic instruction in the doctrines of the Church, the early fathers, and the Scriptures. Theology was as yet not organized into a philosophical system: that was the great work the middle ages had to perform. The seven liberal arts (divided into the *Trivium* —grammar, dialectic, rhetoric; and the more advanced *Quadrivium*—geometry, arithmetic, music, astronomy) were a legacy from old Roman education through the transition centuries. They appear in the *Disciplinarum libri IX.* of Varro in the 2nd century B.C., where are added to them the more utilitarian arts of medicine and architecture. But they reached the middle ages chiefly through the summaries of writers in the transition centuries, of which the best known were the *De nuptiis Philologiae et Mercurii* of the Neo-platonist Martianus Capella, who wrote probably early in the 5th century; the *De artibus ac disciplinis liberalium litterarum* of the Christian Cassiodorus (468-562); and the *Etymologiarum libri XX.* of St Isidore of Seville (570-636).

The scope of the arts was wider than their names would suggest in modern times. Under grammar was included the study of the content and form of literature; and in practice the teaching varied from a liberal literary culture to a dry and perfunctory study of just enough grammar to give some facility in the use of Latin. Dialectic was mainly formal logic. Rhetoric covered the study of law, as well as composition in prose and verse. Geometry was rather what is now understood by geography and natural history, together with the medicinal properties of plants. Arithmetic, with the cumbrous Roman notation, included little more than the simplest practical calculations required in ordinary life and the computation of the calendar. Music embraced the rules of the plain-song of the Church, some theory of sound, and the connexion of harmony and numbers. Astronomy dealt with the courses of the heavenly bodies, and was seldom kept free from astrology. In philosophy the current text-books were the *De consolatione philosophiae* of Boethius (470-524), an eclectic summary of pagan ethics from the standpoint of the Christian view of life, and the same writer's adapted translations of the *Categories* and *De interpretatione* of Aristotle and of Porphyry's *Introduction to the Categories*.

It is evident that though such a scheme of studies might in practice, during ages of intellectual stagnation and general ignorance, be arid in the extreme, it was capable in time of revival of giving scope to the widest extension of culture. It was, indeed, at once comprehensive and unified in conception, and well adapted to educate for the perfectly definite and clear view of life which the Church set before men.

The scholastic revival.

In the 11th century Europe had settled down, after centuries of war and invasion, into a condition of comparative political stability, ecclesiastical discipline, and social tranquillity: the barbarians had been converted, and, as in the case of the Normans, had pressed to the forefront of civilization; civic life had developed in the fortified towns of Italy, raised as defences against the pressure of Saracen and Hungarian invasions. Soon, communication with the East by trade and in the Crusades, and with the highly cultivated Moors in Spain, further stimulated the new burst of intellectual life. Arabic renderings of some of the works of Aristotle and commentaries on them were translated into Latin and exercised a profound influence on the trend of culture. A new translation of Aristotle's *Metaphysics* appeared in 1167, and by the beginning of the 13th century all his physical, metaphysical and ethical treatises were available, and during the next half century the translations from Arabic versions were superseded by renderings direct from the original Greek. As expositions of the real doctrines of Aristotle the translations from the Arabic left much to be desired. Renan calls the medieval edition of the *Commentaries* of Averroës "a Latin translation of a Hebrew translation of a commentary made upon an Arabic translation of a Syriac translation of a Greek text." The study of such works often led to the enunciation of doctrines held heretical by the theologians, and it was only when the real Aristotle was known that it was found possible to bring the Peripatetic philosophy into the service of theology.

There were thus two broad stages in the educational revival commonly known as scholasticism. In the first the controversies were essentially metaphysical, and centred round the question of the nature of universals; the orthodox theological party generally supporting realism, or the doctrine that the universal is the true reality, of which particulars and individuals are only appearances; while the opposite doctrine of nominalism —that universals are "mere sounds" and particulars the only true existences—showed a continual disposition to lapse into heresies on the most fundamental doctrines of the Church. The second stage was essentially constructive; the opposition of philosophy to theology was negated, and philosophy gave a systematic form to theology itself. The most characteristic figure of the former period was Abelard (1079-1142), of the latter St Thomas Aquinas (1225-1274). The former knew little of Aristotle beyond the translations and adaptations of Boethius, but he was essentially a dialectician who applied his logic to investigating the fundamental doctrines of the Church and bringing everything to the bar of reason. This innate rationalism appeared to bring theology under the sway of philosophy, and led to frequent condemnations of his doctrines as heretical. With St Thomas, on the other hand, the essential dogmas of Christianity must be unquestioned. In his *Summa theologiae* he presents all the doctrines of the Church systematized in a mould derived from the Aristotelian philosophy.

It is evident, then, that during the period of the scholastic revival, men's interests were specially occupied with questions concerning the spiritual and the unseen, and that the great instrument of thought was syllogistic logic, by which consequences were deduced from premises received as unquestionably true.

Scholastic education. There was a general acceptance of the authority of the Church in matters of belief and conduct, and of that of Aristotle, as approved by the Church, in all that related to knowledge of this world.

Before the rediscovery of Aristotle exerted such a general influence on the form of education, there was a real revival of classical literary culture at Chartres and a few other schools, and John of Salisbury (d. 1182) in his *Metalogicus* advocated literature as an instrument of education and lamented the barrenness of a training confined to the subtleties of formal logic. But the recrudescence of Aristotle accelerated the movement in favour of dialectic, though at the same time it furnished topics on which logic could be exercised which only a bare materialism can esteem unimportant. The weaknesses of the general educational system which grew up within scholasticism were that haste to begin dialectic led to an undue curtailment of previous liberal culture, and that exclusive attention to philosophical and theological questions caused a neglect of the study of the physical world and a disregard of the critical functions of the intellect. Doubtless there were exceptions, of which perhaps the most striking is the work in physical science done at Oxford by Roger Bacon (1214-1294). But Albertus Magnus (1193-1280), the master of St Thomas, was also a student of nature and an authority for his day on both the natural and the physical sciences. And the work of Grosseteste (d. 1253), as chancellor of the university of Oxford, shows that care for a liberal literary culture was by no means unknown. Always there were such examples. But too often boys hastened to enter upon dialectic and philosophy as soon as they had acquired sufficient smattering of colloquial Latin to engage in the disputes of the schools. A deterioration of Latin was the unavoidable consequence of such premature specialization. The seven liberal arts were often not pursued in their entirety, and students remained satisfied with desiccated compendia of accepted opinions. Thus the encyclopaedias of general information which were in general use during the middle ages show little or no advance in positive knowledge upon the treatment of similar subjects in Isidore of Seville.

The services of scholasticism to the cause of education, however, cannot well be overestimated, and the content of scholastic studies was in fundamental harmony with the intellectual interests of the time. Above all other benefits owed by future ages to scholasticism is the foundation of the universities of western Europe. The intellectual activity of the 11th century led everywhere to a great increase in the number of scholars attending the monastic and cathedral schools. Round famous teachers, such as Abelard, gathered crowds of students from every country. In the 12th century the need for organizing such bodies of teachers and students was imperative, and thus the earlier universities arose in Italy, France and England, not by deliberate foundation of secular or ecclesiastical ruler, but as spontaneous manifestations of the characteristic medieval impulse to organize into institutions. Afterwards, charters conferring powers and privileges were sought from both Church and state, but these only confirmed the self-governing character the universities had borne from the first. Each of the early universities was a specialized school of higher study: Salerno was a school of medicine; Bologna was the centre of that revival of Roman law which wrought so profound an effect upon the legal systems of France and Germany towards the close of the medieval period. But the greatest of medieval universities was that of Paris, emphatically the home of philosophy and theology, which was the model upon which many other universities, including Oxford and Cambridge, were organized.

The foundation of universities.

The German universities were of later origin, the earliest being Prague (1348) and Vienna (1365). They indicate the more recognized position the movement had attained; for nearly all were founded by the civic authority, and then obtained the recognition of the Church and charters from the emperor.

The concentration of higher instruction in universities was not antagonistic to the medieval conception of the Church as the teacher of mankind. University life was modelled on that of the cloister, though the monastic ideal could not be fully realized, and the scholars not infrequently exhibited considerable licence in life. This was inevitable with the very large numbers of the scholars and the great variations of age among them. Moreover students, and to a less extent teachers, passed from university to university, so that the universities of medieval Europe formed a free confederacy of learning in close relation to the Church but untrammelled by state control. Nevertheless, they were less definitely ecclesiastical than the cathedral seminaries which they largely supplanted, and the introduction of studies derived from the Greeks through the Arabians led to an increased freedom of thought, at first within authorized limits, but prepared, when occasion served, to transcend those limits.

University work and life.

The scheme of instruction was arranged on the assumption that special studies should be based on a wide general culture. Thus of the four faculties into which university teaching was organized, that of arts, with its degrees of *Baccalaureat* and *Magister*, was regarded as propaedeutic to those of theology, law and medicine. It often included, indeed, quite young boys, for the distinction between grammar school and university was not clearly drawn. Attention was concentrated on those subjects which treat of man and his relations to his fellow-men and to God, and no attempt was made to extend the bounds of knowledge. The aim was to pass on a body of acquired knowledge regarded as embracing all that was possible of attainment, and the authority of Aristotle in physics as well as in philosophy, and of Galen and Hippocrates in medicine was absolute. The methods of instruction—by lecture, or commentary on received texts; and by disputation, in which the scholars acquired dexterity in the use of the knowledge they had absorbed—were in harmony with this conception, and were undoubtedly thoroughly well suited to the requirements of an age in which the ideal of human thought was not discovery but order, and in which knowledge was regarded as a set of established propositions, the work of reason being to harmonize these propositions in subordination to the authoritative doctrines of the Church.

Such an extension of the means of higher education as was given by the universities was naturally accompanied by a corresponding increase in schools of lower rank. Not only were there grammar schools at cathedral and collegiate churches, but many others were founded in connexion with chantries, and by some of the many gilds into which medieval middle-class life organized itself. The Dominican and Franciscan friars were enthusiastic promoters of learning both in

Medieval schools.

universities and in schools, and in the Netherlands the Brethren of the Common Life, founded by Gerard Groote and approved by Eugenius IV. in 1431, regarded school teaching as one of their main functions, and the promotion of learning by the multiplication of manuscripts as another. The curriculum was represented broadly by the *Trivium*. The greatest attention was paid to grammar, which included very various amounts of reading of classical and Christian authors, the most commonly included being Virgil, parts of Ovid and Cicero, and Boethius. The text-books in grammar were the elementary catechism on the eight parts of speech by Donatus, a Roman of the 4th century, said to have been the tutor of St Jerome, and the more advanced treatise of Priscian, a schoolmaster of Constantinople about A.D. 500, which remained the standard text-book for over a thousand years. In rhetoric Cicero's *De oratore* was read, and dialectic was practised, as in the universities, by means of disputations.

In addition to the grammar schools were writing and song schools of an elementary type, in which instruction was usually in the vernacular. Girls were taught in women's monasteries and in the home, and those of the upper classes at least very generally learned to read, write and keep accounts, as well as fine needlework, household duties and management, and such elementary surgery and medicine as served in cases of slight daily accidents and illnesses. Even those boys and girls who did not receive formal scholastic instruction were instructed orally by the parish priests in the doctrines and duties of the Faith; while the pictures and statues with which the churches were adorned aided the direct teaching of sermons and catechizing in giving a general knowledge of Bible history and of the legends of the saints.

No doubt, in times of spiritual and intellectual lethargy, the practice fell short of the theory; but on the whole it may be concluded that in medieval times the provision for higher instruction was adequate to the demand, and that, relatively to the culture of the time, the mass of the people were by no means sunk in brutish ignorance. Indeed, especially when the paucity of books before the invention of printing is borne in mind, the number of people who could read the vernacular, as evidenced by the demand for books in the vulgar tongue as soon as printing made them available, is clear proof that the latter part of the middle ages was by no means a time of general illiteracy.

Education of chivalry.

Feudalism, the other characteristic aspect of medieval society, had also its system of education, expressing its own view of life, and preparing for the adequate performance of its duties. This was the training in chivalry given to pages and squires in the halls and castles of the great. Hallam has well said: "There are, if I may so say, three powerful spirits which have from time to time moved over the face of the waters, and given a predominant impulse to the moral sentiments and energies of mankind. These are the spirits of liberty, of religion and of honour. It was the principal business of chivalry to animate and cherish the last of these." And this was not in opposition to the spirit of religion which animated the scholastic education which went on side by side with it. Throughout chivalry was sanctified by the offices of the Church. The education of chivalry aimed at fitting the noble youth to be a worthy knight, a just and wise master, and a prudent manager of an estate. Much was acquired by daily experience of a knightly household, but in addition the page received direct instruction in reading and writing; courtly amusements, such as chess and playing the lute, singing and making verses; the rules and usages of courtesy; and the knightly conception of duty. As a squire he practised more assiduously the knightly exercises of war and peace, and in the management of large or small bodies of men he attained the capacity of command.

Decadence of scholasticism.

With the unification of existing knowledge and the systematization of theology the constructive work of scholasticism was done. At the same time the growth of national feeling was slowly but surely undermining feudalism. Moreover, deep resentment was accumulating throughout western Europe against the practical abuses which had become prevalent in the Church, and especially in the court of Rome and in the prince-bishoprics of Germany. In short, Europe was out-growing medieval institutions, which appeared more and more as empty forms unable to satisfy the needs and longings of the human soul. In such conditions, the customary and traditional education of school and university tended to lose touch more and more completely with the new aspirations and views of life which were everywhere gathering adherents among the keenest and most active intellects. Had a new cultural movement not begun, the education of Europe threatened to become as arid as the rhetorical education of the last centuries of the Roman empire had been. From this it was saved by the renaissance of classical studies which began in the 14th century.

The Renaissance.

Italy, by its greater wealth and its more intimate commerce with the eastern empire, was the seed-plot of this new tree of knowledge. Ever since the 11th century the cities of northern Italy had been in advance of Europe beyond the Alps both in culture and in material progress. The old classical spirit and the feeling of Roman citizenship had never quite died out, and the *Divina Commedia* of Dante (1265-1321) furnishes evidence that the poet of the scholastic philosophical theology was also a keen student and lover of the old Latin poets. But the greatest impulse to the revived study of the classics was given by Petrarch (1304-1374) and Boccaccio (1313-1375). Generally throughout western Europe the 14th century, though full of war and political unrest, was a time of considerable intellectual activity, shown in the increase of schools and universities, as well as in the literary and artistic revival in Italy, in the social and theological movement in England and Bohemia associated with the names of Wycliffe and Huss, and in the more or less perfect substitution of Roman law everywhere except in England for the law of custom which had hitherto prevailed.

But it was the literary movement which most affected education, and indeed the whole life of Europe. A decisive step was taken when Manuel Chrysoloras was invited to teach Greek in the university of Florence in 1397. The enthusiasm for classical culture, to which Petrarch had given so great an impetus, gathered force and extended over the whole of Italy, though, of course, felt only by a select few and leaving the mass of the people little, if at all, affected. From Italy it spread gradually to countries north of the Alps. In the old writers men found full expression of that new spirit of self-conscious freedom which was vaguely striving for expression throughout the whole of Christendom. In the free political atmosphere of the Italian communes, with their wealthy and leisured merchant class, that spirit could flourish much more readily than in the

feudalized Europe across the Alps. Moreover, the antique spirit was in direct line of ancestry with that of medieval Italy. Thus, for a couple of centuries, Italy stood in the van of European culture.

The stages of the movement cannot be traced here: suffice it to say it showed itself especially in an enthusiastic search for manuscripts, followed by their multiplication and wider distribution; in an intense devotion to literary form; in a revival of classic taste in architecture; in a wonderful development of painting and sculpture from symbolism of spiritual qualities towards naturalism and romanticism; in a return to Platonism in philosophy; in a contempt, often unreasoning and wanting a foundation in knowledge, for the scholastic Aristotelian philosophy itself, and not simply for the trivialities into which its actual exercise had so commonly degenerated. The invention of printing necessarily gave the movement both a stronger and a wider influence than it could otherwise have attained. And in its search after knowledge it was in full harmony with the spirit of adventure which marked the age, and by the discovery of the New World wrought so profound a change in the relative importance and prosperity of the countries of western Europe.

It is the spirit of the movement which is of interest to the student of education. And that spirit was essentially one of opposition to authority and of assertion of individual liberty, which worked itself out in various forms among peoples of different temperaments. In Italy the form was literary and artistic, and the full development of the Renaissance spirit was seen in a practical Paganism which substituted the attractions of art for the claims of religion and morality, and eventuated in deep and widespread immorality and a contemptuous tolerance of the outward observances of religion without faith in the doctrines they symbolized. The movement became an attempt to reconstitute the past intellectual life of Italy, and, as such, was foredoomed to sterility as soon as the work of re-discovery was completed; for the revived forms were not inspired with the vital spirit which had once made them realities, and consequently men’s minds once again were occupied with mere verbal subtleties. The really valuable service of the Italian humanists to Europe was the restoration to man of the heritage of knowledge which he had allowed to slip from his grasp, and the leading the way to a freer intellectual atmosphere. In Germany the spirit manifested itself in a rebellion against the doctrinal system of the Church as the only effectual means of attaining reform of ecclesiastical abuses. The Protestant reformation of Luther was the real German outcome of the Renaissance. In no other country of Europe did the movement take so distinctive a form.

Influence of the Renaissance on education.

It was, then, not merely the revival of interest in classical studies which so profoundly affected the life and education of western Europe. It was rather that in those literatures men found a response to intellectual and moral cravings which had been blindly gathering force for generations, and which found themselves formulated and objectified in the writings which set forth the Pagan view of life with its assumption of the essential worth and self-reliance of the individual and its frank delight in all the pleasures of existence. It was, in short, in proportion as men not only found delight in Pagan literature but returned in essence to the Pagan view of individual worth and the supremacy of the human intellect, that the Church realized the danger to herself which lurked in the new movement.

At first the revival of interest in the classical literatures did not show any antagonism to Catholic faith and practice, and its warmest supporters were faithful sons of the Church. The view of the relation of classical literature to Christianity adopted by the great humanist schoolmaster Vittorino da Feltre (1378-1446) was broadly that of the early Fathers, and in his school at Mantua he showed that culture was not inconsistent with loyalty to the Church or with purity of life. With him classical literature was not the end and sum of education, but was a means of implanting ideas, of developing taste, and of acquiring knowledge, all as helps and ornaments of a Christian life. Though Pagan literature was the means of education, the Pagan spirit had not supplanted that of Christianity. The school at Mantua may, indeed, be said to have exhibited in practice a Christianized application of the doctrines of Quintilian and Plutarch.

So was it in the other countries of Christendom. In the Netherlands the Brethren of the Common Life introduced humanistic studies into their schools side by side with definite religious teaching and observances and their work was always dominated by the Christian spirit. The earlier German humanists, such as Nicholas de Cusa, Hegius, Agricola and Wimpheling, adopted the same attitude, and Erasmus himself, bitterly as he attacked the practical abuses of the Church, remained in communion with it, and aimed at harmonizing classical culture with the Christian life. In England the same love of culture combined with devotion to the Church was seen in Selling, prior of Christ Church, Canterbury, the first real English humanist, in Grocyn, Linacre, More, Fisher, Colet and many others whose enthusiasm for culture was as undoubted as was their loyalty to Catholicism. It seemed, then, at first as if the greatest educational effect of the classical revival would be the deepening of literary culture, and the substitution of real inquiry for dialectic subtleties in the courses of schools and universities, without any break with established religious teaching. It is true that the majority of schools were but little affected, and many of the universities had given but a half-hearted welcome to humanistic studies when the religious revolt in Germany under the leadership of Luther threw the whole of Europe into two hostile camps. But even the conservative university of Paris—the headquarters of scholastic philosophical theology—had permitted the teaching of Greek as early as 1458, and both Oxford and Cambridge had welcomed the new studies. That the influence of the new movement for classical study was gradually permeating the schools is shown not only by the practice of the Brethren of the Common Life but by the curriculum laid down by the statutes of the schools refounded by Wolsey at Ipswich and by Colet at St Paul’s.

The immediate effect of the religious controversies of the 16th century on education was emphatically, if unintentionally, disastrous. The secularization of ecclesiastical property too often absorbed the endowments of the schools, so that, both in Germany and in England, the majority of grammar schools either disappeared or continued a starved existence with diminished funds; the doctrine of salvation by faith alone and the futility of good works dried up the source from which such endowments had flowed; the violent fulminations of the German reformers against the universities as the homes of the hated scholastic theology and philosophy found an echo in minds fired with the renaissance enthusiasm for poetry and oratory, and correlative distaste

Immediate influence of the Reformation on education.

for the more severe and abstract speculations of logic and philosophy, which expressed itself in abstention from those seats of learning; the preoccupation of men's minds with theological speculations and quarrels led those few who did resort to the universities to neglect their appointed studies and to devote their energies to interminable wrangling over the points in dispute. This decadence in culture was attended by an outbreak of licence and immorality, especially among the young, which called forth violent denunciations from Luther and many of his followers in Germany, and from Latimer and other reformers in England. In some respects these results were only transitory. Humanism and Protestantism, which had so far diverged that Erasmus (1467-1536) had declared that where Lutheranism flourished learning decayed, were brought together again by Melanchthon (1497-1560) under whose influence universities were founded or reorganized and schools re-established in Protestant German states; and in England the reign of Elizabeth saw many new educational foundations. But this restoration of the means of education was only partial, and the doctrine of the worthlessness of "carnal knowledge," which led the Barebones Parliament to propose the suppression of the English universities, was held by many fervent Protestants both in England and in Germany all through the 17th century.

Moreover, the schools established a tradition of curriculum and instruction which ignored the new directions of men's thoughts and the new view of knowledge as something to be enlarged, and not merely a deposit to be handed down from generation to generation. The later humanist theories of education, which the schools continued to follow generally for over two centuries, and in many cases for another hundred years after that, were drawn mainly from Erasmus and Melanchthon, who found in the classical languages and literatures, and especially in Latin, the only essential instruments of education. General knowledge of natural facts might be desirable to the cultured man as ornaments to his rhetoric, but it was to be sought in the writings of antiquity. Even so revolutionary a thinker on education as Rabelais (1495-1553) with all his demand for an encyclopaedic curriculum, held the writings of the ancients as authoritative on natural phenomena. Melanchthon, whose conception of instruction was much narrower, exercised enormous influence in the moulding of Protestant universities and secondary schools, both directly and through such disciples as Trotzendorf and Neander, but especially through his friend Sturm (1507-1589), whose Latin gymnasium at Strassburg became the model which the grammar schools of Protestant Europe strove to imitate. In this school nearly the whole of the energies of the boys was given to acquiring a mastery of the Latin language after the model of Cicero. Sturm, indeed, did not go to the extreme length of the Ciceronians, opposed and satirized by Erasmus, who would allow no word or construction which could not be found in the extant writings of their master, but a like spirit dominated him.

Protestant schools.

In Catholic countries the Church retained control of education. The practical reformation of abuses by the Council of Trent, and the energy and skill of the Society of Jesus, founded by St Ignatius Loyola, in 1534, brought back most of south Germany into the fold of the Church. Everywhere Catholic universities were mainly taught by Jesuit fathers; and under their influence, scholasticism, purged from the excretions which had degraded it, was restored, and continued to satisfy the longings of minds which felt the need of an authoritative harmonizing of faith and knowledge. Everywhere the society established schools, which, by their success in teaching and the mildness of their discipline, attracted thousands of pupils who came even from Protestant homes. Their curriculum was purely classical, but it was elaborated with much skill, and the methods of instruction and discipline were made the subject of much thought and of long-continued experiment. In the methods thus determined all Jesuit fathers were trained, so that the teachers in Jesuit schools attained a degree of skill in their art which was too generally wanting elsewhere.

The Society of Jesus.

So long as Latin remained the language of learning, and new fields of knowledge were not appropriated, the schools remained in harmony with the culture of their time, though, as Mulcaster (1530-1611) pointed out, such a training was not of value to the majority of boys. For them he urged an elementary education in the vernacular; but neither in this nor in his advocacy of the training of teachers was his advice followed.

Early proposals for reform.

In the 17th century the dislocation between the Latin schools and the needs of life began to be accentuated as Latin gradually ceased to be the language of learning; and, as a consequence, the numbers attending the schools decreased, and the mass of the people sunk continually lower in ignorance. In vain Hoole urged the establishment of a universal system of elementary schools giving instruction in the vernacular, Petty put forth his plan for elementary trade schools, and Cowley proposed the establishment of a college devoted to research. Ideas of reform were in the air, but the main current of scholastic practice flowed on unaffected by them. Some attention was, indeed, paid to the conservative reforms advocated by the Port Royalists, of which the most important was the inclusion of the vernacular as a branch of instruction, but the cry for more fundamental changes based on the philosophy of Bacon was unheeded. Of these, none was a more active propagandist than Comenius (1571-1635). Unfortunately his *Great Didactic*, in which he set forth his general principles, attracted little attention and won less adherence, though his school books, in which he attempted with very little success to apply his principles, were widely used in schools. But these were little more than bald summaries of real and supposed facts, stated in Latin and the vernacular in parallel columns. In content they differed from such medieval summaries of knowledge as the well-known work of Bartholomew Anglicus, which had been widely used since the 13th century, chiefly by their greater baldness and aridity of statement.

In the universities, too, the 16th and 17th centuries saw a continuous decadence. The 16th century was not ripe for real intellectual freedom; and Protestantism, having based its revolt on the right of private judgment, soon produced a number of conflicting theological systems, vying with each other in rigidity and narrowness, which, as Paulsen says, "nearly stifled the intellectual life of the German people." Further, the idea of national autonomy, which exercised so great an effect on the politics of the time, included the universal adherence of the citizens to the religion of the state. Hence, till the end of the 17th century the universities of Protestant Europe were regarded mainly as instruments for securing adhesion to the national theological system on the part of

Decadence of universities.

future clergy and officials, and the state interfered more and more with their organization and work. Theology occupied the most important place in the higher studies pursued, which for the rest differed little in content and less in spirit from those of preceding centuries, except that more attention was paid to the study of classical literature. Even that decayed into formal linguistics as the Renaissance enthusiasm for poetry and oratory died out, and interest in logical and philosophical questions, fostered by the dominance of dogmatic controversial theology, again became dominant. In Paris, on the other hand, the faculty of theology had decayed through the withdrawal of those preparing for the priesthood into episcopal seminaries, and the higher studies pursued were mainly law and medicine. Thus, generally, the universities were less and less fulfilling the function of providing a general liberal education. Another change, due to the same causes and making for the same results, was the isolation of universities, often directly fostered by the state governments, which for the universal interchange of medieval thought substituted a narrow provincial culture and outlook. It is no wonder that numbers everywhere decayed and that complaints as to the habits of the students were loud and frequent.

Education of the higher classes.

At the close of the 17th century, then, universities as well as schools had reached a very low level of efficiency and were held in little respect by the cultured. Indeed, from the middle of the century, the main current of intellectual life had drifted away from the orthodox centres of learning. The formation of the Berlin Academy in Germany and of the Royal Society in England, and the refusal of Leibnitz to accept a chair in any German university, were signs of the times. In France, and later in Germany, the education of the noble youth was increasingly carried on apart from the schools, and was really an outgrowth from the education of chivalry. In the 16th century Castiglione and Montaigne had advocated a training directly adapted to prepare for polite life, and Elyot wrote on similar lines. But the most important movement in this direction was the formation of the courtly academies which flourished in France in the 17th century, and were soon imitated in the *Ritterakademien* of Germany. In these schools of the nobility French was more honoured than classics, and the other subjects were chosen as directly adapted to prepare for the life of a noble at the court. Milton in his *Tractate* advocated the foundation of such academies in England, though he proposed a curriculum far more extensive than had ever been found possible. More and more, too, foreign travel had, from the middle of the 16th century, been looked upon as a better mode of finishing the education of a gentleman than a course at a university.

Revival of university life.

The later years of the 17th century saw a revival of university life in Cambridge, through the work of Newton and the increasing attention paid to mathematics and the physical sciences, though the number of students continued very small. In Germany, also, a new era opened with the foundation of the universities of Halle (1694) and Göttingen (1737), which from the first discarded the old conception that the function of a university is to pass on knowledge already complete, and so opened the door of the German universities to the new culture and philosophy. It was soon seen that students could thus be attracted, and the influence spread to the other German universities, which by the end of the 18th century had regained their position as homes of the highest German thought.

Education of the poor.

At Halle, too, was set the example by Francke of providing for the education of the children of the poor, and to his disciple Hecker Germany owes the first *Realschule*. Simultaneous movements for the education of the poor were made by St Jean-Baptiste de la Salle and the Brothers of the Christian Schools in France, and by the Society for the Promotion of Christian Knowledge in England. But the total results were not great; the mass of the people in every European country remained without schooling throughout the 18th century.

18th-century thought and education.

The intellectual movements of that century were, indeed, essentially aristocratic. Voltaire and the Encyclopaedists aimed at the enlightenment of the select few, and Rousseau declared baldly that the poor need no education. That these movements influenced education profoundly is undoubted. The individualistic and abstract rationalism of Voltaire, derived from the sensationist philosophy of Locke through the more thorough-going Condillac, and finding its logical outcome in the materialistic atheism of La Mettrie and the refined selfishness of Rochefoucault, infected the more cultured classes. In Lord Chesterfield's *Letters to his Son* is shown its educational outcome—a veneer of superficial culture and artificial politeness covering, but not hiding, the most cold-blooded selfishness. Against this fashionable artificiality, as well as against the obvious social and political abuses of the time, Rousseau's call for a return to nature was a needed protest.

Rousseauism.

Rousseauism, however, was not merely a transitory revolt against a conventionality of life that had become unbearable; it was emphatically the voicing of a view of life and of education which has profoundly influenced Europe ever since. In that Rousseau (1712-1778) attempted to look at life as a whole he was on truer ground than were the intellectualists of the "Enlightenment"; but in that he found the essence of life in the gratification of the desires and impulses of the moment, he enunciated a doctrine which banished high principle and strenuous effort from life and consequently from education. In the *Émile* is presented a purely fantastic scheme of education based on a psychology of development so crude as to be absolutely false, and producing a young man utterly unable to guide his own life or to control his emotions and impulses. Rousseauism is, indeed, in its essence the application to education of the doctrines of naturalism—the philosophy which regards human life as a mere continuation of physical process, and consequently as determined wholly by environment. So Rousseau would abolish all moral training and leave the child to the reactions of the physical world upon his actions.

Kant.

Against this position the educational teaching of Kant (1724-1804), influenced though he was by the *Émile*, is essentially a protest. The most necessary element in education, according to Kant, is constraint, which by the formation of habit prepares the young to receive as principles of conduct the laws at first imposed upon them from without. And the supreme guide of life is the law of duty which is always more or less opposed to the promptings of inclination. Kant exaggerates the dualism: Rousseau would abolish it by ignoring the more important of the two antitheses.

The French Revolution—the natural outcome of the teachings of Voltaire and of Rousseau—was the second stage in the movement of which the Reformation was the first. It was essentially the assertion of the natural rights of man, and, as a logical sequence, of the right of every child to be properly trained for life. The reaction due to the excesses of the revolutionists no doubt delayed the acknowledgment for a time, but its gradual recognition is emphatically the characteristic mark of the educational history of the 19th century.

Educational outcome of the Revolution.

Preached and practised by Pestalozzi (1746-1827) in Switzerland, the general education of the poor was first made a reality by Prussia after the crushing defeat of Jena. In France and England it remained for nearly three-quarters of the century the work of the Church and other voluntary agencies, though aided by the state. Finally a state system of schools has been more or less fully set up in every state of western Europe and in America, and subjected to more or less state regulation and control. Equally marked has been the growing care for the scholastic education of girls as well as boys, though only in America are the two regarded as practically identical in form and content.

State education.

Thus the 19th century saw the final working out of the idea that the state should be substituted for the Church as the official agent of education, an idea which had its roots in the Renaissance conception of the right of man to direct his life apart from theological determinations. The more direct outcome of the same idea is apparent in the absolute liberty with which the presuppositions of knowledge are questioned, and the maxim of Descartes—to prove everything by the reason and to accept nothing which fails to stand the test—is acted upon. No greater contrast is possible than that between the medieval student and the modern searcher after truth.

The influence of the same spirit has wrought an equally momentous change in the methods of instruction. The impetus given by the exaggerated doctrine of Rousseau to the view that the nature of the child should determine the means of education, led to more thorough-going attempts than had hitherto been made to base educational method on a knowledge of child psychology. Pestalozzi and Froebel (1782-1852), by their insistence on the need of educating a child through his own activity, and by their widespread influence, made the new view of method an actuality. The influence of Rousseau has, thus, passed into modern educational practice in a form that, in its essence, is true, though in practice it has shown itself apt to run into the same excess of emphasis on impulse and feeling which vitiated the teaching of Rousseau himself. The influence of Herbart (1776-1841) has tended to counteract this. The essence of Herbartianism is that mental life consists of presentations, or reactions of the mind on the environment, and that will springs from the circle of thought thus developed. The emphasis is therefore placed on intellect and instruction while in Froebelianism it is placed on spontaneous activity and on the arrangement of the environment. Each exaggerates the function of the one factor in concrete experience which it makes the centre of interest, and each is tinged with the individualistic conception of life which characterized the 18th and early 19th century.

Methods of instruction.

The most marked change in the outward aspect of education has been the modification of the curriculum of school and university by the introduction of various branches of natural science. Conjointly with this has been much increase of specialization, and that not only in the university but in the school. There is no longer a universally recognized circle of knowledge constituting a liberal education preparatory to specialist studies, as there was in the middle ages. Nor is there general agreement as to what such educational institutions as schools and universities should attempt to do, or even as to the end that should be sought by education as a whole. Nor can agreement on such points be expected while men differ widely as to the meaning and purpose of life. The work of the organization of the material means of education has largely been accomplished by the civilized world: that of determining the true theory and practice of the educative process itself is still incomplete. To that, both discussion of the philosophy of life and of the relative values in life, of various kinds of experience and experiment in the light of the conclusions reached, are needed. The problem will never be absolutely solved, for that would imply an absolutely best education irrespective of conditions, but its practical solution will be reached when a true adjustment is made between the process of education and the life for which that education is intended to be a preparation.

Curriculum of instruction.

See also the articles Academies; Classics; Co-education; Examinations; Polytechnic; Schools; Technical Education; Universities; Women; &c.

(J. Wn.)

II. National Systems of Public Education

A statement of the principles commonly recognized by modern communities as governing the action of the state in relation to education may facilitate at the outset a clearer understanding of the problems which the organization of public education presents. The cardinal doctrine of state interference in the educational domain is universally accepted by all the great nations of the modern world; and in regard to its extent and limits a large measure of agreement has now been reached.

In the first place, it is recognized as the duty of the state to insist upon a certain minimum of education for every future citizen. This does not necessitate a monopoly of education on the part of the state, such as was claimed by the Napoleonic despotism under the traditional influence (it would seem) of the old authoritative Gallo-Roman tradition, transformed in its outward manifestation but not in its inward spirit by the French Revolution. Such a monopoly would be plainly repugnant to the spirit of Anglo-Saxon individualism, and it is interesting to note that attempts to reassert it have in recent times been repudiated in republican France by some of the best exponents of modern free thought, as an infringement of personal liberty not calculated to justify itself by any corresponding public gain. Nevertheless, the recognition of this primary duty of the state plainly implies a state system of at least elementary education. The masses of the industrial population cannot afford the

Principles of state interference.

necessary minimum of instruction which the public interest demands, and private and voluntary effort cannot efficiently supply the want resulting from the unequal distribution of wealth. But it is in the nature of things that, so far as private effort attempts anything in this direction, it should be motived in the main by religion and associated with the great historical religious organizations; thus it comes about that the moment the state steps in to make good the deficiency of voluntary effort a fruitful and embittering source of difficulty and friction is disclosed. Hence, in England, the history of public elementary education since the beginning of the 19th century has been very largely the history of what is called the religious difficulty. Here we find ourselves in the region of acute controversy in which it is useless to do more than note empirically the various solutions adopted by different states. Perhaps all that can safely be indicated as commanding universal acceptance is the principle that the state must not impose upon an individual citizen in the person of his child any form of religious instruction to which he conscientiously objects. Modern controversies show the difficulty of applying even this rudimentary principle to the complicated circumstances of a free community split up into a number of groups differing profoundly in religious sentiment, and zealous each for the recognition of its own ideal within the common system. So far, however, as secular instruction (*i.e.* the teaching of other subjects than religion) is concerned it is now generally accepted that the elementary minimum must be both compulsory and free for every individual child whose parents will not or cannot (as the case may be) provide such instruction for it efficiently elsewhere than in the state-supported schools.

Next, the action of the modern state cannot stop short at elementary education. The principle of "the career open to talent" is no longer a matter of abstract humanitarian theory, a fantastical aspiration of revolutionary dreamers; for the great industrial communities of the modern world it is a cogent practical necessity imposed by the fierce international competition which prevails in the arts and industries of life. The nation that is not to fail in the struggle for commercial success, with all that this implies for national life and civilization, must needs see that its industries are fed with a constant supply of workers adequately equipped in respect both of general intelligence and technical training.

