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THE ENCYCLOPÆDIA BRITANNICA

A DICTIONARY OF ARTS, SCIENCES, LITERATURE AND GENERAL INFORMATION

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Atherstone to Austria

Articles in This Slice

ATHERSTONE, WILLIAM GUYBON (1813-1898), British geologist, one of the pioneers in South African geology, was born in 1813, in the district of Uitenhage, Cape Colony. Having qualified as M.D. he settled in early life as a medical practitioner at Grahamstown, subsequently becoming F.R.C.S. In 1839 his interest was aroused in geology, and from that date he “devoted the leisure of a long and successful medical practice” to the pursuit of geological science. In 1857 he published an account of the rocks and fossils of Uitenhage (the latter described more fully by R. Tate, *Quart. Journal Geol. Soc.*, 1867). He also obtained many fossil reptilia from the Karroo beds,

and presented specimens to the British Museum. These were described by Sir Richard Owen. Atherstone's identification in 1867 as a diamond of a crystal found at De Kalk near the junction of the Riet and Vaal rivers, led indirectly to the establishment of the great diamond industry of South Africa. He encouraged the workings at Jagersfontein, and he also called attention to the diamantiferous neck at Kimberley. He was one of the founders of the Geological Society of South Africa at Johannesburg in 1895; and for some years previously he was a member of the Cape parliament. He died at Grahamstown, on the 26th of June 1898.

See the obituary by T. Rupert Jones, *Natural Science*, vol. xiv. (January 1899).

ATHERSTONE, a market-town in the Nuneaton parliamentary division of Warwickshire, England, 102½ m. N.W. from London by the London & North-Western railway. Pop. (1901) 5248. It lies in the upper valley of the Anker, under well-wooded hills to the west, and is on the Roman Watling Street, and the Coventry canal. The once monastic church of St Mary is rebuilt, excepting the central tower and part of the chancel. The chief industry is hat-making. On the high ground to the west lie ruins of the Cistercian abbey of Merevale, founded in 1149; they include the gatehouse chapel, part of the refectory and other remains exhibiting beautiful details of the 14th century. Coal is worked at Baxterley, 3 m. west of Atherstone.

Atherstone (*Aderestone, Edridestone, Edrichestone*), though not mentioned in any pre-Conquest record, is of unquestionably ancient origin. A Saxon barrow was opened near the town in 1824. It is traversed by Watling Street, and portions of the ancient Roman road have been discovered in modern times. Atherstone is mentioned in Domesday among the possessions of Countess Godiva, the widow of Leofric. In the reign of Henry III. it passed to the monks of Bec in Normandy, who in 1246 obtained the grant of an annual fair at the feast of the Nativity of the Virgin, and the next year of a market every Tuesday. This market became so much frequented that in 1319 a toll was levied upon all goods coming into the town, in order to defray the cost of the repair to the roads necessitated by the constant traffic, and in 1332 a similar toll was levied on all goods passing over the bridge called Feldenbrigge near Atherstone. The September fair and Tuesday markets are still continued. In the reign of Edward III. a house of Austin Friars was founded at Atherstone by Ralph Lord Basset of Drayton, which, however, never rose to much importance, and at its dissolution in 1536 was valued at 30 shillings and 3 pence only.

ATHERTON, or Chowbent, an urban district in the Leigh parliamentary division of Lancashire, England, 13 m. W.N.W. of Manchester on the London & North-Western and Lancashire & Yorkshire railways. Pop. (1901) 16,211. The cotton factories are the principal source of industry; there are also iron-works and collieries. The manor was held by the local family of Atherton from John's reign to 1738, when it passed by marriage to Robert Gwillym, who assumed that name. In 1797 his eldest daughter and co-heiress married Thomas Powys, afterwards the second Lord Lilford. Up to 1891 the lord of the manor held a court-leet and court-baron annually in November, but in that year Lord Lilford sold to the local board the market tolls, stallages and pickages, and since this sale the courts have lapsed. The earliest manufactures were iron and cotton. Silk-weaving, formerly an extensive industry, has now almost entirely decayed. The first chapel or church was built in 1645. James Wood, who became Nonconformist minister in the chapel at Atherton in 1691, earned fame and the familiar title of "General" by raising a force from his congregation, uncouthly armed, to fight against the troops of the Pretender (1715).

ATHETOSIS (Gr. ἄθετος, "without place"), the medical term applied to certain slow, purposeless, deliberate movements of the hands and feet. The fingers are separately flexed and extended, abducted and adducted in an entirely irregular way. The hands as a whole are also moved, and the arms, toes and feet may be affected. The condition is usually due to some lesion of the brain which has caused hemiplegia, and is especially common in childhood. It is occasionally congenital (so called), and is then due to some injury of the brain during birth. It is more usually associated with hemiplegia, in which condition there is first of all complete voluntary immobility of the parts affected: but later, as there is a return of a certain amount of power over the limbs affected, the slow rhythmic movements of athetosis are first noticed. This never develops, however, where there is no recovery of voluntary power. Its distribution is thus nearly always hemiplegic, and it is often associated with more or less mental impairment. The movements may or may not continue during sleep. They cannot be arrested for more than a moment by will power, and are aggravated by voluntary movements. The prognosis is unsatisfactory, as the condition usually continues unchanged for years, though improvement occasionally occurs in slight cases, or even complete recovery.

ATHIAS, JOSEPH (d. 1700), Jewish rabbi and printer, was born in Spain and settled in Amsterdam. His editions of the Hebrew Bible (1661, 1667) are noted for beauty of execution and the general correctness of the text. He also printed a Judaeo-German edition of the Bible in 1679, a year after the appearance of the edition by Uri Phoebus.

ATHLETE (Gr. ἀθλητής; Lat. *athleta*), in Greek and Roman antiquities, one who contended for a prize (ἆθλον) in the games; now a general term for any one excelling in physical strength. Originally denoting one who took part in musical, equestrian, gymnastic, or any other competitions, the name became restricted to the competitors in gymnastic contests, and, later, to the class of professional athletes. Whereas in earlier times competitors, who were often persons of good birth and position, entered the lists for glory, without any idea of material gain, the professional class, which arose as early as the 5th century B.C., was chiefly recruited from the lower orders, with whom the better classes were unwilling to associate, and took up athletics entirely as a means of livelihood. Ancient philosophers, moralists and physicians were almost unanimous in condemning the profession of athletics as injurious not only to the mind but also to the body. The attack made upon it by Euripides in the fragment of the *Autolycus* is well known. The training for the contests was very rigorous. The matter of diet was of great importance; this was prescribed by the *aleiptes*, whose duty it also was to anoint the athlete's body. At one time the principal food consisted of fresh cheese, dried figs and wheaten bread. Afterwards meat was introduced, generally beef, or pork; but the bread and meat were taken separately, the former at breakfast, the latter at dinner. Except in wine, the quantity was unlimited, and the capacity of some of the heavy-weights must have been, if such stories as those about Milo are true, enormous. In addition to the ordinary gymnastic exercises of the palaestra, the athletes were instructed in carrying heavy loads, lifting weights, bending iron rods, striking at a suspended leather sack filled with sand or flour, taming bulls, &c. Boxers had to practise delving the ground, to strengthen their upper limbs. The competitions open to athletes were running, leaping, throwing the discus, wrestling, boxing and the pancratium, or combination of boxing and wrestling. Victory in this last was the highest achievement of an athlete, and was reserved only for men of extraordinary strength. The competitors were naked, having their bodies salved with

oil. Boxers wore the *caestus*, a strap of leather round the wrists and forearms, with a piece of metal in the fist, which was sometimes employed with great barbarity. An athlete could begin his career as a boy in the contests set apart for boys. He could appear again as a youth against his equals, and though always unsuccessful, could go on competing till the age of thirty-five, when he was debarred, it being assumed that after this period of life he could not improve. The most celebrated of the Greek athletes whose names have been handed down are Milo of Crotona, Hipposthenes, Polydamas, Promachus and Glaucus. Cyrene, famous in the time of Pindar for its athletes, appears to have still maintained its reputation to at least the time of Alexander the Great; for in the British Museum are to be seen six prize vases carried off from the games at Athens by natives of that district. These vases, found in the tombs, probably, of the winners, are made of clay, and painted on one side with a representation of the contest in which they were won, and on the other side with a figure of Pallas Athena, with an inscription telling where they were gained, and in some cases adding the name of the eponymous magistrate of Athens, from which the exact year can be determined.

Amongst the Romans athletic contests had no doubt taken place from the earliest times, but according to Livy (xxxix. 22) professional Greek athletes were first introduced at Rome by M. Fulvius Nobilior in 186 B.C. After the institution of the Actian games by Augustus, their popularity increased, until they finally supplanted the gladiators. In the time of the empire, gilds or unions of athletes were formed, each with a temple, treasury and exercise-ground of its own. The profession, although it ranked above that of a gladiator or an actor, was looked upon as derogatory to the dignity of a Roman, and it is a rare thing to find a Roman name amongst the athletes on inscriptions. The system was entirely, and the athletes themselves nearly always, Greek. (See also Games, Classical.)

Krause, *Gymnastik und Agonistik der Hellenen* (1841); Friedländer, *Sittengeschichte Roms*, ii.; Reisch, in Pauly-Wissowa, *Realencyc.*

ATHLETIC SPORTS. Various sports were cultivated many hundred years before the Christian era by the Egyptians and several Asiatic races, from whom the early Greeks undoubtedly adopted the elements of their athletic exercises (see Athlete), which reached their highest development in the Olympic games, and other periodical meetings of the kind (see Games, Classical). The original Celtic inhabitants of Great Britain were an athletic race, and the earliest monuments of Teutonic literature abound in records of athletic prowess. After the Norman conquest of England the nobles devoted themselves to the chase and to the joust, while the people had their games of ball, running at the quintain, fencing with club and buckler, wrestling and other pastimes on green and river. The chroniclers of the succeeding centuries are for the most part silent concerning the sports of the folk, except such as were regarded as a training for war, as archery, while they love to record the prowess of the kings and their courts. Thus it is told of Henry V. that he "was so swift a runner that he and two of his lords, without bow or other engine, would take a wild buck in a large park." Several romances of the middle ages, quoted by Strutt (*Sports and Pastimes of the People of England*), chronicle the fact that young men of good family were taught to run, leap, wrestle and joust. In spite of the general silence of the historians concerning the sports of the people, it is evident that they were indulged in very largely, since several English sovereigns found it necessary to curtail, and even prohibit, certain popular pastimes, on the ground that they seduced the people from the practice of archery. Thus Edward III. prohibited weight-putting by statute. Nevertheless a variety of this exercise, "casting of the barre," continued to be a popular pastime, and was afterwards one of the favourite sports of Henry VIII., who attained great proficiency at it. The prowess of the same monarch at throwing the hammer is a matter of history, and his reign seems to have been at a time of general athletic revival. We even find his secretary, Richard Pace, advising the sons of noblemen to practise their sports and "leave study and learning to the children of meaner people," and Sir William Forest, in his *Poesye of Princeelye Practice*, thus admonishes his high-born readers:—

"In featis of maistries bestowe some diligence.
Too ryde, runne, lepe, or caste by violence
Stone, barre or plummett, or such other thinge,
It not refuseth any prince or kynge."

Mr Montague Shearman, to whose volume on *Athletics* in the Badminton series the reader is referred, notes that Sir Thomas Elyot, who wrote at about the same period, deprecated too much study and flogging for schoolboys, saying: "A discrete master may with as much or more ease both to himself and his scholler lead him to play at tennis or shoote." Elyot recommends the perusal of Galen's *De sanitate tuenda*, and suggests as suitable athletic exercises within doors "deambulations, labouryng with poyses made of ledde, lifting and throwing the heavy stone or barre, playing at tennis," and dwells upon "rennyng" as a "good exercise and laudable solace." It is probable that the disciples of the "new learning," who had become prominent in Sir Thomas's time, endeavoured to combat the influence of athletic exercises, their point of view being exemplified by the dictum of Roger Ascham, who, in his *Toxophilus*, declares that "running, leaping and quoiting be too vile for scholars."

In the 16th century the great football match played annually at Chester was abolished in favour of a series of foot-races, which took place in the presence of the mayor. A list of the common sports of that time is contained in some verses by Randel Holme, a minstrel of the North country, and makes mention of throwing the sledge, jumping, "wrastling," stool-ball (cricket), running, pitching the bar, shooting, playing loggets, "nine holes or ten pins," "football by the shinnes," leap-frog, morris, shove-groat, leaping the bonfire, stow-ball (golf), and many other outdoor and indoor sports, some of them now obsolete. Shakespeare and the other Elizabethan poets abound in allusions to sport, which formed an important feature in school life and at every fair. The Stuart kings were warm encouragers of sport, the *Basilikon Doron* of James I., written for his son, containing a recommendation to the young prince to practise "running, leaping, wrestling, fencing, dancing, and playing at the caitch, or tennise, archerie, palle-malle, and such like other fair and pleasant field games."

An extraordinary variety of sports has been popular in Great Britain with high and low for the past five centuries, no other country comparing with it in this respect. Nor have Ireland and Scotland lagged behind England in athletic prowess. Indeed, so far as history and legend record, Ireland boasts of by far the most ancient organized sports known, the Tailtin Games, or Lugnasad, traditionally established by Lugaid of the Long Arm, one of the gods of Dia and Ana, in honour of his foster-mother Tailti, some three thousand years ago. For many centuries these games, and others like them, were kept up in Ireland, and though the almost constant wars which harried the country finally destroyed their organization, yet the Irish have always been, and still are, a very important factor in British athletics, as well as in America and the colonies.

The Scottish people have, like the Irish, ever delighted in feats of strength and skill, especially the Celtic highlanders, the character of whose country and mode of life have, however, prevented organized athletics from attaining the same prominence as in England. Nevertheless, the celebrated Highland games held at Braemar, Bridge of Allan, Luss, Aboyne and other places have served to bring into prominence many athletes of the first class, although the records, on account of the roughness of the grounds, have not generally vied with those made farther south.

The Briton does not lose his love of sport upon leaving his native soil, and the development of athletics in the United States and the British colonies has kept step with that of the mother-land. Upon the continent of Europe sports have occupied a more or less prominent place in the life of the nations, but their development has been but an echo of that in Great Britain. A great advance, however, has been made since the institution of the modern Olympic games.

About the year 1812 the Royal Military College at Sandhurst inaugurated regular athletic sports, but the example was not followed until about 1840, when Rugby, Eton, Harrow, Shrewsbury and the Royal Military Academy at Woolwich came to the front, the "Crick Run" at Rugby having been started in 1837. At the two great English universities there were no organized sports of any kind until 1850, when Exeter College, Oxford, held a meeting; this example has been followed, one after the other, by the other colleges of both institutions. The first contest between Oxford and Cambridge occurred at Oxford in 1864, the programme consisting of eight events, of which four were won by each side. The same year saw the first contest of the Civil Servants, still an annual event.

In 1866 the Amateur Athletic Club was formed in London for "gentlemen amateurs," most of its members being old university men. Its first championship meeting, held in that year, was the beginning of a series afterwards continued to the present day by the Amateur Athletic Association, founded in 1880, which has jurisdiction over British athletic sports. The most important individual English athletic

organization is the London Athletic Club, which antedated the Amateur Athletic Club, and whose meetings have always been the most important events except the championships.

In America a revival of interest in athletic sports took place about the year 1870. Ten years later was formed the National Association of Amateur Athletes of America, which, in 1888, became the Amateur Athletic Union. This body controls athletics throughout the United States, and is allied with the Canadian Amateur Athletic Association. It is supreme in matters of amateur status, records and licensing of meetings, and has control over the following branches of sport: basket-ball, billiards, boxing, fencing (in connexion with the Amateur Fencers' League of America), gymnastics, hand-ball (fives), running, jumping, walking, weight-putting (hammer, shot, discus, weights), hurdle-racing, lacrosse, pole-vaulting, swimming, tugs-of-war and wrestling. The Amateur Athletic Union has eight sectional groups, and is allied with the Intercollegiate Association of Amateur Athletes of America (founded 1876) and the Western Intercollegiate Association. The first American intercollegiate athletic meeting took place at Saratoga in 1873, only three universities competing, though the next year there were eight and in 1875 thirteen. Professional athletes in America are confined almost entirely to base-ball, boxing, bicycling, wrestling and physical training.

The Canadian athletic championships are held independently of the American. Annual championship meetings are also held in South Africa, New Zealand and the different states of Australia. For the Australasian championships New Zealand joins with Australia.

The organization of university sports in America differs from that at Oxford and Cambridge, where there is no official control on the part of the university authorities, and where a man is eligible to represent his college or university while in residence. In nearly all 848
American universities and colleges athletic and other sports are under the general control of faculty committees, to which the undergraduate athletic committees are subordinate, and which have the power to forbid the participation of any student who has not attained a certain standard of scholarship. For some years prior to 1906 no student of an American university was allowed to represent his university in any sport for longer than four years. Early in that year, however, many of the most important institutions, including Harvard, Yale, Princeton and Pennsylvania, entered upon a new agreement, that only students who have been in residence one year should play in 'varsity teams in any branch of athletics and that no student should play longer than three years. This, together with many other reformatory changes, was directly due to a widespread outcry against the growing roughness of play exhibited in American football, basket-ball, hockey and other sports, the too evident desire to win at all hazards, the extraordinary luxury of the training equipment, and the enormous gate-receipts of many of the large institutions—the Yale Athletic Association held a surplus of about $100,000 (£20,000) in December 1905, after deducting immense amounts for expenses. The new rule against the participation of freshmen in 'varsity sports was to discourage the practice of offering material advantages of different kinds to promising athletes, generally those at preparatory schools, to induce them to become students at certain universities.

At the present day athletic sports are usually understood to consist of those events recognized in the championship programmes of the different countries. Those in the competitions between Oxford and Cambridge are the 100 yards, 440 yards, 880 yards, 1-mile and 3-mile runs; 120 yards hurdle-race; high and long jumps; throwing the hammer; and putting the weight (shot). To the above list the English A.A.A. adds the 4-mile and 10-mile runs; the 2-mile and 7-mile walking races; the 2-mile steeplechase; and the pole-vault. The American intercollegiate programme is identical with that of the Oxford-Cambridge meeting, except that a 2-mile run takes the place of the 3-mile, and the pole-vault is added. The American A.A.U. programme includes the 100 yards, 220 yards, 440 yards, 880 yards, 1-mile and 5-mile runs; 120 yards high-hurdle race; 220 yards low-hurdle race; high and broad (long) jumps; throwing the hammer; throwing 56-lb weight; putting 16-lb shot; throwing the discus; and pole-vault. Of these the running contests are called "track athletics," and the rest "field" events.

International athletic contests of any importance have, with the exception of the modern Olympic games, invariably taken place between Britons, Americans and Canadians, the continental European countries having as yet produced few track or field athletes of the first class, although the interest in sports in general has greatly increased in Europe during the last ten years. In 1844 George Seward, an American professional runner, visited England and competed with success against the best athletes there; and in 1863 Louis Bennett, called "Deerfoot," a full-blooded Seneca Indian, repeated Seward's triumphs, establishing running records up to 12 miles. In 1878 the Canadian, C.C. McIvor, champion sprinter of America, went to England, but failed to beat his British professional rivals. In 1881 L.E. Myers of New York and E.E. Merrill of Boston competed successfully in England, Myers winning every short-distance championship except the 100-yards, and Merrill all the walking championships save the 7-miles. The same year W.C. Davies of England won the 5-mile championship of America, but, like several other British runners who have had success in America, he competed under the colours of an American club. In 1882 the famous English runner, W.G. George, ran against Myers in America in races of 1 mile, ¾ mile and ½ mile, winning over the first two distances. In 1884 Myers again went to England and made new British records over 500, 600, 800 and 1000 yards, and world's records over ½ mile and 1200 yards. The next year he won both the British ¼-mile and ½-mile championships. The same year a team of Irish athletes, among them W.J.M. Barry, won several Canadian championships. In 1888 a team of the Manhattan Athletic Club, New York, competed in England with fair success, and during the same season an Irish team from the Gaelic Athletic Association visited America without much success. In 1890 a team from the Salford Harriers was invited to America by the Manhattan Athletic Club, but the evidently commercial character of the enterprise caused its failure. One of the Harriers, E.W. Parry, won the American steeplechase championship. The next year saw another visit to Europe of the Manhattan athletes, who had fair success in England and won every event at Paris. In 1895 the London Athletic Club team competed in New York against the New York Athletic Club, but lost every one of the eleven events, several new records being established. During the previous summer (1894) occurred the first of the international matches between British and American universities which still retain their place as the most interesting athletic event. In that contest, which took place at Queen's Club, London, Oxford beat Yale by 5½ to 3½ events. The next summer Cambridge, as the champion English university, visited America and was beaten by Yale (3 to 8). In 1899 both British universities competed at Queen's Club against the combined athletes of Harvard and Yale, who were beaten by the odd event. The return match took place between the same universities at New York in the summer of 1901, the Americans winning 6 to 3 events. In 1904 Harvard and Yale beat Oxford and Cambridge at Queen's Club by the same score.

Outside Great Britain and America the most important athletic events are undoubtedly the revived Olympic games. They were instituted by delegates from the different nations who met in Paris on the 16th of June 1894, principally at the instigation of Baron Pierre de Coubertin, the result being the formation of an International Olympic Games Committee with Baron de Coubertin at its head, which resolved that games should be held every fourth year in a different country. The first modern Olympiad took place at Athens, 6th to 12th April 1896, in the ancient stadium, which was rebuilt through the liberality of a Greek merchant and seated about 45,000 people. The programme of events included the usual field and track sports, gymnastics, wrestling, pole-climbing, lawn tennis, fencing, rifle and revolver shooting, weight-lifting, swimming, the Marathon race and bicycle racing. Among the contestants were representatives of nearly every European nation, besides Americans and Australians. Great Britain took little direct interest in the occasion and was inadequately represented, but the United States sent five men from Boston and four from Princeton University, who, though none of them held American championships, succeeded in winning every event for which they were entered. The Marathon race of 42 kilometres (26 miles), commemorative of the famous run of the Greek messenger to Athens with the news of the victory of Marathon, was won by a Greek peasant. The second Olympiad was held in Paris in June 1900. Again Great Britain was poorly represented, but American athletes won eighteen of the twenty-four championship events. The third Olympiad was held at St Louis in the summer of 1904 in connexion with the Louisiana Purchase Exposition, its success being due in great measure to James E. Sullivan, the physical director of the Exposition, and Caspar Whitney, the president of the American Olympic Games Committee. The games were much more numerous than at the previous Olympiads, including sports of all kinds, handicaps, inter-club competitions, and contests for aborigines. In the track and field competitions the American athletes won every championship except weight-throwing (56 lb) and lifting the bar. The sports of the savages, among whom were American Indians, Africans of several tribes, Moros, Patagonians, Syrians, Ainus and Filipinos, were disappointing; their efforts in throwing the javelin, shooting with bow and arrow, weight-lifting, running and jumping, proving to be feeble compared with those of white races. The Americanized Indians made the best showing.

The Greeks, however, were not altogether satisfied with the cosmopolitan character of the revival of these celebrated games of their ancestors, and resolved to give the revival a more definitely Hellenic stamp by intercalating an additional series, to take place at 849
Athens, in the middle of the quadrennial period. Their action was justified by the success which attended the first of this additional series at Athens in 1906. This success may have been partly due to the personal interest taken in the games by the king and royal family of Greece, and to the presence of King Edward VII., Queen Alexandra, and the prince and princess of Wales; but to whatever cause it should be assigned it was generally acknowledged that neither in France nor in America had the games acquired the same prestige as those held on the classical soil of Greece. In 1906 the governments of Germany, France and the United States made considerable grants of money to defray the expenses of the competitors from those countries. These games aroused much more

interest in England than the earlier ones in the series, but though upwards of fifty British competitors took part in the contests, they were by no means representative in all cases of the best British athletics. The American representatives were slightly less numerous, but they were more successful. It was noteworthy that no British or Americans took part in the rowing races in the Bay of Phalerum, nor in the tennis, football or shooting competitions. The Marathon race, by far the most important event in the games, was won in 1906 by a British athlete, M.D. Sherring, a Canadian by birth. The Americans won a total of 75 prizes, the British 39, and the Swedes and Greeks each 28.

The games of the 4th Olympiad (1908) were held in London in connexion with the Franco-British Exhibition of that year. An immense sensation was caused by the finish for the Marathon race from Windsor Castle to the stadium in the Exhibition grounds in London. The first competitor to arrive was the Italian, Dorando Pietri, whose condition of physical collapse was such that, appearing to be on the point of death, he had to be assisted over the last few yards of the course. He was therefore disqualified, and J. Hayes, an American, was adjudged the winner; a special prize was presented to the Italian by Queen Alexandra. In the whole series of contests the United Kingdom made 38 wins, the Americans 22, and the Swedes 7. In the Olympic games proper, British athletes, including two wins by colonials from Canada and Africa, scored 25 successes, and the Americans 18. In the track events 8 wins fell to the British, including two Colonials, and 6 to American athletes; but the latter gained complete supremacy in the field events, of which they won 9, while British competitors secured only two of minor importance.

For records, &c., see the annual *Sporting and Athletic Register*; for the Olympic games see Theodore Andrea Cook's volume, published in connexion with the Olympiad of 1908.

ATHLONE, a market-town of Co. Westmeath, Ireland, on both banks of the Shannon. Pop. of urban district (1901) 6617. The urban district, under the Local Government (Ireland) Act 1900, is wholly in county Westmeath, but the same area is divided by the Shannon between the parliamentary divisions of South Westmeath and South Roscommon. Athlone is 78 m. W. from Dublin by the Midland Great Western railway, and is also served by a branch from Portarlington of the Great Southern & Western line, providing an alternative and somewhat longer route from the capital. The main line of the former company continues W. to Galway, and a branch N.W. serves counties Roscommon and Mayo. The Shannon divides the town into two portions, known as the Leinster side (east), and the Connaught side (west), which are connected by a handsome bridge opened in 1844. There is a swivel railway bridge. The rapids of the Shannon at this point are obviated by means of a lock communication with a basin, which renders the navigation of the river practicable above the town. The steamers of the Shannon Development Company ply on the river, and some trade by water is carried on with Limerick, and with Dublin by the river and the Grand and Royal canals. Athlone is an important agricultural centre, and there are woollen factories. The salmon fishing both provides sport and is a source of commercial wealth. There are two parish churches, St Mary and St Peter, both erected early in the 19th century, of which the first has near it an isolated church tower of earlier date. There are three Roman Catholic chapels, a court-house and other public offices. Early remains include portions of the castle, of the town walls (1576), of the abbey of St Peter and of a Franciscan foundation. On several islands of the picturesque Lough Ree, to the north, are ecclesiastical and other remains.