On political grounds too, the increasing democratization of institutions renders a wide diffusion of knowledge and the cultivation of a high standard of intelligence among the people a necessary precaution of prudent statesmanship, especially for the great imperial states which confide the most momentous issues of world policy to the arbitrament of the popular voice. The state then must satisfy itself that the means of education are placed within the reach of all, in grades adapted to the varying degrees of intelligence and educational opportunity to be found among a community upon the majority of whose members is imposed the necessity of entering upon the practical business of life at a more or less early age. The organization of the higher grades of education constitutes a task of less formidable magnitude than the organization of elementary education, for the reason that, at any rate in the prevailing social conditions, it is only a minority who can benefit by it, and that of this minority a large proportion can afford the whole or a considerable portion of the cost in each individual case. The class, however, whose education must needs be assisted by the state if it is not to remain inefficient must always be considerable; and account must be taken also of the necessities of the further class whose exceptional mental development is such as to make it worth while for the state to bestow gratuitously an education higher than elementary at the public expense. University education is distinguished from education of the lower grades by the fact that, being necessarily restricted to an élite of intellect or birth, it cannot, save in very exceptional circumstances, usefully be organized locally. Although universities are the necessary complement of a public educational system they do not in strictness or necessity form part of such a system, and in so far as they are brought within the purview of public authority it must be as a matter of national, rather than municipal or provincial, concern. Accordingly university education is separately treated (see Universities), and will not be referred to, save incidentally, in the present article.

Reserving to a final section the history of education in the United States of America, a brief description is given here of the educational systems of the leading European countries by way of introduction to a more detailed, but still summary, historical sketch of public education in England. The highly organized educational systems of France and Prussia (as representing Germany) are manifestly suitable for the purposes of a general study of the principles of educational polity as worked out upon logical and consistently thought-out plans by highly centralized states. As to other European countries, a brief mention must suffice of certain features of special interest presented by smaller progressive states of such different types as Switzerland, Belgium and Holland. Similarly, in the case of the United Kingdom, considerations of space forbid more than a brief notice of the educational systems of Scotland (*q.v.*) and Ireland (*q.v.*). For other countries see the sections in the articles under the headings of the respective states.

France.

France (*q.v.*) presents the most complete type of a state system of education organized under a strongly centralized administration in all grades. This centralized administration in education, as in other departments, represents the Napoleonic heritage of the Republic, and, although there has been an increasing tendency of recent years to study local conditions in the internal organization of schools, anything approaching to local autonomy is unknown in educational affairs. The necessary checks upon bureaucracy are supplied not by popularly elected municipal bodies but by a strong infusion of the pedagogic element in the administrative machinery. The pedagogic element in turn does but represent another side of the collective activities of the state. The teaching profession both in the primary and higher spheres—and the two are sharply marked off from one another—consists of a highly organized body of state functionaries, united by a strong *esprit de corps* and actuated by ideals and aims which are inspired by the state. The importance of this condition of things lies in the fact that the Republic is something more than a form of government: it is the social and moral expression of the democratic ideal as conceived by a people profoundly imbued by tradition with the sense of social solidarity, or collectivism; and nowhere has this expression been more characteristic or more complete than in the domain of public education. Yet the educational system of modern France is by no means exclusively the creation of the Third Republic, and the main stages in its development deserve to be traced historically.

No historical sketch, however slight, of French education can ignore the great Catholic religious educator of the 18th century, Jean Baptiste de la Salle, the founder of *Les Frères de la Doctrine chrétienne*, commonly known as the "Christian Brothers." The Brothers were not merely pioneers of elementary education, they may also be regarded (as M. Buisson, formerly director of public instruction, has shown) as the originators of higher primary instruction. Under the Restoration they upheld the method of simultaneous teaching against the partisans of the mutual (or monitorial) method, successfully demonstrating the superiority of the trained teacher. The unfortunate effects of the monitorial system upon English education show the reality of the service which this religious congregation rendered to the national pedagogy in France.

Frères de la Doctrine chrétienne.

The Constitution of 1791 decreed that primary instruction should be compulsory and gratuitous. (It may be explained that the term "free education," *instruction libre*, does not bear the same meaning in France as in England. In France a free school means a school not under state control and not forming part of the state system.) In this as in much else the Revolution was powerless to do more than enunciate general principles which it left for later generations, in the present instance after the lapse of nearly a century, to carry into effect. True to its theories of individualistic liberty, the Revolution admitted liberty of teaching. Napoleon, on the other hand, by the law of 1806, centralized all forms of education in one official teaching body under the name of the Imperial University, thus securing a monopoly of teaching to the state. The Napoleonic idea of the university, doubtless because a true expression of the national genius, has never ceased to exert a profound influence upon French education, an influence which of late years has been revivified and reinforced by the modern ideal of social solidarity.

The Revolution and Napoleon.

Under the Restoration education fell inevitably under the control of the church, but under the Liberal Monarchy Guizot in 1833 passed a law which laid the foundations of modern primary instruction, obliging the communes to maintain schools and pay the teachers. It is also to the credit of Guizot as an educational reformer that he perceived the necessity for the higher primary as distinct from the secondary school. The higher primary schools which he founded were unfortunately suppressed by the *Loi Falloux*; their restoration constitutes one of the great positive services rendered by the Third Republic to the cause of popular education.

Reforms of Guizot.

The *Loi Falloux* of 1850, passed by the Second Republic under the influence of the prince president, is chiefly memorable for its restoration of the liberty of teaching, which in a Catholic country means in effect free scope for priestly schools. This law also made provision for separate communal schools for girls, for adult classes and for the technical instruction of apprentices. In 1854 France was divided for purposes of educational administration into sixteen academies, each administered by a rector with an academy inspector under him for each department. This organization survives to-day, with the difference that for each academy (except Chambéry) there is now a local teaching university.

Loi Falloux.

The ministry of the well-known educationist M. Duruy (1865-1869), corresponding to the period of the Liberal Empire, was notable for marked administrative progress. A permanent memorial of this epoch is the enactment rendering primary schools for girls obligatory in communes of over 500 inhabitants. Duruy also provided for the introduction of gratuitous instruction at the option of the commune.

Ministry of M. Duruy.

The task of educational reform imposed itself upon the republic by a twofold necessity. The wars of 1866 and 1870 were victories for the Prussian schoolmaster, and aroused all western Europe to the national importance of popular education. For France then the reform of popular education was an essential part of the work of national restoration. For the republic too, menaced by older and hostile traditions, the creation of a national system of education inspired by its own spirit was an essential condition of the permanence and security of its government and the social ideals of which that government was the expression. Hence the energy with which the republican state addressed itself to the organization of primary instruction, "obligatory, gratuitous, secular."

The Third Republic.

By the law of June 1, 1878, there was imposed upon the communes the obligation of acquiring their school buildings; and as a grant in aid a sum of £2,400,000 was set aside for this purpose by the state. In 1879 a law was passed compelling every department to maintain a training college for male and female teachers respectively. The two higher normal schools of Fontenay and St Cloud were also founded to supply the training colleges with professors. During the same period, among other *certificats* or professional diplomas, there were established the *certificat d'aptitude pédagogique*, which qualifies probationer-teachers (*stagiaires*) for appointment as teachers in full standing (*titulaires*), and the *certificat d'aptitude* for primary inspectors and heads of normal schools. The law of June 16, 1881, rendered obligatory for all teachers, whether public or private, the *brevet de capacité*. It was found impracticable to carry this law into immediate effect, and as late as 1902 only about 60% of the men and 52% of the women were provided with the professional certificate necessary for becoming *titulaires*.

Acquisition of elementary school buildings and organization of teaching profession.

The laws making primary education gratuitous, compulsory and secular, are indissolubly associated with the name of Jules Ferry. The law of June 16, 1881, abolished fees in all primary schools and training colleges, the law of 1882 established compulsory attendance, and finally the law of October 30, 1886, enacted that none but lay persons should teach in the public schools, and abolished in those schools all distinctively religious teaching. In the boys' schools members of religious communities were to be displaced within five years, but in girls' schools the *religieuses* might remain till death or resignation.

Reforms of Jules Ferry. Laicization.

Religious teaching was replaced in the state schools under the Ferry law by moral instruction according to official curricula, a change which has been described by M. Séailles (*Éducation ou révolution*) as a revolution of the profoundest philosophical meaning. The difficult and delicate topics of the relation of the

Moral instruction. state school to religion and the value of the substituted moral instruction have recently received illuminating and objective treatment from different points of view in the series of reports on *Moral Instruction and Training in Schools*, edited by Professor M.E. Sadler (1908, vol. ii.); the barest reference to the questions at issue must here suffice. As regards the character of the moral instruction, it would appear to have shifted from a Kantian to a purely sociological basis. Roman Catholic opinion is at least not unanimous in regarding the "lay" or neutral school as essentially or necessarily anti-religious, and plainly there is no inherent reason why the neutrality should not be a real neutrality, but with the existing relations between the Catholic Church and modern thought in France the influence of the Normalist teachers is in fact apt to be anti-religious, and moreover no system of independent moral doctrine, whether based upon a priori or inductive reasoning, can be acceptable to the Roman Catholic Church. In whatever degree the blame may be rightly apportionable between church and state, the fact is that the two find themselves in acute conflict, and that from the conflict there has resulted a certain moral confusion which Christian and non-Christian moralists alike view with alarm. It may be that the mischief would have been mitigated had more moderate counsels prevailed at the time of the Ferry law, and had the church been willing to accept (as the Republic might then have been willing to concede) right of entry for the clergy into the schools. But the real causes of the trouble lie deep in the philosophical and religious problems of our time, and in the constant and self-sacrificing devotion of the French to logical ideals on either side. Perhaps it is not too sanguine to discern in the growing tendency to idealism in French philosophy, and to liberal ideas in French and Catholic religious thought, the promise of a happier state of things. In the meantime, the religious difficulty in the schools divides the nation into two hostile camps (*les deux Frances*, as a Swiss Protestant writer puts it) in the shape of the state secular schools on the one side and the private religious schools on the other.

In the year 1903-1904 the total number of pupils in private primary schools was 1,298,591, as against 4,935,000 in the public primary schools, but these figures were liable to be materially affected by the rigorous enforcement of the laws against the religious orders.

In 1889 an important change was made in educational finance by transferring the cost of teachers' salaries in primary schools from the communes to the state, a right consequence of the changes which made the teacher a state official. Thus the state assumed the greater part of the burden of primary instruction, leaving to the communes merely the cost of fabric, and to the department the maintenance of the fabric of the normal schools and certain expenses of inspection.

Financial reform of 1889.

At this point it will be convenient to describe shortly the various central and local authorities that constitute the official machine. The minister, the head of the entire hierarchy, is assisted by a *conseil supérieur* consisting of fifty-seven members, of whom the majority are elected by the higher teaching profession, while a few are nominated by the president, including a small number to represent private schools, and a few are elected by the primary teachers. Practically the ordinary work of the council is carried on by a sub-committee consisting of the nine nominees of the president and six others designated for this purpose by the minister. The council has administrative, judicial and disciplinary, as well as advisory, powers which enable it to exert a direct influence upon the internal organization of schools. There is also a pedagogic *comité consultatif* and a legal *comité contentieux*, whose respective functions are purely advisory.

Administrative machinery. Minister and conseil supérieur.

The *inspecteurs généraux* "act," says Mr Brereton in his official report to the English Board of Education, "as the eyes and ears of the central authority." Their duties are: first to inspect the normal schools; next to supervise the work of the ordinary inspectorate; lastly to give general and comparative information on the progress of primary instruction in the various parts of France. For the purpose of general inspection France is divided into seven districts.

Inspecteurs généraux.

As already indicated, for the purpose of educational administration, the departments of France are grouped in seventeen divisions called academies. At the head of each academy is the rector. He is appointed directly by the president and must hold the doctor's degree. He is not only the head of the local teaching university, but is also charged in a general way with the oversight of all three departments of education, superior, secondary and primary; in regard to the last, however, his functions are confined to the pedagogic side. The direct share of the rector in administration is mainly confined to the normal schools and the higher primary schools. The rector is assisted by an academic council composed almost exclusively of pedagogic elements.

Rector and council of academy.

Each department of France has an academy inspector appointed by the minister. The duties of the academy inspector embrace both higher and primary education. In the latter sphere he is the real head of the local administration, and the primary inspectors are his subordinate officers. He appoints the probationer-teachers and nominates the regular teachers for appointment by the *préfet*.

The academy inspector.

The *préfet*, the chief administrative officer of each department, not only appoints the teachers upon the proposition of the academy inspector, he is also as president of the *conseil départemental* concerned generally with the externa of school administration, including the supply of schools. The *conseil départemental* with respect to its powers corresponds in some degree to our own local education authorities, but as regards its constitution it is in no sense a municipal body, the representatives of the *conseil général* of the department (which corresponds to the county council) being greatly outnumbered by the pedagogical members.

Préfet and conseil départemental.

The inspectors of primary schools, as has already been stated, act under the academy inspector. They are appointed upon the result of examination and not by direct nomination as in England. The examination is severe, and it is from the body of the professors of the normal schools rather than from the ranks of the primary teachers that the successful candidates are chiefly

Primary inspectors.

drawn.

Very limited powers are entrusted to certain communal and cantonal authorities. The *commission scolaire* is a committee organized in each commune for the purpose of improving school attendance, to which end they administer a *caisse des écoles* or school fund for supplying clothing and meals to needy children. The *maire* of the commune has the right of visiting the schools, but neither he nor any of the minor local authorities can interfere with the teaching. Similar duties are assigned to the *délégués cantonaux*, who are appointed by the *conseil départemental* for each canton (a wider area than the commune), and can best be described as local visitors or visiting committees rather than managers in our sense of the word. "All this hierarchy of central and local officials," says Mr Brereton, "will doubtless seem complicated to English minds. The extraordinary thing is that, so far as I could learn, the machine, for all its complexity, works smoothly enough. The truth is that the province of each particular functionary is so clearly defined that there is no debateable ground over which ambitious rival authorities can wrangle."

Minor local authorities.

In proceeding to sketch the French system of higher primary and secondary schools, it may be observed that European systems of higher education have generally been framed upon the view that the divisions of education are longitudinal, not latitudinal, and that secondary education is a training complete in itself from the preparatory stage to the university, with aims and ideals of general culture which differentiate it radically and at the very outset from education of the elementary type. On the other hand, in the United States the view has prevailed that the divisions of education must be latitudinal, that the secondary school must be complementary to the elementary school, in which even the élite must receive their preparatory or elementary training. At any rate down to the reform of 1902, which will presently be explained, the French system could be regarded as a typical and even extreme example of the European theory, little consistent as this might seem to be with the broader principles of democracy. This view of the matter is expressed by the French terminology, by which what in England is called "elementary" is in France termed "primary" education.

Conception of secondary education.

The thoroughness with which the principle of the autonomous character of the two divisions of education was carried out undoubtedly favoured in a special degree the complete organization given to higher primary instruction in the *écoles primaires supérieures* under the Third Republic. The aim of these schools is to fill the void which must otherwise exist for those who need a higher education than the primary school can give, but for whose subsequent careers secondary education would be ill-adapted and injudicious. Throughout the organization of primary education the French have kept steadily in view the danger of creating an intellectual proletariate. "Nous poursuivons la culture générale du caractère et de l'esprit, mais nous cherchons en même temps à orienter l'enfant vers la vie pratique," says an official report. The aim of the higher primary school is to continue education in this spirit up to the age of sixteen so as to prepare the scholar to take an honourable place in the higher ranks of skilled industry rather than to deflect him towards a professional career or intellectual pursuits for which he is unfitted, not so much by the accidents of birth and social circumstance as by his own natural aptitudes. Within the limits necessarily marked out for them the higher primary schools of France have aimed at imparting what may be termed a general culture as distinct from purely technical or trade teaching, and this development has been greatly furthered by the separate organization given to the latter teaching in the *écoles professionnelles*. At the same time, prominence is given in the higher primary schools to practical training of an educational character with special reference to the industries and circumstances of the locality, and in the rural districts a special agricultural bias is imparted to the curriculum. It is interesting to note that the institution of the higher primary schools was due in large part to the spontaneous initiative of the municipalities, and that in the later phases of state organization special care has been taken to avoid anything in the nature of a rigid uniformity in these schools.

Higher primary schools.

A wider extension has been given to higher primary instruction by the establishment of *cours complémentaires* in certain schools, at centres at which it would be impossible to organize separate higher primary schools. A similar solution of the continuation school problem has recently commended itself to the consultative committee of the Board of Education for England.

Supplementary courses.

Admission to the higher primary schools in France is only accorded to those who have obtained the elementary school leaving certificate, *certificat d'études primaires*. A feature of importance for continuation work in rural districts is the provision made for boarding scholars in attendance at these schools. The boarding arrangements are generally, as in the case of the secondary schools, left to the head teacher, but in some instances municipal hostels have been provided. No fees may be charged for higher primary instruction, and scholarships (*bourses*) are provided to a certain extent in the form either of boarding scholarships or maintenance allowances to compensate the parent for the loss of the child's labour. The number of scholars in the public higher primary schools for the year 1903-1904 was 34,084, and in *cours complémentaires* 21,777, making a total of 55,861. In addition there were 8891 scholars in receipt of higher primary instruction in private schools.

French secondary education is given in the *lycées* which are first-grade schools maintained and controlled by the state, and the *collèges*, which are schools of the second grade maintained partly by the state and partly by the municipality. A considerable number of scholars pass annually from the collèges to the lycées. In both grades of schools the teachers are paid by the state and nominated directly or indirectly by the minister of education. They are required to possess certain specified academic qualifications which can only be obtained from the *université*, but failing teachers with the prescribed qualifications the classes are taught by teachers styled *chargés de cours* as distinct from professors.

Secondary schools, lycées and collèges.

With a view to supplying teachers for the secondary schools, the state maintains the École Normale Supérieure, a college in which instruction, board and lodging are given free to a number of scholars selected by competition from the best secondary school boys, though residence in the institution is no longer

École Normale Supérieure.

compulsory. By the decrees of November 10, 1903, and May 10, 1904, the École Normale became practically the College of Pedagogy of the University of Paris. Its students are entered as students of the university, and study for their qualifying examination as teachers in secondary schools (*agrégation*) under university professors, partly at the Sorbonne, partly at the École Normale, while their professional preparation is entrusted solely to the latter institution.

The Republic has not reorganized secondary education by a comprehensive law; it has, however, introduced by decree, under parliamentary authority, an important reform in the internal organization of the schools which marks a notable departure from the traditional view of secondary education as a self-contained whole. Article 1 of the decree of May 31, 1902, declares that secondary education is co-ordinated with primary education in such a way as to constitute a continuation of a course of primary studies of a normal duration of four years. The decree goes on to provide for a full course of secondary studies of seven years' duration, divided into two cycles of four and three years respectively. In the first cycle the scholar has two options. In section 1 Latin is obligatory and Greek optional from the beginning of the third year (*classe iv.*). In section 2 there is no Latin. At the end of the first cycle the state grants a *certificat d'études secondaires du premier degré*. In the second cycle one of four courses may be taken; section 1 with Latin and Greek continues the old classical education; section 2 with Latin and modern languages corresponds to the German Realgymnasium; section 3 with Latin and science, and section 4 with modern languages and science, to the Oberrealschule. The *baccalauréat*, or secondary school-leaving examination, conducted by the university, is adapted to all the courses on the principle that courses of study of equal length, whether classical or modern, literary or scientific, are entitled to equal advantages. This system of alternative courses with leaving examinations of equal value is mainly German in origin, and may be said to represent the results of the best European thought upon the problem of the organization of secondary education.

Classical and modern education. Reform of 1902.

It is remarkable in view of the thoroughness with which the principle of laicization has been applied to the primary schools that the lycées still retain their chaplains (*aumôniers*) for the purpose of giving religious instruction. This difference of treatment is apparently based upon the consideration that the gratuitous and compulsory character of primary education demanded a much stricter interpretation of the principle of the neutrality of the state than was necessary in the case of secondary education, which is neither compulsory nor gratuitous.

Religious instruction in lycées.

In addition to the state schools there have until lately been in France a large number of private secondary schools, the most important of which have been associated with the Catholic religious orders. The enforcement of the laws against these communities has resulted in the closure of a number of these schools, and in the reorganization of others under a lay teaching staff. It is conceivable that the action of the Republic may largely forward the movement, otherwise perceptible in the Roman Catholic Church, to transfer education, even when combined with specific religious teaching, from ecclesiastical to lay hands. Evidence of this tendency is to be found in the boarding-schools (some four in number) founded upon the plan of M. Demolins (author of *A quoi tient la supériorité des Anglo-Saxons*) after the English public school model, but with a distinctly Catholic colouring.

Private secondary schools.

Apart from the position of the religious orders, the future of private education in France is far from secure at the present time. The liberty of teaching secured by the *Loi Falloux* is regarded as a pseudo-liberty by the advanced republican educationists, and the principle that education is a function of the state and not a matter of supply and demand is deeply rooted in the public mind. Proposals have been mooted for making the baccalauréat strictly a school leaving examination attached to the state schools. The adoption of any such measure would practically destroy liberty of teaching by reason of the power which the baccalauréat secures to the state as the key to the professions.

The foundation of secondary schools for girls in connexion with the educational reform of Jules Ferry is in its way one of the most notable achievements of the republic. There is little doubt that the expulsion of the religious orders is destined to exercise a profound influence upon the education of women in France. The place of the closed convent schools is being taken either by new state schools or by Catholic schools under lay teachers, and the number of scholars affected by this process of laicization is far larger in the case of girls than of boys. This change is calculated to produce far-reaching effects in the social and religious order, by no means necessarily, however, of an anti-Catholic or irreligious kind.

Secondary education for girls.

For an account of the resuscitation by the Republic of the local universities under the one great state teaching body collectively known as the University, see Universities.

Germany.

Under the German empire education is left to the exclusive control of each of the federated states. The only point of direct contact between the Empire and education lies in the mutual undertaking of the federated states to bring the law of compulsory school attendance to bear upon all subjects of the empire resident within their respective borders. Of far greater moment is the moral influence exerted upon the other states by the Prussian hegemony, in virtue of which the Prussian educational system comes to be in all essential characteristics typical and representative of Germany as a whole. It is remarkable that though, as Matthew Arnold was able to report to the Schools Inquiry Commission in 1866, "the school system of Germany in its completeness and carefulness is such as to excite the foreigner's admiration," neither Prussia herself, nor Bavaria, nor several other of the principal states of the Empire, have found it practicable to pass a comprehensive education law, owing to the religious and political difficulties with which any general legislative assertion of principle is attended in Germany as in England. The consequence is that the Prussian system in particular is the result of a long and complicated series of special laws, decrees and administrative

regulations. In such circumstances it is inevitable that, especially in secondary education, some considerable local variations and anomalies should remain, but the centralized authority of the state has confined these to questions of patronage and external administration, and even within this sphere has successfully asserted its own ultimate supremacy as the guardian of the educational interests of its citizens. A detailed historical study would bring out clearly the intimate connexion between the development of the educational system and the growth of the Prussian state, and again between these and the expansion of the national life of the German people; incidentally it would exhibit the supremacy of Prussia in the modern Empire as the inevitable result not merely of military force but of a genuine hegemony of intellect and culture.

Influence of Luther.

Stress is rightly laid by all educational writers upon Luther's famous letter to the German municipalities in 1524, urging upon them the duty of providing schools and upon parents the duty of sending their children to school. An attempt to give effect to this teaching was at once made by the electoral government of Saxony, which by a school ordinance of 1528 provided for the establishment in every town and village of Latin schools, for in Germany as in England the influence of the Protestant reformers was solidly on the side of classical education as the key to the study of the Scriptures and theological learning. All the more remarkable, therefore, was the initiative of the electorate of Württemberg, whose school ordinance of 1559 represents the first systematic attempt to make provision for both elementary and higher education, directing that elementary schools should be set up throughout the country, and *Particularschulen* or Latin schools in every considerable centre of population. The educational efforts both of the early Reformers and of the remarkable Jesuit educationists, who contributed so largely to the partial reconquest of south Germany for the Catholic Church, were brought to naught amid the troublous times of the Thirty Years' War, and the desolation and national decadence which that calamity brought in its train. To this result the aridity of the Protestant scholastics who succeeded Luther and Melanchthon, and the frivolity, incompetence and petty despotism of the small German courts, contributed in no slight measure. The permanent and positive value of Luther's pronouncement of 1524 consists not so much in the direct effects which it produced as in the hallowed association which it established for Protestant Germany between the national religion and the educational duties of the individual and the state, and doubtless this association largely contributed to the creation of that healthy public opinion which in Prussia rendered the principle of compulsory school attendance easy of acceptance at a much earlier date than in England and elsewhere, save only Scotland, where a similar historical religious influence was supplied by John Knox.

Early Prussian measures.

State interference in education is almost coincident with the rise of the Prussian state. Already in 1717 Frederick William I. ordered all children to attend school where schools existed, and fixed the fee at 5 pf. (½d.) a week. This was followed in 1736 by edicts for the establishment of schools in certain provinces and by a royal grant of 50,000 thalers for that purpose in the following year. In 1763 the *General Landschulreglement* of Frederick the Great laid down the broad lines upon which the Prussian state has since proceeded, asserting the principle of compulsory school attendance, fixing the fees, with provision for the assistance of very poor children, prescribing the course of instruction, and giving directions for the examination and supervision of teachers. Much progress was made, more especially in the organization of higher education, under Baron von Zedlitz, who was appointed minister for Lutheran church and school affairs by Frederick the Great in 1771, and retired under Frederick William II. in 1788. The last-mentioned year saw the establishment of the *Abiturientenexamen*, or leaving examinations, which form the determining element in the state organization of secondary education in Germany. As in England, the fear of the French Revolution produced a corresponding reaction in educational affairs, and the policy of Frederick William II. was to bind ever closer school and church in a system practically independent of state control. The first departure from this policy was marked by the *Allgemeines Landrecht* of 1794, which boldly proclaims that schools and educational institutions may be founded only with the knowledge and consent of the state, and must always be under its supervision and subject to its examination and control. This law also laid upon heads of families in every place the duty of providing and maintaining schools.

Reconstruction after Jena.

It was not till the disaster of Jena and the prostration of Prussia at the feet of Napoleon awoke the dormant spirit of patriotism, and concentrated all the intellectual forces of north Germany upon the task of national regeneration, that the principles of the *Allgemeines Landrecht* of 1794 bore full fruit. "The organization of the Prussian school system," says Dr James E. Russell in his work on *German Higher Schools*, "waited on the reorganization of the Prussian State." One of the first acts of the great patriotic minister von Stein, upon his assuming control of the civil administration in 1807, was to abolish the semi-ecclesiastical Oberschulkollegium which had been set up as the central authority under the churchly policy of Frederick William II., and to place education under the Ministry of the Interior as a special section. Wilhelm von Humboldt was placed at the head of this section in 1809, and the work which this "great master of the science and art of education" (as Professor Seeley terms him in his *Life of Stein*) inaugurated in his one year of office entitles him to be ranked among the founders of German unity. Humboldt's greatest positive achievements—the foundation of the university of Berlin and its organization under a professorial staff which included Fichte, Schleiermacher, Savigny, Wolf and Niebuhr, as also the internal reform of secondary schools undertaken with the pedagogical assistance of Wolf and under the inspiration of Fichte—lie beyond the scope of this article. It may, however, be observed that Humboldt's policy in secondary education represents a compromise between the narrow philological pedantry of the old Latin schools and the large demands of the new humanism of the period; and the recent reform of the Prussian secondary schools may be said to represent a return to the spirit of Humboldt in this respect. The measure introduced by Humboldt in 1810 for the state examination and certification of teachers checked the then common practice of permitting unqualified theological students to teach in the schools, and at once raised the teaching profession to a high level of dignity and efficiency which of itself sufficed to place Prussia in the forefront of educational progress. It was due also to the initiative of Humboldt that the methods of Pestalozzi were introduced into the teachers' seminaries, through them to vitalize the elementary schools. To the period of the national struggle belong the revival in 1812 of the Abiturientenexamen which had fallen into abeyance, and the institution about the same time of the local

authorities called *Schulvorstände* for the country and *Schuldeputationen* for the towns.

Though the period which succeeded the peace of 1815 was one of political reaction, the cabinet order of Frederick William III. in 1825 strengthened the law of compulsory attendance and carried on the work of administrative organization by defining the duties of the Provinzial-Schul-Kollegium and the Regierung. In 1834 an important development was given to secondary education by making it necessary for candidates for the learned professions as well as for the civil service, and for university studies, to have passed the leaving examination of the gymnasia. Thus through the leaving examination the state holds the key to the liberal careers, and has thereby been able to impose its own standard upon all secondary schools. Apart from the privileges relative to professional studies, the system of leaving examinations has exerted a wide influence upon popular education in connexion with the institution of compulsory military service, in virtue of a regulation which entitles those who pass the leaving examination of any of the recognized kinds of secondary schools to the much-coveted privilege of service for one year as a "volunteer" instead of two years as an ordinary conscript.

Reforms of 1825 and 1834. Abiturientenexamen.

The revolutionary and national movement of 1848 was followed by a period of further educational activity. The Act of Constitution of 1850 declared teachers civil servants and elementary education free. In practice, the abolition of school fees did not become general until 1888. Since then the view has more and more prevailed that elementary education must be free,[2] and, broadly speaking, fees in elementary schools are now charged only for children attending from another school district.

In connexion with the *Kulturkampf*, or struggle between the state and the Roman Catholic Church, the *Schulaufsichtsgesetz* of 1872 reasserted the absolute right of the state alone to the supervision of the schools; but the severity of this law as a measure against Roman Catholic clerical education was considerably modified as a result of the subsequent reconciliation with the papacy under Leo XIII., and the Prussian system remains to-day both for Catholics and Protestants essentially denominational. All schools, whether elementary or secondary, are Evangelical, Catholic, Jewish or mixed. In the elementary sphere, in particular, recourse is only had to the mixed school (*Simultanschule* or *paritätische Schule*), where the creeds are so intermingled that a confessional school is impracticable. In all cases the teachers are appointed with reference to religious faith; religious instruction is given compulsorily in school hours and is inspected by the clergy. The general purport of the Prussian school law of 1906 is to strengthen the system of separate confessional schools, which it extends to certain provinces where it had not previously been in operation.

Kulturkampf and the confessional system.

In financial respects the last-mentioned law effected some readjustment of burdens by charging a proportion of the expenditure upon landed property. Other recent changes relate to the reform of secondary education referred to below. The system of educational administration as it stood in 1909 may shortly be described as follows.

Under the ministerium in Berlin stands the Provinzial-Schul-Kollegium, the chairman of which is the *Ober-Präsident* of the province, composed of four or five *Räte* or councillors, generally selected from the directors of training colleges and gymnasia. This body is concerned mainly with higher education.

Administrative machinery.

Each province is divided for purposes of general administration into two *Regierungen* or governments, and in each Regierung there is a section of usually three or four Schulräte, which controls the elementary schools. This council is usually recruited from the ranks of directors of training colleges and from the inspectorate. The Regierung is divided into *Kreise* or districts, and in each district an administrative officer, called the *Landrat*, represents the government. The Landrat is concerned with the provision and repair of elementary school buildings; as regards internal organization, the elementary schools are under the Kreisschulinspektor.

In the Protestant districts the inspectors (*Kreisschulinspektoren*) are usually Evangelical clergymen holding the position of superintendent in the Lutheran Church. In the Catholic and certain other exceptional districts inspectors with pedagogical qualifications and the status of full government inspectors are appointed. Every candidate for Lutheran ordination is required to spend six months at a training college, but pedagogical opinion is hostile to the system, which must be regarded as a survival of the traditional union of church and state in educational affairs, retained at the present day from motives of economy and a desire to conciliate the church.

Inspection.

For every school there is an *Ortsschulinspektor*, usually the clergyman of the parish, who discharges the duties of local manager and correspondent. This local inspector is also chairman of the *Schulvorstand* or committee, elected by the *Schulgemeinde*, and charged with questions of attendance and maintenance rather than with internal affairs. The Schulgemeinde need not coincide with the civil parish. Parishes may unite to provide one school, or within one parish different religious communities may form separate school "parishes."

Thus the administrative system of Prussia in education as in other matters may be described in general as a decentralized bureaucracy. This bureaucracy is somewhat checked by the rights of patronage attaching to the local boards in certain cases, but the exercise of such rights is in all cases subject to government approval. As regards higher-grade elementary and secondary schools, the local boards in the towns (*Schuldeputationen*) are able to exert a considerable influence in the way of selection of the type of school, and even of suggestion for the modification of recognized types, as is shown by the cases of the famous "reformed" secondary curricula of Altona and Frankfort. Still, the legal powers of the local board are restricted to the establishment of an approved type of school, the control of externa, and the right of nominating teachers.

Elementary Schools.—The single-class school (*Einklassige Schule*) and the half-day school (*Halbtagsschule*) are features of the Prussian elementary system which require notice. The Einklassige

Peculiarities of elementary education.

Schule is a school taught by a single teacher, who may teach a maximum number of eighty children. The Halbtagsschule is a single-class school of which half the children are taught in the morning and half in the afternoon. During the summer months, owing to the exigencies of agricultural labour, many single-class schools are taught as half-day schools. The system of course is regarded as a makeshift, but in this, as in the matter of buildings for rural elementary schools, the Prussian administration attaches great weight to the consideration of financial economy. As regards staff, a large measure of economy is rendered possible by the high average standard of merit reached by German elementary teachers, whose powers of oral exposition have struck English observers as specially remarkable, and again by the national readiness to be content with a moderate salary in return for official status. A survival of the old close connexion between church and school is to be found in the *Kirchendienste*, the duties of training the choir, playing the organ, &c., which are attached in many cases to the post of schoolmaster, and afford an additional source of emolument, rendered feasible by the practical absence of religious dissent.

For the preliminary training of elementary teachers there are special schools called *Präparanden-Anstalten*, of which most are state institutions, some are municipal, and a few are private. The training colleges themselves are provided by the state and have a three years' course.

Continuation Schools (Fortbildungsschulen).—Germans have been foremost to realize the truth which is gradually being brought home to English educationists, that adequate value for the heavy expenditure of public funds upon education can only be obtained by providing for the continued education for two or three years of the children of the working classes who leave school at fourteen years of age. One of the educational results of the war of 1870, with its great lesson of the importance of national education, was the Saxon law of 1873 making attendance at continuation schools compulsory for three years (*i.e.* up to seventeen) in that kingdom: The Saxon law appears to have been justified by the experience of nearly a generation. It must suffice here to note the following features of its working. (1) The schools are taught by the primary teachers, supplemented in the towns by some technical instructors. (2) The school session may be either for the whole year or for only half the year, and may also be held on Sunday, like the old English secular Sunday schools. (3) The schools are brought into close relation with trades, not only for purposes of curriculum, but also with a view to considering the exigencies and meeting the convenience of employers with respect to hours of attendance. (4) The discipline of the continuation school is extended to supervision out of school hours. "Visits to dancing-halls and all such exhibitions as are dangerous to uprightness and purity are forbidden to scholars of continuation schools." Further, useful institutions such as savings banks, and also associations for social intercourse and the promotion of *esprit de corps*, are organized in connexion with continuation schools. There is no doubt that in this matter of continuation schools, as in so many other fields of social organization, the adoption of compulsion has been facilitated by the habituation of the working classes to compulsory military service, which has made the German workman more disciplined, more "organizable" as a social unit, more accustomed to subordinate the principle of individual freedom and self-will to the collective claims of the state, than the workman reared in the traditions of Anglo-Saxon individualism.

Continuative education.

Attendance at continuation schools is now compulsory by state law in 12 states, including (besides Saxony) Baden, Württemberg and Bavaria. The city of Munich is notable for its highly organized system of technical continuation schools for apprentices. In Prussia compulsory attendance is still the exception (save in the provinces of Posen and West Prussia, where it is enforced by state law), but the permissive act is being rapidly adopted by the great cities, including Berlin.

Secondary Education.—The official classification or grading according to the type of curriculum of secondary schools in Prussia (and indeed throughout Germany) is very precise. The following are the officially recognized types. I. Classical schools: (*a*) Gymnasium, with nine years' course; (*b*) Progymnasium, with six years' course. II. Modern schools: (*a*) with Latin (semi-classical)—(i.) Realgymnasium (nine years' course), (ii.) Realprogymnasium (six years' course); (*b*) without Latin (non-classical)—(i.) Oberrealschule (nine years' course), (ii.) Realschule (six years' course). The six-year classical and semi-classical schools are comparatively unimportant subdivisions in smaller towns.

Grading of secondary schools.

Lower-grade Secondary Education.—Inasmuch as French is taught in the lowest class of the Realschule under the official curriculum (English, on the other hand, beginning in Tertia, the fourth class from the lowest), it follows that this, the lowest type of secondary school, is not directly co-ordinated with the elementary school. The Realschulen of Berlin, however, form an important exception to the general rule; their curriculum, sanctioned by the ministry at the instance of the Berlin municipality, provides for the beginning of French in Quarta (the third class from the bottom) and English in Secunda. The consequence is that in Berlin a very large number of pupils pass from the elementary schools to the Realschulen, which take the place of the Mittelschulen or higher-grade elementary schools that are to be found in some towns, though something in the nature of higher elementary education is afforded by the top sections of the elementary schools.

Co-ordination of elementary and secondary education.