The military importance of Athlone dates from the erection of the castle and of a bridge over the river by John de Grey, bishop of Norwich and justiciar of Ireland, in 1210. It became the seat of the presidency of Connaught under Elizabeth, and withstood a siege by the insurgents in 1641. In the war of 1688 the possession of Athlone was considered of the greatest importance, and it consequently sustained two sieges, the first by William III. in person, which failed, and the second by General Godart van Ginkel (*q.v.*), who, on the 30th of June 1691, in the face of the Irish, forded the river and took possession of the town, with the loss of only fifty men. Ginkel was subsequently created earl of Athlone, and his descendants held the title till it became extinct in 1844. In 1797 the town was strongly fortified on the Roscommon side, the works covering 15 acres and containing two magazines, an ordnance store, an armoury with 15,000 stands of arms and barracks for 1500 men. The works are now dismantled. Athlone was incorporated by James I., and returned two members to the Irish parliament, and one member to the imperial parliament till 1885.

ATHOL, a township of Worcester county, northern Massachusetts, U.S.A., having an area of 35 sq. m. Pop. (1900) 7061, of whom 986 were foreign-born; (1910 U.S. census) 8536. Its surface is irregular and hilly. The village of Athol is on Miller's river, and is served by the Boston & Albany and the Boston & Maine railways. The streams of the township furnish good water-power, and manufactures of varied character are its leading interests. Athol was first settled in 1735, and was incorporated as a township in 1762. It was named by its largest landowner Col. James Murray, after the ancestral home of the Murrays, dukes of Atholl.

See L.B. Caswell, *Athol, Mass., Past and Present* (Athol, 1899).

ATHOLL, EARLS AND DUKES OF. The Stewart line of the Scottish earls of Atholl, which ended with the 5th Stewart earl in 1595, the earldom reverting to the crown, had originated with Sir John Stewart of Balveny (d. 1512), who was created earl of Atholl about 1457 (new charter 1481). The 5th earl's daughter, Dorothea, married William Murray, earl of Tullibardine (cr. 1606), who in 1626 resigned his earldom in favour of Sir Patrick Murray, on condition of the revival of the earldom of Atholl in his wife and her descendants. The earldom thus passed to the Murray line, and John Murray, their only son (d. 1642), was accordingly acknowledged as earl of Atholl (the 1st of the Murrays) in 1629.

John Stewart, 4th earl of Atholl, in the Stewart line (d. 1579), son of John, 3rd earl, and of Grizel, daughter of Sir John Rattray, succeeded his father in 1542. He supported the government of the queen dowager, and in 1560 was one of the three nobles who voted in parliament against the Reformation and the Confession of Faith, and declared their adherence to Roman Catholicism. Subsequently, however, he joined the league against Huntly, whom with Murray and Morton he defeated at Corrichie in October 1562, and he supported the projected marriage of Elizabeth with Arran. On the arrival of Mary from France in 1561 he was appointed one of the twelve privy councillors, and on account of his religion obtained a greater share of the queen's favour than either Murray or Maitland. He was one of the principal supporters of the marriage with Darnley, became the leader of the Roman Catholic nobles, and with Lennox obtained the chief power in the government, successfully protecting Mary and Darnley from Murray's attempts to regain his ascendancy by force of arms. According to Knox he openly attended mass in the queen's chapel, and was especially trusted by Mary in her project of reinstating Roman Catholicism. The fortress of Tantallon was placed in his keeping, and in 1565 he was made lieutenant of the north of Scotland. He is described the same year by the French ambassador as "très grand catholique hardi et vaillant et remuant, comme l'on dict, mais de nul jugement et expérience." He had no share in the murders of Rizzio or Darnley, and after the latter crime in 1567, he joined the Protestant lords against Mary, appeared as one of the leaders against her at Carberry Hill, and afterwards approved of her imprisonment at Lochleven Castle. In July he was present at the coronation of James, and was included in the council of regency on Mary's abdication. He, however, was not present at Langside in May 1568, and in July became once more a supporter of Mary, voting for her divorce from Bothwell (1569). In March 1570 he signed with other lords the joint letter to Elizabeth asking for the queen's intercession and supporting Mary's claims, and was present at the convention held at Linlithgow in April in opposition to the assembly of the king's party at Edinburgh. In 1574 he was proceeded against as a Roman Catholic and threatened with excommunication, subsequently holding a conference with the ministers and being allowed till midsummer to overcome his scruples. He had failed in 1572 to prevent Morton's appointment to the regency, but in 1578 he succeeded with the earl of Argyll in

driving him from office. On the 24th of March James took the government into his own hands and dissolved the regency, and Atholl and Argyll, to the exclusion of Morton, were made members of the council, while on the 29th Atholl was appointed lord chancellor. Subsequently, on the 24th of May, Morton succeeded in getting into Stirling Castle and in regaining his guardianship of James. Atholl and Argyll, who were now corresponding with Spain in hopes of assistance from that quarter, then advanced to Stirling with a force of 7000 men, when a compromise was arranged, the three earls being all included in the government. While on his way from a banquet held on the 20th of April 1579 on the occasion of the reconciliation, Atholl was seized with sudden illness, and died on the 25th, not without strong suspicions of poison. He was buried at St. Giles's cathedral in Edinburgh. He married (1) Elizabeth, daughter of George Gordon, 4th earl of Huntly, by whom he had two daughters, and (2) Margaret, daughter of Malcolm Fleming, 3rd Lord Fleming, by whom, besides three daughters, he had John, 5th earl of Atholl, at whose death in 1595 the earldom in default of male heirs reverted to the crown.

John Murray, 1st earl of Atholl in the Murray line (see above), died in 1642. On the outbreak of the civil war he called out the men of Atholl for the king, and was imprisoned by the marquess of Argyll in Stirling Castle in 1640.

John Murray, 2nd earl and 1st marquess of Atholl (1631-1703), son of the 1st earl and of Jean, daughter of Sir Duncan Campbell of Glenorchy, was born on the 2nd of May 1631. In 1650 he joined in the unsuccessful attempt to liberate Charles II. from the Covenanters, and in 1653 was the chief supporter of Glencairn's rising, but was obliged to surrender with his two regiments to Monk on the 2nd of September 1654. At the restoration Atholl was made a privy councillor for Scotland and sheriff of Fife, in 1661 lord justice-general of Scotland, in 1667 a commissioner for keeping the peace in the western Highlands, in 1670 colonel of the king's horseguards, in 1671 a commissioner of the exchequer, and in 1672 keeper of the privy seal in Scotland and an extraordinary lord of session. In 1670 he became earl of Tullibardine by the death of his cousin James, 4th earl, and on the 7th of February 1676 he was created marquess of Atholl, earl of Tullibardine, viscount of Balquhidder, Lord Murray, Balvenie and Cask. He at first zealously supported Lauderdale's tyrannical policy, but after the raid of 1678, called the "Highland Host," in which Atholl was one of the chief leaders, he joined in the remonstrance to the king concerning the severities inflicted upon the Covenanters, and was deprived of his office of justice-general and passed over for the chancellorship in 1681. In 1679, however, he was present at the battle of Bothwell Brig; in July 1680 he was made vice-admiral of Scotland, and in 1681 president of parliament. In 1684 he was appointed lord-lieutenant of Argyll, and invaded the country, capturing the earl of Argyll after his return from abroad in June 1685 at Inchinnan. The excessive severities with which he was charged in this campaign were repudiated with some success by him after the Revolution.[1] The same year he was reappointed lord privy seal, and in 1687 was made a knight of the Thistle on the revival of the order. At the Revolution he wavered from one side to the other, showing no settled purpose but waiting upon the event, but finally in April 1689 wrote to William to declare his allegiance, and in May took part in the proclamation of William and Mary as king and queen at Edinburgh. But on the occasion of Dundee's insurrection he retired to Bath to drink the waters, while the bulk of his followers joined Dundee and brought about in great measure the defeat of the government troops at Killiecrankie. He was then summoned from Bath to London and imprisoned during August. In 1690 he was implicated in the Montgomery plot and subsequently in further Jacobite intrigues. In June 1691 he received a pardon, and acted later for the government in the pacification of the Highlands. He died on the 6th of May 1703. He married Amelia, daughter of James Stanley, 7th earl of Derby (through whom the later dukes of Atholl acquired the sovereignty of the Isle of Man), and had, besides one daughter, six sons, of whom John became 2nd marquess and 1st duke of Atholl; Charles was made 1st earl of Dunmore, and William married Margaret, daughter of Sir Robert Nairne, 1st Lord Nairne, becoming in her right 2nd Lord Nairne.

John Murray, 2nd marquess and 1st duke of Atholl (1660-1724), was born on the 24th of February 1660, and was styled during his father's lifetime Lord Murray, till 1696, when he was created earl of Tullibardine. He was a supporter of William and the Revolution in 1688, taking the oaths in September 1689, but was unable to prevent the majority of his clan, during his father's absence, from joining Dundee under the command of his brother James. In 1693 as one of the commissioners he showed great energy in the examination into the massacre of Glencoe and in bringing the crime home to its authors. In 1694 he obtained a regiment, in 1695 was made sheriff of Perth, in 1696 secretary of state, and from 1696 to 1698 was high commissioner. In the latter year, however, he threw up office and went into opposition. At the accession of Anne he was made a privy councillor, and in 1703 lord privy seal for Scotland. The same year he succeeded his father as 2nd marquess of Atholl, and on the 30th of June he was created duke of Atholl, marquess of Tullibardine, earl of Strathtay and Strathardle, Viscount Balquhidder, Glenalmond and Glenlyon, and Lord Murray, Balvenie and Gask. In 1704 he was made a knight of the Thistle. In 1703-1704 an unsuccessful attempt was made by Simon, Lord Lovat, who used the duke of Queensberry as a tool, to implicate him in a Jacobite plot against Queen Anne; but the intrigue was disclosed by Robert Ferguson, and Atholl sent a memorial to the queen on the subject, which resulted in Queensberry's downfall. But he fell nevertheless into suspicion, and was deprived of office in October 1705, subsequently becoming a strong antagonist of the government, and of the Hanoverian succession. He vehemently opposed the Union during the years 1705-1707, and entered into a project for resisting by force and for holding Stirling Castle with the aid of the Cameronians, but nevertheless did not refuse a compensation of £1000. According to Lockhart, he could raise 6000 of the best men in the kingdom for the Jacobites. On the occasion, however, of the invasion of 1708 he took no part, on the score of illness, and was placed under arrest at Blair Castle. On the downfall of the Whigs and the advent of the Tories to power, Atholl returned to office, was chosen a representative peer in the Lords in 1710 and 1713, in 1712 was an extraordinary lord of session, from 1713 to 1714 was once more keeper of the privy seal, and from 1712 to 1714 was high commissioner. On the accession of George I. he was again dismissed from office, but at the rebellion of 1715, while three of his sons joined the Jacobites, he remained faithful to the government, whom he assisted in various ways, on the 4th of June 1717 apprehending Robert Macgregor (Rob Roy), who, however, succeeded in escaping. He died on the 14th of November 1724. He married (1) Catherine, daughter of William Douglas, 3rd duke of Hamilton, by whom, besides one daughter, he had six sons, of whom John was killed at Malplaquet in 1709, William was marquess of Tullibardine, and James succeeded his father as 2nd duke on account of the share taken by his elder brother in the rebellion; and (2) Mary, daughter of William, Lord Ross, by whom he had three sons and several daughters.

The *Atholl Chronicles* have been privately printed by the 7th duke of Atholl (b. 1840). See also S. Cowan, *Three Celtic Earldoms* (1909).

1 A. Lang, *Hist. of Scotland*, iii. 407.

ATHOLL, or Athole, a district in the north of Perthshire, Scotland, covering an area of about 450 sq. m. It is bounded on the N. by Badenoch, on the N.E. by Braemar, on the E. by Forfarshire, on the S. by Breadalbane, on the W. and N.W. by Lochaber. The Highland railway bisects it diagonally from Dunkeld to the borders of Inverness-shire. It is traversed by the Grampian mountains and watered by the Tay, Tummel, Garry, Tilt, Bruar and other streams. Glen Garry and Glen Tilt are the chief glens, and Loch Rannoch and Loch Tummel the principal lakes. The population mainly centres around Dunkeld, Pitlochry and Blair Atholl. The only cultivable soil occurs in the valleys of the large rivers, but the deer-forest and the shootings on moor and mountain are among the most extensive in Scotland. It is said to have been named Athfotla (Atholl) after Fotla, son of the Pictish king Cruithne, and was under the rule of a Celtic *mormaer* (thane or earl) until the union of the Picts and Scots under Kenneth Macalpine in 843. The duke of Atholl's seats are Blair Castle and Dunkeld House. What is called Atholl brose is a compound, in equal parts, of whisky and honey (or oatmeal), which was first commonly used in the district for hoarseness and sore throat.