First-grade Schools.—One of the most striking features of German secondary education is the careful differentiation of schools according to the type of curriculum adopted. Thus, every German school is a homogeneous unit with a definite educational aim and organization, conforming to a common standard approved by public authority for the particular type to which it belongs. Hence the importance attached by the Germans to nomenclature; so that in selecting a Gymnasium, a Realgymnasium or an Oberrealschule, the parent knows exactly the type of education he is going to secure for his son. In England, on the other hand, as has often been observed, a great school tends to multiply within itself different types of curricula in a haphazard way according to the demand of parents, whose original choice of school is based rather on social than on educational grounds. Modern sides, army classes and engineering classes grow up as excrescences upon an

First grade secondary schools.

originally classical type, with the waste of power that results from loss of consistency and concentration of purpose. The difference between the English and German systems is due ultimately to the adoption in Germany of the day-school system and the absence, very remarkable in an otherwise aristocratically governed country, of the caste spirit in education above the elementary level, thanks to which the nobly born are not ashamed to sit on the school bench side by side with the children of the trading classes. On the other hand, the English boarding-school system, despite all the want of social solidarity, and all the class jealousy and exclusiveness with which it is inevitably associated, has admittedly favoured those ideals of the cultivation of character as distinct from book-learning which give a special value to what is in England called a public school education.

The present differentiation of first-grade schools in Prussia is the result of a natural educational development corresponding with the economic changes which have transformed Prussia and the empire from an agricultural to an industrial state. It was in 1855 that semi-classical schools (teaching Latin without Greek) were first recognized for a nine years' course under the title of Realschule I. Ordnung, and in 1871 pupils possessing their leaving certificates were admitted to mathematical studies in the universities. The Latinless Realschule II. Ordnung is the direct product of the great industrial development of the modern empire. In 1882 the Realschule I. Ordnung received the title of Realgymnasium, and the Realschule II. Ordnung that of Oberrealschule, both types being at the same time admitted to certain privileges in the universities, schools of technology and civil service.

Rise of semi-classical schools.

About the same period official recognition was obtained for reformed secondary curricula, first at Altona and afterwards (1892) at Frankfort. These two types differ from each other in detail, but the feature which distinguishes both from the older types is the postponement of Latin to Untertertia. The design is to secure for all types of secondary education a common non-classical base coextensive with the first three years of school life, followed by a trifurcation or threefold choice between the classical, semi-classical and non-classical types. The principle of the "reform-school" has been adopted in a considerable number of German (chiefly Prussian) schools, but it would be premature to see in it at present more than a new variety of Realgymnasium or semi-classical school; it can hardly be said as yet to have affected the course of classical studies in the full sense. The widespread sentiment of discontent with the old philological type of classical school was vigorously expressed in a private letter written by the emperor William II. as crown prince of Prussia in 1885, but not published until some-years later. In December 1890 the Prussian ministry convoked a conference at Berlin of secondary school experts, and the emperor presided in person at the opening session. His majesty delivered a speech criticizing the Gymnasia as wanting a national basis. "It is our duty to educate young men to become young Germans and not young Greeks or Romans" was the keynote of the imperial discourse. The outcome of the conference was a shortening of the hours allowed to Latin in the Gymnasia, a reduction of the hours of study in view of over-pressure, and an expression of official opinion adverse to the Realgymnasium. These changes, introduced in 1892, did not go far enough to satisfy the reformers, whilst the reduction of the hours allowed for Latin caused misgivings among the upholders of the traditional Gymnasium. Moreover, the Realgymnasium showed greater vitality among the large towns than its official critics anticipated. The ensuing decade witnessed a certain reaction in favour of the classical humanities as a barrier against the materialistic influences of the new industrialism. At the same time the protagonists of the classics came to recognize that side by side with the old humanities there must be accorded to modern and scientific subjects that place in the high-grade schools which the practical exigencies of industrial life demanded. Thus, the opinion grew that the best line of defence for the classical schools lay in the concession of equal privileges to the non-classical types; in this way only could the classical schools be kept safe from demands upon their time that could not be conceded without endangering their proper work. It was upon this basis that an agreement was reached between the contending parties at a second school conference that met in Berlin in June 1900. As the result of this conference there was issued a royal decree laying down certain general principles, of which the following are the most important. (1) There must be equality of privileges as between classical, semi-classical and non-classical first-grade schools. The decree recognizes, however, that this principle must be applied with a certain elasticity and with due regard to the necessity for training in particular branches of knowledge as a preliminary to certain lines of university study and certain professional pursuits. Consequently the Prussian system of privileges has become extremely complicated, and it is truer to speak, as the decree goes on to do, of an extension of the privileges of the non-classical schools, rather than of absolute equality. (2) "In thus acknowledging the equality of the three types of higher institutions, it will be possible more thoroughly to strengthen the special characteristics of each type. In this connexion," the royal decree proceeds, "I shall offer no objection to an increase in the number of hours devoted to Latin in the Gymnasium and Realgymnasium." Thus, both as to the place of Latin in the curriculum of classical schools and as to the status of semi-classical schools, the decree of 1900 involves a reversal of the policy of 1890. (3) The decree expresses approval of the reformed curricula of Altona and Frankfort, and a desire for an extension of the experiment where the conditions are suitable.

The "reform school" movement.

Notwithstanding the growing official encouragement of education upon semi-classical or non-classical lines, the upper and professional classes of Germany continue to show a marked preference for the fully classical Gymnasium; hence, in Germany as in England, the tendency for a widening gulf to disclose itself between the education of the directing classes in politics and administration and the bulk of the industrial population, which suggests that the problem of combining in just proportions the liberal and practical elements in a thoroughly national system of education has not yet reached the solution that the needs of the age require.

Switzerland.

Switzerland affords perhaps the best type of a democratic system of local authorities. The central authority is the canton, not the federation. The interference of the federal authority is confined to the

Educational influence of federal constitution.

imposition of certain broad principles by the constitution, to the indirect influence exerted by the examination of recruits for the national army, and to financial grants for technical instruction, its most important direct educational work being the support of the technological university at Zurich. The federal constitution (1) states that primary instruction must be under the control of the canton (an important point in view of the strength of ecclesiastical influence in some of the Catholic cantons), and must be compulsory and gratuitous; (2) declares that it must be possible for the public schools to be attended by the adherents of all creeds without hurting their freedom of conscience; (3) forbids the employment of child labour before completion of the fourteenth year, with a provision that in the fifteenth and sixteenth years factory work, together with the time given to school and religious instruction, must not exceed eleven hours a day. (4) All recruits for the federal army (in which service is compulsory on a militia basis) are examined in their twentieth year, and the results are published. This examination affords an instructive index to the state of education in the several cantons and promotes a healthy emulation among them.

The cantonal organization of education presents the variety which the extraordinary diversity of race, language, religion and physical conditions of the component states of the federation would lead one to expect. The large canton of Bern may be instanced as the type of a strong central authority. The commune or parish is the unit for elementary education. The communal council nominates a school board of at least five members, whose function is to spend the money voted for school purposes by the general communal council. Several communes in combination form a district authority for the support of what are in reality higher primary schools, though called in Switzerland *Sekundarschulen*, maintained by the district. The maintenance both of the primary and higher primary schools is aided by grants from the central authority. The true secondary schools, called middle or higher schools, are maintained and controlled by the central or cantonal authority. The existence of separate local authorities for each grade of education is characteristic of Switzerland generally, this system being the opposite to that adopted in England in 1902.

Cantonal organization.

The central grants in Switzerland always take the form of payments to the local authorities of a proportion of the teachers' salaries; they are never, as in England, assessed upon the number of children in attendance, nor are they dependent, as was formerly the case in England, upon the results of examination, nor again are grants made in respect of particular subjects as is the case with the grants for special, *i.e.* practical, instruction in England.

Religious instruction in the Swiss communal schools generally follows the faith of the majority; in a few cantons separate schools being provided for minorities if sufficiently numerous. In the town of Lucerne, Catholic instruction is given in school hours and Protestant instruction is provided out of school and out of hours for the Protestant minority.

In 19 out of the 25 cantons attendance at continuation schools is compulsory (at least in some districts) for boys up to 17, and in 3 cantons it is compulsory also wholly or in part for girls.

Belgium.

Belgian treatment of religious question.

The interesting feature in Belgian education is the treatment of the religious question in successive laws.

1. The law of 1842 obliged the communes to provide primary instruction, which was to be free in the case of poor children. The state made grants in aid, subject to inspection. Subject to a conscience clause, religious instruction was obligatory, and was placed under ecclesiastical inspection.

2. The law of 1879 removed religious instruction from the curriculum, and provided for facilities to the clergy to give such instruction outside school hours. This law furnishes a striking instance of the futility of a parliamentary majority legislating in a sense opposed to the convictions of a considerable section of the community. The law evoked a storm of opposition in the country, still profoundly Catholic and attached to ecclesiastical traditions, and within eighteen months the Catholics founded private elementary schools with 455,000 scholars. In 1883 the Catholic private schools numbered 622,000 scholars, whilst the attendance at the communal schools had sunk to 324,000. Their doctrinaire treatment of the education question resulted in the political annihilation of the Belgian Liberals, and was responsible for the strongest and most persistent Roman Catholic reaction that has been witnessed in western Europe since the beginning of the 19th century.

3. The law of 1884 was the work of the moderate Catholic party. It did not make religious instruction obligatory, but it gave liberty to the communes to provide for the giving of religious and moral instruction at the beginning or end of school hours, subject to a conscience clause. Power was given to the communes to "adopt" private confessional schools and maintain them. Provision was further made entitling any twenty parents of children of school age to demand a school of the normal communal type as against a proposal to adopt a confessional school. Power was also given to a like number of parents to compel the adoption of a confessional school in the case of the commune refusing to provide religious instruction of the type demanded by them, or putting obstacles in the way of its being given by the clergy or their representatives.

4. The law of 1895 is the work of the more authoritarian Catholics, and makes religious instruction obligatory, placing it directly under the control of the clergy. It also increased the subsidies to private schools. This law was passed in face of opposition from the moderate section, who saw in it an exaltation of state authority which might be turned by opponents to the disadvantage of the religious interest. It is by no means clear that Belgium has yet attained a final solution of the religious difficulty; the life of the present law is probably to be measured by that of the Catholic political majority.

Holland.

The outstanding feature of public education in Holland is the strength of the private primary schools. Under the law of 1857 secular teaching alone was provided in the primary schools at the public cost. The law of 1878 allowed communes to make grants to private schools on condition of their becoming neutral in the matter of religion. The law of 1889 allowed private denominational schools to receive government grants while retaining their denominational character, but forbade further grants to such schools by the communes.

In 1905 there were 566,460 children in the public and 278,632 in the private schools.

Scotland.

The diverse religious and social conditions of the three constituent parts of the United Kingdom must necessarily cause the education problem to assume a different shape and to receive different solutions in England, Scotland and Ireland respectively; latterly also the special conditions obtaining in Wales have received partial recognition at the hands both of the legislature and the executive. In Scotland the conditions have been less complex than in England. The practical unanimity of the people in religious faith, which has remained undisturbed by the institutional divisions of recent times, the wider diffusion of a sense of the value of education, the greater simplicity of life which has rendered all classes largely content to avail themselves of the preparatory education afforded by the common school and favoured the development in the secondary sphere of day rather than boarding schools, are among the causes which have contributed to the early building up of a national system which in some respects resembles the continental rather than the English type.

Historical development.

The national appreciation of education is found marked already before the Reformation in a statute of James IV. (1494) requiring all freeholders of substance to send their heirs to school and to keep them there until they had perfect Latin. The Reformation, asserting itself by common consent under one ecclesiastical form, and free from the divisions of religious organization which tended to neutralize it as an educational force in England, put fresh life into the educational aspirations of the people. As early as 1560 the Church Assembly, largely under the influence of John Knox, put forth the *Book of Discipline*, providing that “every several kirk” in a town “of any reputation” was to have its Latin school, that the “upaland” or country parts were to have a teacher of the “first rudiments” in every parish, and that each “notable” town was to have “a college for logic, rhetoric and the tongues.” Practical effect was later given to this scheme by an act of the Scottish parliament in 1696, under which parish schools were set up in connexion with the Established Church of Scotland. This system was extended by an act of 1803, which made better provision for teachers’ salaries and also confirmed the position of the parish school as an adjunct of the parish church. The system of inspection and state aid introduced in England in 1839 was made applicable to Scotland, thus grafting upon Scotland the English system of voluntary state-aided schools. At the same period another new factor was imported into Scottish education by the ecclesiastical disruption of 1843. As a result of these changes in 1861 a new act was passed which relaxed, though it did not sever, the ties which bound the parish school to the church.

Scottish school boards and school attendance law.

The Education (Scotland) Act of 1872 set up elective school boards for parishes and boroughs, and vested in them the existing parish and burgh schools. Long prior to the act it had been the practice of the Church of Scotland to allow exemption in the schools from religious instruction; consequently in imposing a compulsory conscience clause the act did little more than confirm existing usage. The school boards were left full liberty as to the religious instruction to be given in their schools, and in practice school boards universally adopt the Shorter Catechism, which is acceptable to all denominations of Presbyterians. The act made the school boards responsible for the supply of school accommodation, and introduced compulsory attendance, for which opinion in England was not at that time ripe. By the act of 1901, the age of compulsory attendance was raised to fourteen, with provision for exemption after twelve.

Administrative progress.

The experience of the Scottish Education Department, like that of the English, has led to the gradual abandonment of individual examination as the basis for the payment of grants. The institution of the merit certificate is one of the features in which the Scottish system differs from the English. Prior to the code of 1903 the merit certificate, awarded on examination after the age of twelve, was properly described as the leaving certificate of the elementary school. Under the more recent codes merit certificates are awarded under a system designed to encourage the transference of promising pupils at an early age to supplementary courses or higher-grade departments. Under this system the fitness of the pupil to enter upon a course of higher studies is determined not solely by the results of a single examination, but by the whole character of his work during the preceding school course.

Higher-grade schools.

A notable factor historically in Scottish education was the extent to which the parish schools supplied their best pupils with higher or further education. The administrative changes last mentioned have led to a remarkable development of organized higher-grade schools and departments. These departments have now been organized upon the lines of the higher primary schools of France, “to continue a stage further” (says the report of the Scottish Education Department) “the general education of that considerable body of pupils who, under new conditions, may be expected to remain at school till fifteen or sixteen.” The function “of giving something of the nature of a specialized education to pupils who will leave school at a comparatively early age” is now discharged by the supplementary courses.

Free education.

Elementary education has generally been rendered free by the fee grants under the parliamentary vote, and by the sums accruing under the Local Taxation (Customs and Excise) Act 1890 and the Education and Local Taxation (Scotland) Act 1892.

Voluntary schools are not numerous, being chiefly those of the Roman Catholic Church. The average cost of maintenance per child in average attendance in public schools

(according to the official report 1907-1908) was £3, 11s. 1¼d., of which £2, 4s. 4½d. was met by government grants for elementary education. In voluntary schools the average cost of maintenance was £2, 15s. 1¾d., of which £2, 2s. 7d. was met by elementary grants, including a special aid grant of 3s. per head under the Education (Scotland) Act 1897.

The total number of children (1907-1908) in average attendance in grant-earning schools was 712,076, and the percentage of attendances to numbers on the register was 87.66%. As regards teaching power, 81.52% of the male teachers and 56.71% of the female teachers in the elementary teachers had been trained in training colleges.

Education (Scotland) Act 1908.

Certain miscellaneous additional powers are conferred upon school boards by the Education (Scotland) Act 1908, including powers to provide school meals; in outlying parts, to provide means of conveyance, or pay travelling expenses of teachers or pupils, or defray the cost of lodging pupils in convenient proximity to a school; to provide for medical inspection; and as to children neglected by reason of the ill-health or poverty of the parent, to supply food, clothing and personal attention.

Compulsory continuation classes.

Perhaps the most noteworthy provision in the act of 1908 is that which enables (not obliges) school boards to make bye-laws requiring attendance at continuation classes up to the age of seventeen years. Apart from compulsory attendance, the act lays upon school boards the duty of making suitable provision of continuation classes with reference to the crafts and industries practised in the district.

Secondary education.

The Scottish Education Act of 1872 distinguished certain burgh and parish schools as “higher class public” or secondary schools. The act of 1908 deals in some detail with secondary education, modifying and strengthening the framework in various ways, but without introducing organic changes. “Secondary” schools are distinguished from “intermediate,” the former being defined as providing at least a five years’ course; the latter as providing at least a three years’ course in languages, mathematics, science and such other subjects as may from time to time be deemed suitable for the instruction of pupils who have reached a certain standard of attainment in elementary subjects under the code. Intermediate and secondary schools may be provided and maintained either by school boards or otherwise, and provision is contained in the act for the transfer of endowed schools to the school board. Thus secondary (as well as elementary and continuative) education is organized upon the basis of the parish or burgh; it receives, however, grants in aid through the agency of county (or large urban) authorities (called district committees) constituted under schemes of the Scottish Education Department. For the purpose of such grants in aid the funds available under the various local taxation acts, together with parliamentary grants, other than a fee grant at the rate of 12s. per child in average attendance, form a fund called the Education (Scotland) Fund. After provision has been made for (*inter alia*) grants for universities, higher technical education and training colleges, the fund is allocated to the district committees according to a scheme laid before parliament and approved by the king in council. Out of the “district education fund” the school board receives (ordinarily) a sum equal to one-half of the amount by which the net cost to the school board (after deducting income from grants made by the department and from fees) exceeds the amount which would be produced by such rate per pound upon the district of the school board as the committee may determine, not being more than a rate of twopence in the pound. Important powers are also conferred upon the district committee for organizing and aiding within their district the provision by the school boards of medical examination and supervision of school children, the supply of bursaries for purposes of all forms of higher education, and the provision of instruction in special subjects, such as agriculture, &c.

Ireland.

Special difficulties of Irish education.

The full development of a system of public education in Ireland has been hampered and retarded by the general difficulties inherent in the problem of Irish government. In consequence of the fundamentally different social, religious and political conditions in the two countries, the English and Irish systems have developed down to the present time upon divergent lines. In England, popular education was founded in the first instance upon individual initiative combining in organized voluntary effort, and, though the voluntary agencies have been first supplemented and latterly to a large extent supplanted by public action, the tendency has been in the direction of municipalization rather than in that of central state control. In Ireland, on the other hand, education has suffered in the past from the general absence of individual initiative and local interest almost as seriously as from the mistakes of the English government. These causes, more directly perhaps than the prevailing poverty of the country, made it necessary to throw the burden of supporting the schools to an increasing extent upon the state, while the want of local self-government precluded any devolution of powers and duties upon municipal authorities.

Historic retrospect.

State intervention is actually of earlier date in Ireland than in England. From the reign of Elizabeth onwards, English Protestant schools were founded by the government in a sporadic and intermittent fashion in pursuance of its Anglicizing policy. To mention briefly one or two historical features, the great religious educational enterprise of Edmond Rice in founding the well-known Irish Catholic order of the Christian Brothers in 1802 forms an exception to the general lack of initiative among the people themselves. About the same period the Kildare Place Society (founded in 1811 while the first commission of inquiry into Irish education was sitting) attempted to grapple with the peculiar difficulties of the religious situation upon lines somewhat similar to those just laid down by Lancaster and his followers in England. This organization comprised both Roman Catholic and Protestant schools upon a common religious basis of Bible reading without note or comment, and received government grants which rose to £30,000 a year before they were discontinued in 1833. The religious compromise which the system embodied broke down in consequence of Catholic dissatisfaction, and that it was at first fairly successful may seem extraordinary in view of the later attitude of the Catholic Church towards the question

of common schools and combined religious instruction.

In 1833, as the result of a second commission of inquiry (1824) and a select committee of the House of Commons (1828), Mr Stanley inaugurated the national system of elementary schools under a board of commissioners nominated from the different religious denominations. The government appears from the outset to have aimed at combined secular and separate religious instruction for Roman Catholics and Protestants. At the same time, an attempt was inconsistently made to provide an ethical basis for the secular instruction by means of Bible extracts. The story of the preparation of these extracts by an ingenious compound of the Protestant Authorized and Douai versions of Scripture is in its way one of the curiosities of religious history. The extracts were designed to meet the recognized Catholic objection to the indiscriminate reading of the Bible without note or comment. In practice they were chiefly used in the Protestant schools (in which their use is now practically extinct), and the growing Catholic objection to the policy of the National Board in this respect found authoritative, though somewhat cautiously worded, expression in a decree of the Roman Congregation De Propaganda Fide of January 11, 1846, declaring that non-sectarian religious instruction was dangerous to youth. “Tutius multo esse ut literarum tantummodo humanarum magisterium fiat in scholis promiscuis, quam ut fundamentales, ut aiunt, et communes religionis Christianae articuli restricte tradantur, reservata singulis sestis peculiari seorsum eruditione. Ita enim cum pueris agere periculosum valde videtur.” The religious difficulty in Irish elementary education may be said to have been solved in process of time by the conversion of the national system in practice, though not in theory, into a system strongly denominational and therefore widely different from the design of its founders, combined Biblical instruction being discarded, and separate schools for the most part taking the place of common schools for the two creeds. In the latter respect the like tendency has been noted in the case of Germany.

The national system.

The following are the chief specific points upon which the Irish system of elementary education differs from the English.

Finance.—The state still makes building grants to the extent of two-thirds of the cost. Such grants are only made to what are called vested schools, that is to say, schools of which the premises are vested in trustees or in the commissioners themselves. The state further pays in the case of all national schools the entire cost of maintenance except only the upkeep of the building, and the provision of books after the exhaustion of a first free grant.

Irish elementary education.

Appointment and Payment of Teachers.—For the purpose of promotion the state through its inspectors undertakes the duty of classifying the individual teachers in four grades, passage from one grade to another being secured by examination. Appointments of teachers to schools are made by the school managers subject to the approval of the commissioners. Rights of dismissal are reserved to the local managers and also to the commissioners independently. Lastly, the teachers’ salaries are now paid directly by the state. The old system of payment by results was abandoned in 1900, and the teacher is paid (*a*) a fixed salary according to grade, (*b*) a continued good service salary which may be increased triennially, (*c*) a capitation payment.

Convent Schools.—In addition to the national schools supported as above, there are a considerable number of convent or monastery schools which receive capitation grants after the English plan, but not direct salaries. There were 308 such schools in 1908, with an average attendance of 70,003. There were also 83 other convent or monastery schools paid by personal salaries, with an average attendance of 11,075.

School Attendance and Free Education.—The Irish Education Act 1892 provided for compulsory attendance in towns and for the adoption of compulsion in other districts. In virtue of the financial sections of this act, which provided an increased grant for salaries, most national schools have become free.

General Elementary-School Statistics.—In 1908 the average number of scholars on the rolls of all the schools was 708,992, and the average daily attendance was 494,662, or 69.8% as compared with the number on the rolls. As regards religious denomination, 74.42% of the scholars on the rolls were Roman Catholics; 28.6% were in schools attended by both Roman Catholic and Protestant children and 71.4% in schools attended solely by Roman Catholics or solely by Protestants. The total expenditure on the schools and teaching staffs was £1,591,214, of which £1,451,139, equivalent to £2, 19s. 3d. per scholar, was contributed from state grants, and £140,074, equivalent to 5s. 9d. per scholar, from local (*i.e.* voluntary) sources, the rate per scholar from all sources being £3, 5s.

Training of Teachers.—Salaried monitors are employed in the Irish schools, but, unlike the English pupil teachers, are not explicitly recognized as forming part of the school staff. There are now seven training colleges, viz. one undenominational college maintained by the commissioners, five Roman Catholic colleges, and one college in connexion with the Protestant Episcopal Church of Ireland. Of the scholars in the undenominational college, 73 out of 312 were Roman Catholics. The total number of students in training was 1189, viz. 514 men and 675 women. The percentage of trained teachers to the total number of teachers was 64.7. A special training college for the instruction of teachers in Irish has been recognized.

One of the chief desiderata in Irish education is a single central authority for all branches of education, elementary, secondary (or “intermediate”) and technical. There are two central authorities dealing with secondary education, viz. the Intermediate Education Board and the Department for Agriculture and Technical Instruction. The Intermediate Board administers sums available under the Intermediate Education Act of 1878 from the Irish Church Surplus, and also the sum allocated under the Local Taxation Act 1890. The vice of the system in the opinion of educational experts lies in the statutory obligation to award grants on the result of an individual examination of the scholars. As a result of the vice-regal commission of 1898, power was taken to introduce a system of school inspection, though not to dispense with the individual examination as the basis for the award of the grants; this measure of reform was ultimately carried out in 1909. The sum distributed in result grants is about £50,000 per annum.

Secondary education.

Prior to the Agriculture and Technical Instruction (Ireland) Act 1899, science and art grants were administered by the Science and Art Department in England; by this act they were transferred to the new Irish Department for Agriculture and Technical Instruction. This department makes block grants to secondary schools in respect of science and art teaching, and manual instruction or domestic economy. Measures have been taken for the co-ordination of the duties of the Technical Department and the Intermediate Board, and the impetus given to the teaching of experimental science by grants for the erection of laboratories represents a reform of undoubted value for higher education in Ireland, especially when considered in connexion with the enlistment of the local interest of the technical education committees in the intermediate schools. Nevertheless, in the absence of a reform of the results system of intermediate grants, the special subsidizing of science teaching has tended to put an undue premium upon this subject to the detriment of the rest of the curriculum.

Ireland possesses no such system of scholarships for assisting the passage of scholars from the elementary to the secondary school as England enjoys as a result of the municipalization of the educational system. Nevertheless, Irish children as a fact pass much more freely from the elementary to the secondary school than is the case in England where social prejudices are stronger. The schools of the Christian Brothers are usually organized in two departments, primary and intermediate, and thus supply for the Roman Catholic population the demand for the cheap type of secondary day school represented by the municipal schools in England. It must be added that the Irish intermediate schools are purely denominational. The widespread demand for secondary education among the people, to which the report of Messrs Dale and Stephens bears witness, is a gratifying feature of Irish life, while the recent establishment (1908) of the long-deferred national university, and the perceptible quickening of intellectual interests throughout the country in connexion with the Celtic revival, point to better conditions for higher education and to the development of a wider, deeper and truer, because more national, culture.

England.

It was justly observed by Sir Joshua Fitch (*Ency. Brit.*, 10th ed., xxvii. p. 655) that “the public provision for the education of the people in England is not the product of any theory or plan formulated beforehand by statesmen or philosophers; it has come into existence through a long course of experiments, compromises, traditions, successes, failures and religious controversies. What has been done in this department of public policy is the resultant of many diverse forces and of slow evolution and growth rather than of pure purpose and well-defined national aims. It has been effected in different degrees by philanthropy, by private enterprise, by religious zeal, by ancient universities and endowed foundations, by municipal and local effort, and only to a small extent by legislation. The genius—or rather characteristic habit—of the English people is averse from the philosophical system, and is disposed to regard education, not as a science, but as a body of expedients to be discovered empirically and amended from time to time as occasion may require.” Clearly, then, the English system of public education, as it results from successive acts of the administration and the legislature, is one which can only adequately be appreciated in the light of an historical survey of the various stages which have led up to it and the social conditions by which they were determined. The history of state education in England begins tardily in 1832, when after a generation of hesitation and controversy a beginning was made upon an exceedingly modest scale with the system of treasury grants in aid of elementary schools. The diverse forces which were at that date at work in the education of the nation as a whole, retarding state interference and marking out the limits within which it was long to be confined, derive their origin from a much remoter period.

Influence of the English Reformation.

The apprenticeship laws of Henry VIII. contain the earliest germ of state interference. These laws obliged children between five and thirteen years of age who were found begging or idle to be bound apprentices to some handicraft. If the immediate object was the prevention of crime rather than education as such, this early legislation is at least significant of the primary and intimate connexion that exists between popular education and industrial and economic needs. Yet in the shaping of the educational system the original influences were religious rather than economic; hence the importance of the canons of 1604, which secured the control of education to the Established Church. This of course was no novel doctrine, but merely the reaffirmation by the Reformed Church of the Catholic tradition of religious exclusiveness, presenting itself to the mind of contemporaries rather as the recognition of a national, that was also a religious, duty than as the assumption of an ecclesiastical privilege. Whatever mischief the Tudor statesmen wrought by indiscriminate destruction of chantries and other foundations which combined educational work with observances that the new religion branded as superstitions, however far the English Reformation fell short of the organized enthusiasm for popular education and culture that marked the first most vigorous and constructive period of Lutheranism in Germany, the Protestant, and especially the Puritan, spirit unquestionably inspired a considerable volume of individual educational effort during the latter half of the 16th and the first half of the 17th centuries. Here, as in Germany, the influence of the Reformation was wholly on the side of classicism, the dead languages being the key to the theological learning which was of primary concern to the men of that theological age. The conception of elementary education as a system complete in itself and adapted to the needs of the masses of the people was unfamiliar at this date. The earliest elementary schools were *petits* schools, which (as the name implies) were really preparatory departments of the grammar-schools. Education in fact was still regarded as the privilege of an élite, but, as in the middle ages, the élite for whom it was sought to provide a ladder to the university by means of the endowed schools so numerously founded about this time was an élite of intellect and not of mere wealth; the class feeling which became so marked a feature of English higher education was of much later growth.

Rise of elementary

Towards the end of the 17th century elementary education began to differentiate itself, partly by way of reaction against the unnatural classicism of the preceding age, but more especially as the result of the growth of towns and the creation of a considerable industrial population. At the close of the century the moral evils attendant upon industrialism alarmed the religious conscience and prompted one of the great educational movements that stand to the credit of the national

education. church. In 1699 Dr Bray founded the Society for Promoting Christian Knowledge, and the movement thereby initiated may be traced in the numerous “charity” or “Blue Coat” schools scattered plentifully throughout the country and especially in the great centres of population. The foundation of these schools, which was pushed forward with vigour during the early years of the 18th century, represents an energetic and well-planned attempt to cope with the social evil of poverty by educational means. The instruction was elementary, the scholars were clothed as well as taught free, and the schools in the first instance were supported not so much by permanent endowment as by voluntary effort, so that with this movement the voluntary system may be said to make its appearance. Lastly, all these philanthropic efforts were inspired by a solid but sober piety nurtured by a church which came nearer than at any other period of its history to enjoying the undivided allegiance of the people. Another notable movement in connexion with the church was one confined to Wales, that of the Welsh “circulating schools” established by Griffith Jones about 1730, consisting of an organized staff of schoolmasters who went round teaching adults to read the Bible in Welsh. In the English rural parishes the comparative religious unanimity favoured the quiet development of elementary education in a small way upon less specifically religious lines. Numerous small endowments for the elementary education of poor children were provided by well-to-do parishioners; indeed to such an extent did the practice of making charitable (and largely educational) bequests increase that the legislature intervened in the interest of private inheritance by reviving the law of mortmain in an act of 1736. The village schoolmaster became a feature of rural life, frequently enjoying a schoolhouse provided sometimes by endowment and sometimes even directly by the parishioners at the cost of the rate levied by the vestry, but more often aided only by a little stipend from an endowment for teaching poor children, and eking out an always scanty subsistence by the fees of such paying scholars as he could succeed in getting together.

Towards the end of the 18th century the emergency of the industrial revolution evoked a fresh religious effort upon a more highly organized scale in the shape of the Sunday-school movement, which may be said to represent the educational contribution of the Evangelical revival Robert Raikes, the founder of the Sunday School Union, established his first Sunday school in 1782. The idea of the Sunday school did not originate with Raikes; among earlier pioneers in this field were John Wesley, who held Sunday classes at Savannah in 1737; Theophilus Lindsey at Catterick in the North Riding of Yorkshire, about 1769; Hannah Ball at High Wycombe in 1769; and Jenkin Morgan near Llanidloes in 1770. Sunday schools, too, had been founded in England by Joseph Alleine, the Puritan Father, in the 17th century, and in Catholic Italy and France by St Charles Borromeo and Jean Baptiste de la Salle in the 16th and 17th centuries respectively. Nevertheless, in virtue of his achievement in organization, Raikes is rightly regarded as the founder of the English Sunday school. The peculiar value of the Sunday-school system in its early days lay in the combination of secular with religious instruction; in many cases the school was held on Saturday as well as Sunday, and its restriction to the one day or two days was due to the prevalence of child labour under stress of the great industrial expansion. With better economic conditions and with the development of day schools the Sunday schools gradually became restricted in function to purely religious instruction. Even with this limitation there is no doubt that the great Sunday-school organizations of the various churches still deserve to be reckoned among the educational assets of the nation, and as agencies both of religious instruction and of general culture they may tend, under modern educational and religious developments, to play an increasingly important part.

The Sunday-school movement.

At the end of the 18th century the development of industry and the social unrest which followed the French Revolution combined to bring home to the public mind the need of a national system of day schools. Unfortunately, just at this moment the revival of Nonconformity as the result of the religious vitality of the Evangelical movement shattered the religious peace of the early Hanoverian period and divided the nation once more into hostile camps, to which class distinctions lent additional bitterness. The famous controversy between Andrew Bell and Joseph Lancaster and their respective followers in the opening years of the 19th century served to define the religious difficulty substantially in the form in which it exists after the lapse of a century for the present generation. Both these remarkable men conceived independently the idea of a national system of popular education upon a voluntary basis; both concurred in extolling the merits of the monitorial system, which each claimed to have originated. The controversy between them, begun upon personal grounds, resolved itself into a national contest of rival principles of religious teaching. Lancaster as a young Quaker schoolmaster, confronted with pupils drawn from various religious bodies, planned his religious instruction upon the lines of doctrine common to all the orthodox Christian denominations. Thus he is the father of the undenominational religious teaching which later formed the basis of the Cowper-Temple compromise. But whereas the Cowper-Temple clause is purely negative in form and so seems to point to an undogmatic religion, the Lancasterian teaching was essentially positive and dogmatic within its limits. In 1805 Mrs Trimmer opened the attack upon Lancaster’s system with a work bearing the expressive title of *A Comparative View of the New Plan of Education promulgated by Mr Joseph Lancaster and of the System of Christian Instruction founded by our Forefathers for the initiation of the young members of the Established Church in the Principles of the Reformed Religion*. The church as a whole refused to co-operate in religious teaching upon the basis of a common Christianity, and joined issue with Lancaster and his Whig and Nonconformist following not merely upon the question of the exclusion of dogmatic formularies, but also upon the question of the control of whatever religious teaching should be given. In fact the vital question at this period was whether the clergy of the Established Church were to control the national education. The religious issue was prominent in connexion with the remarkable attempt at legislation made by the Whig statesman Mr Whitbread in his Parochial Schools Bill of 1807. As originally introduced, the bill proposed to make it compulsory on parochial vestries to levy rates for the support of schools for teaching reading, writing and arithmetic. The compulsory provisions were dropped in the House of Commons, but the bill was rejected by the Lords, mainly on the ground that it did not place education on a religious basis or sufficiently secure control to the minister of the parish.

Movements of Lancaster and Bell, and rise of the religious controversy.

The failure of the liberal proposals of Whitbread, and the strength of the Dissenting opposition to any settlement on purely church lines (such as that advocated by Bell in 1808 for establishing schools under the

Foundation of voluntary schools.

control of the parochial clergy), rendered recourse to voluntary effort inevitable. In 1808 the Royal Lancasterian Society was formed to carry on the work of Lancaster, the name being afterwards changed, owing to personal difficulties due to the wayward character of Lancaster, to the British and Foreign School Society. In the following year the National Society for Promoting the Education of the Poor in the Principles of the Established Church throughout England and Wales was formed, with Bell as its superintendent. In voluntary effort on a grand scale the church easily outdistanced her opponents, and in 1831 the National Society was able to show that there were in all over 13,000 schools in connexion with the church, of which 6470 were both day and Sunday schools, having a total attendance of 409,000.

The rapid development of the voluntary school system was no doubt greatly facilitated by the monitorial plan of teaching, upon which Bell and Lancaster equally relied. Probably the first idea of utilizing the older pupils to teach the younger presented itself independently to Lancaster in the Borough Road and to Bell in Madras. The monitorial plan never rested upon any educational theory; it was simply a makeshift, a rough-and-ready expedient for overcoming the practical difficulty caused by the dearth of competent teachers. Historically it is important as the precursor of the pupil-teacher system which so long formed the exclusive basis of the English elementary system.

Monitorial system.

Meantime a further political move was attempted by Brougham, who included educational reform among his multifarious activities. In 1816 he procured the appointment of a general commission of inquiry into endowed charities. The labours of this great inquisition lasted for twenty years and led to the reformation of many cases of abuse or waste of wealthy endowments, and eventually to the establishment of the Charity Commission in 1853. In 1820 Brougham introduced a remarkable bill which proposed to make the magistrates in quarter sessions the rating authority, to require teachers to be members of the Church of England and to be appointed upon a certificate from the parochial clergyman, and on the other hand to prohibit religious formularies and to confine religious instruction to Bible reading without comment. The bill naturally failed through the opposition cf the Dissenters, and served only to accentuate the religious impasse.

Activities of Brougham.

In 1832 the Whig government which passed the Reform Bill placed on the Estimates a sum of £20,000 for public education, thus initiating the system of the annual grant voted by parliament and dispensed under regulations framed by administrative act. The grant of 1832 was administered by the treasury and not by a special department, under certain conditions laid down by treasury minute of August 30, 1833. The chief of these were that grants were confined to the erection of school buildings, and were to be administered only through the National and the British and Foreign School societies; there was a provision for audit, but no condition of inspection.

Treasury grants.

In 1839 Lord Melbourne’s government by means of an order in council established a separate education office under the style of the Committee of Council on Education, and the sum voted by parliament was increased to £39,000. The original intention of the government was to establish a state normal school or training college as the foundation of a national system of education. Unfortunately this design had to be abandoned in view of the religious difficulty, with the result (so fruitful in controversy at the present time) that the training of elementary teachers was left in private hands and became a stronghold of the voluntary and denominational interests. In view of the limited resources placed at their disposal by parliament, the Committee of Council were at first compelled to confine their assistance to capital grants in aid of the provision of school buildings, but in the distribution of the money three important conditions were at once imposed. In the first place, the continuing right of inspection was required in all cases; secondly, promoters were obliged to conform to a fixed standard of structural efficiency; thirdly, the building must be settled upon trusts permanently securing it to the education of poor children.

Establishment of State-aided system.

By the minute of August 10, 1840, the Committee of Council concluded what came to be known as the concordat with the church. Under this minute no appointment was to be made of any person to inspect schools in connexion with the Church of England without the concurrence of the archbishop of the province, and, what seems still more extraordinary to modern ideas, any such appointment was to be revoked should the archbishop at any time withdraw his concurrence. The inspectors were charged with the duty of inspecting religious teaching, but under instructions to be framed by the archbishop, and their reports were to be transmitted in duplicate to the archbishop and the bishop for the information of these authorities. Further, the general instructions of the Committee of Council themselves were to be communicated to the archbishop before being finally sanctioned. The march of events, and in particular the altered financial relations between the state and the voluntary managers brought about by the institution of maintenance grants, soon rendered this concordat obsolete, but it remains historically important as showing how at the outset the denominational principle was recognized and fostered by the state.

Concordat with the church.

Among the first acts of the Committee of Council was the promulgation of a set of model trusts deeds, one or other of which applicants for building grants were required to adopt for the settlement of their school premises. The necessary conditions were the permanent appropriation of the site to purposes of education, and the permanent right of government inspection; it must, however, be noted that this latter right was generally limited in terms to the inspection provided for by the minute of August 10, 1840. A conscience clause was not obligatory, and indeed was only offered in the limited form of exemption from instruction in formularies and attendance at Sunday school or public worship. A more systematic attempt to promote public control by means of trust deeds in 1846 led the Committee of Council into a controversy with the National Society which extended over a period of three years, turning chiefly upon the management clauses and the question of appeals, and resulting in compromises which constituted a fresh concordat with the church. In point of fact, the management clauses proved to be of little practical consequence, save in a few controversial cases, until the act of 1902, which

Trust deeds.

had the effect of bringing them once more into prominence in connexion with the constitution of statutory bodies of foundation managers. The act of 1902 also dealt specifically with two other points arising upon the old trust deeds, viz. the control of religious instruction and the appeal to the bishop in religious questions. Special facilities for the conveyance of land for school purposes were afforded to limited owners by the School Sites Acts of 1841 and subsequent years. The landed gentry responded with great public spirit to the call thus made upon their generosity by the state, with the result that the vast majority of rural, and many urban, parishes were freely endowed with sites for elementary schools.

The Grammar Schools Act of 1840, which was passed to deal with the case of the decayed "grammar" (*i.e.* classical) schools which abounded throughout the country, belongs to the history of elementary rather than secondary education. It expressly empowered the Court of Chancery, where the endowment was insufficient for a classical school, to substitute subjects of useful learning analogous to those contained in the original trusts. As a result of this act a considerable number of ancient endowments were reorganized so as to afford an improved elementary instead of an inefficient classical education, and the schemes made under the act constituted an early, but not very successful, experiment in the direction of higher elementary schools.

Grammar Schools Act 1840.

In 1843 the Committee of Council decided to make grants in aid of the erection of normal schools or training colleges in connexion with the National Society and the British and Foreign School societies, thus marking the definite abandonment of the provision of training colleges to voluntary effort.

Training-college grants.

In 1846 an important step forwards was taken in the foundation of the pupil-teacher system. The regulations of this year inaugurated annual maintenance grants in the form of stipends for apprenticed pupil teachers receiving a prescribed course of instruction under the head teacher, and a lower grade of stipendiary monitors in schools where such instruction could not be provided. These regulations inaugurated the system of Queen's Scholarships to assist pupil teachers to proceed to a training college; they also established capitation grants for the support of such colleges, and annual grants to elementary schools under government inspection of from £15 to £30 in aid of the salary of every trained teacher employed. Provision was at the same time made for retiring pensions to elementary teachers.

Pupil-teacher system.

Down to 1847 state aid was confined to two religious categories of schools: those giving specifically Church of England teaching, and those in connexion with the British and Foreign School Society giving simple Bible teaching. To facilitate the recognition of other denominational schools the Committee of Council in 1847 issued a minute dispensing schools not connected with the Established Church from inquiries concerning their religious condition, and in the same year state aid was extended to Wesleyan and Roman Catholic schools. The settlement of model trust deeds gave occasion for each of these two great religious bodies to negotiate a kind of concordat with respect to school management, and the Roman Catholic deed was only settled after a controversy, similar to that which had arisen with the National Society, as to the rights of ecclesiastical authority. Jewish schools received recognition in 1851 upon condition that the Scriptures of the Old Testament should be daily read in them.

Extension of state aid to Wesleyans, Roman Catholics and Jews.

During the middle years of the century various unsuccessful legislative attempts were made to establish a national system of elementary schools upon the basis of rate-aid. These attempts began with the education clauses of Sir Robert Peel's Factory Bill of 1842, and were renewed in a series of bills from 1853 to 1857, of which one set was introduced by Lord John Russell on behalf of the Whig government, whilst a second was promoted by an organization called the Manchester and Salford Committee on Education, in the denominational interest, and a third set by an organization called the Lancashire (afterwards the National) Public Schools Association, in the secular interest. The only one of these attempts which calls for notice here is the bill introduced by Lord John Russell (called the Borough Bill, on account of its being restricted to municipal boroughs) in 1853, and forming part of a comprehensive scheme of legislative and administrative reform of which a portion was actually carried into effect. The bill as a measure for elementary education was supplemented by an administrative system of capitation grants for rural areas. The government scheme also comprised a measure dealing with the administration of charitable trusts (which took shape as the Charitable Trusts Act 1853), the constitution of the Department of Science and Art, and university reform upon the lines recommended by the Oxford and Cambridge commissions. The Borough Bill left it optional with municipalities to adopt the act. It provided for the appointment of a school committee, one half of whose members might be non-members of the council. The school committee was merely given power to assist existing voluntary schools out of the rates. No provision was made for public control beyond the requirement of audit; the sole condition as to religious instruction was the acceptance of a conscience clause.

Bills of 1842-57.

The failure of the Borough Bill did not affect the new system of capitation grants which was introduced by minute of the Committee of Council dated April 2, 1853. These grants were fixed at a scale varying from 3s. to 6s. per head, payable upon certain conditions, of which the most important were that the school must be under a certificated teacher, and that three-fourths of the children must pass a prescribed examination. In consequence of the failure of the several fresh bills introduced in 1855 by the government, the church party and the secular party respectively amplifying the proposals previously brought forward, the capitation grant was, by minute of January 26, 1856, extended to urban areas. As in the case of all the early grants, the regulations governing the distribution of the capitation grants were framed upon the principle that subventions of public money must be met by local funds derived from voluntary contributions, endowments and school fees; thus the basis of the denominational system as fostered by the state at this stage was one of financial partnership.

Capitation grants.

In 1856 a purely administrative bill was passed, establishing the office of vice-president of the Committee of Council on Education as a minister responsible to parliament. At the same time, the Science and Art

Department was transferred from the Board of Trade to the Committee of Council.

Education minister, 1856.

The progress of state-aided education during this period may be measured by the increase of the annual parliamentary grant, which rose from £30,000 in 1839 to £100,000 in 1846, £150,000 in 1851, £396,000 in 1855, and £663,400 in 1858. This expansion was viewed with misgiving by the friends of the denominational system, and by the strong individualist school of that day, who upon wider grounds clung to the old ideal of voluntary initiative. These sections combined with the advocates of further state intervention to press for a commission of inquiry, and at the instance of Sir John Pakington (the eminent Conservative educationist who was responsible for the denominational bills of the ‘fifties) a royal commission was appointed in 1858, under the chairmanship of the duke of Newcastle, to inquire into the state of popular education in England, and to consider and report what measures, if any, were required for the extension of sound and cheap elementary instruction to all classes of the people. The *Report* of the Newcastle Commission, issued in 1861, contains an exhaustive account of the existing condition of elementary education, and, with due allowance for the grave defects revealed, and in particular the glaring inefficiency of the numerous little private-venture schools kept by “dames” and others, the graphic picture drawn by the commissioners constitutes a striking tribute to the sterling qualities of self-help and religious earnestness which were so characteristic of the early Victorian period. It was found that in round numbers about 2,500,000 children were attending day schools, the proportion to population being 1 in 7, as compared with 1 in 9 in France, 1 in 8 in Holland, and 1 in 6 in Prussia, where education was compulsory. On the other hand, of this number only 1,675,000 were in public schools of all kinds, only 1,100,000 in schools liable to inspection, and 917,000 in schools receiving annual grant. The result was that only one child in every twenty was attending a school whose efficiency could be in any way guaranteed by the state. In the constructive portion of their work the comments and recommendations of the commissioners reflected the prevailing perplexity of the public mind. A consistent individualistic minority considered that the annual grant should be withdrawn altogether, and that any further state aid should be confined to building grants, which they would concede not as desirable in themselves but as necessitated out of considerations of fairness to the parishes that had not yet received such aid. The commissioners as a body rejected free and compulsory education in view of the religious difficulty and upon general grounds of individualistic principle. Of the religious difficulty itself the commissioners had some wise words to say which hold good in substance at the present time. In their judgment the considerable evidence they had amassed conclusively proved that the religious difficulty originated with the managers, promoters and organizers of the schools, and not with the parents themselves; yet the indifferent or comparatively passive attitude of the people nowise materially diminished the practical difficulty of introducing a comprehensive system, since it was not with the body of the people but with the founders and supporters of schools that legislators would always have to deal. In view of the solution adopted in 1902 it is of interest to note that the Newcastle Commissioners deliberately rejected the parish as unfit to be taken as the unit of elementary education upon the ground that management by parochial ratepayers must tend to be illiberal and niggardly, bent upon economy of the rates to the detriment of educational interests; accordingly they recommended the constitution of county boards (which in the absence of elective councils must needs originate with quarter sessions) clothed with power to levy a rate for the aid of existing voluntary schools.

Newcastle Commission.

The one definite achievement of the Newcastle Commission was the famous system of payment by results, which may be said to have excited a keener and more prolonged controversy than any other measure of a purely educational character. Impressed by the defects of the existing teaching, the commissioners reported that there was only one way of securing efficiency, and that was to institute a searching examination by competent authority of every child in every school to which grants were to be paid, with the view of ascertaining whether the indispensable elements of knowledge were thoroughly acquired, and to make the prospects and position of the teacher dependent to a considerable extent upon the results of this examination. Thus the commissioners hoped to counteract what appeared to them to be the crying defect of the existing training college system, viz. that it tended mainly to adapt the young schoolmaster to advance his higher, rather than to thoroughly ground his junior, pupils. They recognized that to raise the character of the children, both morally and intellectually, was and must always be the highest aim of education, and they were far from desiring to supersede this by any plan of a mere examination into the more mechanical work of elementary education, the reading, writing and arithmetic of young children; but they thought that the importance of this training, which must be the foundation of all other teaching, had been lost sight of, and that there was justice in the common complaint that while a fourth of the scholars were really taught, three-fourths after leaving school forgot everything they had learnt there.

Payment by results.

Mr Lowe (Lord Sherbrooke) as vice-president of the Committee of Council (1859-1864) adopted the system of payment by results in what became famous in history as the Revised Code, issued in 1862 and so called because it was a revision of the minutes and regulations of the Committee of Council, which were first collected and issued in the form of a code in 1860. The Revised Code provided for the payment of a grant of 4s. upon the old principle and a further grant of not more than 8s. upon the result of examination. Mr Lowe declared of the system in the House of Commons that “if it was costly it should at least be efficient; and if it was inefficient it should at least be cheap.” In fact, it proved to be cheap; the giant fell from £813,400 in 1861 to £636,800 in 1865. The upholders of the existing system denounced the Revised Code as an undeserved slight upon the voluntary managers, and even as a breach of faith with the great religious denominations. On purely educational grounds, which need not be here re-capitulated, it was at once viewed with misgiving by many authorities, including Matthew Arnold. To meet objections, some modifications were introduced in the code under the Conservative government in 1867. The system of paying grant upon the result of individual examination of the scholars was not finally abolished till 1904.

Revised Code.

The years immediately preceding 1870 were occupied with discussion and preparation for the great legislative measure for which the time was now felt to have arrived. Good work was done in this direction by

Proceedings preliminary to the act of 1870.

the Select Committee of the House of Commons in 1866, over which Sir John Pakington presided. For reasons connected with the political situation of the moment this committee never reported, but the minutes of evidence and the draft report prepared by Sir John Pakington contained much valuable material in the way of criticism of the existing system and suggestion for the coming settlement; in particular the draft report insisted upon the inevitableness of an education rate. In 1868 the Conservative government brought in, but did not proceed with, an education bill deliberately discarding the principle of rate-aid on the ground that it would destroy voluntary contributions and gradually starve out the denominational schools. In 1867 and again in 1868 Mr Bruce (afterwards Lord Aberdare), Mr W.E. Forster and Mr Algernon Egerton introduced a bill which formed the basis of the measure of 1870. As redrafted in 1868 the bill of Mr Bruce and his coadjutors proposed a universal system of municipal and parochial rating with liberty for voluntary schools to unite themselves to the rate-aided system under their existing management, subject to the acceptance of a conscience clause. The bill also proposed to empower town councils to co-opt outsiders upon their education committees. Thus both in the principle of co-optation and in the extension of rate aid to schools not under public control the bill of these Liberal statesmen in 1868 anticipated certain controverted features of Mr Balfour's Education Act of 1902. In the meantime, in the country the Education League, originated at Birmingham, was carrying on a propaganda in favour of free secular schools, whilst the Education Union, formed to counteract the influence of the league, urged a settlement upon the old lines. As a concession to the popular feeling against secularism, the league proposed to allow Bible reading without doctrinal exposition. Thus opinion was sufficiently focussed to enable Mr Gladstone's administration in 1870 to undertake the comprehensive measure of educational reform for which the country had had to wait so long.

The Elementary Education Act of 1870 bore in every respect the marks of compromise. As Mr Forster explained in introducing the bill, the object of the government was "to complete the voluntary system and to fill up gaps," not to supplant it. To this end the Education Department was charged with the duty of ascertaining whether or not there was in every parish a deficiency of public school accommodation, and provision made for the formation of school boards in every school district (*i.e.* parish or municipal borough) requiring further public school accommodation. Such accommodation might consist either of public elementary schools as defined by the act, or other schools giving efficient and suitable elementary education. The definition of public elementary school contained in section 7 of the act is still in force. Shortly, a public elementary school is a school subject to a conscience clause entitling scholars to complete exemption from all religious instruction and observance whatsoever. Any religious instruction or observance in the school must be either at the beginning or the end of the school meeting. The school must also be open at all times to the government inspectors and must be conducted in accordance with the conditions required to be fulfilled in order to obtain an annual parliamentary grant. In the same connexion an important change was made in the conditions of inspection by declaring that it should be no part of the duties of the inspector to inquire into religious instruction, whilst a later section of the act provided that no parliamentary grant should be made in respect of any religious instruction.

Act of 1870.

Three important changes were made in the measure during its passage through parliament. As at first proposed, (1) the school boards were not to be directly elected by the ratepayers, but were to be appointed by the town council or the vestry. (2) These nominated boards were empowered either to provide schools themselves or to assist existing public elementary schools, provided that such assistance was granted on equal terms to all such schools, upon conditions to be approved by the Education Department. Thus the school board, if it exercised the option of assisting denominational schools, would have been obliged to assist all or none. (3) With regard to its own schools, the school board was to settle the form of religious instruction. These proposals raised serious opposition in the country, and when the committee stage of the bill was reached two fundamental changes were made in the policy of the bill. In the first place, as Mr Gladstone put it, the government had decided "to sever altogether the tie between the local board and the voluntary schools." In lieu of the suggested rate-aid they proposed an increased grant from the treasury, that is to say, the voluntary schools were left standing as state-aided schools under private management, side by side with the new rate-supported schools.

Next, the character of the religious instruction in the board schools was determined upon an undenominational basis by a provision which has become known to history after the name of its author, then Mr Cowper-Temple, as the Cowper-Temple clause (section 14 of the act), directing that "no religious catechism or religious formulary which is distinctive of any particular denomination shall be taught in the school." The clause was not intended to exclude doctrinal exposition, and was in fact a compromise not merely between absolute secularism and denominationalism, but between denominationalism and the view of those who would have the Bible read without note or comment. The Apostles' Creed as a symbol common to all denominations of Christians was held by Mr Forster (at the suggestion of Mr Gladstone) not to be excluded under the Cowper-Temple clause. The result was the establishment in the schools, upon the lines laid down by Joseph Lancaster at the beginning of the 19th century, of what may be termed the common Protestantism of the English nation; and though Mr Disraeli urged that a religion without formularies was in fact a new religion, and that in leaving its exposition to the teachers we were creating a new sacerdotal class, the Cowper-Temple compromise, notwithstanding its inherent want of logic, stood the test of experience for more than a generation against the consistent denominationalists on the one hand and the party of secular education on the other. It is important to observe that the act of 1870 left the giving of religious instruction, whether in voluntary schools (in which its inclusion might be assumed as of course) or in board schools, purely permissive. In practice it was only in Wales that school boards availed themselves to any extent of the liberty to abstain from giving religious instruction, and this comparative secularism of Wales certainly argued no lack of religious life among the people.

Cowper-Temple clause.

The third change in the bill was the substitution of the *ad hoc* school board for the municipally appointed board originally proposed, a change which commended itself in view of the special difficulty presented by

the case of London. These boards were elected by the system of cumulative voting under which each elector had as many votes as there were candidates to be elected, with liberty to give all his votes to one candidate or to distribute them amongst the candidates as he thought fit. This system was much criticized as being unduly favourable to minorities, whose representation it was devised to secure; it continued, however, until the supersession of the *ad hoc* authorities by committees of the county and urban councils under the act of 1902.

School boards were empowered not only to acquire sites for schools under powers of compulsory purchase, but also to take transfers of existing voluntary schools from their managers. The section which enables managers to transfer schools to the school board or local education authority for the purpose of board or council schools freed from religious trusts unquestionably marks an important inroad by the state upon the sanctity of trusts. Thus though the act of 1870 did not itself introduce the principle of compulsory transfer, it formed the point of departure for the proposals in this direction which were the basis of the unsuccessful bills of 1906 and 1908. The act of 1870 did not introduce either direct compulsory attendance or free education, but it took a distinct step forward in each direction by enabling school boards to frame by-laws rendering attendance compulsory, and also to pay the school fees in the case of poverty of the parent.

The policy of compromise between the two systems of voluntary and rate-established schools was carried out in the provisions relating to the future supply of schools. On the one hand, building grants were continued temporarily for the benefit of those who applied (as voluntary managers alone could apply) before the 31st of December 1870. On the other hand, the Education Department was authorized to refuse parliamentary grants to schools established in school board districts after the passing of the act if they thought such schools unnecessary.

Progress under the act of 1870.

The following figures are of interest as showing the progress made under the act of 1870. In the year 1870 there was accommodation in inspected day schools for about 2,000,000 children; the average attendance was 1,168,000, and the number on the books about 1,500,000. It was computed, however, that there were, exclusive of the well-to-do classes, at least 1,500,000 children who attended no school at all or schools not under inspection. In 1876 accommodation had been provided for nearly 3,500,000, and of the 1,500,000 new places nearly two-thirds were provided by voluntary agencies. “These voluntary agencies,” says Sir H. Craik, “had received grants in aid for about one-third of the schools they had built, the grants defraying about one-fifth of the cost of the aided schools.” On the other hand, the growth of school boards was rapid and continuous, notwithstanding the permissive character of the act and the strenuous efforts of the voluntaryists to keep pace with the new demands. In 1872, 9,700,000 of the population were under school boards, and of these 8,142,000 were under by-laws; in 1876 the numbers were respectively 12,500,000 and 10,400,000. In the same period the annual grants increased from £894,000 in 1870 to £1,600,000 in 1876.

Act of 1876.

The development evidenced by the above figures, and in particular the fact that 52% of the population were subject to by-laws, enabled Mr Disraeli’s government in 1876 to take a notable step forward in the direction of universal direct compulsion. The act of 1876 embodied the declaration that “it shall be the duty of the parent of every child to cause such child to receive efficient elementary instruction in reading, writing and arithmetic, and if such parent fail to perform such duty he shall be liable to such orders and penalties as are provided by the Act”; next, it rendered an employer liable to a penalty who took into his employment a child under the age of ten years, or a child between the ages of ten and fourteen years who had not obtained the required certificate of proficiency in reading, writing and arithmetic, or of previous attendance at a certified efficient school. In order to complete the machinery for compulsion, the act directed that, in every district where there was no school board, a school attendance committee should be appointed by the local authority. The law as to school attendance, resting upon this and subsequent enactments, is complicated and in some details obscure. The subject was dealt with in the report of an inter-departmental committee in 1909, who recommended the abolition of the partial exemptions permitted, and the raising of the age of exemption to 13.

Act of 1880.

In 1880 Mr Mundella, as vice-president of the Council in Mr Gladstone’s administration, passed a short act which made the framing of by-laws compulsory upon school boards and school attendance committees, thus completing the system of universal direct compulsion. Under the acts of 1876 and 1880 the average attendance increased from 2,000,000 in 1876 to 3,500,000 in 1878 and 4,000,000 in 1881; in terms of percentage to population, 8.06 in 1876, 9.60 in 1878, and 10.69 in 1881. In the last-mentioned year the annual grant rose to £2,200,000, having more than doubled in the decade.

Development of public opinion.

With the passing of the Elementary Education Act 1880 the education question entered upon a new phase. The country was now possessed of a national system of elementary education, in the sense that provision was made for the supply of efficient schools and for compulsory attendance. The question of free education was brought within the range of practical politics by the adoption of universal compulsion, but as yet it was advocated only by a small political group of pronounced collectivist tendencies. Whilst opinion was maturing on this topic, there began to force itself upon the public mind the vastly more difficult problem of combining the two systems of voluntary, denominational, state-aided schools on the one hand, and public, undenominational, rate-supported schools on the other. From the denominational point of view the problem presented itself as that of a burden imposed and a danger threatened in ever-increasing degree by the competition of the board schools, a competition that was felt not so much by direct rivalry of school with school as indirectly by the steady raising of the standard of efficiency with respect to buildings, equipment, salaries of teachers and educational attainment which inevitably resulted from the establishment of authorities with power to draw upon the rates. On the other hand, from the purely educational point of view, it was seen that the dual system tended in practice to an illicit but almost inevitable recognition of two standards of efficiency, the lower being conceded to voluntary schools in consideration of their comparative poverty. Experience, too, of the shortcomings of small country school boards was beginning to confirm the misgivings entertained long

before by the Newcastle Commissioners as to the wisdom of entrusting autonomous powers to the parish, when the reform of local government by the creation of popularly elected county authorities turned attention once more to the question of organizing education upon a county basis.

Cross Commission, 1887.

In 1887 a royal commission under the presidency of Viscount Cross was appointed to inquire into the working of the education acts. The labours of this commission produced a thorough discussion of the educational problem in all its aspects, political, administrative, scholastic and religious. For any clear recommendations with regard to the reorganization of education generally the moment was not opportune, inasmuch as the commission just preceded the establishment of the new county authorities and the powers with respect to instruction other than elementary which parliament was shortly to confide to them under the Technical Instruction Acts. Nevertheless the report of the majority of the commissioners pointed unmistakably towards the solution adopted in the act of 1902, and their definite recommendation that voluntary schools should be accorded rate-aid without the imposition of the Cowper-Temple clause, served as the basis of that legislation. The commission brought into strong relief the opposing currents of thought in educational politics, the majority report, representing the principles of denominationalism, being balanced by a strong minority report embodying the views of those who looked for progress along the lines of the school-board system. Taken together, the two reports form a comprehensive survey of the difficulties which still in the main beset public education in this country.

Elementary Education Act 1891.

Of the developments which followed the Cross report, it is convenient to mention in the first place, out of chronological sequence, the practical establishment of free education by the act of 1891, not by the absolute prohibition of school fees but by the device of a special grant payable by parliament in lieu of fees, called the fee grant. The result of this legislation and of subsequent administrative action was to place free education within the reach of every child, fees being retained (with few exceptions) only where some instruction of a higher elementary type was given.

Education other than elementary.

The establishment of county councils by the Local Government Act 1888 introduced a new factor which was destined to exert a determining influence upon subsequent developments of public education. In the first place, it at once rendered possible the partial and experimental provision for higher education attempted by the Technical Instruction Acts, which affected secondary education as well as technical education in the proper sense of the term. In order to understand the state of secondary education at this period, it is necessary to refer back to the first attempts made to deal with secondary education a generation earlier.

Public Schools Commission, 1861.

In 1861, that is to say, nearly thirty years after the state began to concern itself with elementary education, the first step in the way of intervention in what is now called secondary or intermediate education was taken by the appointment of a royal commission, presided over by Lord Clarendon, to inquire into the condition of nine of the chief endowed schools in the country, viz. Eton, Winchester, Westminster, Charterhouse, St Paul’s, Merchant Taylors, Harrow, Rugby and Shrewsbury. The report of this commission led to a statute, the Public Schools Act of 1864, which introduced certain reforms in the administration of seven of these schools, leaving the two great London day schools, St Paul’s and Merchant Taylors, outside its operation. The results achieved were seen to be important enough to call for a further and much wider inquiry.

Schools Inquiry Commission, 1864-68.

Accordingly in 1864 the Schools Inquiry Commission was appointed under the presidency of Lord Taunton to inquire into all the schools which had not been included either in the commission of 1861 or the Popular Education Commission of 1858. It included several men of eminent distinction, such as Dr Temple (afterwards archbishop of Canterbury), Mr W.E. Forster, Dean Hook, and Sir Stafford Northcote; and it was singularly fortunate in its staff of assistant commissioners, among whom were numbered Mr James Bryce, Mr Matthew Arnold, and Mr (afterwards Sir Joshua) Fitch. It thoroughly explored the field of secondary education, discussing all the problems, administrative and pedagogic, which the subject presents, and “its luminous and exhaustive report” (to quote the words of Mr Bryce’s Commission of 1894) remains the best introduction to the problem of public secondary education in England. The existence of numerous and frequently very wealthy endowments arising from private benefactions and bequests has at all times been a feature in education as in other departments of English social life. In the organization of secondary education in particular, private endowments have played and continue still to play a part which cannot be paralleled in any other country. This circumstance has undoubtedly resulted in a great economy of resources, though in numerous instances the difficulties occasioned by the haphazard distribution of endowments and the local jealousies invariably aroused by any attempt to readjust their areas to modern conditions have obstructed useful reform and proved a source of misdirected and wasted effort. At the date of the Schools Inquiry Commission the state of the ancient endowments was largely one of abuse. Very many endowments intended for advanced education were applied for instruction of a purely elementary character, and that of an inferior kind; indeed the possession of an endowment in a rural locality not infrequently operated to prevent the establishment of an efficient state-aided school. The evidence showed that the proportion of scholars in the country grammar-schools who were receiving some tincture of the classical education intended by the founders was steadily decreasing, and nothing had been done to bring the curriculum into harmony with the actual needs of the time. No doubt a small élite of classical scholars were sent to the older universities by these schools, but in the main they were in a feeble and decadent state, giving, more or less inefficiently, an education wholly unsuited to the wants of the class to whom they ministered. In addition to the general inelasticity of the curriculum, the special evils from which the grammar-schools suffered were the want of effective governing bodies and the freehold tenure of the headmasterships.

The commission was singularly successful in bringing about the reform of these abuses, its report being immediately followed in 1869 by the Endowed Schools Act, which was based upon its recommendations and conferred upon a special commission (united in 1874 with the Charity Commission) very wide and drastic

Endowed Schools Acts 1869-74.

powers of reorganizing ancient endowments. A direction for extending the benefits of endowments to girls did much to assist the movement for the secondary education of girls. The Endowed Schools Acts 1869-1874 introduced modifications of importance and general interest into the law of trusts. Under the existing rules of the court of chancery, which rules were also binding upon the Charity Commissioners, educational endowments were generally treated, in the absence of evidence to the contrary, as subject to a trust for instruction in the doctrines of the Church of England. Under the Endowed Schools Acts the presumption is reversed, and ancient trusts are treated as free from denominational restrictions, save in virtue of express conditions imposed by or under the authority of the founder. The result was that in framing schemes for the reorganization of ancient endowed schools the commissioners found themselves able to treat the majority of cases as undenominational. In such cases the general practice was to direct that instruction should, subject to a strict conscience clause, be given in the principles of the Christian faith; this provision corresponded in a way to the Cowper-Temple clause in elementary education, with the important distinction that it was positive, not negative, and did not exclude special doctrinal instruction.

Besides the recommendations for the reform of endowed schools, to which substantial effect was given directly or indirectly by means of the Endowed Schools Acts, the Schools Inquiry Commission also submitted proposals for the general administrative organization of a system of secondary education. They recommended the establishment of three authorities—(1) a central authority; (2) a local or provincial authority, representing the county or a group of counties, with a certain jurisdiction both in proposing schemes for the reform of endowed schools in their area (such as that afterwards conferred upon the joint education committees under the Welsh Intermediate Education Act), and in administering these schools; and (3) a central council of education charged with examination duties. Further, it was proposed to raise the level of proprietary and private schools by offering them inspection and examination and by establishing a system of school registration. Lastly, in order that the supply of public secondary schools might not be dependent upon endowments, it was proposed to confer upon towns and parishes powers of rating for the establishment of new schools. For these proposals as a whole the time was not ripe. The bill of 1869 as originally introduced in the House of Commons attempted to give effect, with some variations, to one of these suggestions, namely, that for the creation of a central council, but exigencies of parliamentary time made it necessary to drop this part of the measure; the result was that the plan of the commissioners was only half carried out. Nevertheless, owing to the multiplicity and wealth of endowments, the work accomplished was sufficient to exert a considerable influence upon the secondary education of the country. Thus in 1895 Mr Bryce's Commission was able to report that schemes under the Endowed Schools Acts had been made for 902 endowments in England, excluding Wales and Monmouth, leaving only 546 endowments out of the total of 1448 endowments in England known to be subject to the Endowed Schools Acts, which had not felt the reforming hand of the commissioners. The total income of the endowments known to be Subject to the Endowed Schools Acts, and therefore available for purposes of secondary education, according to the estimate of the Secondary Education Commission (still in 1909 the latest available source of complete information), was in 1895 about £735,000 gross.

Schools Inquiry Commission's proposals for reform of secondary education.

Twenty years after the Schools Inquiry Commission the creation by the Local Government Act in 1888 of the representative and popular county authorities of which the need had been felt by reformers alike in secondary and elementary education, rendered the first step in the direction of the municipalization of secondary instruction at last possible. In 1889 the Technical Instruction Act (extended in some particulars by an act of 1891) empowered the councils of counties, boroughs and urban districts to levy a rate (not exceeding a penny in the pound) for the support or aid of technical or manual instruction. Comparatively few councils were prepared to resort to their rating powers, but progress under these acts was greatly facilitated by the Local Taxation (Customs and Excise) Act of 1890, which mentioned technical instruction as one of the purposes to which the imperial contribution paid to local authorities in respect of the beer and spirit duties might be applied. By virtue of the very liberal interpretation given to technical instruction by these acts the financial assistance afforded under them was extended to cover the whole field of mathematical and physical science, as well as modern languages.

Technical Instruction Acts 1889, &c.

The Department of Science and Art acted as an agency in the development of secondary education upon the same lines as the Technical Instruction Acts, administering a parliamentary grant which was gradually extended with a view to encouraging literary studies as well as the scientific and mathematical subjects to the promotion of which it was primarily directed. Thus the combined effect of the local resources available under the Technical Instruction Act and the imperial grant administered by the department was gradually to develop a national system of secondary education with a marked bias on the side of physical science.

Grants of science and art department.

An undoubted stimulus was given to secondary education in the great centres of industry during the last quarter of the 19th century by the rise of the new university colleges, among which must be reckoned those established expressly for women. In the main the influence of these new institutions made for a non-classical and scientific type of curriculum in the popular secondary schools.

Influence of new university colleges.

At the same time, the pressure of the school boards influenced secondary education in two ways. In the first place, the elementary schools were found to act as feeders for schools of a higher type, and the idea of the "educational ladder" began to play a leading part in plans for the organization of national education. It was seen that there must be schools to which the more advanced scholars could pass from the public elementary schools, and scholarships to assist such scholars to continue their education in this way. In the next place, it was recognized that to provide adequately for the further education of public elementary scholars a new type of school was required. Thus there came into being through the initiative of the great school boards what were known as higher-grade elementary schools. These were really secondary

Influence of school boards.

schools of the third grade, and, as the Commission on Secondary Education observed, the school boards simply stepped in to fill the educational void which the Schools Inquiry Commissioners had proposed to fill by schools of that name. The happy obscurity of the legal definition of elementary education left these schools free to develop during the long years of the neglect of secondary education by the state, and when in 1901 the famous judgment in the test case of *Rex* v. *Cockerton* pronounced them to be illegal, it was at once recognized that the legislature must without delay step in to secure the educational work which the undoubtedly correct principles of judicial interpretation had placed in jeopardy.

Such were the agencies at work in the domain of secondary education when in 1894 a royal commission was appointed under the presidency of Mr Bryce to inquire into this branch of education. The terms of reference excluded elementary education, and the report may be taken as embodying the views of that school of educational statesmen who held that progress would best be attained by keeping elementary and secondary education entirely separate for purposes of local administration, the parish being regarded as the natural unit for elementary and the county for secondary education, a topic to which it will be necessary to revert in connexion with the act of 1902. The principal recommendations of the commission were: (1) the unification of the existing central authorities, viz. the Department of Science and Art, the Charity Commission (so far as it dealt with educational endowments), and the Education Department, in one central office, and the establishment of an educational council to advise the minister of education in certain professional matters; (2) the establishment of local authorities, to consist of committees of the county councils with co-opted elements; (3) the formation of a register of teachers with a view to the encouragement of professional training, and a system of school registration upon the basis of inspection and examination. The first of these recommendations was carried out by the Board of Education Act 1899, as mentioned below, and under the same act an attempt was made to give some effect to the third-named object, which, though it unfortunately fell short of success, may serve as a point of departure for further efforts. The realization of the second, and the most important, of the recommendations was deferred till 1902, when it was brought about as a part of a wider reorganization of the educational system.

Secondary Education Commission, 1894.

The religious difficulty in elementary education during the period immediately succeeding the report of Mr Bryce's Commission in 1895 once more reached an acute stage, and this circumstance was immediately unfavourable to a resolute handling of educational problems as such, public attention being largely concentrated upon the demand of the supporters of voluntary schools for relief from the growing financial burden which was laid upon them by that steady raising of the standard to which reference has been made above. In 1896 an endeavour was made to meet the demands of the voluntary managers by means of a bill introduced by Sir John Gorst on behalf of the Conservative government. This bill with its provision for a special aid grant to be administered by county education authorities, which were to exist side by side with the school boards, represented a kind of compromise between the systems of 1870 and 1902. It encountered opposition in all quarters and was withdrawn. In 1897, however, the position of the denominational schools was strengthened by the Voluntary Schools Act, which provided for a special aid grant of five shillings per head of the scholars in average attendance in these schools.

Agitation on behalf of voluntary schools.

In view of the difficulties which beset any comprehensive treatment of the education question, partial effect was given to the recommendations of the Secondary Education Commission by the Board of Education Act of 1899, which abolished the office of vice-president of the council, united the Department of Science and Art with the Education Department in one central office under the title of the Board of Education, with a president and parliamentary secretary; and provided for the transfer to this board of the powers of the Charity Commissioners in relation to educational endowments; also for the association with the board of a consultative committee, consisting as to not less than two-thirds of persons qualified to represent the views of university and other bodies interested in education, for the purpose (1) of framing a register of qualified teachers, and (2) of advising the Board of Education upon any matters referred to the committee by the board. The administrative reorganization of the Education Office was completed shortly after the passing of the act of 1902, when a tripartite division was adopted to correspond with the three branches of education with which the Board of Education is concerned, viz. elementary, secondary and technological.

Board of Education Act 1899.