ATHOS (Gr. Ἄγιον Ὄρος; Turk. *Aineros*; Ital. *Monte Santo*), the most eastern of the three peninsular promontories which extend, like the prongs of a trident, southwards from the coast of Macedonia (European Turkey) into the Aegean Sea. Before the 19th century the name Athos was usually confined to the terminal peak of the promontory, which was itself known by its ancient name, *Acte*. The peak rises like a pyramid, with a steep summit of white marble, to a height of 6350 ft., and can be seen at sunset from the plain of Troy on

the east, and the slopes of Olympus on the west. On the isthmus are distinct traces of the canal cut by Xerxes before his invasion of Greece in 480 B.C. The peninsula is remarkable for the beauty of its scenery, and derives a peculiar interest from its unique group of monastic communities with their medieval customs and institutions, their treasures of Byzantine art and rich collections of documents. It is about 40 m. in length, with a breadth varying from 4 to 7 m.; its whole area belongs to the various monasteries. It was inhabited in the earliest times by a mixed Greek and Thracian population; of its five cities mentioned by Herodotus few traces remain; some inscriptions discovered on the sites were published by W.M. Leake (*Travels in N. Greece*, 1835, iii. 140) and Kinch. The legends of the monks attribute the first religious settlements to the age of Constantine (274-337), but the hermitages are first mentioned in historical documents of the 9th century. It is conjectured that the mountain was at an earlier period the abode of anchorites, whose numbers were increased by fugitives from the iconoclastic persecutions (726-842). The "coenobian" rule to which many of the monasteries still adhere was established by St Athanasius, the founder of the great monastery of Laura, in 969. Under a constitution approved by the emperor Constantine Monomachos in 1045, women and female animals were excluded from the holy mountain. In 1060 the community was withdrawn from the authority of the patriarch of Constantinople, and a monastic republic was practically constituted. The taking of Constantinople by the Latins in 1204 brought persecution and pillage on the monks; this reminded them of earlier Saracenic invasions, and led them to appeal for protection to Pope Innocent III., who gave them a favourable reply. Under the Palaeologi (1260-1453) they recovered their prosperity, and were enriched by gifts from various sources. In the 14th century the peninsula became the chosen retreat of several of the emperors, and the monasteries were thrown into commotion by the famous dispute over the mystical Hesychasts.

Owing to the timely submission of the monks to the Turks after the capture of Salonica (1430), their privileges were respected by successive sultans: a tribute is paid to the Turkish government, which is represented by a resident *kaimakam*, and the community is allowed to maintain a small police force. Under the present constitution, which dates from 1783, the general affairs of the commonwealth are entrusted to an assembly (σύναξις) of twenty members, one from each monastery; a committee of four members, chosen in turn, styled *epistatae* (ἐπιστάται), forms the executive. The president of the committee (ὁ πρῶτος) is also the president of the assembly, which holds its sittings in the village of Karyes, the seat of government since the 10th century. The twenty monasteries, which all belong to the order of St Basil, are: Laura (ἡ Λαῦρα), founded in 963; Vatopédi (Βατοπέδιον), said to have been founded by the emperor Theodosius; Rossikon (Ῥωσσικόν), the Russian monastery of St Panteleïmon; Chiliándari (Χιλιαντάριον: supposed to be derived from χίλιοι ἄνδρες or χίλια λεοντάρια), founded by the Servian prince Stephen Nemanya (1159-1195); Iveron (ἡ μονὴ τῶν Ἰβήρων), founded by Iberians, or Georgians; Esphigmenu (τοῦ Ἐσφιγμένου: the name is derived from the confined situation of the monastery); Kutlumush (Κουτλουμούση); Pandocratoros (τοῦ Παντοκράτορος); Philotheu (Φιλοθέου); Caracallu (τοῦ Καρακάλλου); St Paul (τοῦ ἁγίου Παύλου); St Denis (τοῦ ἁγίου Διονυσίου); St Gregory (τοῦ ἁγίου Γρηγορίου); Simópetra (Σιμόπετρα); Xeropotámu (τοῦ Ξηροποτάμου); St Xenophon (τοῦ ἁγίου Ξενοφῶντος); Dochiaríu (Δοχειαρείου); Constamonítu (Κωνσταμονίτου); Zográphu (τοῦ Ζωγράφου); and Stavronikítu (τοῦ Σταυρονικίτου, the last built, founded in 1545). The "coenobian" monasteries (κοινόβια), each under the rule of an abbot (ἡγούμενος), are subjected to severe discipline; the brethren are clothed alike, take their meals (usually limited to bread and vegetables) in the refectory, and possess no private property. In the "idiorrhythmic" monasteries (ἰδιόρρυθμα), which are governed by two or three annually elected wardens (ἐπίτροποι), a less stringent rule prevails, and the monks are allowed to supplement the fare of the monastery from their private incomes. Dependent on the several monasteries are twelve *sketae* (σκῆται) or monastic settlements, some of considerable size, in which a still more ascetic mode of life prevails: there are, in addition, several farms (μετοχία), and many hundred sanctuaries with adjoining habitations (κελλία) and hermitages (ἀσκητήρια). The monasteries, with the exception of Rossikón (St Panteleïmon) and the Serbo-Bulgarian Chiliándari and Zográphu, are occupied exclusively by Greek monks. The large *skete* of St Andrew and some others belong to the Russians; there are also Rumanian and Georgian *sketae*. The great monastery of Rossikón, which is said to number about 3000 inmates, has been under a Russian abbot since 1875; it is regarded as one of the principal centres of the Russian politico-religious propaganda in the Levant. The tasteless style of its modern buildings is out of harmony with the quaint beauty of the other monasteries. Furnished with ample means, the Russian monks neglect no opportunity of adding to their possessions on the holy mountain; their encroachments are resisted by the Greek monks, whose wealth, however, was much diminished by the secularization of their estates in Rumania (1864). The population of the holy mountain numbers from 6000 to 7000; about 3000 are monks (καλόγεροι), the remainder being lay brothers (κοσμικοί). The monasteries, which are all fortified, generally consist of large quadrangles enclosing churches; standing amid rich foliage, they present a wonderfully picturesque appearance, especially when viewed from the sea. Their inmates, when not engaged in religious services, occupy themselves with husbandry, fishing and various handicrafts; the standard of intellectual culture is not high. A large academy, founded by the monks of Vatopedi in 1749, for a time attracted students from all parts of the East, but eventually proved a failure, and is now in ruins. The muniment rooms of the monasteries contain a marvellous series of documents, including chrysobulls of various emperors and princes, *sigilla* of the patriarchs, *typica*, iradés and other documents, the study of which will throw an important light on the political and ecclesiastical history and social life of the East from the middle of the 10th century. Up to comparatively recent times a priceless 852
collection of classical manuscripts was preserved in the libraries; many of them were destroyed during the War of Greek Independence (1821-1829) by the Turks, who employed the parchments for the manufacture of cartridges; others fell a prey to the neglect or vandalism of the monks, who, it is said, used the material as bait in fishing; others have been sold to visitors, and a considerable number have been removed to Moscow and Paris. The library of Simopetra was destroyed by fire in 1891, and that of St Paul in 1905. There is now little hope of any important discovery of classical manuscripts. The codices remaining in the libraries are for the most part theological and ecclesiastical works. Of the Greek manuscripts, numbering about 11,000, 6618 have been catalogued by Professor Spyridion Lambros of Athens; his work, however, does not include the MSS. in some of the *sketae*, or those in the libraries of Laura and Vatopedi, of which catalogues (hitherto unpublished) have been prepared by resident monks. The canonic MSS. only of Vatopedi and Laura have been catalogued by Benessevich in the supplement to vol. ix. of the *Bizantiyskiy Vremennik* (St Petersburg, 1904). The Slavonic and Georgian MSS. have not been catalogued. Apart from the illuminated MSS., the mural paintings, the mosaics, and the goldsmith's work of Mount Athos are of infinite interest to the student of Byzantine art. The frescoes in general date from the 15th or 16th century: some are attributed by the monks to Panselinos, "the Raphael of Byzantine painting," who apparently flourished in the time of the Palaeologi. Most of them have been indifferently restored by local artists, who follow mechanically a kind of hieratic tradition, the principles of which are embodied in a work of iconography by the monk Dionysius, said to have been a pupil of Panselinos. The same spirit of conservatism is manifest in the architecture of the churches, which are all of the medieval Byzantine type. Some of the monasteries were seriously damaged by an earthquake in 1905.

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(J. D. B.)

ATHY (pronounced Athý), a market-town of Co. Kildare, Ireland, in the south parliamentary division, 45 m. S.W. of Dublin on a branch of the Great Southern & Western railway. Pop. of urban district (1901) 3599. It is intersected by the river Barrow, which is here crossed by a bridge of five arches. The crossing of the river here was guarded and disputed from the earliest times, and the name of the town is derived from a king of Munster killed here in the 2nd century. There are picturesque remains of Woodstock Castle of the 12th or 13th century, and White Castle built in 1506, and rebuilt in 1575 by a member of the family whose name it bears, and still occupied. Both were erected to defend the ford of the Barrow. There are also an old town gate, and an ancient cemetery with slight monastic remains. Previous to the Union Athy returned two members to the Irish parliament. The trade, chiefly in grain, is aided by excellent water communication, by a branch of the Grand Canal to Dublin, and by the river Barrow, navigable from here to Waterford harbour.

ATINA, the name of three ancient towns of Italy.

1. A town (mod. *Àtena*) of Lucania, upon the Via Popillia, 7 m. N. of Tegianum, towards which an ancient road leads, in the valley of the river now known as Diano. Its ancient importance is vouched for by its walls of rough cyclopean work, which may have had a total extent of some 2 m. (see G. Patroni in *Notizie degli scavi*, 1897, 112; 1901, 498). The date of these walls has not as yet been ascertained, recent excavations, which led to the discovery of a few tombs in which the earliest objects showing Greek influence may go back to the 7th century B.C., not having produced any decisive evidence on the point. To the Roman period belong the remains of an amphitheatre and numerous inscriptions.

2. A town (mod. *Atina*) of the Volsci, 12 m. N. of Casinum, and about 14 m. E. of Arpinum, on a hill 1607 ft. above sea-level. The walls, of carefully worked polygonal blocks of stone, are still preserved in parts, and the modern town does not fill the whole area which they enclose. Cicero speaks of it as a prosperous country town, which had not as yet fallen into the hands of large proprietors; and inscriptions show that under the empire it was still flourishing. One of these last is a boundary stone relating to the assignation of lands in the time of the Gracchi, of which six other examples have been found in Campania and Lucania.

3. A town of the Veneti, mentioned by Pliny, *H.N.* iii. 131.

ATITLÁN, or SANTIAGO DE ATITLÁN, a town in the department of Sololá, Guatemala, on the southern shore of Lake Atitlán. Pop. (1905) about 9000, almost all Indians. Cotton-spinning is the chief industry. Lake Atitlán is 24 m. long and 10 m. broad, with 64 m. circumference. It occupies a crater more than 1000 ft. deep and about 4700 ft. above sea-level. The peaks of the Guatemala Cordillera rise round it, culminating near its southern end in the volcanoes of San Pedro (7000 ft.) and Atitlán (11,719 ft.). Although the lake is fed by many small mountain torrents, it has no visible outlet, but probably communicates by an underground channel with one of the rivers which drain the Cordillera. Mineral springs abound in the neighbourhood. The town of Sololá (*q.v.*) is near the north shore of the lake.

ATKINSON, EDWARD (1827-1905), American economist, was born at Brookline, Massachusetts, on the 10th of February 1827. For many years he was engaged in managing various business enterprises, and became, in 1877, president of the Boston Manufacturers' Mutual Fire Insurance Company, a post which he held till his death. He was a strong controversialist and a prolific writer on such economic subjects as banking, railways, cotton manufacture, the tariff and free trade, and the money question. He was appointed in 1887 a special commissioner to report upon the status of bimetallism in Europe. He also made a special study of mill construction and fire prevention, and invented an improved cooking apparatus, called the "Aladdin oven." He was an active supporter of anti-imperialism. He died at Boston on the 11th of December 1905.

His principal works were *Right Methods of Preventing Fires in Mills* (1881); *Distribution of Products* (1885); *Industrial Progress of the Nation* (1889); *Taxation and Work* (1892); *Science of Nutrition* (10th ed., 1898).

ATKINSON, SIR HARRY ALBERT (1831-1892), British colonial statesman, prime minister and speaker of the legislative council, New Zealand, was born at Chester in 1831, and in 1855 emigrated to Taranaki, New Zealand, where he became a farmer. In 1860 the Waitara war broke out, and from its outset Atkinson, who had been selected as a captain of the New Plymouth Volunteers, distinguished himself by his contempt for appearances and tradition, and by the practical skill, energy and courage which he showed in leading his Forest Rangers in the tiresome and lingering bush warfare of the next five years. For this work he was made a major of militia, and thanked by the government. Elected to the house of representatives in 1863, he joined Sir Frederick Weld's ministry at the end of November 1864 as minister of defence, and, during eleven months of office, was identified with the well-known "self-reliance" policy, a proposal to dispense with imperial regulars, and meet the Maori with colonials only. Parliament accepted this principle, but turned out the Weld ministry for other reasons. For four years Atkinson was out of parliament; in October 1873 he re-entered it, and a year later became minister of lands under Sir Julius Vogel. Ten months later he was treasurer, and such was his aptitude for finance that, except during six months in 1876, he thenceforth held that post whenever his party was in power. From October 1874 to January 1891 Atkinson was only out of office for about five years. Three times he was premier, and he was always the most formidable debater and fighter in the ranks of the Conservative opponents of the growing Radical party which Sir George Grey, Sir Robert Stout and John Ballance led in succession. It was he, who was mainly responsible for the abolition of the provinces into which the colony was divided from 1853 to 1876. He repealed the Ballance land-tax in 1879, and substituted a property-tax. He greatly reduced the cost of the public service in 1880, and again in 1888. In both these years he raised the customs duties, amongst other taxes, and gave them a quasi-protectionist character. In 1880 he struck 10% off all public salaries and wages; in 1887 he reduced the salary of the governor by one-third, and the pay and number of ministers and members of parliament. By these resolute steps revenue was increased, expenditure checked, and the colony's finance reinstated. Atkinson was an advocate of compulsory national assurance, and the leasing as opposed to the selling of crown lands. Defeated in the general election of December 1890, he took the appointment of speaker of the legislative council. There, while leaving the council chamber after the sitting of the 28th of June 1892, he was struck down by heart disease and died in a few minutes. Though brusque in manner and never popular, he was esteemed as a vigorous, upright and practical statesman. He was twice married, and had seven children, of whom three sons and a daughter survived him.