No law of recent years has excited an acuter or more prolonged controversy than the Education Act of 1902, and amid the dust of religious and political strife it is not easy for contemporaries to view it objectively and in its true proportions. Nevertheless, considered historically, the act becomes intelligible as the product of the forces, partly religious and partly educational, which have been already described. The immediate impulse for this measure must be sought in the agitation that during the preceding decade had been gathering force among the adherents of the Established and Roman Catholic churches for equality of financial treatment as between voluntary and board schools. It must be placed to the credit of the constructive statesmanship of the Conservative party that it availed itself of an ecclesiastical agitation to take an important step forward in the organization of national education. The difficulty inherent in such a measure was the admitted difficulty of securing public control, as a necessary concomitant of public maintenance, without jeopardizing or destroying the special religious character of the voluntary schools. The act of 1902 sought to solve this problem, so difficult of solution under democratic conditions, upon the principle of a division of financial responsibility justifying a corresponding division of control between the voluntary managers and the local authority. The constitution of the local authority to be charged not only with the delicate duty of participating in the dual control of the voluntary public elementary schools, but also with the responsible task of co-ordinating public higher with public elementary education, presented features of controversy only less formidable than the purely religious question itself. Boldly reversing the settlement of 1870, the act of 1902 abolished the parochial school boards, and with them the system of *ad hoc* election, and made the county councils, already seised of technical and secondary education under the Technical Instruction Acts, the local authorities for all forms of education, thus reverting to the solution propounded

Act of 1902, general principles.

by Conservative statesmanship in the middle period of the 19th century and endorsed by an important memorandum contributed by Lord Sandford (formerly permanent secretary of the Education Department) to the report of the Cross Commission. The unquestionable niggardliness and inefficiency of many small country school boards, which had been foretold by the prescience of the Newcastle Commissioners, constituted the chief educational argument for the selection of the wider area so far as the interests of elementary education alone were concerned. On the other hand, experience has shown that in the rural districts against the undoubted gain in general efficiency there must be set a certain loss on account of the decay of local and personal interest consequent upon the centralization of authority in the hands of the county councils. Account, too, must be taken of the comparative heaviness with which a uniform county rate is apt to press upon sparsely populated agricultural parishes, especially in counties which include considerable industrial districts. Notwithstanding these minor drawbacks, it may be said that upon the whole the best opinion has endorsed the policy of 1902 with respect to the area of administration. At any rate it has been necessary to recognize the impracticability of disestablishing the strongly organized provincial authorities which the act brought into being, and proposals for amendment in this particular have been confined to schemes, favoured in principle by all parties, for securing some measure of decentralization and delegation of powers calculated to restore and stimulate local interest without derogating from the financial and administrative responsibility of the county council.

The principal provisions of the act of 1902 may be summarized as follows:—

Act of 1902, summary of provisions.

Part I. Local Education Authority. The council of every county and of every county borough is the local education authority for the purposes of the act, *i.e.* for both higher and elementary education, but for the purpose of elementary education autonomous powers are conferred upon boroughs with a population of over 10,000, and urban districts with a population of over 20,000 (§ 1).

Part II. Higher Education. “The L.E.A. (local education authority) shall consider the educational needs of their area and take such steps as seem to them desirable, after consultation with the Board of Education, to supply or aid the supply of education other than elementary, and to promote the general co-ordination of all forms of education.” For this purpose the application of the money received by the local authority under the Local Taxation (Customs and Excise) Act 1890, heretofore optional, is made compulsory, and power is given to levy a rate which in the case of a county is not to exceed two pence in the pound, or such higher rate as the county council with the consent of the Local Government Board may fix (§ 2). Concurrent powers are given to the councils of non-county boroughs and urban districts, with the limit of a penny rate (§ 3). A council must not require any particular form of religious instruction or observance, but the usual conscience clause in schools, colleges, or hostels provided by the council is modified by a provision for facilities for any particular religious instruction to be given at the request of parents of scholars at such times and under such conditions as the council think desirable, otherwise than at the cost of the council (§ 4).

Part III. Elementary Education. (1) Powers and duties. School boards and school attendance committees are abolished and their powers and duties are transferred to the L.E.A., who are also to be responsible for and have the control of all secular instruction in public elementary schools not provided by them (§ 5).

(2) Management of schools. (*a*) For public elementary schools provided by the L.E.A. (now officially styled “council schools”): (1) in counties, there is to be a body of six managers, viz. four appointed by the county council and two by the borough or urban district council, or parish council or parish meeting as the case may be, called in the act the minor local authority; (2) in non-county areas, the L.E.A. (being the borough or urban district council) may, if they think fit, appoint a body of managers consisting of such number as they may determine (§ 6 [1]).

(*b*) For schools not provided by the L.E.A. (voluntary schools) the act directs that there shall be a body of six managers, of whom four are to be “foundation managers,” and two are to be appointed as follows: in counties, one by the L.E.A. and one by the minor local authority, and in autonomous boroughs or urban districts both by the borough or urban district council (§ 6 [2]). Directions for the appointment of foundation managers are given by § 11, which in effect declares that, unless the trust deed of the school provides for the appointment of the required number, the foundation managers must be appointed under an order of the Board of Education, in making which the board are to have regard to the ownership of the school building and to the principles on which the education given in the school had been conducted in the past. It was found necessary for the board to make over 11,000 of these orders, a heavy task which was rendered the more formidable by the controversial character of the questions arising upon trust deeds as to the mode of appointment and the qualifications of managers.

(3) Maintenance of schools (§ 7). (*a*) Powers. The L.E.A. are required to maintain and keep efficient all public elementary schools which were necessary (*i.e.* which, as defined by § 9, have an average attendance of not less than thirty), under certain specified conditions, of which the most material are as follows. The managers must carry out the directions of the L.E.A. as to the secular instruction to be given in the school, including any directions with respect to the number and educational qualifications of the teachers, and for the dismissal of any teacher on educational grounds (§ 7 [1] [*a*]). The consent of the L.E.A. is required to the appointment of teachers, but that consent may not be withheld except on educational grounds; and the consent of the authority is also required to the dismissal of a teacher unless the dismissal is on grounds connected with the giving of religious instruction (§7 [1] [*c*]).

(*b*) Liabilities. The managers are required to provide the school premises to the L.E.A. for use as a public elementary school free of charge, except that a rent is payable for the teacher’s residence where one exists; and the managers are further required out of funds provided by them to keep the school premises in good repair and to make such alterations and improvements in the buildings as might reasonably be required by the L.E.A. On the other hand, the L.E.A. are required to make good such damage as they consider to be due to fair wear and tear of rooms used by them (§ 7 [1] [*d*]). Thus, by virtue of the teacher’s house rent and the wear-and-tear allowance the voluntary managers secured a valuable set-off against the cost of ordinary repairs.

Any question arising under this section (§ 7) between the L.E.A. and the managers of a voluntary school is

to be determined by the Board of Education (§ 7 [3]).

It is further provided with respect to teachers in voluntary schools that assistant teachers and pupil teachers may be appointed "if it is thought fit" without reference to religious creed and denomination, and in any case in which there are more candidates for the post of pupil teacher than there are places to be filled, the appointment is to be made by the L.E.A. (§ 7. [5]).

A provision, § 7 (6), known from the name of its author (d. 1908), Colonel Kenyon Slaney, M.P., as the Kenyon-Slaney clause, attracted considerable attention and formed the subject of much ecclesiastical controversy during the passage of the bill through parliament. The Kenyon-Slaney clause requires the religious instruction in voluntary schools to be in accordance with the provisions (if any) of the trust deed, but also to be under the control of the managers as a whole, whereas the common form of trust deed of the National Society reserves the control of religious instruction to the clergyman, whilst the clause was equally in conflict with the well-known sacerdotal principles of the Roman Catholic Church. Thus the clause represented a revival, as did the questions with respect to foundation managers, of the early controversy over the management clauses of the Committee of Council on Education. Its special interest lies, not so much in its intrinsic importance, as in the precedent it affords, specially notable as emanating from a Conservative source, for the overruling of trust deeds upon grounds of public policy. By way of saving another familiar provision of the trust deeds, a proviso to the Kenyon-Slaney clause reserves the existing trust-deed rights of appeal to the bishop or other denominational authority as to the character of the religious instruction.

Provision of New Schools.—New schools may be provided either by the L.E.A. or any other persons, subject to the issue of three months' public notice, and to a right of appeal on the part of the managers of any existing school, the L.E.A. (in the case of proposed voluntary schools) or any ten ratepayers of the district, to the Board of Education on the ground that the proposed school is not required, or that a school provided by the L.E.A., or not so provided, as the case might be, is better suited to meet the wants of the district than the proposed school. Any enlargement of a public elementary school which in the opinion of the Board of Education is such as to amount to the provision of a new school is to be so treated for the purposes of the section, and any transfer of a school to or from the L.E.A. must be treated as the provision of a new school. In deciding appeals as to new schools and in determining a case of dispute whether a school was necessary or not, the board are directed to have regard to the interest of secular instruction, the wishes of parents as to the education of children, and the economy of the rates, but existing schools are not to be considered unnecessary if the average attendance is not less than thirty (§§ 8-9). The last-mentioned canons have played a prominent part in subsequent discussions. Experience of these sections has shown that though it is extremely difficult to set up new voluntary schools in face of opposition from the L.E.A., such opposition is rarely offered or pressed where any really strong local demand is shown to exist.

Aid Grant.—Section 10 provides a new aid grant payable to the L.E.A. in respect of the number of scholars in average attendance in schools maintained by them. This new grant, calculated by an elaborate method which need not here be set out, took the place of the grants under the Voluntary Schools Act 1897, and § 97 of the act of 1870 as amended by the Elementary Education Act 1897.

Education Committees.—The constitution of education committees is dealt with by § 17. All councils having powers under the act, except those having concurrent powers as to higher education only, must establish education committees in accordance with schemes made by the councils and approved by the Board of Education (§ 17 [1]). A scheme may provide for more than one education committee under a single council, but before approving such a scheme the board must satisfy themselves that due regard is paid to the importance of the general co-ordination of all forms of education (§ 17 [6]). All matters relating to the exercise by a council of their powers under the act, except the power of raising a rate or borrowing money, stand referred to the education committee; the council may also delegate to the education committee any of their powers other than financial powers as above (§ 17 [2]). Every scheme must provide (*a*) for the appointment of a majority of the committee by the council, the persons so appointed to be persons who are members of the council unless in the case of a county the council otherwise determine; (*b*) for the appointment by the council, on the nomination or recommendation, where it appears desirable, of other bodies (including associations of voluntary schools) of persons of experience in education, and of persons acquainted with the needs of the various kinds of schools in the area of the council; (*c*) for the inclusion of women. Provision was also made (*d*) for the representation in the first instance of members of existing school boards (§ 17 [3]).

Expenses.—All parliamentary grants are made payable to the L.E.A. instead of as previously to the managers (§ 18 [2]). The county council must charge a proportion of all capital expenditure and liabilities, including rent, on account of the provision or improvement of any public elementary school on the parish or parishes which in the opinion of the council are served by the school, such proportion to be not less than one-half or more than three-fourths as the council think fit (§ 18 [1] [*c*] [*d*]). The county council may also if they think fit charge on the parishes benefited any expenses incurred with respect to education other than elementary (§ 18 [1] [*a*]).

Endowments.—The act introduced a new principle into the administration of endowments by directing that their income so far as necessarily applicable in any case for those purposes of a public elementary school for which the local authority are liable must be paid to that authority for the relief of the parochial rate (§ 13). As the result of technicalities of legal interpretation the section has been found to have in practice a narrower scope than had been generally anticipated.

The act of 1902 was extended to London by a separate act in 1903, containing certain special provisions of only minor importance.

"Passive resistance" to 1902 act.

The hostility of Nonconformists to the extension of rate-aid to denominational schools led to the organization upon a considerable scale of what became known as the "Passive Resistance" movement, a number of Nonconformist rate-payers refusing to pay the education rate on the ground that their consciences forbade their supporting the religious teaching in denominational schools; and their willingness to become subject to distraint and consequent inconveniences rather than pay the rates became the foundation of a widespread political campaign. In Wales,

Default Act 1904.

where in the rural districts the schools were commonly Anglican whilst the population was Nonconformist, particular difficulties arose in administering the act in consequence of the hostile attitude of the county authorities. Friction likewise manifested itself in one or two English areas, which reflected militant Nonconformist views. Accordingly the government passed the Local Education (Local Authority Default) Act 1904, empowering the Board of Education, in the case of default by the local authority, to make payments direct to the managers of the school and to deduct the amount from the sums payable to the defaulting authority on account of parliamentary grants.

Bill of 1906.

When the liberal party came into power again in 1906, Mr Birrell as president of the Board of Education in Sir Henry Campbell-Bannerman's administration introduced a bill to amend the Education Acts 1902-1903, with the object of securing full public control of all rate-aided schools and the appointment of teachers without reference to religious belief. The bill was of a highly complex character; its principal features were,—compulsory transfer of existing voluntary schools to the local authority, facilities for the giving of denominational instruction in transferred schools out of school hours by persons other than the regular teachers, and the recognition in populous districts, upon the demand of parents, of special publicly maintained schools in which denominational teaching could be included in the curriculum; the latter schools might (according to the bill as finally amended) in the last resort, *i.e.* if the local authority refused to maintain them, be recognized as state-aided schools. The bill encountered strong opposition from Anglicans and Catholics (though the Catholic Irish members finally voted for it as amended); it passed the House of Commons by a large majority, but after unavailing attempts at compromise upon the amendments introduced in the House of Lords, the two Houses failed to agree and the measure was lost.

Bills of 1908.

Mr Birrell was soon transferred to another office, and nothing more was done to amend the act of 1902 till early in the session of 1908, his successor Mr McKenna introduced a bill based on what was known as "contracting out." In single-school parishes the existing schools were to be compulsorily transferred, subject to the grant of denominational facilities out of school hours; elsewhere a sufficiency of places in schools with Cowper-Temple teaching, which the bill proposed to make compulsory in all provided schools, must be supplied by the local authority, while existing voluntary schools might become state-aided schools upon terms of receiving a grant of 47s. per head. The bill was accompanied by a financial scheme for a new system of allocating the parliamentary grant. In view of the improbability of its passing into law the bill was not pressed beyond the stage of second reading. Meanwhile, when Mr Asquith reorganized the cabinet, Mr Runciman succeeded Mr McKenna at the education office, and in the autumn he introduced a fresh measure framed as the result of negotiations between the government and the archbishop of Canterbury (Dr Randall Davidson) and designed to be passed rapidly through parliament by consent of all parties. Mr Runciman's bill, like his predecessor's, was based upon the principle of compulsory transfer in single-school parishes and contracting out elsewhere, but it gave a right of entry for denominational teaching on two days a week during school hours in all council schools whether transferred voluntary schools or otherwise, with liberty to employ for this purpose assistant teachers, but not (save temporarily at first in transferred schools) head teachers. Provision was also made for the payment of a small rent which would be applicable for or towards the cost of the denominational instruction. Unfortunately, the compromise failed at the last moment for want of agreement as to the financial terms of "contracting out," the government offering 50s. per head and the Church demanding 7s. more. It is obvious that "contracting out" is open to serious objection upon educational and economic grounds, and that if resorted to upon any very considerable scale it would involve a disruption of the public elementary system, and a duplication of schools which would constitute a wasteful drain upon the national exchequer. Upon such a system, therefore, some check is necessary, and, once decided that the check should take the form of financial pressure, rather than request of parents as in Mr Birrell's bill, or some form of administrative control, the question of pecuniary terms became one of principle and not merely of financial detail. Moreover, the difficulty of adjusting differences was intensified by the opposition of the extremists on either side, which daily gathered force, and the bill was withdrawn by the government when in committee of the House of Commons. The conciliatory efforts of Mr Runciman and Dr Randall Davidson revealed the existence of a considerable body of influential opinion among all schools of thought in favour of a national compromise, and the proposals embodied in the bill marked on the part both of Churchmen and Nonconformists important concessions to each other's views, engendering reasonable hopes of an ultimate settlement being reached at no distant date.

Feeding of school children.

Two subsidiary points as regards educational machinery have to be noted. The Education (Provision of Meals) Act 1906 enabled local education authorities to aid voluntary agencies in the provision of meals for children attending public elementary schools, and in certain cases with the consent of the Board of Education to defray the cost of the food themselves. In 1907-1908 forty, and in 1908-1909 seventy-five authorities in England and Wales were authorized by the board to expend moneys from the rates on food under this act. In addition, a number of authorities expended funds on equipment and service.

Medical inspection.

In 1907 an uncontroversial act entitled the Education (Administrative Provisions) Act, besides dealing with various matters of technical and administrative detail, laid upon local education authorities the new duty of providing for the medical inspection of all children attending public elementary schools. In connexion with this act the Board of Education established a medical department to advise and assist them in supervising local education authorities in carrying out their statutory duties in this regard. The whole departure is significant of the new sense of the importance of physical culture and hygiene which has been one of the remarkable features in recent educational developments.

General progress in

Sir Joshua Fitch, in his article on education in the 10th edition of this work, describes how experience had led the Education Department to abandon the system of payment by results, to establish "in place of testing the proficiency of individual scholars, ... one summary estimate of the work of the school; in place of an annual examination, occasional inspection without notice; in place of a variable grant dependent on a report in detail on the several subjects of instruction and on

elementary education.

particular educational merits and defects, one block grant payable to all schools alike." He at the same time expressed some misgiving as to the effect of "so large a relaxation of the conditions by which it had hitherto been sought to secure accuracy and thoroughness in teaching." The act of 1902, by placing secular education in public elementary schools under the control of strongly organized local education authorities may be said to have largely removed such dangers as were to be apprehended from the relaxation in question. Thus it was possible for the Board of Education in the code of 1904 to abolish the last traces of the system of payment by results, by setting forth (in the language of their report for 1903-1904) "a properly co-ordinated curriculum suitable to the needs of the children, with an indication of the relation which the various subjects of instruction should bear to each other, in place of the relatively haphazard list of possible branches of knowledge which were formerly presented to the choice of individual schools or authorities." In the new code also the board for the first time endeavoured to state for the guidance of teachers and parents the proper aim of the public elementary school, laying stress upon that element of the training of character which the system of payment by results had so unfortunately obscured. The new spirit was strikingly manifested in the volume of *Suggestions for the Considerations of Teachers*, issued by the Board of Education in 1905. This volume represented a notable attempt to connect administration with educational theory, without in any way seeking to crush individual initiative, or to impose a bureaucratic uniformity of method upon those engaged in the actual work of the schools. Apprehension of the true aim of elementary education as essentially and primarily a preparation for practical life has led to a corresponding development of instruction of a practical character, observation lessons and nature study being treated as a necessary element in the curriculum, while handicraft and gardening, and domestic subjects (for girls), are encouraged by special grants. Particular attention has been bestowed both by the central and local authorities upon the problem of rural instruction, and much has been done in many areas to bring the schools into closer relations with the needs of agricultural and rural life generally. In this way the old and perhaps not altogether ill-founded distrust of popular education as tending to unfit the working classes for industrial pursuits is being broken down and a public opinion more favourable to educational progress in the widest sense is being created.

According to the official returns for 1907-1908, the total number of scholars on the registers (England only) was as follows:—council schools, 2,991,741; voluntary schools, 2,566,030; total, 5,557,771, and the total attendance upon which grant was paid was 4,928,659. The percentage of actual average attendance to average number on the registers was 88.50%. The parliamentary grant (England and Wales) for elementary schools, other than higher elementary, amounted to £11,023,433.

Higher elementary schools.

The development of higher elementary education in England is now proceeding very much upon the lines that have been noted in France. The old higher-grade board-schools (declared illegal under the Elementary Education Acts by the judgment in the case of *Rex* v. *Cockerton* in 1901, and legalized temporarily by an act passed for the purpose in the same year) were mostly converted into municipal secondary schools under the act of 1902. In the succeeding years provision was made in the code for higher elementary schools of a specialized and technical type intended only for industrial districts. In 1906, as the result of the recommendations of the Consultative Committee, a new type of higher elementary school was admitted for children over twelve, corresponding generally to the French *école primaire supérieure*, described as having "for its object the development of the education given in the ordinary public elementary school, and the provision of special instruction bearing on the future occupations of the scholars, whether boys or girls." It may be possible to supplement this system in the rural areas to some extent by "higher tops" to the ordinary elementary schools in cases where it is not practicable to establish a fully organised higher elementary school; but for such "higher tops" no central grant is available. The total number of scholars upon the registers of higher elementary schools (England) in 1907-1908 was: New Type, 3178 (against 2715 in the previous year); Old Type, 4492 (against 5866 in the previous year).

Expenditure on elementary education.

The total expenditure (exclusive of capital outlay) of the local authorities (1906-1907) in England only upon elementary education, including "industrial" and "special" schools, was £19,776,733, of which (*a*) £10,408,242 was met by the ordinary parliamentary grant, and (*b*) £8,930,468 was the balance required to be met by rates, the difference being represented by receipts from various sources. The average cost per child of elementary schools in England and Wales (excluding London) may be taken at £3 (including London £3, 4s. 10d.), and the average central grant (excluding grants for special purposes) at 41s., leaving 19s. to be raised locally.

Preliminary training of elementary teachers.

The training of teachers for the two great branches of public education, elementary and secondary respectively, is an important part of the general administrative problem. Since the middle of the 19th century there has been a great development of public opinion with regard to their professional qualifications. Sir Joshua Fitch (*Ency. Brit.* 10th ed.) pointed out that the full appreciation of the importance of training began at the lower end of the social scale. Shuttleworth and Tufnell in 1846 urged the necessity of special training for the primary teacher, and hoped to establish State Training Colleges to supply this want; but the one college at Battersea which was founded as an experiment was soon transferred to the National Society (the "National Society for educating the poor in the principles of the Established Church": founded in 1811). Before this, Bell and Lancaster had made arrangements in their model schools for the reception of a few young people to learn the system by practice. In Glasgow, David Stow, who founded in 1826 the Normal Seminary which afterwards became the Free Church College, was one of the first to insist on the need of systematic professional preparation. The religious bodies in England, notably the Established Church, availed themselves promptly of the failure of the central government, and a number of diocesan colleges for men, and separately for women, were gradually established. In 1854 the British and Foreign School Society (founded 1808) placed their institutes at the Borough Road and Stockwell on a collegiate footing, and subsequently founded other colleges at Swansea, Bangor, Darlington and Saffron Walden; the Roman Catholic Church provided two for women and one for men; and the Wesleyans two, one for each sex.

The new provincial colleges of university rank were invited by the Education Department to attach normal classes to their ordinary course and to make provision for special training and suitable practice in schools for those students who desired to become teachers. Thus the government came to recognize two kinds of training schools—the residential colleges of the old type and the day colleges attached to institutions of university rank; both were subsidized by grants from the Treasury, and regularly inspected. As the need of special training for teachers became further recognized by the consideration of the same question as regards teachers in higher and intermediate schools (Cambridge instituting in 1879 examinations for a teacher's diploma, and other universities providing courses for secondary as well as primary teachers, and establishing professorships of education), the attitude of the government, *i.e.* the Board of Education, towards the problem gradually became more and more a subject of controversy and of public interest, as indicated by the clause in the Act of 1899 providing for a public registration of qualified teachers and for the gradual elimination from the profession of those who were unqualified. And meanwhile the increased solidarity of the National Union of Teachers (founded in 1870), the trade union, so to speak, of the teachers, brought an important body of professional opinion to bear on the discussion of their own interests.

The question of the preliminary education of elementary teachers had after some years of discussion reached a critical stage in 1909. The history of pupil teachership as a method of concurrent instruction and employment shows that it was in its inception something in the nature of a makeshift; the ideal placed before local education authorities in the recent regulations and reports of the Board of Education is the alternative system whereby with the aid of national bursaries (instituted in 1907) "the general education of future teachers may be continued in secondary schools until the age of seventeen or eighteen, and all attempts to obtain a practical experience of elementary school work may be deferred until the training college is entered, or at least until an examination making a natural break in that general education and qualifying for an admission to a training college has been passed." Under the revised pupil-teacher system established by the regulations of 1903 provision is made for the instruction of pupil teachers in centres which as far as possible are attached to secondary schools receiving grants from the Board of Education under the regulations for secondary schools, about two-thirds of the secondary schools on the grant list undertaking this work. Accordingly, the result of recent changes is to modify the old system in two ways: first by providing the alternative of a full course of secondary education, secondly by associating pupil teachership itself as far as possible with part-time attendance at a secondary school. The total number of pupil teachers recognized during the year 1907-1908 was 20,571, and of these 9770 were in centres forming integral parts of secondary schools. The number of bursars who passed the leaving examination was 1486.

Training colleges.

One of the principal difficulties which confronted the state and the local authorities in their task of organizing an improved system of public education under the act of 1902 lay in the deficiency of training colleges in view of the increased number of teachers. Local authorities naturally hesitated to burden themselves with the cost of providing such institutions in view of the fact that there is nothing to prevent teachers trained at great expense by one authority taking service under a less public-spirited authority who had contributed nothing to such training; hence a widespread feeling that the provision of training colleges should be undertaken by the state as a matter of national concern. Under these circumstances a new system of building grants in aid of the establishment of training colleges was instituted in 1905. In 1906 these grants were raised from 25 to 75% of the capital expenditure, but were limited to colleges provided by local authorities. A further difficulty in view of the municipalization of education arose from the fact that the majority of the residential colleges were in the hands of denominational trusts which did not admit a conscience clause. Under the presidency of Mr McKenna in 1907, the Board of Education, in regulations which excited much controversy, "with a view to throwing open as far as possible the advantages of a course of training in colleges supported mainly by public funds to all students who are qualified to profit by it irrespective of religious creed or social status," laid down that the application of a candidate might in no circumstances be rejected on any religious ground, nor on the ground of social antecedents or the like. The same regulations provided that no new training colleges would be recognized except on terms of compliance with certain conditions as to freedom from denominational restrictions or requirements. The obligation as to religious exemptions has since been limited to 50% of the admissions. There were in attendance (*Statistics*, England, 1907-1908) in the various colleges, 6561 women and 2835 men, of whom 1619 women and 335 men were in colleges provided by local education authorities. The grants made by the Board of Education for training colleges were as follows: maintenance grants £383,851; building grants £45,000. These figures include Wales.

Continuative education.

The fear has been widely entertained that a considerable part of the national expenditure upon elementary education is wasted for want of an effective system of continuative instruction to be given out of working hours to adolescents engaged in industrial employment. The whole subject was exhaustively treated by the report in 1909 of the Consultative Committee of the Board of Education. This report seeks to base an efficient continuative system upon the improvement of elementary education by reducing the size of the classes in the elementary schools upon the lines now laid down by the new staffing regulations of 1909; by increasing the amount of instruction in hand-work with a view to rendering the curriculum less bookish and more efficient as a training for industrial and agricultural life; and by legislation to reform the system of half-time attendance and raise the age of compulsory attendance to thirteen and ultimately fourteen. Upon the foundation of an improved and prolonged elementary education there would be reared a superstructure of continuative schools or classes, attendance at which up to seventeen would be compulsory under bye-laws adoptive locally at the option of the local education authorities. In 1906-1907 about 21 per thousand of the population of England and Wales attended evening schools and classes inspected by the Board of Education, and grant amounting to £361,596 was paid in respect of 440,718 regular attendants.

Secondary

The most marked progress has undoubtedly been in secondary education, and in no direction has the act of 1902 proved more fruitful. At the end of the 19th century secondary instruction in England was still provided chiefly by endowed grammar-schools, by proprietary schools established by religious bodies or joint-stock companies, and by private enterprise. No public provision

education. was made for secondary education as such; what financial assistance was forthcoming from municipal sources was given indirectly under cover of the grants under the Technical Instruction Acts, while in the administration of central grants for the first years of the working of the Board of Education Act 1899, no absolute differentiation between secondary and technological functions was recognized. The establishment of local authorities with direct duties in respect of secondary education, and the reorganization of the central office with reference to the three branches of education, elementary, secondary and technological, rendered possible for the first time an adequate treatment of the problem of public secondary education as a whole. "The regulations for secondary schools," says the prefatory memorandum to the regulations of the Board of Education, "grew up round the old provisions of the Directory of the Science and Art Department. Detached science classes were gradually built up into schools of science. Schools of science were subsequently widened into schools of what was known as the 'Division A' type, providing a course of instruction in science in connexion with, and as part of, a course of general education. Aid was afterwards extended to schools of the 'Division B' type in which science did not form the preponderating element of the instruction given. In 1904 the board recast the regulations so as to bring all schools aided by grants within the general definition of a school offering a general education up to and beyond the age of sixteen through a complete graded course of instruction, the object of which should be to develop all the faculties, and to form the habit of exercising them."

Two main tendencies distinguish the recent development: on the one hand the tendency to municipalization, or at least to the establishment of public control; on the other hand the tendency (marked especially by the regulations of 1907) to greater elasticity in regard to curricula, and so to the freer encouragement of local initiative and local effort.

In 1907 the government of Sir Henry Campbell-Bannerman placed greatly increased funds at the disposal of the Board of Education for the purpose of secondary education. The regulations under which the increased grant was administered imposed conditions in respect of freedom from denominational restrictions or requirements, representative local control, and accessibility to all classes of the people, which, like the analogous rules with regard to training colleges, roused considerable controversy. With regard to religious instruction, the requirement was made that no catechism or formulary distinctive of any particular religious denomination might be taught in the school except upon the request in writing of the parent or guardian and at the cost of funds other than grants of public money. Power was at the same time reserved to the board to waive the new conditions in the event of the local education authority passing a resolution that the school was in their view required as part of the secondary school provision for their area, and that the conditions, or one or more of them, might be waived with advantage in view of the educational needs of the area. It will be noticed that one effect of the regulations (as of the training college regulations) was to recognize as a kind of established religion those elements of Christianity which are shared in common by the various Protestant churches, according to the system of Lancaster and the Cowper-Temple compromise. Normally schools are required to provide 25% of free places for scholars from public elementary schools, and, with a view to encouraging the transference of children from the public elementary school at an early age, a grant of £2 was made payable on account of ex-public elementary scholars between ten and twelve years of age. The full scale of grants is £2 for ex-public elementary scholars between ten and twelve, and £5 for scholars between twelve and eighteen. To schools previously recognized and failing to comply with the new conditions, grant may be paid on the lower scale of £2 and £2, 10s. respectively.

Secondary school grants are assessed upon average attendance, and efficiency is guaranteed by inspection and not by individual examination. All recognized schools must provide at least the substantial equivalent of the four-years' course formerly required, and recognition is withheld or withdrawn if an adequate number of the scholars do not remain at least four years in the school, or do not remain up to sixteen; in rural areas, however, and small towns, a school life of three years and a leaving age of fifteen may be accepted. "The board are now in a position, through their inspectorate, to keep a watch and exercise a guidance which were previously impossible over the planning and working of school curricula. Detailed reports following upon full inspections, and the more constant if less obvious influence exercised through informal visits, conferences, reports and suggestions, may now be relied upon to guard against the risks of one-sided education, of ill-balanced schemes of instruction, and of premature or excessive specialization" (Report of Board of Education, 1906-1907, page 68). The curriculum must provide instruction duly graded and duly continuous, in the English language and literature, in geography and history, in mathematics, science and drawing, and in at least one language other than English. Where two languages other than English are taken, Latin must ordinarily be one. Provision must be made for organized games, physical exercises and manual instruction, and in girls' schools science and mathematics other than arithmetic may be replaced by an approved scheme of practical housewifery for girls over fifteen. The total number of secondary schools recognized for grant (*Statistics*, 1907-1908) was 736, of which only 220 were directly provided by local authorities. The number of pupils in attendance was 68,104 boys and 56,359 girls, total 124,463. The government grants for 1907-1908 amounted to £320,873 besides grants from local authorities.

Wales.

Notwithstanding the important differences which exist between the social and especially the religious conditions of England and Wales respectively, Wales continued to be treated as one with England for purposes of educational administration down to quite recent years. Towards the end of the 19th century the striking revival of Welsh nationality, in itself largely an educational and a literary movement, led to a spontaneous demand among the Welsh people for the organization of a national system of higher education. In accordance with the recommendations of a special royal commission the Welsh Intermediate Education Act passed in 1889 provided for the creation in every county in Wales (including Monmouthshire) of joint education committees consisting of three nominees of the county council and two nominees of the lord president of the council. To these committees were entrusted the duties of framing (under the Charity Commissioners) schemes for the establishment of intermediate and technical schools and for the application of endowments, and for administering a ½d. county rate, which was supplemented by a treasury grant not

exceeding the amount raised by the rate. Certain supervisory functions were entrusted to a Central Education Board, to which are committed the duties of inspection and examination. The joint education committees have now (except for the purpose of framing schemes for endowments) been superseded by the local education authorities under the act of 1902. The public assistance afforded to secondary education in Wales under the Intermediate Act is supplemented by the grants of the Board of Education, and the Board's revised Secondary School Regulations were applied to Wales in 1908. There were (1907-1908) 92 county secondary schools in Wales administered under schemes made under the Welsh Intermediate Act, attended by 6235 boys and 6727 girls, total 12,962; and 12 other secondary schools, of which 8 were provided by local authorities. The total attendance at all secondary schools was 13,615, viz. 6819 boys and 6796 girls. The Board of Education grant amounted to £31,090. The expenditure of the local authorities for the year 1906-1907 was £85,242.

The number of scholars on the registers of ordinary public elementary schools in Wales was (*Statistics*, 1907-1908), in council schools 330,413, and in voluntary schools 100,290, total 430,703. The percentage of average attendance was 86.98. The ordinary parliamentary grant (1906-1907) was £794,161, and the net expenditure of local authorities £561,234.

In 1907 a Welsh department of the Board of Education was established with a permanent secretary and a chief inspector, each responsible directly to the president. A movement was in progress in Wales in 1908-1909 for the creation of a national council of education under an independent minister, but this change could in any case only be effected by legislation; and meanwhile the special religious and social conditions in Wales caused administrative difficulties in working an act (that of 1902) primarily designed to meet those prevailing in England.

(G. B. M. C.)

United States.

History.—The first white settlers who came to North America were typical representatives of those European peoples who had made more progress in civilization than any other in the world. Those settlers, in particular those from England and from Holland, brought with them the most advanced ideas of the time on the subject of education. The conditions of life in the New World emphasized the need of schools and colleges, and among the earliest public acts of the settlers were provisions to establish them. The steps taken between 1619 and 1622 to provide schools for the colony of Virginia were frustrated by the Indian war which broke out in the latter year, and were never successfully renewed during the colonial period. In New York, where the influence of the Dutch was at first predominant, elementary schools were maintained at the public expense, and were intended for the education of all classes of the population. This policy reflected the very advanced views as to public elementary education which were then held in the Netherlands. The assumption of control in the colony of New York by the English was a distinct check to the development of public elementary education, and little or no further progress was made until after the Revolution. The most systematic educational policy was pursued in the colony of Massachusetts. As early as 1635, five years after it was founded, the town of Boston took action to the end that "our brother Philemon Pormort shall be entreated to become schoolmaster for the teaching and nurturing children with us." The General Court of the colony in 1636 made the first appropriation for what was to become Harvard College, taking its name in honour of the minister, John Harvard, who died in 1638, leaving his library and one-half of his property, having a value of £800, to the new institution. The amount of this appropriation of 1636 (£400) was remarkable in that it was probably equal to the whole colony tax for a year. In 1642 followed a legislative act which, while saying nothing of schools, gave to the selectmen in every town power to oversee both the education and the employment of children. It is made the duty of the selectmen to see that the children can read and understand the principles of religion and the capital laws of the country, and that they are put to some useful work.

Beginnings.

Five years later, in 1647, was enacted the law which is not only the real foundation of the Massachusetts school system, but the type of later legislation throughout the United States. This epoch-making act, the first of its kind in the world, represented the public opinion of a colony of about 20,000 persons, living in thirty towns. It required every town of fifty house-holders to establish a school, the master of which should be paid either by the parents of the children taught or by public tax, as the majority of the town committee might decide; and it further required every town of one hundred families or house-holders to set up a grammar school in which pupils might be prepared for the "University," as the new institution at Cambridge was designated. Moreover, a penalty was attached to neglect of this legislative requirement, in the form of a fine to be devoted to the maintenance of the nearest school. Horace Mann said of the act of 1647: "It is impossible for us adequately to conceive the boldness of the measure, which aimed at universal education through the establishment of free schools. As a fact it had no precedent in the world's history; and, as a theory, it could have been refuted and silenced by a more formidable array of argument and experience than was ever marshalled against any other institution of human origin. But time has ratified its soundness. Two centuries of successful operation now proclaim it to be as wise as it was courageous, and as beneficent as it was disinterested." The significance of these acts of 1642 and 1647 is that they foreshadow the whole American system of education, including elementary schools, secondary schools and colleges, and that they indicate the principles upon which that system rests. These principles as summarized by George H. Martin in his *Evolution of the Massachusetts Public School System* are the following:—(1) The universal education of youth is essential to the well-being of the state. (2) The obligation to furnish this education rests primarily upon the parent. (3) The state has a right to enforce this obligation. (4) The state may fix a standard which shall determine the kind of education and the minimum amount. (5) Public money raised by general tax may be used to provide such education as the state requires. The tax may be general, though the school attendance is not. (6) Education higher than the rudiments may be supplied by the state. Opportunity must be provided at the public expense for youths who wish to be fitted for college. These principles have now found expression in the public acts of every state, and upon them education in the United States is founded.