(W. P. R.)

ATLANTA, the capital and the largest city of Georgia, U.S.A., and the county-seat of Fulton county, situated at an altitude of 1000-1175 ft., in the N.W. part of the state, near the Chattahoochee river. Pop. (1860) 9554; (1880) 37,409; (1890) 65,533; (1900) 89,872, of whom 35,727 were negroes and 2531 were foreign-born; (1910) 154,839. It is served by the Southern, the Central of Georgia, the Georgia, the Seaboard Air Line, the Nashville, Chattanooga & St Louis (which enters the city over the Western & Atlantic, one of its leased lines), the Louisville & Nashville, the Atlanta, Birmingham & Atlantic, and the Atlanta & West Point railways. These railway communications, and the situation of the city (on the Piedmont Plateau) on the water-parting between the streams flowing into the Atlantic Ocean and those flowing into the Gulf of Mexico, have given Atlanta its popular name, the "Gate City of the South." Atlanta was laid out in the form of a circle, the radius being 1¾ m. and the centre the old railway station, the Union Depot (the new station is called the Terminal); large additions have been made beyond this circle, including West End, Inman Park on the east, and North Atlanta. Among the best residence streets are Peachtree and West Peachtree streets to the north, and the older streets to the south of the business centre of the city—Washington Street, Whitehall, Pryor and Capitol Avenues. Among the principal office buildings are the Empire, the Equitable, the Prudential, the Fourth National, the Austell, the Peters, the Century, the English-American and the Candler

buildings; and there are many fine residences, particularly in Peachtree and Washington streets, Inman Park and Ponce de Leon Circle. Among prominent public buildings are the State Capitol (completed 1889), containing a law library of about 65,000 volumes and a collection of portraits of famous Georgians, the north-west front of the Capitol grounds containing an equestrian statue (unveiled in 1907) of John Brown Gordon (1832-1904), a distinguished Confederate general in the American Civil War and governor of Georgia in 1887-1890; the court house; the Carnegie library, in which the young men's library, organized in 1867, was merged in 1902; the post office building; and the Federal prison (about 4 m. south of the city). The principal parks are: the Piedmont (189 acres), the site of the Piedmont Exposition of 1887 and of the Cotton States and International Exposition of 1895; the Grant, given to the city by L.P. Grant, an Atlanta railroad builder, in 1882, and subsequently enlarged by the city (in its south-east corner is Fort Walker); the Lakewood, 6 m. south of the city; and Ponce de Leon Park, owned by an electric railway company and having mineral springs and a fine baseball ground. Four miles south of the centre of Atlanta is Fort McPherson, an important United States military post, occupying a reservation of 40 acres and having barracks for the accommodation of 1000 men. In Oakland Cemetery is a large monument to Confederate soldiers; another monument in Oakland, "To the unknown Confederate Dead," is a reproduction of the Lion of Lucerne; in West View Cemetery (4 m. west of the city) is a memorial erected by the United Confederate Veterans. The city obtains its water-supply from the Chattahoochee river (above the mouth of Peachtree Creek), whence the water is pumped by four pumps, which have a daily capacity of 55,000,000 gallons. Atlanta is widely known for its public spirit and enterprise, to which the expositions of 1881, 1887 and 1895 bear witness. The air is bracing, largely because of the city's altitude; the mean annual temperature is 60.8° F. (winter 44.1°, spring 60.5°, summer 77°, autumn 61.5°).

Atlanta is an important educational centre. Its public-school system was organized in 1871. Here are the Georgia School of Technology, founded in 1885 (opened 1888) as a branch of the university of Georgia; the Atlanta College of Physicians and Surgeons (established in 1898 by the union of the Atlanta Medical College, organized in 1855, and the Southern Medical College, organized in 1878); the Atlanta School of Medicine (1905); the Georgia College of Eclectic Medicine; the Atlanta Theological Seminary (1901, Congregational), the only theological school of the denomination in the South in 1908; the Atlanta Dental College; the Southern College of Pharmacy (1903); Washington Seminary (1877) for girls; and the following institutions for negroes—Atlanta University, founded in 1869, which is one of the best institutions in the country for the higher education of negroes, standing particularly for "culture" education (as opposed to industrial training), which has done particularly good work in the department of sociology, under the direction of Prof. W.E.B. du Bois (b. 1868), one of the most prominent teachers of negro descent in the country, and which had in 1908 339 students; Clark University, founded in 1870 by the Freedman's Aid and Southern Educational Society of the Methodist Episcopal Church; the Atlanta Baptist College, founded in 1867; Morris Brown College (African Methodist Episcopal, founded in 1882, and opened in 1885), which has college preparatory, scientific, academic, normal and missionary courses, correspondence courses in English and theology, an industrial department, and departments of law, theology (Turner Theological Seminary), nurse-training, music and art; the Gammon Theological Seminary (Methodist Episcopal, chartered in 1888), which has its buildings just outside the city limits; and the Spelman Seminary for women and girls (Baptist) opened in 1881 as the Atlanta Baptist Female Seminary—the present name being adopted in 1883 in honour of the parents of Mrs John D. Rockefeller—and incorporated in 1888. At Decatur (pop. 1418 in 1900), a residential suburb, 6 m. east-north-east of Atlanta, is the Agnes Scott College (1890) for white girls; connected with the college is a school of music, art and expression, and an academy.

The city's principal charitable institutions are the Grady Memorial hospital (opened in 1892), supported by the city and named in honour of Henry W. Grady; the Presbyterian hospital; the Baptist Tabernacle Infirmary; the Wesley Memorial hospital; St Joseph's infirmary; the Municipal hospital for contagious diseases; the Florence Crittenden home. Three miles south-east of the city is a (state) soldiers' home, for aged, infirm and disabled Confederate veterans. The Associated Charities of Atlanta was organized in 1905.

The principal newspapers are the *Constitution* (morning), edited from 1880 until 1889 by Henry W. Grady (1851-1889),[1] one of the most eloquent of Southern orators, who did much to promote the reconciliation of the North and the South after the Civil War, and whose statue stands opposite the post office; the *Journal* (evening), of which Hoke Smith (b. 1855), a prominent political leader, secretary of the interior in President Cleveland's cabinet in 1893-1896, and later governor of Georgia, was long the proprietor; and the *Georgian* (evening), founded in 1906 as a Prohibition organ.

As regards commerce and manufactures, Atlanta ranks first among the cities of Georgia. In 1907 its whosesale and retail trade was estimated at $100,000,000. The city is said to receive two-fifths of the total freight delivered in the state of Georgia. From 1895 to 1907 the bank clearings increased from about $65,000,000 to about $260,000,000. In recognition of the city's financial strength, Atlanta has been designated by the secretary of the treasury as one of the cities whose bonds will be accepted as security for Federal deposits. Atlanta is the Southern headquarters for a number of fire and life insurance companies, and is the third city of the United States in the amount of insurance business written and reported to resident agents, the annual premium receipts averaging about $10,000,000. It is an important horse and mule market, and handles much tobacco.

The development of manufactures has been especially notable. In 1880 the capital invested in manufacturing industries was approximately $2,468,000; in 1890 it was $9,508,962; in 1900 it had increased to $16,045,156; and in 1905, when only establishments under the "factory system" were counted in the census, to $21,631,162. In 1900 the total product was valued at $16,707,027, and the factory product at $14,418,834; and in 1905 the factory product was valued at $25,745,650, an increase of 78.6% in five years. Among the products are cotton goods (the product value of which in 1905 was 14% of the total value of the city's manufactures), foundry and machine-shop products, lumber, patent medicines, confectionery, men's clothing, mattresses, spring-beds and other furniture. Since 1904 part of the power utilized for manufacturing has been obtained from the Chattahoochee river, 15 m. from the city. There are many manufactories just outside the city limits.

History.—Atlanta owes its origin to the development of pioneer railroads of Georgia. In 1836 the Western & Atlantic, the first road built into North Georgia, was chartered, and the present site of Atlanta was chosen as its southern terminal, which it reached in 1843, and which was named "Terminus." The Georgia and the Central of Georgia then projected branches to Terminus in order to connect with the Western & Atlantic, and completed them in 1845 and 1846. The town charter of 1843 changed the name to Marthasville, in honour of the daughter of Governor Wilson Lumpkin; and the city charter of 1847 changed this to Atlanta. The population in 1850 was 2572; in 1860, 9554. Manufacturing interests soon became important, and during the Civil War Atlanta was the seat of Confederate military factories and a depot of supplies. In 1864 it was the objective point of the first stage of General William T. Sherman's invasion of Georgia (see American Civil War), which is therefore generally known as the "Atlanta campaign."

After the battles around Marietta (*q.v.*), and the crossing of the Chattahoochee river on the 8th and 9th of July, Sherman continued his advance against Atlanta. His plan of operations was directed primarily to the seizure of the Decatur railway, by which the Confederate commander, General J.E. Johnston, might receive support from Virginia and the Carolinas. The three Union armies under Sherman's command, outnumbering the Confederates about 3 to 2, began their movement on the 16th of July; the Army of the Cumberland (Gen. G.H. Thomas) on the right marching from Marietta by the fords of the Upper Chattahoochee on Atlanta, the Army of the Ohio (Gen. J.M. Schofield) in the centre direct on Decatur, and the Army of the Tennessee (Gen. J.B. McPherson) still farther east towards Stone Mountain. At the moment of marching out to meet the enemy, Johnston was relieved of his command and was replaced by Gen. J.B. Hood (July 17). Hood at once prepared to attack Thomas as soon as that general should have crossed Peachtree Creek (6 m. north of the city) and thus isolated himself from Schofield and McPherson. Sherman's confidence in Thomas and his troops was, however, justified. Hood's attack (battle of Peachtree Creek, July 20) was everywhere repulsed, and Schofield and McPherson closed up at the greatest speed. Hood had to retire to Atlanta, with a loss of more than 4000 men, and the three Union armies gradually converged on the north and east sides of the city. But Hood, who had been put in command as a fighting general, was soon ready to attack afresh. This time he placed Gen. W.J. Hardee's corps, the largest of his army, to the south of Atlanta, facing the left flank of McPherson's army. As Hardee's attack rolled up the Union army from left to right, the remainder of the Confederate army was to issue from the Atlanta fortifications and join in the battle. Hardee opened his attack at noon on the 22nd of July (battle of Atlanta). The troops of the Army of the Tennessee were swiftly driven back, and their commander, McPherson, killed; but presently the Federals re-formed and a severe struggle ensued, in which most of Hood's army joined. The veterans of the Army of the Tennessee, led by Gen. J.A. Logan, offered a stubborn resistance, however, and Schofield's army now intervened. After prolonged attacks lasting to nightfall, Hood had once more to draw off, with about 10,000 men killed and wounded. The Confederates now abandoned all idea of regaining the Decatur line, and based themselves on Jonesboro' and the Macon railway. Sherman quickly realized this, and the Army of the Tennessee, now commanded by Gen. O.O. Howard, was counter-marched from left to right, until it formed up on the right of the Union line about Ezra Church (about 4 m. west of Atlanta). The railway from Chattanooga to Atlanta, destroyed by Johnston as he fell back in May and June, was now repaired and working up to Thomas's camps. Hood had meanwhile extended his entrenchments southwards to

cover the Macon railway, and Howard's movement led to another engagement (battle of Ezra Church, July 28) in which the XV. corps under Logan again bore the brunt of Hood's attack. The Confederates were once more unsuccessful, and the losses were so heavy that the "fighting" policy ordered by the Confederate government was countermanded. Sherman's cavalry had hitherto failed to do serious damage to the railway, and the Federal general now proceeded to manoeuvre with his main body so as to cut off Hood from his Southern railway lines (August). Covered by Howard at Ezra Church, Schofield led this advance, but the new Confederate lines baffled him. A bombardment of the Atlanta fortifications was then begun, but it had no material result. Another cavalry raid effected but slight damage to the line, and Sherman now decided to take his whole force to the south side. This apparently dangerous movement (August 25) is a remarkable illustration of Sherman's genius for war, and in fact succeeded completely. Only a small force was left to guard the Chattanooga railway, and the Union forces, Howard on the right, Thomas in the centre, and Schofield on the left, reached the railway after some sharp fighting (action of Jonesboro', September 1). The defence of Atlanta was now hopeless; Hood's forces retreated southward the same evening, and on the 2nd of September the Union detachment left behind on the north side entered Atlanta unopposed.

All citizens were now ordered to leave, the place was turned into a military camp, and when Sherman started on his "March to the Sea," on the 15th of November, a large part of the city was burned. Consequently the present city is a product of the post-bellum development of Georgia. The military government of Georgia was established here in 1865. In 1868 Atlanta was made the capital of the state.

In 1881 an International Cotton Exposition was held in Atlanta. This was American, even local, in character; its inception was due to a desire to improve the cultivation and manufacture of cotton; but it brought to the notice of the whole country the industrial transformation wrought in the Southern states during the last quarter of the 19th century. In 1887 the Piedmont Exposition was held in Atlanta. The Cotton States and International Exposition, also held at Atlanta, in 1895, attracted widespread attention, and had exhibits from thirty-seven states and thirteen foreign countries.

1 Grady was succeeded as managing editor by Clark Howell (b. 1863); and Joel Chandler Harris was long a member of the editorial staff.

ATLANTIC, a city and the county-seat of Cass county, Iowa, U.S.A., on East Nishnabatna river, about 80 m. W. by S. of Des Moines. Pop. (1890) 4351; (1900) 5046; (1905, state census) 5180 (625 foreign-born); (1910) 4560. It is served by the Chicago, Rock Island & Pacific railway, and by an inter-urban electric line connecting with Elkhorn and Kimballton, and is the trade centre of a fine agricultural country; among its manufactures are machine-shop products, canned corn, flour, umbrellas, drugs and bricks. The municipality owns the water-works and electric-lighting plant. Atlantic was chartered as a city in 1869. 855

ATLANTIC CITY, a city of Atlantic county, New Jersey, U.S.A., on the Atlantic Ocean, 58 m. S.E. of Philadelphia and 137 m. S. by W. of New York. Pop. (1890) 13,055; (1900) 27,838, of whom 6513 were of negro descent and 3189 were foreign-born; (1910 census) 46,150. It is served by the Atlantic City (Philadelphia & Reading) and the West Jersey & Seashore (Pennsylvania system) railways. Atlantic City is the largest and most popular all-the-year-round resort in the United States, and has numerous fine hotels. The city extends for 3 m. along a low sandy island (Absecon Beach), 10 m. long by ¾ m. wide, separated from the mainland by a narrow strip of salt water and 4 or 5 m. of salt marshes, partly covered with water at highest storm tide. There are good bathing, boating, sailing, fishing and wild-fowl shooting. A "Board Walk" stretches along the beach for about 5 m.—the newest part of it is of concrete—and along or near this walk are the largest hotels, and numerous shops, and places of amusement; from the walk into the ocean extend several long piers. Other features of the place are the broad driveway (Atlantic Avenue) and an automobile boulevard. There are several seaside sanitoriums and hospitals, including the Atlantic City hospital, the Mercer Memorial home, and the Children's Seashore home. On the north end of the beach is Absecon Lighthouse, 160 ft. high. The municipality owns the water-works. Oysters are dredged here and are shipped hence in large quantities. There was a settlement of fishermen on the island in the latter part of the 18th century. In 1852 a movement was made to develop it as a seaside resort for Philadelphia, and after the completion of the Camden & Atlantic City railway in 1854 the growth of the place was rapid. A heavy loss occurred by fire on the 3rd of April 1902.

ATLANTIC OCEAN, a belt of water, roughly of an S-shape, between the western coasts of Europe and Africa and the eastern coasts of North and South America. It extends northward to the Arctic Basin and southward to the Great Southern Ocean. For purposes of measurement the polar boundaries are taken to be the Arctic and Antarctic circles, although in discussing the configuration and circulation it is impossible to adhere strictly to these limits. The Atlantic Ocean consists of two characteristic divisions, the geographical equator forming a fairly satisfactory line of division into North and South Atlantic. The North Atlantic, by far the best-known of the main divisions of the hydrosphere, is remarkable for the immense length of its coast-line and for the large number of enclosed seas connected with it, including on the western side the Caribbean Sea and Gulf of Mexico, the Gulf of St Lawrence and Hudson Bay, and on the eastern side the Mediterranean and Black Sea, the North Sea and the Baltic. The North Atlantic is connected with the Arctic Basin by four main channels: (1) Hudson Strait, about 60 m. wide, communicating with the gulfs and straits of the North American Arctic archipelago; (2) Davis Strait, about 200 m. wide, leading to Baffin Bay; (3) Denmark Strait, between Greenland and Iceland, 130 m. wide; and (4) the "Norwegian Sea," about 400 m. wide, extending from Iceland to the Faeroe Islands, the Shetland Islands and the coast of Norway. The width of the North Atlantic in lat. 60°, approximately where it breaks up into the branches just named, is nearly 2000 m.; in about lat. 50° N. the coasts of Ireland and Newfoundland approach to 1750 m.; the breadth then increases rapidly to lat. 40° N., and attains its maximum of 4500 m. in lat. 25° N.; farther south the minimum breadth is reached between Africa and South America, Cape Palmas being only 1600 m. distant from Cape St Roque. In marked contrast to this, the South Atlantic is distinguished by great simplicity of coast-line; inland seas there are none, and it attains its greatest breadth as it merges with the Southern Ocean; in lat. 35° S. the width is 3700 m.

Extent.

The total area of the North Atlantic, not counting inland seas connected with it, is, according to G. Karstens, 36,438,000 sq. kilometres, or 10,588,000 sq. m.; including the inland seas the area is 45,641,000 sq. kilometres or 13,262,000 sq. m. The area of the South Atlantic is 43,455,000 sq. kilometres, or 12,627,000 sq. m. Although not the most extensive of the great oceans, the Atlantic has by far the largest drainage area. The "long slopes" of the continents on both sides are directed towards the Atlantic, which accordingly receives the waters of a large proportion of the great rivers of the world, including the St Lawrence, the Mississippi, the Orinoco, the Amazon, the rivers of the La Plata, the Congo, the Niger, the Loire, the Rhine, the Elbe and the great rivers of the Mediterranean and the Baltic. Sir J. Murray estimates the total area of land draining to the Atlantic to be 13,432,000 sq. m., or with the Arctic area nearly 20,000,000 sq. m., nearly four times the area draining to the Pacific Ocean, and almost precisely four times the area draining to the Indian Ocean. Murray's calculations give the amount of precipitation received on this area at 15,800 cub. m. annually, and the river discharge from it at 3900 cub. m.

Relief of the bed.

The dominant feature of the relief of the Atlantic basin is a submarine ridge running from north to south from about lat. 50° N. to lat. 40° S., almost exactly in the central line, and following the S-shape of the coasts. Over this ridge the average depth is about 1700 fathoms. Towards its northern end the ridge widens and rises to the plateau of the Azores, and in about 50° N. lat. it merges with the "Telegraph Plateau," which extends across nearly the whole ocean from Ireland to

Newfoundland. North of the fiftieth parallel the depths diminish towards the north-east, two long submarine ridges of volcanic origin extend north-eastwards to the south-west of Iceland and to the Faeroe Islands, and these, with their intervening valleys, end in a transverse ridge connecting Greenland, through Iceland and the Faeroe Islands, with North-western Scotland and the continental mass of Europe. The mean depth over this ridge is about 250 fathoms, and the maximum depth nowhere reaches 500 fathoms. The main basin of the Atlantic is thus cut off from the Arctic basin, with which the area north of the ridge has complete deep-water communication. This intermediate region, which has Atlantic characteristics down to 300 fathoms, and at greater depths belongs more properly to the Arctic Sea, commonly receives the name of Norwegian Sea. On both sides of the central ridge deep troughs extend southwards from the Telegraph plateau to the Southern Ocean, the deep water coming close to the land all the way down on both sides. In these troughs the depth is seldom much less than 3000 fathoms, and this is exceeded in a series of patches to which Murray has given the name of “Deeps.” In the eastern trough the Peake Deep lies off the Bay of Biscay in 20° W. long., Monaco Deep and Chun Deep off the north-west of Africa, Moseley Deep off the Cape Verde Islands, Krech Deep off the Liberian coast, and Buchanan Deep off the mouth of the Congo. The western trough extends northwards into Davis Strait, forming a depression in the Telegraph plateau; to the south of Newfoundland and Nova Scotia are Sigsbee Deep, Libbey Deep and Suhm Deep, each of small area; north-east of the Bahamas Nares Deep forms the largest and deepest depression in the Atlantic, in which a sounding of 4561 fathoms was obtained (70 m. north of Porto Rico) by the U.S. ship “Blake” in 1883. Immediately to the south of Nares Deep lies the smaller Makarov Deep; and off the coast of South America are Tizard Deep and Havergal Deep.

Before the Antarctic expeditions of 1903-1904 our knowledge of the form of the sea bottom south of 40° S. lat. was almost wholly derived from the soundings of the expedition of Sir J.C. Ross in the “Erebus” and “Terror” (1839-1843), and the bathymetrical maps published were largely the result of deductions based on one sounding taken by Ross in 68° 34′ S. lat., 12° 49′ W. long., in which he recorded a depth exceeding 4000 fathoms. The Scottish Antarctic expedition has shown this sounding to be erroneous; the “Scotia” obtained samples of bottom, in almost the same spot, from a depth of 2660 fathoms. Combining the results of recent soundings, Dr W.S. Bruce, the leader of the Scottish expedition, finds that there is a ridge “extending in a curve from Madagascar to Bouvet Island, and from Bouvet Island to the Sandwich group, whence there is a forked connexion through the South Orkneys to Graham’s Land, and through South Georgia to the Falkland Islands and the South American continent.” Again, the central ridge of the South Atlantic extends a thousand miles farther south than was supposed, joining the east and west ridge, just described, between the Bouvet Islands and the Sandwich group.

The foundations of our knowledge of the relief of the Atlantic basin may be said to have been laid by the work of H.M.S. “Challenger” (1873-1876), and the German ship “Gazelle” (1874-1876), the French expedition in the “Travailleur” (1880), and the U.S. surveying vessel “Blake” (1877 and later). Large numbers of additional soundings have been made in recent years by cable ships, by the expeditions of H.S.H. the prince of Monaco, the German “Valdivia” expedition under Professor Chun (1898), and the combined Antarctic expeditions (1903-1904).

Islands.

The Atlantic Ocean contains a relatively small number of islands. The only continental groups, besides some islands in the Mediterranean, are Iceland, the British Isles, Newfoundland, the West Indies, and the Falklands, and the chief oceanic islands are the Azores, Madeira, the Canaries, the Cape Verde Islands, Ascension, St Helena, Tristan da Cunha and Bouvet Island.

Mean depth, and bottom deposits.

The mean depth of the North Atlantic is, according to G. Karstens, 2047 fathoms. If we include the enclosed seas, the North Atlantic has a mean depth of 1800 fathoms. The South Atlantic has a mean depth of 2067 fathoms.

The greater part of the bottom of the Atlantic is covered by a deposit of Globigerina ooze, roughly the area between 1000 and 3000 fathoms, or about 60% of the whole. At a depth of about 3000 fathoms, *i.e.* in the “Deeps,” the Globigerina ooze gradually gives place to red clay. In the shallower tropical waters, especially on the central ridge, considerable areas are covered by Pteropod ooze, a deposit consisting largely of the shells of pelagic molluscs. Diatom ooze is the characteristic deposit in high southern latitudes. The terrigenous deposits consist of blue muds, red muds (abundant along the coast of Brazil, where the amount of organic matter present is insufficient to reduce the iron in the matter brought down by the great rivers to produce blue muds), green muds and sands, and volcanic and coral detritus.

The question of the origin of the Atlantic basin, like that of the other great divisions of the hydrosphere, is still unsettled. Most geologists include the Atlantic with the other oceans in the view they adopt as to its age; but E. Suess and M. Neumayr, while they regard the basin of the Pacific as of great antiquity, believe the Atlantic to date only from the Mesozoic age. Neumayr finds evidence of the existence of a continent between Africa and South America, which protruded into the central North Atlantic, in Jurassic times. F. Kossmat has shown that the Atlantic had substantially its present form during the Cretaceous period.

Distribution of temperature.

In describing the mean distribution of temperature in the waters of the Atlantic it is necessary to treat the northern and southern divisions separately. The heat equator, or line of maximum mean surface temperature, starts from the African coast in about 5° N. lat., and closely follows that parallel to 40° W. long., where it bends northwards to the Caribbean Sea. North of this line, near which the temperature is a little over 80° F., the gradient trends somewhat to the east of north, and the temperature is slightly higher on the western than on the eastern side until, in 45° N. lat., the isothermal of 60° F. runs nearly east and west. Beyond this parallel the gradient is directed towards the north-west, and temperatures are much higher on the European than on the American side. From the surface to 500 fathoms the general form of the isothermals remains the same, except that instead of an equatorial maximum belt there is a focus of maximum temperature off the eastern coast of the United States. This focus occupies a larger area and becomes of greater relative intensity as the depth increases until, at 500 fathoms, it becomes an elongated belt extending right across the ocean in about 30° N. lat. Below 500 fathoms the western centres of maximum disappear, and higher temperatures occur in the eastern Atlantic off the Iberian peninsula and north-western Africa down to at least 1000 fathoms; at still greater depths temperature gradually becomes more and more uniform. The communication between the Atlantic and Arctic basins being cut off, as already described, at a depth of about 300 fathoms, the temperatures in the Norwegian Sea below that level are essentially Arctic, usually below the freezing-point of fresh water, except where the distribution is modified by the surface circulation. The isothermals of mean surface temperature in the South Atlantic are in the lower latitudes of an ~-shape, temperatures being higher on the American than on the African side. In latitudes south of 30° S. the curved form tends to disappear, the lines running more and more directly east and west. Below the surface a focus of maximum temperature appears off the coast of South America in about 30° S. lat., and of minimum temperature north and north-east of this maximum. This distribution is most marked at about 300 fathoms, and disappears at 500 fathoms, beyond which depth the lines tend to become parallel and to run east and west, the gradient slowly diminishing.

Salinity.