Despite the praiseworthy attempts made in New York, New Jersey and Pennsylvania to develop schools

and school systems, very little was accomplished in those colonies which was permanent. The sentiment in the more southern colonies was, as a rule, unfriendly to free schools, and nothing of importance was attempted in that section of the country until the time of Thomas Jefferson. Through religious zeal or philanthropy colleges were founded as far south as Virginia, and no fewer than ten of these institutions were in operation in 1776. Their present names and the dates of their foundation are: Harvard University, Massachusetts (1636); College of William and Mary, Virginia (1693); Yale University, Connecticut (1701); Princeton University, New Jersey (1746); Washington and Lee University, Virginia (1749); University of Pennsylvania, Pennsylvania (1749); Columbia University, New York (1754); Brown University, Rhode Island (1764); Rutgers College, New Jersey (1766); and Dartmouth College, New Hampshire (1769). In the colleges the ecclesiastical spirit was at first almost uniformly dominant. The greater number of their students were preparing for the ministry in some one of the branches of the Protestant Church. These facts caused the grammar schools to take on more and more the character of college-preparatory schools; and when this was brought about they supplied the educational needs of but one portion of the community. As time passed, the interdependence of governmental and ecclesiastical interests began to weaken in the colonies, and there arose among those who represented the new secularizing tendency a distrust of the colleges and their influence. This gave rise to a new and influential type of school, the academy, which took its name from the secondary schools established in England by the dissenting religious bodies during the latter part of the seventeenth century at the suggestion of Milton. These academies were intended to give an education which was thought to be more practical than that offered by the colleges, and they drew their students from the so-called middle classes of society. The older academies were usually endowed institutions, organized under the control of religious organizations or of self-perpetuating boards of trustees. Their programme of studies was less restricted than that of the grammar schools, and they gave new emphasis to the study of the English language and its literature, of mathematics and of the new sciences of nature. For two generations the academies were a most beneficent factor in American education, and they supplied a large number of the better-prepared teachers for work in other schools. These schools were in a sense public in that they were chartered, but they were not directly under public control in their management. Early in the 19th century there arose a well-defined demand for public secondary schools—high schools, as they are popularly known. They were the direct outgrowth of the elementary school system. Boston, Philadelphia, Baltimore and New York were the first of the large cities to establish schools of this type, and they spread rapidly. These public secondary schools met with opposition, however, springing partly from the friends of the academies, and partly from those who held that governmental agency should be restricted to the field of elementary education. The legal questions raised were settled by a decision of the supreme court of Michigan, which contained these words: “Neither in our state policy, in our constitution, nor in our laws do we find the primary school districts restricted in the branches of knowledge which their officers may cause to be taught, or the grade of instruction that may be given, if their voters consent, in regular form, to bear the expense and raise the taxes for the purpose.” This decision gave marked impetus to the development of public secondary or high schools, and they have increased rapidly in number. The academies have relatively declined, and in the Western states are almost unknown.

Development.

Meanwhile the elementary school system had grown rapidly. The school district, the smallest civil division, was created in Connecticut in 1701, in Rhode Island about 1750, and in Massachusetts in 1789. From the point of view of efficient, well-supported schools, it has been felt since the time of Horace Mann that the substitution of the small school district for the town as the unit of school administration was a mistake. Yet the school district has exercised a profound influence for good upon the American people. In New York state, for example, there were in 1900 over eleven thousand school districts, and in Illinois over twelve thousand. The districts are small in extent and often sparsely settled. Their government is as democratic as possible. The resident legal voters, often including women, hold a meeting at least once a year. They elect trustees to represent them in the employment of the teacher and the management of the school. They determine whether a new schoolhouse shall be built, whether repairs shall be made, and what sum of money shall be raised for school purposes. In the rural districts this system has often been itself a school in patriotism and in the conduct of public affairs. Recently the tendency is to merge the school districts into the township, in order that larger and better schools may be maintained, and that educational advantages may be distributed more evenly among the people. Most of the southern states have the county system of school administration. This is because the county, rather than the township, has been the political unit in the south from the beginning. Special laws have been made for the school system in cities, and the form of these laws differs very much. In nearly every city there is a separate board of education, sometimes chosen by the voters, sometimes appointed by the mayor or other official, which board has full control of the schools. The city board of education has as its executive officer a superintendent of schools, who has become a most important factor in American educational administration. He exerts great influence in the selection of teachers, in the choice of text-books, in the arrangement of the programme of studies, and in the determination of questions of policy. Sometimes he is charged by law with the initiative in some or all of these matters. He is usually a trained administrator as well as an experienced teacher. The first superintendent was appointed in 1837 at Buffalo. Providence followed in 1839, New Orleans in 1841, Cleveland in 1844, Baltimore in 1849, Cincinnati in 1850, Boston in 1851, New York, San Francisco and Jersey City in 1852, Newark and Brooklyn in 1853, Chicago and St Louis in 1854, and Philadelphia in 1883. In general, it may be said that the progress of public education in the United States is marked by (1) compulsory schools, (2) compulsory licensing of teachers, (3) compulsory school attendance, and (4) compulsory school supervision, and by the increasingly efficient administration of these provisions. The compulsion comes in each case from the state government, which alone, in the American system, has the power to prescribe it and to enforce it. Each state is therefore an independent educational unit, and there is no single, uniform American system of education in any legal sense. In fact, however, the great mass of the American people are in entire agreement as to the principles which should control public education; and the points in which the policies of the several states are in agreement are greater, both in number and in importance, than those in which they differ. An American educational system exists, therefore, in spirit and in substance, even though not in form.

Neither in the Declaration of Independence nor in the Constitution of the United States is there any mention of education. The founders of the nation were by no means indifferent to education, but they shared the common view of their time, which was that the real responsibility for the maintenance of schools and the expense of maintaining them should fall upon the several local communities. The relation of government to education was not then a subject of ordinary consideration or discussion. Later, when this question did arise and the power of taxation was involved, the several states assumed control of education, as it was necessary that they should do. Nevertheless, from the very beginning the national government has aided and supported education, while not controlling it. This policy dates from the 13th of July 1787, when there was passed the famous "Ordinance for the Government of the Territory of the United States North-West of the River Ohio," meaning the territory north and west of the Ohio river now represented by the states of Ohio, Indiana, Illinois, Michigan, Wisconsin, and the eastern side of Minnesota, embracing more than 265,000 sq. m. of territory. This ordinance contains this declaration: "Religion, morality, and knowledge being necessary to good government and the happiness of mankind, schools and the means of education shall for ever be encouraged." The Ordinance of 1787 also reaffirmed the provisions of the so-called Land Ordinance of 1785, by which section No. 16 in every township (a township consists of 36 numbered sections of 1 sq. m. each), or one thirty-sixth of the entire north-west territory, was set aside for the maintenance of public schools within the township. The funds derived from the sale and lease of these original "school lands" form the major portion of the public school endowment of the states formed out of the north-west territory. The precedent thus established became the policy of the nation. Each state admitted prior to 1848 reserved section No. 16 in every township of public land for common schools. Each state admitted since 1848 (Utah being an exception, and having four sections) has reserved sections No. 16 and No. 36 in every township of public lands for this purpose. In addition, the national government has granted two townships in every state and territory containing public lands for seminaries or universities. A third land grant is that made in 1862 for colleges of agriculture and the mechanical arts. The sum total of these three land grants amounted in 1900 to 78,659,439 acres, to which there must be added various special grants made from time to time to the states and devoted to education. The portion of the public domain so set apart in 1900 amounted in all to 86,138,473 acres, or 134,591 English sq. m. This is an area greater than those of the six New England states, New York, New Jersey, Maryland and Delaware added together. It is a portion of the earth's surface as great as the kingdom of Prussia, about seven-tenths as great as France, and considerably greater than the combined areas of Great Britain (including the Channel Islands) and the kingdom of Holland. Besides the enormous grants of land in aid of education, the national government has maintained since 1802 a military academy at West Point, New York, for the training of officers for the army, and since 1845 a naval academy at Annapolis, Maryland, for the training of officers for the navy. It has also taken charge of the education of the children of uncivilized Indians, and of all children in Alaska. It has voted, by act of 1887, a perpetual endowment of $15,000 a year for each agricultural experiment station connected with a state agricultural college, and, by act of 1890, an additional endowment of $25,000 a year for each of the agricultural colleges themselves. The aggregate value of land and money given by the national government for education in the several states and territories is about $300,000,000.

National policy.

In 1867 the Congress established a bureau of education, presided over by a commissioner who is under the jurisdiction of the secretary of the interior, the purpose of which is declared to be to collect "such statistics and facts as shall show the condition and progress of education in the several states and territories, and of diffusing such information respecting the organization and management of school systems and methods of teaching as shall aid the people of the United States in the establishment and maintenance of efficient school systems, and otherwise promote the cause of education throughout the country." The bureau has therefore no direct power over the educational policy of the several states. It has, however, exercised a potent influence for good in its advisory capacity. Up to 1900 this bureau had published 360 separate volumes and pamphlets, including 31 annual reports, covering from 800 to 2300 pages each; and the number has since been much increased. The annual reports alone of the Commissioner of Education are mines of information. These standard works of reference are distributed gratuitously in large numbers to libraries, school officials and other persons interested, and to foreign governments. The several commissioners of education have been: Henry Barnard, 1867-1870; John Eaton, 1870-1886; Nathaniel H.R. Dawson, 1886-1889; William T. Harris,[3] 1889-1906; Elmer Ellsworth Brown, 1906- .

Bureau of education.

In the United States the sovereign powers are not all lodged in one place. Such of those powers as are not granted by the Constitution to the national government are reserved to the states respectively, or to the people. The power to levy taxes for the support of public education has been almost universally held to be one of the powers so reserved. The inhabitants of the several local communities, however indisposed they may have been to relinquish absolute control of their own schools, have been compelled to yield to the authority of the state government whenever it has been asserted, for except under such authority no civil division—county, city, township, or school district—possesses the power to levy taxes for school purposes. Moreover, since the exercise of state authority has uniformly improved the quality of the schools, it has usually been welcomed, not resisted. In general, it may be said that the state has used its authority to prescribe a minimum of efficiency which schools and teachers must reach, and it enforces this minimum through inspection and the withholding of its proper share of the state school fund from any locality where schools or teachers are permitted to fall below the required standard. In extreme cases the state authorities have interfered directly to prevent the evil results of local inefficiency or contumacy. In addition, the states, almost without exception, maintain at their own expense schools for the training of teachers, known as normal schools. Many of the states also offer inducements to the cities, towns and districts to exceed the prescribed minimum of efficiency. Through the steady exercise of state supervision the school buildings have improved, the standard for entrance upon the work of teaching has been raised, the programme of studies has been made more effective and more uniform, and the length of the school term has increased. The Constitution of every state now contains some provision as to public education. Each state has an

State governments and education.

executive officer charged with the enforcement of the state school laws. Sometimes, as in New York, this official has plenary powers; sometimes, as in Massachusetts and Ohio, he is little more than an adviser. In twenty-nine states this official is known as the superintendent of public instruction; in Massachusetts and Connecticut he is called secretary of the state board of education; other titles used are commissioner of public schools, superintendent of common schools, and superintendent of public schools. The schools are administered, on behalf of the taxpayers, by an elected board of school trustees in rural school districts, and by an elected (though sometimes appointed) board of education or school committee in cities and towns. In 836 cities and towns there is a local superintendent of schools, who directs and supervises the educational work and acts as the executive officer of the board of education. The schools in the rural districts are under the direct supervision of a county superintendent of schools or similar official, who is often chosen by the people, but who sometimes is named by the state authorities. The county and city superintendents are often charged with the duty of holding examinations for entrance upon the work of teaching, and of issuing licences to those persons who pass the examinations. This system works best where it is carefully regulated by state law. Thirty states, one territory, and the District of Columbia have enacted compulsory education laws, but the enforcement of them is usually very lax. In fifteen states and territories there are no compulsory education laws, although there are in existence there fully organized school systems free to all children. The usual age during which school attendance is required is from 8 to 14. Provision is made in Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Indiana, Minnesota and Michigan, for sending habitual truants to some special institution. Laws forbidding the employment of children under a specified minimum age in any mercantile or manufacturing establishment are in force in twelve states, and are usually administered in connexion with the compulsory education laws.

The universal establishment in America of public secondary schools (high schools), and the existence of state universities in all of the states south and west of Pennsylvania, have brought into existence a system of state education which reaches from the kindergarten and the elementary school to the graduate instruction offered at state colleges and universities. This system includes (1) about 1500 free public kindergartens scattered over fifteen states; (2) free public elementary schools within reach of almost every home in the land; (3) free public secondary schools (high schools) in every considerable city or town and in not a few rural communities; (4) free land grant colleges, supported in large part by the proceeds of the nation’s endowment of public lands, paying particular attention to agriculture and the mechanical arts, in all the states; (5) state universities, free or substantially so, in all the states south and west of Pennsylvania; (6) free public normal schools, for the professional training of teachers, in nearly every state; (7) free schools for the education of defectives in nearly all the states; and (8) the national academies at West Point and Annapolis for the professional training of military and naval officers respectively.

Kindergartens. Miss Susan E. Blow, herself the leading exponent of kindergarten principles in the United States, has pointed out that the history of the kindergarten movement reveals four distinct stages in its development: the pioneer stage, having Boston as its centre; the philanthropic stage, which began in the village of Florence, Mass., and reached its climax at San Francisco, California; the national or strictly educational stage, which began at St Louis; and the so-called maternal stage, which from Chicago as a centre is spreading over the entire country. During the first stage public attention was directed to a few of the most important aspects of Froebel’s teaching. During the second stage the kindergarten was valued largely as a reformatory and redemptive influence. During the third stage the fundamental principles underlying kindergarten training were scientifically studied and expounded, and the kindergarten became part of the public school system of the country. The fourth stage, which, like the third, is fortunately still in existence, aims at making the kindergarten a link between the school and the home, and so to use it to strengthen the foundations and elevate the ideals of family life. By 1898 there were 4363 kindergartens in the United States (1365 of which were public), employing 9937 teachers (2532 in the public kindergartens) and enrolling 189,604 children (95,867 in the public kindergartens). Of the 164 public normal schools, 36 made provision for training kindergarten teachers. The scientific and literary activity of some of the private kindergarten training classes is very great, and they exert a beneficial and stimulating effect on teaching in the elementary schools. It is generally admitted that from the point of view of the children, of the teachers, of the schools, and of the community at large, the kindergarten has been and is an inspiration of incalculable value.

Elementary schools. The elementary school course is from six to nine years in length, the ordinary period being eight years. The pupils enter at about six years of age. In the cities the elementary schools are usually in session for five hours daily, except Saturday and Sunday, beginning at 9 A.M. There is an intermission, usually of an hour, at midday, and short recesses during the sessions. In the small rural schools the pupils are usually ungraded, and are taught singly or in varying groups. In the cities and towns there is a careful gradation of pupils, and promotions from grade to grade are made at intervals of a year or of a half-year. The best schools have the most elastic system of gradation and the most frequent promotions. In a number of states there are laws authorizing the conveyance of children to school at the public expense, when the schoolhouse is unduly distant from the homes of a portion of the school population. Co-education (*q.v.*) in the elementary school has been the salutary and almost uniform practice in the United States. The programme of studies in the elementary school includes English (reading, writing, spelling, grammar, composition), arithmetic (sometimes elementary algebra also, or plane geometry in the upper grades), geography, history of the United States, and elementary natural science, including human physiology and hygiene. Physical training, vocal music, drawing and manual training are often taught. Sometimes a foreign language (Latin, German or French) and the study of general history are begun. Formal instruction in manners and morals is not often found, but the discipline of the school offers the best possible training in the habits of truthfulness, honesty, obedience, regularity, punctuality and conformity to order. Religious teaching is not permitted, although the exercises of the day are often opened with reading from the Bible, the repetition of the Lord’s Prayer and the singing of a hymn. Corporal punishment is not infrequent, but is forbidden by law in New Jersey, and in many states may be used only under restrictions. Text-books are used as the basis of the instruction given, and the pupils “recite” in class

to the teacher, who, by use of illustration and comment, makes clear the subject-matter of the prescribed lesson. The purpose of the recitation method is to make the work of each pupil help that of his companion. Skilfully used, it is the most effectual instrument yet devised for elementary school instruction.

Secondary schools.

The secondary school course is normally four years in length. The principal subjects studied are Latin, Greek, French, German, algebra, geometry, physics, chemistry, physical geography, physiology, rhetoric, English literature, civics and history. Although but 11.36% of the students in public high schools and 25.36% of those in private secondary schools are preparing for a college or scientific school, yet the conditions prescribed by the colleges for admission to their courses affect powerfully both the secondary school programme and the methods of teaching. Of late years no educational topic has been more widely discussed than that as to the proper relations of secondary schools and colleges. As a result, special examinations for admission to college are either greatly simplified or entirely abolished, and the secondary studies are much more substantial and better taught than formerly. An increasing proportion of secondary school teachers are college graduates. The most extraordinary characteristic of secondary education in recent years is the rapid increase in the number of students taking Latin as a school subject. Meanwhile the proportion of those studying physics and chemistry has fallen off slightly. The rate of increase in the number of pupils who study Latin is fully twice as great as the rate of increase in the number of secondary school students. Between 1890 and 1896, while the number of students in private secondary schools increased 12%, the number of students in public secondary schools increased 87%. Since 1894 the number of students in private secondary schools has steadily declined.

The colleges.

The American college, although it is the outgrowth of the English colleges of Oxford and of Cambridge, has developed into an institution which has no counterpart in Europe. The college course of study, at first three years in length, was soon extended to four years, and the classes are uniformly known as the freshman, the sophomore, the junior and the senior. The traditional degree which crowns the college course is that of Bachelor of Arts (A.B.). The studies ordinarily insisted on in the case of candidates for this degree are Latin, Greek, mathematics, English, philosophy, political economy, history, at least one modern European language (French or German), and at least one natural science. The degrees of Bachelor of Science (B.S.), Bachelor of Philosophy (Ph.B.), and Bachelor of Letters (B.L.) are often conferred by colleges upon students who have pursued systematic courses of study which do not include Greek or the amount of Latin required for the degree of Bachelor of Arts. The best colleges give instruction which is similar in character to that given in Germany in the three upper classes of the gymnasium and in the introductory courses at the universities, in France in the two upper classes of the lycée and in the first two years of university study, and in England in the upper form of the public schools and during the years of undergraduate residence at Oxford and Cambridge. Since 1870 the colleges have developed enormously. Their resources have multiplied, the number of their students has increased by leaps and bounds, the programme of studies has broadened and deepened, the standards have been raised, and the efficiency of the instruction has greatly increased. Rigidly prescribed courses of study have given way to elective courses, and a knowledge of Greek is no longer required for the degree of A.B. at such influential colleges as Harvard, Columbia, Cornell and Williams. A strong effort is being made to have the leading colleges give but one degree, that of Bachelor of Arts, and to confer that upon those who complete any substantial course of college studies. A marked change has taken place in the attitude of the college authorities toward the students. In 1870 the college president was a paterfamilias. He knew each student and came into direct personal contact with him. The president and the faculty had supervision not only of the studies of the students, but of their moral and religious life as well. The older type of college professor was not always a great scholar, but he was a student of human nature, with keen intuitions and shrewd insight. The new type, which had come into existence at the opening of the 20th century, was more scholarly in some special direction, often regarded teaching as a check upon opportunities for investigation, and disdained troubling himself with a student’s personal concerns or intellectual and moral difficulties. The change was not altogether for the better, and a desirable reaction has been observable. Each college, however small or ill-equipped, exercises a helpful local influence. Ninety per cent of all college students attend an institution not more than one hundred miles from their own homes. Few colleges have a national constituency, and even in these cases an overwhelming preponderance of the students come from the immediate neighbourhood. This explains, in a measure, the powerful influence which the college has exercised in the life of the nation. While hardly more than one in a hundred of the white male youth of the country has had a college education, yet the college graduates have furnished one-half of all the presidents of the United States, most of the justices of the Supreme Court, about one-half of the cabinet officers and United States senators, and nearly one-third of the House of Representatives. Before the Revolution eleven colleges were founded. From 1776 to 1800, twelve more were added; from 1800 to 1830, thirty-three; from 1830 to 1865, one hundred and eighty; from 1865 to 1898, two hundred and thirty-six. Their standards, efficiency and equipment are very diverse, many of the so-called colleges being less effective than some of the better organized secondary schools. Except in New York and Pennsylvania, there is no statutory restriction upon the use of the name “college.” This is an abuse to which public attention has in recent years been increasingly called.[4]

The universities.

In the United States the title “university” is used indiscriminately of institutions which are in reality universities, of institutions which are colleges, and of institutions which are so ill-equipped as not to take rank with good secondary schools. Only time and a greatly increased capacity to distinguish the various types of higher schools will remedy this error. Putting aside tentative and unsuccessful attempts to develop genuine university instruction much earlier, it may safely be said that the opening of the Johns Hopkins University at Baltimore in 1876 began the present movement to organize carefully advanced study and research, requiring a college education of those who wish to enter upon it. This is university instruction properly so called, and though found elsewhere, it is given chiefly at fourteen institutions: California University, Catholic University of America, Chicago University, Clark University, Columbia University, Cornell University, Harvard University, Johns Hopkins University, Michigan University, Pennsylvania University, Princeton University, Leland Stanford Jr.

University, Wisconsin University and Yale University. All of these institutions, except the Catholic University of America, are also colleges. The combination of collegiate and university instruction under one corporation and one executive administration is distinctive of higher education in the United States, and its chief source of strength. The crowning honour of the university student is the degree of Ph.D., although that of A.M.—obtainable in less time and much easier conditions—is also sought. The minimum period of study accepted for the degree of Ph.D. is two years after obtaining the bachelor's degree; but in practice, three, and even four, years of study are found necessary. In addition to carrying on an investigation in the field of his main subject of study, the candidate for the degree of Ph.D. is usually required to pass examinations on one or two subordinate subjects, to possess a reading knowledge of French and German (often of Latin as well), and to submit—usually in printed form—the dissertation which embodies the results of his researches. The methods of instruction in the universities are the lecture, discussion and work in laboratory or seminary—the latter transplanted from the German universities. The degree of Master of Arts is conferred upon students who, after one year of university residence and study, pass certain prescribed examinations. This degree, like those of D.D., S.T.D. and LL.D., is often conferred by colleges and universities as a purely honorary distinction. The degree of Ph.D. is not so conferred any longer by the best universities. Not a few of the universities maintain schools of law and medicine. Harvard and Yale universities maintain schools of theology as well. The learned publications issued by the universities, or under the direction of university professors, are of great importance, and constitute an imposing body of scientific literature. The national and state governments make increasing use of university officials for public service requiring special training or expert knowledge. In 1871-1872 there were only 198 resident graduate (or university) students in the United States. In 1887 this number had risen to 1237, and in 1897 to 4392. These figures are exclusive of professional students, and include only those who are studying in what would be called, in Germany, the philosophical faculty. (See also Universities.)

Most extensive provision is made in America for professional, technical and special education of all kinds, and for the care and training of the dependent and defective classes (see Blindness and Deaf and Dumb), as well as for the education of the Indian (see Indians, North American), and—in the Southern states—of the negro (*q.v.*).

(N. M. B.)

Statistics.—Details as to education in each state of the American Union are given in the articles under state headings. But a more comprehensive view may be obtained here from the general statistics. The introduction to the statistical tables in vol. ii. of the Commissioner of Education's Report for 1907 may usefully be quoted. Mr Edward L. Thorndike, of the Teachers' College, Columbia University, there summarizes the national account as follows:—

> "We use in formal school education a material plant valued at from twelve to thirteen hundred million dollars, the labour of 550,000 teachers or other educational officers, and more or less of the time of some eighteen million students.... We pay for the labour of these teachers, many of whom work for only part of the normal city-school year, about $300,000,000. We pay for fuel, light, janitorial services, repairs, depreciation of books, school supplies, insurance and the like, about $90,000,000. For depreciation of the plant not so charged we should properly provide during the year a sinking fund of perhaps $25,000,000. Adding an interest charge of 5% on the investment in the plant, our annual bill for formal school education comes to over $475,000,000. Additions to the plant were made [in 1906-1907] to the extent of from ninety to a hundred million dollars. As a partial estimate of the returns from this investment we may take the number of students whose education has been carried to a specified standard of accomplishment and power. Thus I estimate that, in 1907, 3000 students reached the standard denoted by three years or more of academic, technical or professional study in advance of a reputable college degree; that 25,000 students reached the standard denoted by at least three and not over four years of such study in advance of a four-year high-school course; than an eighth of a million students reached the standard denoted by at least three and not over four years of study in advance of an eight-year elementary-school course; and that three-quarters of a million students reached the standard of completion of an elementary-school course of seven or eight years or its equivalent.... Roughly, nine-tenths of elementary education and the education of teachers, over two-thirds of secondary education, and over a third of college and higher technical education are provided and controlled by the public. Professional education, other than the training of teachers and engineers, is still largely a function of private provision and control.
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> "The following rough comparison may serve to define further the status of education in the country at large. The plant used for formal education is valued at 1% of our entire national wealth, or twice the value of our telephone systems, or ten times the value of our Pullman and private cars, or one-tenth the value of our railroads. The number of teachers is approximately that of the clergymen, engineers, lawyers and physicians together, five times that of the regular army and navy, and about twice that of the saloon-keepers and bar-tenders and their assistants. The annual expenditure for education, exclusive of additions to the plant, is somewhat over twice the expenditure for the war and navy departments of the national government. It is three and a half times the expenditure of the national government in 1907 for pensions. It is about one and a fourth times the cost (New York wholesale prices) of the sugar and coffee we consume annually."

The above comparison indicates perhaps, not inadequately, the "business" conception of the value of education prevailing in the United States, where its practical advantages are realized as in no other country, not even Germany.

From the same report the following statistics may be cited for 1906-1907.

Common Schools (including Elementary and Secondary Public Schools only).

Total number of pupils of all ages	16,820,386[5]
Average number of days schools open	151.2
Average number of days attended by each pupil	106.2
Number of male teachers	105,773
Number of female teachers	369,465

Number of school houses	259,115
Average monthly wage of male teachers	$56.10
Average monthly wage of female teachers	$43.67
Value of all school property	$843,309,410
Income from permanent funds and rents	$16,579,551
Income from State taxes	$46,281,501
Income from local taxes	$230,424,554
Income from other sources	$50,317,132
Expenditure on sites, buildings, furniture, libraries and apparatus	$65,817,870
Expenditure on salaries	$196,980,919
Expenditure on other purposes	$67,882,012
Expenditure per head of population	$3.90
Expenditure per pupil	$27.98

The Bureau of Education in 1907 received reports from 606 universities, colleges and technological schools; they had a teaching force of 24,679, and an enrolment of 293,343 students. The number of public and private normal schools reporting was 259, with an enrolment of 70,439 students in the regular training courses for teachers, 12,541 graduates and 3660 instructors. There were 148 manual and industrial training schools (independently of the manual training taught in the public schools and in 66 Indian schools), with 1692 teachers and an enrolment of 68,427 students; and 445 independent commercial and business schools, with 2856 instructors and 137,364 students.

(X.)

Bibliography.—For the study of education as an aspect of religious, social, moral and intellectual development, the material is practically inexhaustible, and much of the most valuable does not treat specifically of the education given in schools and colleges. The most useful guide is E.P. Cubberley's *Syllabus of Lectures on the History of Education* (1902), which consists of an analytic outline of topics with copious and detailed references to authorities. See also W.S. Monroe's *Bibliography of Education* (1897). The best general history in English is P. Monroe's *Text-Book in the History of Education* (1905), which, like Davidson's much briefer *History of Education*, treats the subject broadly and in relation to other aspects of life. Williams's *History of Ancient, Medieval, and Modern Education* is a useful statement of the main facts of educational progress taken somewhat by itself. In German the standard work is K.A. Schmid's *Geschichte der Erziehung*, a comprehensive and detailed treatment in which each period is dealt with by a specialist. Ziegler's *Geschichte der Pädagogik* is a good short history. In French, Letourneau's *L'Évolution de l'éducation* is especially good on ancient and non-European education. Draper's *Intellectual Development of Europe* is vigorous and interesting, but marred by its depreciation of the work of the Church. Guizot's *History of Civilization* is still of value, as are parts of Hallam's *Literary History*. Lecky's *History of the Rise and Influence of the Spirit of Rationalism in Europe*, and Buckle's *History of Civilization* in England, contain much that is of value. The best encyclopaedias are W. Rein's *Encyklopädisches Handbuch der Pädagogik*, and F. Buisson's *Dictionnaire de pédagogie, première partie*. Sir Henry Craik's *The State and Education* (1883) is an excellent text-book on national education.

Of books dealing with special periods and topics, S. Laurie's *Historical Sketch of Pre-Christian Education*, Freeman's *Schools of Hellas*, Girard's *L'Éducation athénienne au V^e^ et au IV^e^ siècle avant* J.-C., Davidson's *Education of the Greek People*, Mahaffy's *Old Greek Education* and *Greek Life and Thought*, Nettleship's article on "Education in Plato's Republic" in *Hellenica*, Capes's *University Life in Athens*, Hobhouse's *Theory and Practice of Ancient Education*, Grasberger's *Erziehung und Unterricht im classischen Alterthum*, Wilkin's *Roman Education*, and Clarke's *Education of Children at Rome*, are valuable for classical times.

For the somewhat obscure transition centuries there is much of value in Taylor's *Classical Heritage of the Middle Ages*, Dill's *Roman Society in the Last Century of the Western Empire*, especially the chapter on "Culture in the 4th and 5th centuries," Boissier's *La Fin du paganisme*, and Hatch's *Influence of Greek Thought upon the Christian Church*.

The best general account of medieval education is in Drane's *Christian Schools and Scholars*; and J.B. Mullinger's *Schools of Charles the Great* treats well of the Carolingian Revival. G.B. Adams's *Civilization during the Middle Ages* is excellent; and Sandys's *History of Classical Scholarship* is a valuable book of reference. On the scholastic philosophy Turner's *History of Philosophy*, and Hauréau's *Histoire de la philosophie scolastique*, are useful. Medieval schools are described in Furnivall's preface to *The Babees Book*, which deals with "Education in Early England," and in Leach's *Old Yorkshire Schools* and *History of Winchester College*. The most important books on the universities are Rashdall's *Universities of Europe in the Middle Ages*, Jourdain's *Histoire de l'université de Paris aux XVII^e^ et XVIII^e^ siècles*, Lyte's *History of the University of Oxford to 1530*, and Mullinger's *History of the University of Cambridge to the Accession of Charles I.* Paulsen's *Geschichte des gelehrten Unterrichts auf den deutschen Schulen und Universitäten* is the best history of education in Germany.

On the Renaissance in Italy, Villari's Introduction to his *Life and Times of Machiavelli*, and Burckhardt's *Die Kultur der Renaissance in Italien* (translated into English), are of the first importance. Other valuable books are the first volume of the *Cambridge Modern History* and Symonds's great work on *The Renaissance in Italy*, especially the volume on *The Revival of Learning*. Dealing more specifically with education are Woodward's excellent monographs on *Education during the Renaissance*, *Vittorino da Feltre* and *Erasmus*. Janssen's *Geschichte des deutschen Volkes* (translated into English) gives a good account of the social and intellectual condition of Germany in the 14th, 15th and 16th centuries. Christie's *Life of Étienne Dolet* is of value for the Renaissance in France. For the movement in England Seebohm's *Oxford Reformers*, Gasquet's *Eve of the Reformation in England*, Einstein's *The Italian Renaissance in England*, and Leach's *English Schools at the Reformation, 1546-1548*, are particularly important.

For later times the material is chiefly in the form of monographs, of which the following, among others, are of value: Adamson's *Pioneers of Modern Education*, Laas's *Die Pädagogik des Johannes Sturm*, Beard's *Port Royal*, vol. ii., Kuno Fischer's *Fr. Bacon und seine Nachfolger*, Laurie's *John Amos Comenius*, Morley's *Rousseau*, Pinloche's *La Réforme de l'éducation en Allemagne au dix-huitième siècle*, Biedermann's *Deutschlands geistige, sittliche, und gesellige Zustände im XVIII. Jahrhundert*.

For the 19th century and after, the best sources of information are the official Reports, such as those of the Royal Commissions on the English Universities, the Public Schools, and the other English secondary schools; the "Special Reports," issued by the English Board of Education; the encyclopaedic annual Reports of the American Commissioner of Education (dealing not only with the United States, but with progress in other countries); monographs in the French *Musée pédagogique*, and various German Reports.

For education in the United States, see also Boone's *History of Education in U.S.A.* (1889); N.M. Butler (editor), *Education in the U.S.A.* (1900), a series of monographs prepared for the Paris Exposition; E.G. Dexter's *History of Education in the United States* (1904); and the *Proceedings* of the National Educational Association.

On the leading writers on education the monographs in the Great Educator Series are useful, and editions and translations of the best known of these writers are available. The greatest systematic collection is the *Monumenta Germaniae paedagogica*. On the development of the means of education, Montmorency's two books on *State Intervention in English Education from the Earliest Times to 1833*, and *The Progress of Education in England*, Balfour's *Educational Systems of Great Britain and Ireland*, Allain's *L'Instruction primaire en France avant la Révolution*, Lantoine's *Histoire de l'enseignement secondaire en France au XVIII^e^ et au début du XVIII^e^ siècle*, and Konrad Fischer's *Geschichte des deutschen Volkschullehrerstands*, may be mentioned.

(J. Wn.)

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1 For the evolution of the school as such from early times see Schools.

2 See especially *Das öffentliche Unterrichtswesen Deutschlands*, by Dr Paul Stötzner (Leipzig, 1901).

3 A valuable bibliography of Mr Harris's contributions to educational literature is given in the Report of the Commissioner of Education for 1907 (Washington, 1908).

4 See especially the second Annual Report of the President of the Carnegie Foundation for the Advancement of Teaching (pp. 76-80), quoted in the Report for 1907 of the Commissioner of Education.

5 In private schools there were also 1,304,547 pupils.

EDWARD, "The Elder" (d. 924), king of the Angles and Saxons, was the second son of Alfred the Great, and with his sister Æthelflæd was carefully educated at the court of his father. During his father's lifetime he took an active part in the campaigns against the Danes, especially in that of 894, and as early as 898 he signs a charter as "rex," showing that he was definitely associated with his father in the kingship. He succeeded his father in October 899,[1] but not without opposition. The Ætheling Æthelwold, son of Alfred's elder brother Æthelred, seized Wimborne and Christchurch. Edward advanced against him, and Æthelwold took refuge among the Danes in Northumbria. In 904 Æthelwold landed in Essex, and in the next year he enticed the East Anglian Danes to revolt. They ravaged all southern Mercia and, in spite of Edward's activity, returned home victorious, though Æthelwold fell in the battle of the Holme. In 905 or 906 Edward made a peace with the East Anglian and Northumbrian Danes at "Yttingaford," near Linslade in Buckinghamshire, perhaps the peace known as "the Laws of Edward and Guthrum." In 909 and 910 fresh campaigns took place owing to southerly raids by the Danes, and victories were won at Tettenhall and Wednesfield in Staffordshire.[2] From 907 onwards Edward and his sister Æthelflæd, the Lady of the 990
Mercians, were busy strengthening their hold on Mercia and Wessex. Forts were built at Lincoln (907), "Bremesbyrig" (910), "Scergeat" and Bridgenorth (912), and when in the year 911 Æthelflæd's husband Æthelred died, Edward took over from Mercia the government of London and Oxford, with the lands belonging to them, *i.e.* probably Oxfordshire and Middlesex. The policy of constructing "burhs" or fortified towns was continued. Hertford was fortified in 911, Witham in 912, while Æthelflæd fortified Cherbury in Shropshire, "Weardbyrig" and Runcorn (all in 915). In 913 the Danes in Eastern Mercia gave considerable trouble, and in 914 a fresh horde of pirates, coming from Brittany, sailed up the Severn. They raided southern Wales, but were hemmed in by the English forces and besieged until they promised to leave the king's territory. Edward watched the southern shores of the Bristol Channel so carefully that the Danes failed to secure a hold there, and were ultimately forced to sail to Ireland. In the same year Edward fortified Buckingham and received the submission of the jarls and chief men of Bedford. In 915 he fortified Bedford itself, Maldon in 916, and Towcester and "Wigingamere" in 917. In the last-mentioned year Edward captured and destroyed the Danish stronghold of Tempsford, and later in the year he took Colchester. An attack by the Danes on Maldon failed, and in 915 Edward went to Passenham and received the submission of the men of the "borough" of Northampton. The Danish strongholds of Huntingdon and Colchester were now restored and repaired, and Edward received the submission of the whole of the East Anglian Danes. Before midsummer of this year Edward had fortified Stamford, and on the death of his sister he received the submission of the Mercians at Tamworth. There also three kings of the North Welsh took Edward as their lord. Nottingham was now fortified; Thelwall in Cheshire (919) and Manchester soon followed; Nottingham was strengthened by a second fort; Bakewell was fortified and garrisoned, and then came the greatest triumph of Edward's reign. He was "chosen as father and lord" by the Scottish king and nation, by Rægenald, the Norwegian king of Northumbria, by Ealdred of Bamborough, and by the English, Danes or Norwegians in Northumbria, and by the Strathclyde Welsh.

With the conclusion of his wars Edward's activity ceased, and we hear no more of him until in 924 he died at Farndon in Cheshire and was buried in the "New Minster" at Winchester. He was thrice married: (1) to Ecgwyn, a lady of rank, by whom he had a son Æthelstan, who succeeded him, and a daughter Eadgyth, who married Sihtric of Northumbria in 924. This marriage was probably an irregular one. (2) To Ælflæd, by whom he had two sons—Ælfweard, who died a fortnight after his father, and Eadwine, who was drowned in

933—and six daughters, Æthelflæd and Æthelhild nuns, and four others (see ÆTHELSTAN). (3) To Eadgifu, the mother of Kings Edmund and Edred, and of two daughters.

AUTHORITIES.—*Anglo-Saxon Chronicle* (ed. Plummer and Earle, Oxford); Florence of Worcester (Mon. Hist. Brit.); William of Malmesbury, *Gesta regum* (Rolls Series); Simeon of Durham (Rolls Series); Ethelweard (Mon. Hist. Brit.); Birch, *Cartularium Saxonicum*, Nos. 588-635; *D.N.B.*, s.v.