The Atlantic is by far the saltest of the great oceans. Its saltest waters are found at the surface in two belts, one extending east and west in the North Atlantic between 20° and 30° N. lat., and another of almost equal salinity extending eastwards from the coast of South America in 10° to 20° S. lat. In the equatorial region between these belts the salinity is markedly less, especially in the eastern part. North of the North Atlantic maximum the waters become steadily fresher as latitude increases until the channels opening into the Arctic basin are reached. In all of these water of relatively high salinity usually appears for a long distance towards the north on the eastern side of the channel, while on the western side the water is comparatively fresh; but great variations occur at different seasons and in different years. In the higher latitudes of the South Atlantic the salinity diminishes steadily and tends to be uniform from east to west, except near the southern extremity of South America, where the surface waters are very fresh. Our knowledge of the salinity of waters below the surface is as yet very defective, large areas being still unrepresented by a single observation. The chief facts already established are the greater saltness of the North Atlantic compared with the South Atlantic at all depths, and the low salinity at all depths in the eastern equatorial region, off the Gulf of Guinea.

Meteorology.

The wind circulation over the Atlantic is of a very definite character. In the South Atlantic the narrow land surfaces of Africa and South America produce comparatively little effect in disturbing the normal planetary circulation. The tropical belt of high atmospheric pressure is very marked in winter; it is weaker during the summer months, and at that season the greater relative fall of pressure over the land cuts it off into an oval-shaped anticyclone, the centre of which rests on the coolest part of the sea surface in that latitude, near the Gulf of Guinea. South of this anticyclone, from about the latitude of the Cape, we find the region where, on account of the uninterrupted sea surface right round the globe, the planetary circulation is developed to the greatest extent known; the pressure gradient is steep, and the region is swept continuously by strong westerly winds —the “roaring forties.”

In the North Atlantic the distribution of pressure and resulting wind circulation are very largely modified by the enormous areas of

land and frozen sea which surround the ocean on three sides. The tropical belt of high pressure persists all the year round, but the immense demand for air to supply the ascending currents over the heated land surfaces in summer causes the normal descending movement to be largely reinforced; hence the "North Atlantic anticyclone" is much larger, and its circulation more vigorous, in summer than in winter. Again, during the winter months pressure is relatively high over North America, Western Eurasia and the Arctic regions; hence vast quantities of air are brought down to the surface, and circulation must be kept up by ascending currents over the ocean. The Atlantic anticyclone is, therefore, at its weakest in winter, and on its polar side the polar eddy becomes a trough of low pressure, extending roughly from Labrador to Iceland and Jan Mayen, and traversed by a constant succession of cyclones. The net effect of the surrounding land is, in fact, to reverse the seasonal variations of the planetary circulation, but without destroying its type. In the intermediate belt between the two high-pressure areas the meteorological equator remains permanently north of the geographical equator, moving between it and about 11° N. lat.

Currents.

The part of this atmospheric circulation which is steadiest in its action is the trade winds, and this is, therefore, the most effective in producing drift movement of the surface waters. The trade winds give rise, in the region most exposed to their influence, to two westward-moving drifts—the equatorial currents, which are separated in parts of their course by currents moving in the opposite direction along the equatorial belt. These last may be of the nature of "reaction" currents; they are collectively known as the equatorial counter-current. On reaching the South American coast, the southern equatorial current splits into two parts at Cape St Roque: one branch, the Brazil current, is deflected southwards and follows the coast as a true stream current at least as far as the river Plate. The second branch proceeds north-westwards towards the West Indies, where it mingles with the waters of the northern equatorial; and the two drifts, blocked by the <-shape of the land, raise the level of the surface in the Gulf of Mexico, the Caribbean Sea, and in the whole area outside the West Indies. This congestion is relieved by what is probably the most rapid and most voluminous stream current in the world, the Gulf Stream, which runs along the coast of North America, separated from it by a narrow strip of cold water, the "cold wall," to a point off the south-east of Newfoundland. At this point the Gulf Stream water mixes with that from the Labrador current (see below), and a drift current eastwards is set up under the influence of the prevailing westerly winds: this is generally called the Gulf Stream drift. When the Gulf Stream drift approaches the eastern side of the Atlantic it splits into two parts, one going southwards along the north-west coast of Africa, the Canaries current, and another turning northwards and passing to the west of the British Isles. Most of the Canaries current re-enters the northern equatorial, but a certain proportion keeps to the African coast, unites with the equatorial return currents, and penetrates into the Gulf of Guinea. This last feature of the circulation is still somewhat obscure; it is probably to be accounted for by the fact that on this part of the coast the prevailing winds, although to a considerable extent monsoonal, are off-shore winds, blowing the surface waters out to sea, and the place of the water thus removed is filled up by the water derived either from lower levels or from "reaction" currents.

The movements of the northern branch of the Gulf Stream drift have been the object of more careful and more extended study than all the other currents of the ocean put together, except, perhaps, the Gulf Stream itself. The cruises of the "Porcupine" and "Lightning" which led directly to the despatch of the "Challenger" expedition, were altogether within its "sphere of influence"; so also was the great Norwegian Atlantic expedition. More recently, the area has been further explored by the German expedition in the ss. "National," the Danish "Ingolf" expedition, and the minor expeditions of the "Michael Sars," "Jackal," "Research," &c., and since 1902 it has been periodically examined by the International Council for the Study of the Sea. Much has also been done by the discussion of observations made on board vessels belonging to the mercantile marine of various countries. It may now be taken as generally admitted that the current referred to breaks into three main branches. The first passes northwards, most of it between the Faeroe and Shetland Islands, to the coast of Norway, and so on to the Arctic basin, which, as Nansen has shown, it fills to a great depth. The second, the Irminger stream, passes up the west side of Iceland; and the third goes up to the Greenland side of Davis Strait to Baffin Bay. These branches are separated from one another at the surface by currents moving southwards: one passes east of Iceland; the second, the Greenland current, skirts the east coast of Greenland; and the third, the Labrador current already mentioned, follows the western side of Davis Strait.

The development of the equatorial and the Brazil currents in the South Atlantic has already been described. On the polar side of the high-pressure area a west wind drift is under the control of the "roaring forties," and on reaching South Africa part of this is deflected and sent northwards along the west coast as the cold Benguella current which rejoins the equatorial. In the central parts of the two high-pressure areas there is practically no surface circulation. In the North Atlantic this region is covered by enormous banks of gulf-weed (*Sargassum bucciferum*), hence the name Sargasso Sea. The Sargasso Sea is bounded, roughly, by the lines of 20°-35° N. lat. and 40°-75° W. long.

The sub-surface circulation in the Atlantic may be regarded as consisting of two parts. Where surface water is banked up against the land, as by the equatorial and Gulf Stream drift currents, it appears to penetrate to very considerable depths; the escaping stream currents are at first of great vertical thickness and part of the water at their sources has a downward movement. In the case of the Gulf Stream, which is not much impeded by the land, this descending motion is relatively slight, being perhaps largely due to the greater specific gravity of the water; it ceases to be perceptible beyond about 500 fathoms. On the European-African side the descending movement is more marked, partly because the coast-line is much more irregular and the northward current is deflected against it by the earth's rotation, and partly because of the outflow of salt water from the Mediterranean; here the movement is traceable to at least 1000 fathoms. The northward movement of water across the Norwegian Sea extends down from the surface to the Iceland-Shetland ridge, where it is sharply cut off; the lower levels of the Norwegian Sea are filled with ice-cold Arctic water, close down to the ridge. The south-moving currents originating from melting ice are probably quite shallow. The second part of the circulation in the depth is the slow "creep" of water of very low temperature along the bottom. The North Atlantic being altogether cut off from the Arctic regions, and the vertical circulation being active, this movement is here practically non-existent; but in the South Atlantic, where communication with the Southern Ocean is perfectly open, Antarctic water can be traced to the equator and even beyond.

The tides of the Atlantic Ocean are of great complexity. The tidal wave of the Southern Ocean, which sweeps uninterruptedly round the globe from the east to west, generates a secondary wave between Africa and South America, which travels north at a rate dependent only on the depth of the ocean. With this "free" wave is combined a "forced" wave, generated, by the direct action of the sun and moon, within the Atlantic area itself. Nothing is known about the relative importance of these two waves.

(H. N. D.)

See also Oceans and Oceanography.

ATLANTIS, Atlantis, or Atlantica, a legendary island in the Atlantic Ocean, first mentioned by Plato in the *Timaeus*. Plato describes how certain Egyptian priests, in a conversation with Solon, represented the island as a country larger than Asia Minor and Libya united, and situated just beyond the Pillars of Hercules (Straits of Gibraltar). Beyond it lay an archipelago of lesser islands. According to the priests, Atlantis had been a powerful kingdom nine thousand years before the birth of Solon, and its armies had overrun the lands which bordered the Mediterranean. Athens alone had withstood them with success. Finally the sea had overwhelmed Atlantis, and had thenceforward become unnavigable owing to the shoals which marked the spot. In the *Critias* Plato adds a history of the ideal commonwealth of Atlantis. It is impossible to decide how far this legend is due to Plato's invention, and how far it is based on facts of which no record remains. Medieval writers, for whom the tale was preserved by the Arabian geographers, believed it true, and were fortified in their belief by numerous traditions of islands in the western sea, which offered various points of resemblance to Atlantis. Such in particular were the Greek Isles of the Blest, or Fortunate Islands, the Welsh Avalon, the Portuguese Antilia or Isle of Seven Cities, and St Brendan's island, the subject of many sagas in many languages. These, which are described in separate articles, helped to maintain the tradition of an earthly paradise which had become associated with the myth of Atlantis; and all except Avalon were marked in maps of the 14th and 15th centuries, and formed the object of voyages of discovery, in one case (St Brendan's island) until the 18th century. In early legends, of whatever nationality, they are almost invariably described in terms which closely resemble Homer's account of the island of the Phaeacians (*Od.* viii.)—a fact which may be an indication of their common origin in some folk-tale current among several races. Somewhat similar legends are those of the island of Brazil (*q.v.*), of Lyonnesse (*q.v.*), the sunken land off the Cornish coast, of the lost Breton city of Is, and of Mayda or Asmaide—the French *Isle Verte* and Portuguese *Ilha Verde* or "Green Island"—which appears in many folk-tales from Gibraltar to the Hebrides, and until 1853 was marked on English charts as a rock in 44°

48′ N. and 26° 10′ W. After the Renaissance, with its renewal of interest in Platonic studies, numerous attempts were made to rationalize the myth of Atlantis. The island was variously identified with America, Scandinavia, the Canaries and even Palestine; ethnologists saw in its inhabitants the ancestors of the Guanchos, the Basques or the ancient Italians; and even in the 17th and 18th centuries the credibility of the whole legend was seriously debated, and sometimes admitted, even by Montaigne, Buffon and Voltaire.

For the theory that Atlantis is to be identified with Crete in the Minoan period, see "The Lost Continent" in *The Times* (London) for the 19th of February 1909. See also "Dissertation sur l'Atlantide" in T.H. Martin's *Études sur le Timée* (1841).

ATLAS, in Greek mythology, the "endurer," a son of the Titan Iapetus and Clymene (or Asia), brother of Prometheus. Homer, in the *Odyssey* (i. 52) speaks of him as "one who knows the depths of the whole sea, and keeps the tall pillars which hold heaven and earth asunder." In the first instance he seems to have been a marine creation. The pillars which he supported were thought to rest in the sea, immediately beyond the most western horizon. But as the Greeks' knowledge of the west increased, the name of Atlas was transferred to a hill in the north-west of Africa. Later, he was represented as a king of that district, rich in flocks and herds, and owner of the garden of the Hesperides, who was turned into a rocky mountain when Perseus, to punish him for his inhospitality, showed him the Gorgon's head (Ovid, *Metam.* iv. 627). Finally, Atlas was explained as the name of a primitive astronomer, who was said to have made the first celestial globe (Diodorus iii. 60). He was the father of the Pleiades and Hyades; according to Homer, of Calypso. In works of art he is represented as carrying the heavens or the terrestrial globe. The Farnese statue of Atlas in the Naples museum is well known.

The plural form Atlantes is the classical term in architecture for the male sculptured figures supporting a superstructure as in the baths at Pompeii, and in the temple at Agrigentum in Sicily. In 18th-century architecture half-figures of men with strong muscular development were used to support balconies (see Caryatides and Telamones).

A figure of Atlas supporting the heavens is often found as a frontispiece in early collections of maps, and is said to have been first thus used by Mercator. The name is hence applied to a volume of maps (see Map), and similarly to a volume which contains a tabular conspectus of a subject, such as an atlas of ethnographical, subjects or anatomical plates. It is also used of a large size of drawing paper.

The name "atlas," an Arabic word meaning "smooth," applied to a smooth cloth, is sometimes found in English, and is the usual German word, for "satin."

ATLAS MOUNTAINS, the general name for the mountain chains running more or less parallel to the coast of North-west Africa. They extend from Cape Nun on the west to the Gulf of Gabes on the east, a distance of some 1500 m., traversing Morocco, Algeria and Tunisia. To their south lies the Saharan desert. The Atlas consist of many distinct ranges, but they can be roughly divided into two main chains: (1) the Maritime Atlas, *i.e.* the ranges overlooking the Mediterranean from Ceuta to Cape Bon; (2) the inner and more elevated ranges, which, starting from the Atlantic at Cape Ghir in Sús, run south of the coast ranges and are separated from them by high plateaus. This general disposition is seen most distinctly in eastern Morocco and Algeria. The western inner ranges are the most important of the whole system, and in the present article are described first as *the Moroccan Ranges*. The maritime Atlas and the inner ranges in Algeria and Tunisia are then treated under the heading *Eastern Ranges*.