(A. MW.)

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1 See Stevenson's article in *Eng. Hist. Rev.* vol. xiii. pp. 71-77. The whole chronology of this reign is very difficult and certainly is often impossible of attainment.

2 It is possible that these battles are one and the same; the places are within 2 to 3 m. of each other.

EDWARD, "THE MARTYR" (*c.* 926-978), king of the English, was the son of Edgar by his wife Æthelflæd. Edward's brief reign was marked by an anti-monastic reaction. Ælfhere, earl of Mercia, once more expelled many of the monks whom Bishop Æthelwold had installed. There seems also to have been some change in administrative policy, perhaps with regard to the Danes, for Earl Oslac, whom Edgar had appointed to Northumbria, was driven from his province. In ecclesiastical matters there were two parties in the kingdom, the monastic, which had its chief hold in Essex and East Anglia, and the anti-monastic, led by Ælfhere of Mercia. Conferences were held at Kirtlington in Oxfordshire and at Calne in Wiltshire in 977 and 978, but nothing definite seems to have been decided. On the 18th of March 978 Edward's reign was suddenly cut short by his assassination at Corfe Castle in Dorsetshire. The crime was probably inspired by his stepmother, Ælfthryth, who was anxious to secure the succession of her son Æthelred. The body was hastily interred at Wareham and remained there till 980, when Archbishop Dunstan and Ælfhere of Mercia united in transferring it with great ceremony to Shaftesbury. Edward seems to have been personally popular, and the poem on his death in the chronicle calls his murder the worst deed in English history. Very shortly after his death he was popularly esteemed to be both saint and martyr.

See *Saxon Chronicle*; *Vita S. Oswaldi* (*Hist. of Ch. of York*, Rolls Series); *Memorials of St Dunstan* (ed. Stubbs, Rolls Series).

(A. MW.)

EDWARD, "THE CONFESSOR" (d. 1066), so called on account of his reputation for sanctity, king of the English, was the son of Æthelred II. and Emma, daughter of Richard, duke of Normandy, and was born at Islip in Oxfordshire. On the recognition of Sweyn as king of England in 1013, Æthelred, with his wife and family, took refuge in Normandy, and Edward continued to reside at the Norman court until he was recalled in 1041 by Hardicanute. He appears to have been formally recognized as heir to the throne, if not actually associated in the kingship, and on the death of Hardicanute in 1042 "all folk received him to be king," though his actual coronation was delayed until Easter 1043. A few months later Edward, in conjunction with the three great earls of the kingdom, made a raid on the queen-mother Ælfgifu, or Emma, seized all her possessions and compelled her to live in retirement.

In the earlier years of the reign the influence of Earl Godwine was predominant, though not unopposed. His daughter Edith or Eadgyth became Edward's queen in 1045. But the king's personal tastes inclined much more to foreigners than to Englishmen, and he fell more and more into the hands of favourites from beyond the sea. Between Godwine, representing the spirit of nationalism, and these favourites (especially their leader Robert of Jumièges, successively bishop of London and archbishop of Canterbury) there was war to the knife. In 1046 Magnus, king of Norway, who had succeeded Hardicanute in Denmark and claimed to succeed him in England as well, threatened an invasion, but the necessity of defending Denmark against his rival Sweyn Estrithson prevented him from carrying it into effect. In 1049, Godwine's son Sweyn, who had been outlawed for the seduction of the abbess of Leominster, returned and demanded his restoration. This was refused and Sweyn returned into exile, but not before he had with foulest treachery murdered his young kinsman Beorn. He was, however, inlawed next year. The influence of Godwine, already shaken, received a severe blow in 1051 in the appointment of Robert of Jumièges to the archbishopric of Canterbury, and the same year saw the triumph of the foreigners for the moment complete. Edward, indignant at the resistance offered by the men of Dover to the insolence of his brother-in-law Eustace of Boulogne and his French followers, ordered Godwine to punish the town. Godwine refused. The king at the prompting of the archbishop then summoned a meeting of the witan, at which the old charge against Godwine of complicity in the murder of the Ætheling Alfred was to be revived. About the same time came news of a fresh outrage by the foreigners. Godwine gathered his forces and demanded redress, while the earls Leofric of Mercia and Siward of Northumbria hastened to the side of the king. Civil war seemed imminent, but at length a compromise was effected by which the matter was referred to a meeting of the witan to be held at London. At the appointed time Godwine presented himself at Southwark. But his followers were rapidly deserting him, nor would the king give hostages for his security. Alarmed for his safety, he fled to Flanders, while his son Harold went to Ireland. But their exile was brief. The tale of Godwine excited universal sympathy, for it was realized that he represented the cause of national independence. Encouraged by assurances from England, he sailed thither, and joining forces with Harold sailed along the south coast and up the Thames. The king would have resisted but found no support. Yielding to circumstances, he allowed himself to be

reconciled, and Godwine and his house were restored to their old position. The queen at the same time was brought back from the monastery of Wherwell, whither she had been despatched after her father's flight. The foreigners had already ignominiously fled the country, and henceforth the influence of Godwine, and, after his death, of Harold, was supreme. In 1063 Harold made a great expedition into Wales, in which he crushed the power of King Gruffyd, who was killed by his own people. But despite his prowess and his power, he was the minister of the king rather than his personal favourite. This latter position belonged to his younger brother Tostig, who on the death of Siward in 1055 was appointed earl of Northumbria. Here his severity and arbitrary temper rendered him intensely unpopular, and in 1065 his subjects broke into revolt. They elected Morkere as their earl, then marching south demanded Tostig's banishment. Edward desired to crush the revolt by force of arms, but he was overborne and forced to submit. The election of Morkere was recognized, and Tostig went into exile. Intensely mortified at this humiliation, the king fell sick, and henceforth his health failed rapidly. He was unable to gratify his intense desire to be present at the consecration of his new abbey of Westminster, the foundation of which had been the chief interest of his closing years, and on the 5th of January 1066 he died.

The virtues of Edward were monkish rather than kingly. In the qualities of a ruler he was conspicuously deficient; always dependent on others, he ever inclined to the unworthier master. But the charm of his character for the monastic biographer, and the natural tendency to glorify the days before the Norman oppression began, combined to cast about his figure a halo which had not attached to it in life. Allowed to keep her property by William the Conqueror, his widow, Edith, passed the remainder of her life at Winchester, dying on the 19th of December 1075.

Sources.—A number of lives of Edward are brought together in a volume of the Rolls Series entitled *Lives of Edward the Confessor*, and edited by Dr H.R. Luard (London, 1858). Of these by far the most valuable is the contemporary *Vita Edwardi*, which would appear from internal evidence to have been written by an unknown writer soon after the Norman Conquest—some time between 1066 and 1074. The other chief authorities for the reign are (1) the *Saxon Chronicle*, (C. Plummer, Oxford, 1892-1899); (2) *Florence of Worcester*, ed. B. Thorpe, English Historical Society (London, 1848-1849). Reference may also be made to J.M. Kemble, *Codex diplomaticus aevi Saxonici* (London, 1839-1848).

(C. S. P.*)

EDWARD I. (1239-1307), king of England, born at Westminster on the 17th of June 1239, was the eldest son of Henry III. and Eleanor of Provence. He was baptized Edward after Edward the Confessor, for whom Henry had special veneration, and among his godfathers was Simon de Montfort, earl of Leicester, his aunt Eleanor's husband. His political career begins when the conclusion of a treaty with Alphonso X. of Castile, by which he was to marry the Spanish king's half sister Eleanor, necessitated the conferring on him of an adequate establishment. His father granted him the duchy of Gascony, the earldom of Chester, the king's lands in Wales and much else. The provision made was so liberal that Henry's subjects declared he was left no better than a mutilated king. In May 1254 Edward went to Gascony to take possession of his inheritance. He then crossed the Pyrenees, and in October was dubbed knight by Alphonso and married to Eleanor at the Cistercian convent of Las Huelgas, near Burgos. He remained in Gascony till November 1255, but his father was too jealous to allow him a free hand in its administration. After his return, the attempts of his agents to establish English laws in his Welsh possessions brought Edward into hostile relations with the Welsh. Here also his father would give him no help, and his first campaign brought him little result. Edward became extremely unpopular through his association with his Lusignan kinsfolk, his pride and violence, and the disorders of his household. In 1258 his strenuous opposition to the Provisions of Oxford further weakened his position, but, after the banishment of the foreigners, he began to take up a wiser line. In 1259 he led the young nobles who insisted that the triumphant oligarchy should carry out the reforms to which it was pledged. For a moment it looked as if Edward and Leicester might make common cause, but Edward remained an enemy of Montfort, though he strove to infuse his father's party with a more liberal and national spirit. He was the soul of the reconstituted royalist party formed about 1263. In 1264 he took a prominent part in the fighting between the king and the barons. At the battle of Lewes his rash pursuit of the Londoners contributed to his father's defeat. Two days later Edward surrendered to Leicester as a hostage for the good behaviour of his allies. He was forced to give up his earldom of Chester to Leicester, but at Whitsuntide 1265 he escaped from his custodians, and joined the lords of the Welsh march who were still in arms. With their aid he defeated and slew Leicester at Evesham on the 4th of August 1265.

For the rest of Henry III.'s reign Edward controlled his father's policy and appropriated enough of Leicester's ideals to make the royalist restoration no mere reaction. So peaceful became the outlook of affairs that in 1268 Edward took the cross, hoping to join the new crusade of St Louis. Want of money delayed his departure till 1270, by which time St Louis was dead, and a truce concluded with the infidel. Refusing to be a party to such treason to Christendom, Edward went with his personal followers to Acre, where he abode from May 1271 to August 1272. Despite his energy and valour he could do little to prop up the decaying crusading kingdom and he narrowly escaped assassination. At last the declining health of his father induced him to return to the West. He learned in Sicily the death of Henry III. on the 16th of November 1272. On the 20th of November, the day of Henry's funeral, he was recognized as king by the English barons, and from that day his regnal years were subsequently computed. Affairs in England were so peaceful that Edward did not hurry home. After a slow journey through Italy and France he did homage to his cousin Philip III. at Paris, on the 26th of July 1273. He then went to Gascony, where he stayed nearly a year. At last he landed at Dover on the 2nd of August 1274, and was crowned at Westminster on the 18th of the same month.

Edward was thirty-five years old when he became king, and the rude schooling of his youth had developed

his character and suggested the main lines of the policy which he was to carry out as monarch. He was a tall, well-proportioned and handsome man, extravagantly devoted to military exercises, tournaments and the rougher and more dangerous forms of hunting. He had learned to restrain the hot temper of his youth, and was proud of his love of justice and strict regard to his plighted word. His domestic life was unstained, he was devoted to his friends, and loyal to his subordinates. Without any great originality either as soldier or statesman, he was competent enough to appropriate the best ideas of the time and make them his own. His defects were a hardness of disposition which sometimes approached cruelty and a narrow and pedantic temper, which caused him to regard the letter rather than the spirit of his promises. His effectiveness and love of strong government stand in strong contrast to his father's weakness. Though he loved power, and never willingly surrendered it, he saw that to be successful he must make his policy popular. Thus he continued the system which Montfort had formed with the object of restraining the monarchy, because he saw in a close alliance with his people the best means of consolidating the power of the crown.

The first years of Edward's reign were mainly occupied by his efforts to establish a really effective administration. In carrying out this task he derived great help from his chancellor, Robert Burnell, bishop of Bath and Wells. Administrative reform soon involved legislation, and from 1275 to 1290 nearly every year was marked by an important law. Few of these contained anything that was very new or original. They rather illustrate that policy which caused Dr Stubbs to describe his reign as a "period of definition." Yet the results of his conservative legislation were almost revolutionary. In particular he left the impress of his policy on the land laws of England, notably by the clause *De Donis* of the Westminster statute of 1285, and the statute *Quia Emptores* of 1290. The general effect of his work was to eliminate feudalism from political life. At first he aimed at abolishing all franchises whose holders could not produce written warranty for them. This was the policy of the statute of Gloucester of 1278, but the baronial opposition was so resolute that Edward was forced to permit many immunities to remain. Though the most orthodox of churchmen, his dislike of authority not emanating from himself threatened to involve him in constant conflict with the Church, and notably with John Peckham, the Franciscan friar, who was archbishop of Canterbury from 1279 to 1292. The statute of Mortmain of 1279, which forbade the further grant of lands to ecclesiastical corporations without the royal consent, and the writ *Circumspecte Agatis* of 1285, which limited the church courts to strictly ecclesiastical business, both provoked strong clerical opposition. However, Peckham gave way to some extent, and Edward prudently acquiesced in many clerical assumptions which he disliked. He was strong enough to refuse to pay the tribute to Rome which John had promised, and his reign saw the end of that papal overlordship over England which had greatly complicated the situation under his father.

Besides administration and legislation, the other great event of the first fifteen years of Edward's reign was the conquest of the principality of Wales. It was part of Edward's policy of reconciliation after the battle of Evesham that in the treaty of Shrewsbury of 1267 he had fully recognized the great position which Llewelyn ab Gruffyd, prince of Wales, had gained as the ally of Simon de Montfort. However, Llewelyn's early successes had blinded the Welsh prince to the limitations of his power, and he profited by Edward's early absences from England to delay in performing his feudal obligations to the new king. Even after Edward's return Llewelyn continued to evade doing homage. At last Edward lost patience, and in 1277 invaded north Wales. He conducted his campaign like a great siege, blocking all the avenues to Snowdon, and forcing Llewelyn to surrender from lack of supplies. He thereupon reduced the Welsh prince to the position of a petty north Welsh chieftain strictly dependent on the English. For the next five years Edward did his best to set up the English system of government in the ceded districts. The Welsh resentment of this soon gave Llewelyn another chance, and compelled Edward to devote the years 1282-1283 to completing his conquest. In 1284 he issued the statute of Wales, which provided for a scheme for the future government of the principality. Edward is often called the conqueror of Wales, but in truth he only effected the conquest of Llewelyn's dominions. The march of Wales was only indirectly affected by his legislation, and remained subject to its feudal marcher lords until the 16th century.

Edward was very careful in his foreign policy. Though preserving nominal peace with his cousin Philip III. of France, his relations with that country were constantly strained. After Philip III.'s death in 1285, Edward crossed the Channel in 1286, to perform homage to his successor, Philip the Fair. He remained abroad till 1289, busied in attempts to improve the administration of Gascony, and making repeated and finally successful efforts to end by his mediation the still continuing struggle between the houses of Anjou and Aragon. His long absence threw the government of England into confusion, and on his return in 1289 he was compelled to dismiss most of his judges and ministers for corruption. In 1290 he expelled all Jews from England.

The affairs of Scotland furnished Edward with his chief preoccupation for the rest of his reign. After the death of Alexander III., in 1286, Scotland was governed in the name of his granddaughter Margaret, the Maid of Norway. The English king had suggested that Edward of Carnarvon, his eldest surviving son, should marry the little queen of Scots, and thus bring about the union of the two countries. Unluckily the death of Margaret in 1290 frustrated the scheme. The Scottish throne was now disputed by many claimants, and the Scots asked Edward to arbitrate between them. Edward accepted the position, but insisted that, before he acted, the Scots should recognize him as their overlord. The claimants set the example of submission, and soon the chief Scots nobles followed. Thereupon Edward undertook the arbitration, and in 1292 adjudged the throne to John Baliol. The new king did homage to Edward, but his subjects soon began to resent the claims of jurisdiction over Scotland, which Edward declared were the natural results of his feudal supremacy. At last the Scots deprived John of nearly all his power, repudiated Edward's claims, and made an alliance with the French. During the years of the Scottish arbitration Edward had slowly been drifting into war with France. The chronic difficulties caused by French attempts to confine Edward's power in Gascony were now accentuated by the quarrels between the sailors and merchants of the two countries. In 1293 Edward was persuaded by his brother, Edmund, earl of Lancaster, to yield up Gascony temporarily to Philip the Fair. But Philip refused to restore the duchy, and Edward, seeing that he had been tricked, declared war against France, at the very moment when the Scottish resistance gave the French a firm ally in Britain. To make matters worse, the Welsh rose in rebellion. It was therefore quite impossible for Edward to recover

Gascony.

The most critical years of Edward's reign now began. He saw that he could only meet his difficulties by throwing himself on the support of his own subjects, and convoked, in 1295, a representative parliament of the three estates, which has been called in later times the Model Parliament, because it first illustrated the type which was to be perpetuated in all subsequent parliaments. "What touches all," ran Edward's writ of summons, "should be approved of all, and it is also clear that common dangers should be met by measures agreed upon in common." The parliamentary constitution of England was established as the result of Edward's action.

Secure of his subjects' allegiance, Edward put down the Welsh revolt, and conquered Scotland in 1296. When quiet was restored to Britain, he hoped to throw all his energy into the recovery of Gascony, but new troubles arose at home which once more diverted him from his supreme purpose. Led by Archbishop Winchelsea, Peckham's successor, the clergy refused to pay taxes in obedience to the bull of Pope Boniface VIII., called *Clericis Laicos*. Edward declared that if the clergy would not contribute to support the state, the state could afford them no protection. But the clerical opposition was soon joined by a baronial opposition. Headed by the earls of Hereford and Norfolk, many of the barons declined to join in an expedition to Gascony, and Edward was forced to sail to the French war, leaving them behind. Thereupon the recalcitrant barons forced upon the regency a fresh confirmation of the charters, to which new articles were added, safeguarding the people from arbitrary taxation. Edward at Ghent reluctantly accepted this *Confirmatio Cariarum*, but even his submission did not end the crisis. In the same year (1297), all Scotland rose in revolt under the popular hero William Wallace, and next year (1298), Edward was forced to undertake its reconquest. The battle of Falkirk, won on the 22nd of July, was the greatest of Edward's military triumphs; but, though it destroyed the power of Wallace, it did not put an end to Scottish resistance. Bitter experience taught Edward that he could not fight the French and the Scots at the same time, and in 1299 he made peace with Philip, and, Eleanor having died in November 1290, he married the French king's sister Margaret (*c.* 1282-1318), and some years later obtained the restitution of Gascony. In the same spirit he strove to destroy the clerical and baronial opposition. He did not succeed in the former task until a complacent pope arose in his own subject, Clement V., who abandoned Winchelsea to his anger, and suffered the archbishop to be driven into exile. The baronial leaders could not be wholly overthrown by force, and Edward was compelled to make them fresh concessions.

It was not until 1303 that Edward was able to undertake seriously the conquest of Scotland. By 1305 the land was subdued, and Wallace beheaded as a traitor. But Edward had hardly organized the government of his new conquest when a fresh revolt broke out under Robert Bruce, grandson of the chief rival of Baliol in 1290. Bruce was soon crowned king of Scots, and at the age of seventy Edward had to face the prospect of conquering Scotland for the third time. He resolved to take the field in person; but the effort was too great, and on the 7th of July 1307 he died at Burgh-on-Sands, near Carlisle. His death destroyed the last faint hope of conquering Scotland, and showed that the chief ambition of his life was a failure. Yet his conquest of Wales, his legislation, his triumph over his barons, his ecclesiastics, and the greatest of French medieval kings indicate the strength and permanence of his work. He was buried at Westminster under a plain slab on which was inscribed *Edwardus primus Scottorum malleus hic est. Pactum serva.*

By Eleanor of Castile Edward had four sons, his successor Edward II. and three who died young, and nine daughters, including Joan, or Joanna (1272-1307), the wife of Gilbert de Clare, earl of Gloucester (d. 1295), and then of Ralph de Monthermer; Margaret (1275-1318), the wife of John II., duke of Brabant; and Eleanor (1282-1316), who married John I., count of Holland, and then Humphrey Bohun, earl of Hereford (d. 1322). By Margaret of France the king had two sons: Thomas of Brotherton, earl of Norfolk, and Edmund of Woodstock, earl of Kent.

The principal modern authorities for this reign are: W. Stubbs, *Constitutional History of England*, vol. ii. chaps. xiv. and xv. (1896); T.F. Tout, *Edward I.* (1893), and *Political History of England, 1216-1377*, pp. 136-235 (1905); R.B. Seeley, *Life and Reign of Edward I.* (1872); R. Pauli, *Geschichte von England*, iv. pp. 1-198 (Hamburg, 1864-1875); W. Hunt, article on "Edward I." in *Dictionary of National Biography*; J.E. Morris, *Welsh Wars of Edward I.* (Oxford, 1901); and C.V. Langlois's *Philippe le Hardi* (Paris, 1887).

(T. F. T.)

EDWARD II. (1284-1327), "of Carnarvon," king of England, the fourth son of Edward I. by his first wife Eleanor of Castile, was born at Carnarvon Castle on the 25th of April 1284. The story that the king presented the new-born child to the Welsh as their future native prince is quite unfounded, for Edward was only made prince of Wales in the Lincoln parliament of 1301. When a few months old, he became by his elder brother's death the heir to the throne, and Edward I. took great pains to train him in warfare and statecraft. He took part in several Scots campaigns, but all his father's efforts could not prevent his acquiring the habits of extravagance and frivolity which he retained all through his life. The old king attributed his son's defects to the bad influence of his friend, the Gascon knight Piers Gaveston, and drove the favourite into exile. When Edward I. died, on the 7th of July 1307, the first act of the prince, now Edward II., was to recall Gaveston. His next was to abandon the Scots campaign on which his father had set his heart.

The new king was physically almost as fine a man as Edward I. He was, however, destitute of any serious purpose, and was, as Dr Stubbs says, "the first king after the Conquest who was not a man of business." He cared for nothing but amusing himself, and found his chief delight in athletics and in the practice of mechanical crafts. He was not so much vicious as foolish, and wanting in all serious interests. He had so little confidence in himself that he was always in the hands of some favourite who possessed a stronger will

than his own. In the early years of his reign Gaveston held this role, acting as regent when Edward went to France—where, on the 25th of January 1308, he married Isabella, the daughter of Philip the Fair—and receiving the earldom of Cornwall with the hand of the king's niece, Margaret of Gloucester. The barons soon grew indignant at Edward's devotion to his "brother Piers," and twice insisted on his banishment. On each occasion Edward soon recalled his friend, whereupon the barons, headed by the king's cousin Thomas, earl of Lancaster, went to war against king and favourite, and in 1312 treacherously put Gaveston to death. Edward was not strong enough even to avenge his loss. He was forced to stand aside and suffer the realm to be governed by the baronial committee of twenty-one lords ordainers, who, in 1311, had drawn up a series of ordinances, whose effect was to substitute ordainers for the king as the effective government of the country. But in all the ordinances nothing was said about the commons and lower clergy. Parliament meant to the new rulers an assembly of barons just as it had done to the opponents of Henry III. in 1258. The effect of their triumph was to change England from a monarchy to a narrow oligarchy.

During the quarrels between Edward and the ordainers, Robert Bruce was steadily conquering Scotland. His progress was so great that he had occupied all the fortresses save Stirling, which he closely besieged. The danger of losing Stirling shamed Edward and the barons into an attempt to retrieve their lost ground. In June 1314 Edward led a great army into Scotland in the hope of relieving Stirling. On the 24th of June his ill-disciplined and badly led host was completely defeated by Robert Bruce at Bannockburn. Henceforth Bruce was sure of his position as king of Scots, and his pitiless devastation of the northern counties of England was his wild vengeance for the sufferings his land had previously experienced from the English. Edward's disgraceful defeat made him more dependent on his barons than ever. His kinsman, Thomas of Lancaster, had now an opportunity of saving England from the consequences of the king's incompetence. He had shown some capacity as a leader of opposition, but though he had great wealth, and was lord of five earldoms, he had small ability and no constructive power. In his desire to keep the king weak, he was suspected to have made a secret understanding with Robert Bruce. Before long the opposition split up under his incompetent guidance into fiercely contending factions. Under Aymer of Valence, earl of Pembroke, a middle party arose, which hated Lancaster so much that it supported the king to put an end to Lancaster's rule. After 1318 the effect of its influence was to restore Edward to some portion of his authority. However, the king hated Pembroke almost as much as Lancaster. He now found a competent adviser in Hugh le Despenser, a baron of great experience. What was more important to him, he had in Despenser's son, Hugh le Despenser the younger, a personal friend and favourite, who was able in some measure to replace Gaveston. The fierce hatred which the barons manifested to the Despensers showed that they could hate a deserter as bitterly as they had hated the Gascon adventurer. They were indignant at the favours which Edward lavished upon the favourite and his father, and were especially alarmed when the younger Despenser strove to procure for himself the earldom of Gloucester in right of his wife, Edward's niece.

At last, in 1321, the barons met in parliament, and under Lancaster's guidance procured the banishment of the Despensers. The disasters of his friends inspired Edward to unwonted activity. In 1322 he recalled them from exile, and waged war against the barons on their behalf. Triumph crowned his exertions. Lancaster, defeated at Boroughbridge, was executed at Pontefract. For the next five years the Despensers ruled England. Unlike the ordainers, they took pains to get the Commons on their side, and a parliament held at York in 1322 revoked the ordinances because they trenched upon the rights of the crown, and were drawn up by the barons only. From this time no statute was technically valid unless the Commons had agreed to it. This marks the most important step forward in Edward II.'s reign. But the rule of the Despensers soon fell away from this wise beginning. They thought only of heaping up wealth for themselves, and soon stirred up universal indignation. In particular, they excited the ill-will of the queen, Isabella of France. Craftily dissembling her indignation, Isabella kept silence until 1325, when she went to France in company with her eldest son, Edward of Windsor, who was sent to do homage for Aquitaine to her brother, the new French king. When her business was over, Isabella declined to return to her husband as long as the Despensers remained his favourites. She formed a criminal connexion with Roger Mortimer of Wigmore, one of the baronial exiles, and in September 1326 landed in Essex accompanied by Mortimer and her son, declaring that she was come to avenge the murder of Lancaster, and to expel the Despensers. Edward's followers deserted him, and on the 2nd of October he fled from London to the west, where he took refuge in the younger Despenser's estates in Glamorgan. His wife followed him, put to death both the Despensers, and, after a futile effort to escape by sea, Edward was captured on the 16th of November. He was imprisoned at Kenilworth Castle, and a parliament met at Westminster in January 1327, which chose his son to be king as Edward III. It was thought prudent to compel the captive king to resign the crown, and on the 20th of January Edward was forced to renounce his office before a committee of the estates. The government of Isabella and Mortimer was so weakly established that it dared not leave the deposed king alive. On the 3rd of April he was secretly removed from Kenilworth and entrusted to the custody of two dependants of Mortimer. After various wanderings he was imprisoned at Berkeley Castle in Gloucestershire. Every indignity was inflicted upon him, and he was systematically ill-treated in the hope that he would die of disease. When his strong constitution seemed likely to prevail over the ill-treatment of his enemies he was cruelly put to death on the 21st of September. It was announced that he had died a natural death, and he was buried in St Peter's Abbey at Gloucester, now the cathedral, where his son afterwards erected a magnificent tomb.

Edward's wife, Isabella (*c.* 1292-1358), bore him two sons, Edward III. and John of Eltham, earl of Cornwall (1316-1336), and two daughters, Isabella and Joanna (1321-1362), wife of David II., king of Scotland. After the execution of her paramour, Roger Mortimer, in 1330, Isabella retired from public life; she died at Hertford on the 23rd of August 1358.

See R. Pauli, *Geschichte von England*, iv. pp. 199-306; T.F. Tout, *Political History of England*, 1216-1307, pp. 236-304, and article in *Dictionary of National Biography*; W. Stubbs, *Constitutional History*, vol. ii. pp. 319-386, and *Introductions to Chronicles of the Reigns of Edward I. and Edward II.* in Rolls series.

(T. F. T.)

EDWARD III. (1312-1377), “of Windsor,” king of England, eldest son of Edward II. and Isabella of France, was born at Windsor on the 13th of November 1312. In 1320 he was made earl of Chester, and in 1325 duke of Aquitaine, but he never received the title of prince of Wales. Immediately after his appointment to Aquitaine, he was sent to France to do homage to his uncle Charles IV., and remained abroad until he accompanied his mother and Mortimer in their expedition to England. To raise funds for this he was betrothed to Philippa, daughter of the count of Hainaut. On the 26th of October 1326, after the fall of Bristol, he was proclaimed warden of the kingdom during his father’s absence. On the 13th of January 1327 parliament recognized him as king, and he was crowned on the 29th of the same month.

For the next four years Isabella and Mortimer governed in his name, though nominally his guardian was Henry, earl of Lancaster. In the summer he took part in an abortive campaign against the Scots, and was married to Philippa at York on the 24th of January 1328. On the 15th of June 1330 his eldest child, Edward, the Black Prince, was born. Soon after, Edward made a successful effort to throw off his degrading dependence on his mother and her paramour. In October 1330 he entered Nottingham Castle by night, through a subterranean passage, and took Mortimer prisoner. On the 29th of November the execution of the favourite at Tyburn completed the young king’s emancipation. Edward discreetly drew a veil over his mother’s relations with Mortimer, and treated her with every respect. There is no truth in the stories that henceforth he kept her in honourable confinement, but her political influence was at an end.

Edward III.’s real reign now begins. Young, ardent and active, he strove with all his might to win back for England something of the position which it had acquired under Edward I. He bitterly resented the concession of independence to Scotland by the treaty of Northampton of 1328, and the death of Robert Bruce in 1329 gave him a chance of retrieving his position. The new king of Scots, David, who was his brother-in-law, was a mere boy, and the Scottish barons, exiled for their support of Robert Bruce, took advantage of the weakness of his rule to invade Scotland in 1332. At their head was Edward Baliol, whose victory at Dupplin Moor established him for a brief time as king of Scots. After four months Baliol was driven out by the Scots, whereupon Edward for the first time openly took up his cause. In 1333 the king won in person the battle of Halidon Hill over the Scots, but his victory did not restore Baliol to power. The Scots despised him as a puppet of the English king, and after a few years David was finally established in Scotland. During these years England gradually drifted into hostility with France. The chief cause of this was the impossible situation which resulted from Edward’s position as duke of Gascony. Contributing causes were Philip’s support of the Scots and Edward’s alliance with the Flemish cities, which were then on bad terms with their French overlord, and the revival of Edward’s claim, first made in 1328, to the French crown. War broke out in 1337, and in 1338 Edward visited Coblenz, where he made an alliance with the emperor Louis the Bavarian. In 1339 and 1340 Edward endeavoured to invade France from the north with the help of his German and Flemish allies, but the only result of his campaigns was to reduce him to bankruptcy.

In 1340, however, he took personal part in the great naval battle off Sluys, in which he absolutely destroyed the French navy. In the same year he assumed the title of king of France. At first he did this to gratify the Flemings, whose scruples in fighting their overlord, the French king, disappeared when they persuaded themselves that Edward was the rightful king of France. However, his pretensions to the French crown gradually became more important. The persistence with which he and his successors urged them made stable peace impossible for more than a century, and this made the struggle famous in history as the Hundred Years’ War. Till the days of George III. every English king also called himself king of France.

Despite his victory at Sluys, Edward was so exhausted by his land campaign that he was forced before the end of 1340 to make a truce and return to England. He unfairly blamed his chief minister, Archbishop Stratford, for his financial distress, and immediately on his return vindictively attacked him. Before the truce expired a disputed succession to the duchy of Brittany gave Edward an excuse for renewing hostilities with France. In 1342 he went to Brittany and fought an indecisive campaign against the French. He was back in England in 1343. In the following years he spent much time and money in rebuilding Windsor Castle, and instituting the order of the Garter, which he did in order to fulfil a vow that he had taken to restore the Round Table of Arthur. His finances, therefore, remained embarrassed despite the comparative pause in the war, although in 1339 he had repudiated his debt to his Italian creditors, a default that brought about widespread misery in Florence.

A new phase of the French war begins when in July 1346 Edward landed in Normandy, accompanied by his eldest son, Edward, prince of Wales, a youth of sixteen. In a memorable campaign Edward marched from La Hogue to Caen, and from Caen almost to the gates of Paris. It was a plundering expedition on a large scale, and like most of Edward’s campaigns showed some want of strategic purpose. But Edward’s decisive victory over the French at Crécy, in Ponthieu, on the 26th of August, where he scattered the army with which Philip VI. attempted to stay his retreat from Paris to the northern frontier, signally demonstrated the tactical superiority of Edward’s army over the French. Next year Edward effected the reduction of Calais. This was the most solid and lasting of his conquests, and its execution compelled him to greater efforts than the Crécy campaign. Other victories in Gascony and Brittany further emphasized his power. In 1346, David, king of Scots, was also defeated and taken prisoner at Neville’s Cross, near Durham. In the midst of his successes, however, want of money forced Edward to make a new truce in 1347. He was as far from the conquest of France as ever.

Edward returned to England in October 1347. He celebrated his triumph by a series of splendid tournaments, and completed his scheme for the establishment of the order of the Garter. In 1348 he rejected an offer of the imperial throne. In the same year the Black Death first appeared in England, and raged until 1349. Yet the horrors which it wrought hardly checked the magnificent revels of Edward’s court, and neither the plague nor the truce stayed the course of the French war, though what fighting there was was indecisive and on a small scale. Edward’s martial exploits during the next years were those of a gallant knight rather than those of a responsible general. Conspicuous among them were his famous combat with Eustace de Ribemont, near Calais, in 1349, and the hard-fought naval victory over the Spaniards off

Winchelsea, in 1350. Efforts to make peace, initiated by Pope Innocent VI., came to nothing, though the English commons were now weary of the war. The result of this failure was the renewal of war on a large scale. In 1355 Edward led an unsuccessful raid out of Calais, and in January and February 1356 harried the Lothians, in the expedition famous as the Burned Candlemas. His exploits sank into insignificance as compared with those of his son, whose victory at Poitiers, on the 19th of September 1356, resulted in the captivity of King John, and forced the French to accept a new truce. Edward entertained his royal captive very magnificently, and in 1359 concluded with him the treaty of London, by which John surrendered so much that the French repudiated the treaty. Edward thereupon resolved to invade France afresh and compel its acceptance. On the 28th of October he landed at Calais, and advanced to Reims, where he hoped to be crowned king of France. The strenuous resistance of the citizens frustrated this scheme, and Edward marched into Burgundy, whence he made his way back towards Paris. Failing in an attack on the capital, he was glad to conclude, on the 8th of May 1360, preliminaries of peace at Brétigny, near Chartres. This treaty, less onerous to France than that of London, took its final form in the treaty of Calais, ratified by King John on the 9th of October. By it Edward renounced his claim to France in return for the whole of Aquitaine.

The treaty of Calais did not bring rest or prosperity either to England or France. Fresh visitations of the Black Death, in 1362 and 1369, intensified the social and economic disturbances which had begun with the first outbreak in 1348. Desperate, but not very successful, efforts were made to enforce the statute of Labourers, of 1351, by which it was sought to maintain prices and wages as they had been before the pestilence. Another feature of these years was the anti-papal, or rather anti-clerical, legislation embodied in the statutes of Provisors and Praemunire. These measures were first passed in 1351 and 1353, but often repeated. In 1366 Edward formally repudiated the feudal supremacy over England, still claimed by the papacy by reason of John’s submission. Another feature of the time was the strenuous effort made by Edward to establish his numerous family without too great expense. In the end the estates of the houses of Lancaster, Kent, Bohun, Burgh and Mortimer swelled the revenues of Edward’s children and grandchildren, in whose favour also the new title of duke was introduced.

In 1369 the French king, Charles V., repudiated the treaty of Calais and renewed the war. Edward’s French dominions gladly reverted to their old allegiance, and Edward showed little of his former vigour in meeting this new trouble. He resumed the title and arms of king of France, but left most of the fighting and administration of his foreign kingdoms to his sons, Edward and John. While the latter were struggling with little success against the rising tide of French national feeling, Edward’s want of money made him a willing participator in the attack on the wealth and privileges of the Church. In 1371 a clerical ministry was driven from office, and replaced by laymen, who proved, however, less effective administrators than their predecessors. Meanwhile Aquitaine was gradually lost; the defeat of Pembroke off La Rochelle deprived England of the command of the sea, and Sir Owen ap Thomas, a grand-nephew of Llewelyn ab Gruffyd, planned, with French help, an abortive invasion of Wales. In 1371 the Black Prince came back to England with broken health, and in 1373 John of Lancaster marched to little purpose through France, from Calais to Bordeaux. In 1372 Edward made his final effort to lead an army, but contrary winds prevented his even landing his troops in France. In 1375 he was glad to make a truce, which lasted until his death. By it the only important possessions remaining in English hands were Calais, Bordeaux, Bayonne and Brest.

Edward was now sinking into his dotage. After the death of Queen Philippa he fell entirely under the influence of a greedy mistress named Alice Perrers, while the Black Prince and John of Gaunt became the leaders of sharply divided parties in the court and council of the king. With the help of Alice Perrers John of Gaunt obtained the chief influence with his father, but his administration was neither honourable nor successful. His chief enemies were the higher ecclesiastics, headed by William of Wykeham, bishop of Winchester, who had been excluded from power in 1371. John further irritated the clergy by making an alliance with John Wycliffe. The opposition to John was led by the Black Prince and Edmund Mortimer, earl of March, the husband of Edward’s grand-daughter, Philippa of Clarence. At last popular indignation against the courtiers came to a head in the famous Good Parliament of 1376. Alice Perrers was removed from court, and Duke John’s subordinate instruments were impeached. But in the midst of the parliament the death of the Black Prince robbed the commons of their strongest support. John of Gaunt regained power, and in 1377 a new parliament, carefully packed by the courtiers, reversed the acts of the Good Parliament. Not long after Edward III. died, on the 21st of June 1377.

Edward III. was not a great man like Edward I. He was, however, an admirable tactician, a consummate knight, and he possessed extraordinary vigour and energy of temperament. His court, described at length in Froissart’s famous chronicle, was the most brilliant in Europe, and he was himself well fitted to be the head of the magnificent chivalry that obtained fame in the French wars. Though his main ambition was military glory, he was not a bad ruler of England. He was liberal, kindly, good-tempered and easy of access, and his yielding to his subjects’ wishes in order to obtain supplies for carrying on the French war contributed to the consolidation of the constitution. His weak points were his wanton breaches of good faith, his extravagance, his frivolity and his self-indulgence. Like that of Edward I. his ambition transcended his resources, and before he died even his subjects were aware of his failure.

Edward had twelve children, seven sons and five daughters. Five of his sons played some part in the history of their time, these being Edward the Black Prince, Lionel of Antwerp, duke of Clarence, John of Gaunt, duke of Lancaster, Edmund of Langley, afterwards duke of York, and Thomas of Woodstock, afterwards duke of Gloucester. John and Edmund are also important as the founders of the rival houses of Lancaster and York. Each of the last four was named from the place of his birth, and for the same reason the Black Prince is sometimes called Edward of Woodstock. The king’s two other sons both died in infancy. Of his daughters, three died unmarried; the others were Isabella, who married into the family of Coucy, and Mary, who married into that of Montfort.

Authorities.—The two chief modern lives of Edward III. are W. Longman’s *Life and Times of Edward III.*, and J. Mackinnon’s *History of Edward III.* Neither work can be regarded as adequate, and in some ways J. Barnes’s quaint *History of Edward III.* (1688) is less unsatisfactory. The general history of the time can be

read in W. Stubbs's *Constitutional History of England*, vol. ii. chapters xvi. and xvii.; in T.F. Tout's *Political History of England*, 1216-1377, pp. 301-441; in R. Pauli's *Geschichte von England*, iv. pp. 307-504; and in Edward's life by W. Hunt in the *Dictionary of National Biography*. For the Hundred Years' War, see E. Déprez's *Les Préliminaires de la guerre de cent ans, 1328-1342*, and H. Denifle's *La Desolation des églises, monastères et hôpitaux en France pendant la guerre de cent ans*. For economic and social history see W.J. Ashley's *English Economic History*, and W. Cunningham's *Growth of English Industry and Commerce during the Early and Middle Ages*. For the end of the reign see S. Armitage Smith's *John of Gaunt*, J. Lechler's *Wiclif und die Vorgeschichte der Reformation*, translated as *Wycliffe and his English Precursors*, R.L. Poole's *Wycliffe and Movements for Reform*, and G.M. Trevelyan's *England in the Age of Wycliffe*.

(T. F. T.)

EDWARD IV. (1442-1483), king of England, son of Richard, duke of York, by Cicely Neville, was born at Rouen on the 28th of April 1442. As a boy he was styled earl of March, and spent most of his time at Ludlow. After the Yorkist failure at Ludlow field in October 1459, Edward fled with the earls of Salisbury and Warwick, his uncle and cousin, to Calais. Thence in the following July he accompanied them in their successful invasion of England, to be welcomed in London, and to share in the victory over the Lancastrians at Northampton. After the acceptance of Richard of York as heir to the crown, Edward returned to the Welsh marches, where early in the new year he heard of his father's defeat and death at Wakefield. Hastily 996
gathering an army he defeated the earls of Pembroke and Wiltshire at Mortimer's Cross on the 2nd of February 1461, and then marched on London. He was acclaimed by the citizens in an assembly at Clerkenwell, declared king by a Yorkist council, and took possession of the regality on the 4th of March. Soon after the new king and the earl of Warwick went north, and on the 28th of March won a decisive victory at Towton.

Edward owed his throne to his kinsmen the Nevilles, and he was content for the time to be guided by them. For himself he was young and fond of pleasure. Still he made frequent progresses, and took some part in the fighting that went on in the north during 1462 and 1463. But he was absent from the final victory at Hexham on the 14th of May 1464, and was at the very time engaged in contracting a secret marriage with Elizabeth, daughter of Richard Woodville, Lord Rivers, and widow of Sir John Grey of Groby (d. 1461). The marriage was disclosed at Michaelmas, much to the vexation of Warwick, who in pursuit of his foreign policy had projected a match with a French princess. Edward heaped favours on his new relatives; his father-in-law was made treasurer, and great marriages were found for his wife's sisters and brothers. In foreign affairs also Edward thwarted Warwick's plans by favouring an alliance with Burgundy rather than France. There was, however, no open breach till 1469, when Warwick, taking advantage of the unpopularity of the Woodvilles, and supported by the king's next brother George, duke of Clarence, appeared in arms. Edward was surprised and made prisoner at Middleham, and Rivers was beheaded. For six months Edward had to submit to Warwick's tutelage; then on the occasion of a rising in Lincolnshire he gathered an army of his own. Sir Robert Welles, the leader of this rebellion, made a confession implicating Warwick, who fled with Clarence to France. The king thought himself secure, but when Warwick and Clarence made terms with the Lancastrian exiles, Edward in his turn had to seek refuge in Holland (September 1470). His brother-in-law, Charles of Burgundy, at first refused him any assistance, but at last furnished him with money, and on the 14th of March 1471 Edward and his brother Richard landed with a small force at Ravenspur near Hull. Marching south he was welcomed at London on the 11th of April, defeated Warwick at Barnet three days later, and the Lancastrians at Tewkesbury on the 4th of May. From thenceforth Edward's possession of the crown was secure. His position was strengthened by the birth of a son (2nd of November 1470, during his exile), and by the wealth which he acquired through the confiscation of the estates of his opponents. Clarence had made his peace with Edward, but was at enmity with his other brother Richard of Gloucester, who now married Warwick's second daughter and claimed a share in the Neville inheritance. Their rivalry and Clarence's continued intrigues furnished Edward with his chief domestic difficulty; the trouble was ended by the judicial murder of Clarence in 1478.

The only serious enterprise of these latter years was the short French war of 1475, from which Edward was bought out by the treaty of Pecquigny. As foreign policy it was inglorious, and involved a departure from Edward's earlier plan of a Burgundian alliance. However, it shows a certain recognition of England's need to concentrate her energies on her own development. The annual subsidy which Louis XI. agreed to pay further served Edward's purposes by providing him with money for home government, and enabled him to avoid possible trouble through the necessity for too frequent parliaments and heavy taxation. So Edward's personal rule became in its character autocratic; but it was in the art of courting popularity and concealing despotism that he most shows himself as a type of tyranny. He lacked neither ambition nor capacity, but was indolent and only exerted himself spasmodically. He could be ruthless, but was not habitually cruel. His strongest weapons were the fine presence, the affable manners (even with citizens), and the love of pleasure and entertainments which secured his personal popularity. In his last years he was given to self-indulgence and scandalous excesses, which did not, however, alienate the London citizens, with whose wives he was too familiar. Most of the power at court was in the hands of the Woodvilles, in spite of their unpopularity; the more arduous work of administration in the north was left to Richard of Gloucester. If as a prince of the Renaissance Edward was the first to rule tyrannically in England, he also deserves credit as a patron of the new culture and friend of Caxton; he further resembles his Italian contemporaries in the commercial purposes to which he applied his wealth in partnership with London merchants.

Edward died at Westminster on the 9th of April 1483, and was buried at Windsor. By Elizabeth Woodville, who died on the 8th of June 1492, he had two sons, Edward V. and Richard of York, who were murdered in the Tower; and five daughters, of whom the eldest, Elizabeth, married Henry VII. Of his numerous

mistresses the most notorious was Jane Shore. Before his marriage he had been contracted to Lady Eleanor Butler, and this was alleged by Richard III. to have made his children by Elizabeth Woodville illegitimate.

BIBLIOGRAPHY.—Of original authorities for Edward's reign the chief are the *Continuation of the Cropland Chronicle* in Fulman's *Scriptores*; the various London Chronicles, especially for the early years *Gregory's Chronicle*; Warkworth's *Chronicle*, and the *Arrivall of King Edward IV.* (a partisan account of events in 1470-1471), published by the Camden Society; the *Paston Letters* with Dr Gairdner's valuable Introduction; and for foreign affairs the *Mémoires* of Philippe de Comines; the collection called *Chronicles of the White Rose* is useful. For modern authors, consult Sir James Ramsay's *Lancaster and York* (1892), and the *Political History of England*, vol. iv. (1906), by Prof. C. Oman.

(C. L. K.)

EDWARD V. (1470-1483), king of England, was the elder son of Edward IV. by his wife Elizabeth Woodville, and was born, during his father's temporary exile, in the sanctuary of Westminster Abbey on the 2nd of November 1470. In June 1471 he was created prince of Wales. When Edward IV. died in April 1483 a struggle for power took place between the young king's paternal uncle, Richard, duke of Gloucester, who had been appointed as his guardian by Edward IV., and his maternal uncle, Richard Woodville, Earl Rivers. Gloucester obtained possession of the king's person, and, having arrested Rivers and some of his supporters, assumed the crown himself after a very slight and feigned reluctance, on the ground that the marriage of Edward and Elizabeth Woodville was invalid, and consequently its issue was illegitimate. At this time Edward and his brother Richard, duke of York, were living in the Tower of London. Shortly afterwards a movement was organized to free them from captivity, and then it became known that they were already dead; but, though it was the general conviction that they had been murdered, it was twenty years before the manner of this deed was discovered. According to the narrative of Sir Thomas More, Sir Robert Brackenbury, the constable of the Tower, refused to obey Richard's command to put the young princes to death; but he complied with a warrant ordering him to give up his keys for one night to Sir James Tyrell, who had arranged for the assassination. Two men, Miles Forest and John Dighton, then smothered the youths under pillows while they were asleep. The murder was committed most probably in August or September 1483. Horace Walpole has attempted to cast doubts upon the murder of the princes, and Sir C.R. Markham has argued that the deed was committed by order of Henry VII. Both these views, however, have been traversed by James Gairdner, and there seems little doubt that Sir Thomas More's story is substantially correct.

See RICHARD III.; and in addition, Sir Thomas More, *History of Richard III.*, edited by J.R. Lumby (Cambridge, 1883); Horace Walpole, *Historic Doubts on the Life and Reign of Richard III.* (London, 1768); J. Gairdner, *Richard III.* (Cambridge, 1898); J. Gairdner and C.R. Markham in the *English Historical Review*, vol. vi. (London, 1891); Sir C.R. Markham, *Richard III.* (1907).

EDWARD VI. (1537-1553), king of England and Ireland, born at Greenwich on the 12th of October 1537, was the only child of Henry VIII. by his third wife, Jane Seymour, who died of puerperal fever twelve days later. The story that the mother's life was deliberately sacrificed by the performance of Caesarean section is unfounded, although Jane's death was little noticed amid the rejoicings which greeted the advent of a male heir to the throne. But in spite of Holbein's vivacious portrait of Edward at the age of two (now at Hanover), he was a frail child, and a short life was anticipated for him from his early years. This did not prevent a strenuous education; until the age of six he was naturally left in the charge of women, but when he was only seven his tutor Dr Coxe, afterwards bishop of Ely, writes that he could decline any Latin noun and conjugate any regular verb (*L. and P.*, 1544, ii. 726); "every day in the mass-time he readeth a portion of Solomon's Proverbs, wherein he delighteth much." Sir John Cheke, Sir Anthony Cooke and Roger Ascham all helped to teach him Latin, Greek and French; and by the age of thirteen he had read Aristotle's *Ethics* in the original and was himself translating Cicero's *De philosophia* into Greek.

Edward was duke of Cornwall from his birth, but he was never prince of Wales, and he was only nine when he succeeded his father as king of England and Ireland and supreme head of the church (28th of January 1546/7). His nonage threw power into the hands of Somerset and then of Northumberland, and enabled Gardiner and Bonner to maintain that the royal supremacy over the church was, or should be, in abeyance. Projects for his marriage were hardly even the occasion, but only the excuse, for Somerset's war on Scotland and Northumberland's subsequent alliance with France. All factions sought to control his person, not because of his personality but because of his position; he was like the Great Seal, only more so, an indispensable adjunct to the wielder of authority. The Protector's brother tried to bribe him with pocket-money; Northumberland was more subtle and established a complete dominion over his mind, and then put him forward at the age of fourteen as entitled to all the power of Henry VIII. But he was only Northumberland's mask; of his individual influence on the course of history during his reign there is hardly a trace. A posthumous effort was made to give him the credit of a humane desire to save Joan Bocher from the flames; but he recorded with apparently cold-blooded indifference the execution of both his uncles, and he certainly made no attempt to mitigate the harassing attentions which the council paid his sister Mary. This passed for piety with the zealots, and the persecutions of Mary's reign reflected a halo on that of the Protestant Josiah. So strong was the regret that rumours of his survival persisted, and hare-brained youths

were found to personate him throughout Mary's and even far into Elizabeth's reign.

It was well that they were false, for Edward showed signs of all the Tudor obstinacy, and he was a fanatic into the bargain, as no other Tudor was except Mary. The combination would probably have involved England in disasters far greater than any that ensued upon his premature death; and it was much better that the Anglican settlement of religion should have been left to the compromising temper of Elizabeth. As it was, he bequeathed a legacy of woe; his health began to fail in 1552, and in May 1553 it was known that he was dying. But his will and the various drafts of it only betray the agitated and illogical efforts of Northumberland to contrive some means whereby he might continue to control the government and prevent the administration of justice. Mary and Elizabeth were to be excluded from the throne, as not sufficiently pliant instruments; Mary Stuart was ignored as being under Scottish, Catholic and French influence; the duchess of Suffolk, Lady Jane's mother, was excluded because she was married, and the duke her husband might claim the crown matrimonial. In fact, all females were excluded, except Jane, on the ground that no woman could reign; even she was excluded in the first draft, and the crown was left to "the Lady Jane's heirs male." But this draft was manipulated so as to read "the Lady Jane and her heirs male." That Edward himself was responsible for these delirious provisions is improbable. But he had been so impregnated with the divine right of kings and the divine truth of Protestantism that he thought he was entitled and bound to override the succession as established by law and exclude a Catholic from the throne; and his last recorded words were vehement injunctions to Cranmer to sign the will. He died at Greenwich on the 6th of July 1553, and was buried in Henry VII.'s chapel by Cranmer with Protestant rites on the 8th of August, while Mary had Mass said for his soul in the Tower.

J.G. Nichols collected almost all that is known of Edward VI. in his excellent edition of the king's *Journal*. A few additional facts and suggestions can be gleaned from the *Letters and Papers of Henry VIII.* vols. xii.-xxi.; *Acts of the Privy Council*, ed. Dasent, vols. i.-iv.; Domestic, Spanish, Venetian and Foreign *Calendars of State Papers*; Froude's *History*; Dixon's *Hist. Church of England*; A.F. Pollard's *England under Somerset* and *Life of Cranmer*; and *English Historical Review*, xxiii. 286, &c. Sir Clements Markham's *Edward VI.* (1907) emphasizes his interest in geography.

(A. F. P.)

EDWARD VII. (Albert Edward) (1841-1910), king of Great Britain and Ireland, and of the British Dominions beyond the Seas, emperor of India, the eldest son and second child of Queen Victoria and of Albert, prince consort, was born at Buckingham Palace on the 9th of November 1841. He was created prince of Wales and earl of Chester on the 4th of December following, and was baptized on the 25th of January 1842. In his childhood he was educated by the dowager Lady Lyttelton; and in his boyhood successively by the Rev. Henry Mildred Birch, Mr F.W. Gibbes, the Rev. C.F. Tarver and Mr Herbert W. Fisher. He afterwards resided at Edinburgh, studying chemistry in its industrial applications under Professor (afterwards Lord) Playfair at the university; at Christ Church, Oxford; and at Trinity College, Cambridge. In November 1858 he was made a knight of the Garter and a colonel in the army. In 1859 he travelled in Italy and Spain, and in 1860 paid a visit as "Lord Renfrew" to the United States and Canada.

Upon the completion of his Cambridge course in June 1861 he joined the camp at the Curragh. The prince consort died on the 13th of December, and in 1862 the prince of Wales went for a tour in the Holy Land (February-June) under the guidance of Arthur Penrhyn Stanley, afterwards dean of Westminster. Early in 1863 he was sworn of the privy council, and took his seat in the House of Lords as duke of Cornwall. The estate of Sandringham, in Norfolk, was purchased for him out of the savings of his minority, and his town residence was fixed at Marlborough House.

His impending marriage to the princess Alexandra, daughter of Christian IX., king of Denmark (b. December 1, 1844), had already been announced, and took place on the 10th of March at Windsor, the beauty and grace of the princess captivating the heart of the nation. Parliament granted the prince an income of £40,000 a year, exclusive of the revenues of the duchy of Cornwall, and he relinquished his right of succession to the duchy of Saxe-Coburg-Gotha. Prince Albert Victor, afterwards duke of Clarence, was the first offspring of the marriage, being born on the 8th of January 1864. The births followed of Prince George Frederick Ernest Albert, afterwards duke of York (see George V.), on the 3rd of June 1865; Princess Louise Victoria Alexandra Dagmar, by marriage duchess of Fife, princess royal, on the 20th of February 1867; Princess Victoria Alexandra Olga Mary, on the 6th of July 1868; and Princess Maud Charlotte Mary Victoria, afterwards queen of Norway, on the 26th of November 1869.

From the time of their marriage the prince and princess were prominently before the country. Queen Victoria remained in retirement, but they filled her place at important public functions. The prince's readiness to promote every worthy cause was most marked; no one was a more constant attendant at meetings for objects of public utility of a non-political nature, and his speeches were always characterized by excellent sense. The most important external event of these years was a tour to Egypt, undertaken in 1869 in company with the duke of Sutherland, Sir Samuel Baker and others, an account of which was published by Mrs William Grey. The prince also visited Ireland more than once, and opened the International Exhibition of 1871.

On the 23rd of November 1871 it was announced that the prince would be prevented from paying a visit which had been arranged to the Maharajah Dhuleep Singh by a feverish attack. It soon appeared that the malady was typhoid, contracted as was supposed, on a visit to Scarborough. The case became so serious that on November 29 the queen and Princess Alice hurried to Sandringham. On the 1st of December there was a slight rally, but on the 8th so serious a relapse occurred that for some days the prince's life was despaired of. Under the skilful treatment of Sir William Jenner, Sir William Gull and Sir James Paget,

however, the crisis was surmounted by December 16, and by Christmas day the danger was regarded as virtually over. On the 27th of February 1872 a thanksgiving was held at St Paul's, amid imposing demonstrations of public joy.

In January 1874 the prince of Wales attended the marriage at St. Petersburg of his brother, the duke of Edinburgh, with the grand-duchess Marie of Russia. In the same year he paid a historic visit to Birmingham, where Mr Joseph Chamberlain, not yet a member of parliament, received him officially as mayor. In March 1875 it was officially announced that he would make a visit to India, carrying out an idea originally conceived by the first Indian viceroy, Earl Canning. He was supposed to travel as heir-apparent, not as representative of the queen; but the characters could not be kept apart, and in fact the prince's visit was a political event of great importance. Leaving England on October 11, he was received at Bombay by the viceroy, Lord Northbrook. Here he met a very large number of Indian feudatory princes, whose acquaintance he subsequently improved by visiting at their courts during the seventeen weeks which he spent in the country. During these four months the prince travelled nearly 8000 m. by land and 2500 m. by sea, became acquainted with more rajahs than had all the viceroys who had reigned over India, and saw more of the country than any living Englishman. The visit led up to the queen's assumption of the title of empress of India in the following year.

The prince's life after this date was full of conspicuous public appearances. In 1885 he visited Ireland at a time of much political excitement, and was received enthusiastically in many quarters and without symptoms of ill-will in any. In 1886 he filled the presidency of the Indian and Colonial Exhibition, opened the Mersey Tunnel, and laid the first stone of the Tower Bridge. In 1887 a large share of the arrangements for the queen's Jubilee devolved upon him. On the 27th of July 1589 his eldest daughter, Princess Louise, was married to the duke of Fife. In the autumn he paid a semi-incognito visit to Paris, where he was always highly popular, viewed the Exhibition, and ascended the Eiffel Tower. In 1890 he opened the Forth Bridge. On the 14th of January 1892, however, a heavy blow fell upon him and his house by the death of his eldest son, Prince Albert Victor, duke of Clarence, after a brief illness. The young prince, who with his brother George had made the tour of the world (1879-1882) in H.M.S. "Bacchante," and after a short career at Oxford and Cambridge was just settling down to play his part in public life, had recently become engaged to Princess Victoria Mary of Teck (b. May 26, 1867), and the popularity of the heir to the crown had been increased by the expression of his satisfaction at his son's bride being an English princess. On the 6th of July 1893 the broken thread was reunited by her marriage to Prince George, duke of York.

The year 1894 was a busy one for the prince of Wales, who became a member of the royal commission on the housing of the poor, opened the Tower Bridge, attended the Welsh Eisteddfod and was duly initiated, and paid two visits to Russia—one for the marriage of the grand-duchess Xenia, the other for the funeral of the tsar, his brother-in-law. In 1896 he became first chancellor of the university of Wales, and his first act after his installation at Aberystwyth was to confer an honorary degree upon the princess. He had already been for some years a trustee of the British Museum. On the 22nd of July 1896 his daughter. Princess Maud, was married to Prince Charles of Denmark, who in 1905 was offered and accepted the crown of the new kingdom of Norway. The arrangements for the queen's Jubilee of 1897 depended upon the prince even more than those of the corresponding celebration in 1887: he rode on the queen's right at the great procession to St Paul's, and as an admiral of the fleet presided at the naval review at Spithead. In July 1898 the prince had the misfortune to fracture his knee-cap while on a visit to Baron Ferdinand de Rothschild, but completely recovered from the effects of the accident. In December 1899, while passing through Brussels on his way to St Petersburg, he was fired at by a miserable lad named Sipido, crazed by reading anarchist literature. Fortunately no injury was done.

It was the especial distinction of Albert Edward, while prince of Wales, to have been a substantial support of the throne before he was called upon to fill it. This cannot be said of any of his predecessors except Edward the Black Prince. He was exemplary in the discharge of his public duties, and in his scrupulous detachment from party politics. He was a keen patron of the theatre, and his thoroughly British taste for sport was as pronounced as his inclination for most of the contemporary amusements of society. The "Tranby Croft Case" (1890), in which Sir William Gordon Cumming brought an unsuccessful libel action for having been accused of cheating at a game of baccarat, caused some comment in connexion with the prince's appearance in the witness-box on behalf of the defendants. But it did him no disservice with the people to have twice won the Derby with his horses Persimmon (1896) and Diamond Jubilee (1900)—his third victory, in 1909, with Minoru, being the first occasion on which the race had been won by a reigning sovereign; and his interest in yacht-racing was conspicuously shown at all the important fixtures, his yacht "Britannia" being one of the best of her day. His activity in the life of the nation may be illustrated by his establishment (1897) of the Prince of Wales's (afterwards King Edward's) Hospital Fund, his devotion to the cause of Masonry (he was first elected grand master of the Freemasons of England in 1874), and his position as a bencher of the Middle Temple, where he also became (1887) treasurer.

On the death of Queen Victoria on the 22nd of January 1901, the question what title the new king would assume was speedily set at rest by the popular announcement that he would be called Edward the Seventh. The new reign began auspiciously by the holding of a privy council at St James's Palace, at which the king announced his intention to follow in his predecessor's footsteps and to govern as a constitutional sovereign, and received the oaths of allegiance. On the 14th of February the king and queen opened parliament in state. Shortly afterwards it was announced that the visit of the duke and duchess of York to Australia, in order to inaugurate the new Commonwealth, which had been sanctioned by Queen Victoria, would be proceeded with; and on the 16th of March they set out on board the "Ophir" with a brilliant suite. The tour lasted till November 1, the duke and duchess having visited Australia, New Zealand, the Cape and Canada; and on their return the king, on November 9, created the duke prince of Wales and earl of Chester. Meanwhile parliament had settled the new civil list at £470,000 a year, and the royal title had been enlarged to include the colonial empire by an act enabling the king to style himself "Edward VII., by the grace of God, of the United Kingdom of Great Britain and Ireland, and of all the British Dominions beyond the Seas, King, Defender of the Faith, Emperor of India." At the end of May 1902 the long-drawn-out war in South Africa

came at last to an end, and the coronation was fixed for the 26th of June. But on the 24th, amid general consternation, the king was announced to be suffering from perityphlitis, necessitating the immediate performance of an operation; and the coronation, for which unprecedented preparations had been made, had to be postponed. The operation—performed by Sir Frederick Treves—was, however, so marvellously successful, and the king's progress towards recovery so rapid and uninterrupted, that within a fortnight he was pronounced out of danger, and soon afterwards it was decided to hold the coronation service on August 9. Though shorn of much of the magnificence which would have been added to it in June by the presence of foreign royalties and the preparations for a great procession through London, the solemnity duly took place on that date in Westminster Abbey amid great rejoicings. The king spent several weeks (partly in a yachting trip round the coast and up to Stornoway) in recruiting his health, and on the 25th of October he went in procession through the main streets of south London, when he was most enthusiastically received. Next day the king and queen attended St Paul's cathedral in state to return thanks for his restoration to health. On New Year's day 1903 the coronation was proclaimed in India at a magnificent durbar at Delhi.

At home the king opened parliament in person in February 1903, and on the 31st of March he sailed from Portsmouth to pay a visit to the king of Portugal at Lisbon, leaving Lisbon for Gibraltar on the 7th of April. On the 11th he held a review of the garrison troops and next day left for Malta, and the tour was continued to Naples (23rd of April). On the 27th of April he was received at Rome by the king of Italy—the first time an English king as such had been there; and two days later he paid a visit to Leo XIII. at the Vatican. On May day he was received in Paris by President Loubet. Later in the year return visits were paid to England by President Loubet (July) and the king and queen of Italy (November). On the 11th of May His Majesty paid his first formal visit to Edinburgh, and held courts at Holyrood. In July the king and queen went to Ireland, and though the Dublin corporation refused to vote a loyal address the reception was generally cordial. In September the king took his annual "cure" at Marienbad, and paid a visit to Vienna, where he was received by the Austrian emperor. In 1904 again the king and queen went to Ireland; in June the king was cordially received by the German emperor at the yacht-races at Kiel, and he included a visit to Hamburg, where the welcome was hearty. In November the king and queen of Portugal were entertained at Windsor and at the Guildhall.

The success of King Edward as a promoter of international friendliness, and the advantage of so efficient a type of kingship, attracted universal attention, and treaties of arbitration were concluded by Great Britain with France, Spain, Italy, Germany and Portugal in 1903 and 1904. In his first two years the king had already earned the title of Edward the Peacemaker, and established his position as a source of new strength to the state. This reputation was confirmed in the years which followed, during which the royal hand was to be seen in the progress of foreign affairs in a manner somewhat new to old-fashioned politicians. The *entente* with France was promoted by his influence, notably by his reception of President Fallières in England in 1908. It was noticed that the permanent under-secretary for foreign affairs, Sir Charles Hardinge, generally accompanied the king, as one of his suite, on his visits abroad: and the conclusion of the Anglo-Russian agreement (1907)—which was attributed with some reason to royal policy—was hotly criticized in Radical quarters. It was pointed out that neither the foreign secretary (Sir E. Grey) nor any other secretary of state accompanied the king on his foreign visits. These objections were, however, scouted by the government, and undeniably public opinion approved of the sovereign's personal activity in a sphere peculiarly his own. The strengthening of British influence in Europe, which was the marked result of the Anglo-French and Anglo-Russian *ententes*, and of the closer ties between England and countries like Portugal and Spain (whose young king Alfonso married Princess Ena of Battenberg, King Edward's niece), had, indeed, temporarily the effect of rousing German suspicion, the view taken being that the object of British foreign policy was to isolate Germany; and during 1907 and 1908 the political situation was coloured by the discussions in the press with regard to Anglo-German rivalry. But in February 1909 the king and queen paid a state visit to the Kaiser in Berlin, where the greatest cordiality was displayed on all sides; the event was prepared for, in both countries, as a means of dispelling the clouds which had gathered over the relations between England and Germany, and the success of the visit proved once more how powerful King Edward's personality could be as an agency for peace and international amity.

During the year 1909, however, the political situation at home was developing into an acute constitutional crisis, which seemed likely to involve the Crown in serious difficulties. Mr Lloyd-George's budget convulsed the House of Commons and the country, and was eventually rejected by the House of Lords; and the Liberal government now put in the forefront of its programme the abolition of the Peers' "veto." As was hinted, not obscurely, later by the doctors, King Edward, although certainly not prejudiced against a Liberal ministry, was seriously disturbed in mind and health by the progress of events, which culminated in the return of Mr Asquith to office after the elections of January 1910, and in his statement that, if necessary, guarantees would be sought from the Crown for the purpose of enforcing the will of the representative chamber. A remarkable sign of the king's discomfort was his insertion, in the official "King's Speech" at the opening of parliament, of the words "in the opinion of my advisers," in connexion with the passage dealing with the House of Lords. The king had been far from robust for some little time, and while he was taking change and rest at Biarritz in the early spring of 1910 he had a bronchial attack which caused some anxiety, although the public heard nothing of it. When he returned to England there is no doubt that he was acutely affected by the prospect of being forcibly dragged into the political conflict. In the country at large there was indeed considerable confidence that the king's tact and experience would help to bring order out of chaos; but this was not to be. Within two days the public heard with consternation that he was ill, and then was dead. On May 5 it was announced that he had bronchitis; and he died at 11.45 P.M. on the 6th, of heart failure. On May 17, 18 and 19 there was an impressive lying-in-state in Westminster Hall, attended by unprecedented crowds; and on May 20 the burial took place at Windsor, after a great funeral procession through London, the coffin being followed by the new king, George V., and by eight foreign sovereigns—the German emperor, the kings of Greece, Spain, Portugal, Denmark, Norway, Belgium and Bulgaria—besides the archduke Franz Ferdinand of Austria (heir to the throne of Austria-Hungary), the prince consort of Holland and many other royalties, and a number of special ambassadors, including Mr Roosevelt as representative of the United States. Mourning was as sincere as it was universal; for not only England and the British Empire, but the

world, had lost a king who was both a very human man and a tried and trusted statesman.

Queen Victoria's long reign had solidly established the constitutional monarchy; it remained for her son to rehabilitate the idea of English kingship by showing how the sovereign could be no less constitutional but personally more monarchical. While prince of Wales he had had little real training in statecraft, but when he became king his genuine capacity for affairs was shown. Ably advised by such men as Lord Knollys and Lord Esher, he devoted himself to the work of removing the Throne from its former isolation, and bringing it into touch with all sections of the community for the promotion of social happiness and welfare. His own love of pageantry and his interest in the stately ordering of court functions responded, moreover, to a marked inclination on the part of the public and of "society" for such things. It was significant that even Radicals and Socialists began to advocate extensions of the prerogative, and to insist on the active part which the Crown should play in public life. The king won the genuine affection and confidence of the people; and in Queen Alexandra he had an ideal consort, to whom all hearts went out.

(H. Ch.)

EDWARD, prince of Wales, known as "The Black Prince" (1330-1376), the eldest son of Edward III. and Philippa of Hainaut, was born at Woodstock on the 15th of June 1330. Contemporaries called him Edward of Woodstock, and his surname of the Black Prince cannot be traced back earlier than the 16th century. It is supposed to have been derived from his wearing black armour. In 1333 he was made earl of Chester, and in 1337 duke of Cornwall, being the first duke ever created in England. Nominal warden of England during his father's absences abroad in 1338 and 1342, he was created prince of Wales in 1343, and in 1345 he first accompanied his father on a foreign expedition.

His real career begins, however, with Edward III.'s Norman campaign of 1346. On landing at La Hogue he 1000
was knighted by his father, and took a prominent part in the whole of the campaign. He commanded the right wing of the English forces at Crécy, and, though hard pressed for a time by the French, took his full share in gaining the victory. Next year he was at the siege of Calais, and returned to England in October 1347 with his father. He was one of the original knights of the Garter, and participated in his father's chivalrous adventures at Calais in 1349 and in the battle off Winchelsea in 1350. In September 1355 he was sent to Gascony at the head of an English army, having been appointed his father's lieutenant there in July. He was warmly welcomed by the Gascons, and at once led a foray through Armagnac and Languedoc. By November he had got as far as Narbonne, whence he returned to Bordeaux, where he kept his Christmas court. In August 1356 he started from Bergerac on another marauding expedition, this time in a northerly direction. He penetrated as far as the Loire, but was there compelled to retire before the superior forces of King John of France. On the 19th of September the two armies met in the battle of Poitiers, fought about 6 m. south-east of the city. It was the hardest-fought and most important battle of the Hundred Years' War, and Edward's victory was due both to the excellence of his tactical disposition of his forces and to the superior fighting capacity of his army. The flank march of the Captal de Buch, which decided the fate of the day, was of Edward's own devising, and the captivity of King John attested the completeness of his triumph. He treated his prisoner with almost ostentatious magnanimity, and took him to Bordeaux, whence they sailed to England in May 1357. On the 24th of that month he led his prisoner in triumph through the streets of London. In 1359 he took part in his father's invasion of northern France, and had a large share in the negotiations at Brétigny and Calais.

In October 1361 Edward married his cousin Joan, countess of Kent (1328-1385), the daughter and heiress of Edmund of Woodstock, earl of Kent, the younger son of Edward I. by his second wife Margaret of France. The lady, who enjoyed a great reputation for beauty, was in her thirty-third year, and the widow of Sir Thomas Holand, by whom she had had three children. Froissart says that the marriage was a love match, and that the king had no knowledge of it. However, Edward III. approved of his son's choice, and in July 1362 handed over to him all his dominions in southern France, with the title of prince of Aquitaine. In February 1363 Edward and Joan took ship for Gascony, which became his ordinary place of residence for the next eight years. He maintained a brilliant court at Bordeaux and Angoulême, and did his best to win the support of the Gascons. He was not, however, successful in winning over the greater nobles, who, with John, count of Armagnac, at their head, were dissatisfied with the separation from France, and looked with suspicion upon Edward's attempts to reform the administration as being likely to result in the curtailment of their feudal rights. Edward was better able to conciliate the towns, whose franchises he favoured and whose trade he fostered, hoping that they would prove a counterpoise to the aristocracy. He kept the chief posts of the administration mainly in English hands, and never really identified himself with the local life and traditions of his principality. He succeeded in clearing Aquitaine of the free companies, and kept good peace for nearly six years.

In 1367 Peter the Cruel, the deposed king of Castile, visited Edward at Bordeaux, and persuaded him to restore him to his throne by force. In February 1367 Edward led an army into Spain over the pass of Roncesvalles. After a difficult and dangerous march Edward reached the Ebro, and on the 3rd of April defeated Bertrand du Guesclin at Nájera, the last of his great victories. He then proceeded to Burgos, and restored Peter to the throne of Castile. He remained in Castile for four months, living principally at Valladolid. His army wasted away during the hot Spanish summer, and Edward himself contracted the beginnings of a mortal disease. In August 1367 Edward led the remnant of his troops back through the pass of Roncesvalles, and returned to Bordeaux early in September. He had exhausted all his resources on the Spanish expedition, and was forced to seek from the estates of Aquitaine extraordinary sources of supply. A hearth tax for five years was willingly granted to him, and generally paid. The greater barons, however, found in this impost a pretext for revolt. The count of Armagnac, who had already made a secret understanding with Charles V., appealed against the hearth tax to the parlement of Paris. Cited before this

body in January 1369, Edward declared that he would answer at Paris with sixty thousand men behind him. War broke out again, and Edward III. resumed the title of king of France. Thereupon Charles V. declared that all the English possessions in France were forfeited, and before the end of 1369 all Aquitaine was in full revolt. With weak health and impaired resources, the Black Prince showed little activity in dealing with his insurgent subjects, or in warding off French invasion. Though too ill to ride on horseback, he insisted upon commanding his troops, and on the 19th of September 1370 won his last barren success, by capturing the revolted city of Limoges and putting the population to the sword. Early in 1371 he returned to England, leaving the impossible task of holding Gascony to his brother John of Gaunt. In August 1372 he joined his father in an abortive expedition to France, but contrary winds prevented their landing, and he now abandoned military life for good. In October he resigned his principality on the ground that he could not afford to retain any longer so expensive a charge. His health now rapidly declined, but he still followed politics with interest, and did what he could to support the constitutional opposition of the great ecclesiastics to the administration of John of Gaunt and the anti-clerical courtiers. His last public act was to inspire the attack on Lancaster's influence made by the Good Parliament in the spring of 1376. The famous parliament was still in session when he died at Westminster on the 8th of July. He was buried in the east end of Canterbury cathedral on the 29th of September, where his magnificent tomb, erected in accordance with the instructions in his will, may still be seen. By Joan, "the fair maid of Kent," who died on the 7th of August 1385, the Black Prince left an only son, afterwards King Richard II.

For authorities see EDWARD III. To these may be added W. Hunt's article in the *Dict. Nat. Biog.*; A. Collins's *Life of Edward, Prince of Wales* (1740); G.P.R. James's *Life of Edward the Black Prince* (1839); J. Moisant's *Le Prince Noir en Aquitaine* (1894); and R.P. Dunn-Pattison's *The Black Prince* (1910).

(T. F. T.)

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