The Moroccan Ranges.—This section of the Atlas, known to the inhabitants of Morocco by its Berber name, Idráren Dráren or the "Mountains of Mountains," consists of five distinct ranges, varying in length and height, but disposed more or less parallel to one another in a general direction from south-west to north-east, with a slight curvature towards the Sahara.

1. The main range, that known as the Great Atlas, occupies a central position in the system, and is by far the longest and loftiest chain. It has an average height of over 11,000 ft., whereas the loftiest peaks in Algeria do not exceed 8000 ft., and the highest in Tunisia are under 6000 ft. Towards the Dahra district at the north-east end the fall is gradual and continuous, but at the opposite extremity facing the Atlantic between Agadir and Mogador it is precipitous. Although only one or two peaks reach the line of perpetual snow, several of the loftiest summits are snowclad during the greater part of the year. The northern sides and tops of the lower heights are often covered with dense forests of oak, cork, pine, cedar and other trees, with walnuts up to the limit of irrigation. Their slopes enclose well-watered valleys of great fertility, in which the Berber tribes cultivate tiny irrigated fields, their houses clinging to the hill-sides. The southern flanks, being exposed to the hot dry winds of the Sahara, are generally destitute of vegetation.

At several points the crest of the range has been deeply eroded by old glaciers and running waters, and thus have been formed a number of devious passes. The central section, culminating in Tizi n 'Tagharat or Tinzár, a peak estimated at 15,000 ft. high, maintains a mean altitude of 11,600 ft., and from this great mass of schists and sandstones a number of secondary ridges radiate in all directions, forming divides between the rivers Dra'a, Sús, Um-er-Rabíã, Sebú, Mulwíya and Ghír, which flow respectively to the south-west, the west, north-west, north, north-east and south-east. All are swift and unnavigable, save perhaps for a few miles from their mouths. With the exception of the Dra'a, the streams rising on the side of the range facing the Sahara do not reach the sea, but form marshes or lagoons at one season, and at another are lost in the dry soil of the desert.

For a distance of 100 m. the central section nowhere presents any passes accessible to caravans, but south-westward two gaps in the range afford communication between the Tansíft and Sús basins, those respectively of Gindáfi and Bíbáwan. A few summits in the extreme south-west in the neighbourhood of Cape Ghir still exceed 11,000 ft., and although the steadily rising ground from the coast and the prominence of nearer summits detract from the apparent height, this is on an average greater than that of the European Alps. The most imposing view is to be obtained from the plain of Marrákesh, only some 1000 ft. above sea-level, immediately north of the highest peaks. Besides huge masses of old schists and sandstones, the range contains extensive limestone, marble, diorite, basalt and porphyry formations, while granite prevails on its southern slopes. The presence of enormous glaciers in the Ice Age is attested by the moraines at the Atlantic end, and by other indications farther east. The best-known passes are: (1) The Bíbáwan in the upper Wad Sús basin (4150 ft.); (2) the Gindáfi, giving access from Marrákesh to Tárudánt, rugged and difficult, but low; (3) the Tagharat, difficult and little used, leading to the Dra'a valley (11,484 ft.); (4) the Gláwi (7600 ft.); (5) Tizi n 'Tilghemt (7250 ft.), leading to Tafilet (Tafílált) and the Wad Ghír.

2. The lower portion of the Moroccan Atlas (sometimes called the Middle Atlas), extending north-east and east from an undefined point to the north of the Great Atlas to near the frontier of Algeria, is crossed by the pass from Fez to Tafílált. Both slopes are wooded, and its forests are the only parts of Morocco where the lion still survives. From the north this range, which is only partly explored, presents a somewhat regular series of snowy crests.

3. The Anti-Atlas or Jebel Saghru, also known as the Lesser Atlas, running parallel to and south of the central range, is one of the least elevated chains in the system, having a mean altitude of not more than 5000 ft., although some peaks and even passes exceed 6000 ft. At one point it is pierced by a gap scarcely five paces wide with walls of variegated marbles polished by the transport of goods. As to the relation of the Anti-Atlas to the Atlas proper at its western end nothing certain is known.

The two more or less parallel ranges which complete the western system are less important:—(4) the Jebel Bani, south of the Anti-Atlas, a low, narrow rocky ridge with a height of 3000 ft. in its central parts; and (5) the Mountains of Ghaiáta, north of the Middle Atlas, not a continuous range, but a series of broken mountain masses from 3000 to 3500 ft. high, to the south of Fez, Táza and Tlemçen.

The Eastern Ranges.—The eastern division of the Atlas, which forms the backbone of Algeria and Tunisia, is adequately known with the exception of the small portion in Morocco forming the province of Er-Ríf. The lesser range, nearer the sea, known to the French as the Maritime Atlas, calls for little detailed notice. From Ceuta, above which towers Jebel Músa—about 2800 ft.—to Melilla, a distance of

some 150 m., the Ríf Mountains face the Mediterranean, and here, as along the whole coast eastward to Cape Bon, many rugged rocks rise boldly above the general level. In Algeria the Maritime Atlas has five chief ranges, several mountains rising over 5000 ft. The Jurjura range, extending through Kabylia from Algiers to Bougie, contains the peaks of Lalla Kedija (7542 ft.), the culminating point of the maritime chains, and Babor (6447 ft.). (See further Algeria.) The Mejerda range, which extends into Tunisia, has no heights exceeding 3700 ft. It was in these coast mountains of Algeria that the Romans quarried the celebrated Numidian marbles.

The southern or main range of the Eastern division is known by the French as the Saharan Atlas. On its western extremity it is linked by secondary ranges to the mountain system of Morocco. The Saharan Atlas is essentially one chain, though known under different names: Jebel K'sur and Jebel Amur on the west, and Jebel Aures in the east. The central part, the Záb Mountains, is of lower elevation, the Saharan Atlas reaching its culminating point, Jebel Shellia (7611 ft. above the sea), in the Aures. This range sends a branch northward which joins the Mejerda range of the Maritime Atlas, and another branch runs south by Gafsa to the Gulf of Gabes. Here Mount Sidi Ali bu Musin reaches a height of 5700 ft., the highest point in Tunisia. In the Saharan Atlas the passes leading to or from the desert are numerous, and in most instances easy. Both in the east (at Batna) and the west (at Ain Sefra) the mountains are traversed by railways, which, starting from Mediterranean seaports, take the traveller into the Sahara.

History and Exploration.—The name Atlas given to these mountains by Europeans—but never used by the native races—is derived from that of the mythical Greek god represented as carrying the globe on his shoulders, and applied to the high and distant mountains of the west, where Atlas was supposed to dwell. From time immemorial the Atlas have been the home of Berber races, and those living in the least accessible regions have retained a measure of independence throughout their recorded history. Thus some of the mountain districts of Kabylia had never been visited by Europeans until the French military expedition of 1857. But in general the Maritime range was well known to the Romans. The Jebel Amur was traversed by the column which seized El Aghuat in 1852, and from that time dates the survey of the mountains.

The ancient caravan route from Mauretania to the western Sudan crossed the lower Moroccan Atlas by the pass of Tilghemt and passed through the oasis of Tafílált, formerly known as Sajilmása ["Sigilmassa"], on the east side of the Anti-Atlas. The Moroccan system was visited, and in some instances crossed, by various European travellers carried into slavery by the Salli rovers, and was traversed by René Caillé in 1828 on his journey home from Timbuktu, but the first detailed exploration was made by Gerhard Rohlfs in 1861-1862. Previous to that almost the only special report was the misleading one of Lieut. Washington, attached to the British embassy of 1837, who from insufficient data estimated the height of Mount Tagharat, to which he gave the indefinite name of Miltsin (*i.e. Mul et-Tizin*, "Lord of the Peaks"), as 11,400 ft. instead of about 15,000 ft.

In 1871 the first scientific expedition, consisting of Dr (afterwards Sir) J.D. Hooker, Mr John Ball and Mr G. Maw, explored the central part of the Great Atlas with the special object of investigating its flora and determining its relation to that of the mountains of Europe. They ascended by the Ait Mízan valley to the Tagharat pass (11,484 ft.), and by the Amsmiz valley to the summit of Jebel Tezah (11,972 ft.). In the Tagharat pass Mr Maw was the only one of the party who reached the watershed; but from Jebel Tezah a good view was obtained southward across the great valley of the Sús to the Anti-Atlas, which appeared to be from 9000 to 10,000 ft. high. Dr Oskar Lenz in 1879-1880 surveyed a part of the Great Atlas north of Tárudant, determined a pass south of Iligh in the Anti-Atlas, and penetrated thence across the Sahara to Timbuktu. He was followed in 1883-1884 by Vicomte Ch. de Foucauld, whose extensive itineraries include many districts that had never before been visited by any Europeans. Such were parts of the first and middle ranges, crossed once; three routes over the Great Atlas, which was, moreover, followed along both flanks for nearly its whole length; and six journeys across the Anti-Atlas, with a general survey of the foot of this range and several passages over the Jebel Bani. Then came Joseph Thomson, who explored some of the central parts, and made the highest ascent yet achieved, that of Mount Likimt, 13,150 ft., but broke little new ground, and failed to cross the main range (1888); and Walter B. Harris, who explored some of the southern slopes and crossed the Atlas at two points during his expedition to Tafílált in 1894. In 1901 and again in 1905 the marquis de Segonzac, a Frenchman, made extensive journeys in the Moroccan ranges. He crossed the Great Atlas in its central section, explored its southern border, and, in part, the Middle and Anti-Atlas ranges. A member of his expeditions, de Flotte Rocquevaire, made a triangulation of part of the western portion of the main Atlas, his labours affording a basis for the co-ordination of the work of previous explorers. (See also Morocco, Algeria, Tunisia and Sahara.)

Authorities.—Vicomte Ch. de Foucauld, *Reconnaissance au Maroc 1883-1884* (Paris, 1888, almost the sole authority for the geography of the Atlas; his book gives the result of careful surveys, and is illustrated with a good collection of maps and sketches); Hooker, Ball and Maw, *Marocco and the Great Atlas* (London, 1879, a most valuable contribution, always scientific and trustworthy, especially as to botany and geology); Joseph Thomson, *Travels in the Atlas and Southern Morocco* (London, 1889, valuable geographical and geological data); Louis Gentil, *Mission de Segonzac, &c.* (Paris, 1906; the author was geologist to the 1905 expedition); Gerhard Rohlfs, *Adventures in Morocco* (London, 1874); Walter B. Harris, *Tafilet, a Journey of Exploration in the Atlas Mountains, &c.* (London, 1895), full of valuable information; Budgett Meakin, *The Land of the Moors* (London, 1901), first and last chapters; Dr Oskar Lenz *Timbuktu: Reise durch Marokko*, vol. i. (Leipzig, 1884).

ATMOLYSIS (Gr. ἀτμός, vapour: λύειν, to loosen), a term invented by Thomas Graham to denote the separation of a mixture of gases by taking advantage of their different rates of diffusion through a porous septum or diaphragm (see Diffusion).

ATMOSPHERE (Gr. ἀτμός, vapour; σφαῖρα, a sphere), the aeriform envelope encircling the earth; also the envelope of a particular gas or gases about any solid or liquid. Meteorological phenomena seated more directly in the atmosphere obtained early recognition; thus Hesiod, in his *Works and Days*, speculated on the origin of winds, ascribing them to the heating effects of the sun on the air. Ctesibius of Alexandria, Hero and others, founded the science of pneumatics on observations on the physical properties of air. Anaximenes made air the primordial substance, and it was one of the Aristotelian elements. A direct proof of its material nature was given by Galileo, who weighed a copper ball containing compressed air.

Before the development of pneumatic chemistry, air was regarded as a distinct chemical unit or element. The study of calcination and combustion during the 17th and 18th centuries culminated in the discovery that air consists chiefly of a mixture of two gases, oxygen and nitrogen. Cavendish, Priestley, Lavoisier and others contributed to this result. Cavendish made many analyses: from more than 500 determinations of air in winter and summer, in wet and clear weather, and in town and country, he discerned the mean composition of the atmosphere to be, oxygen 20.833% and nitrogen 79.167% The same experimenter noticed the presence of an inert gas, in very minute amount; this gas, afterwards investigated by Rayleigh and Ramsay, is now named argon (*q.v.*).

The constancy of composition shown by repeated analyses of atmospheric air led to the view that it was a chemical compound of nitrogen and oxygen; but there was no experimental confirmation of this idea, and all observations tended to the view that it is simply a mechanical mixture. Thus, the gases are not present in simple multiples of their combining weights; atmospheric air results when oxygen and nitrogen are mixed in the prescribed ratio, the mixing being unattended by any manifestation of energy, such as is invariably associated with a chemical action; the gases may be mechanically separated by atmolysis, *i.e.* by taking advantage of the different rates of diffusion of the two gases; the solubility of air in water corresponds with the "law of partial pressures," each gas being absorbed in amount proportional to its pressure and coefficient of absorption, and oxygen being much more soluble than nitrogen (in the ratio of .04114 to .02035 at 0°); air expelled from water by boiling is always richer in oxygen.

Various agencies are at work tending to modify the composition of the atmosphere, but these so neutralize each other as to leave it practically unaltered. Minute variations, however, do occur. Bunsen analysed fifteen examples of air collected at the same place at different times, and found the extreme range in the percentage of oxygen to be from 20.97 to 20.84. Regnault, from analyses of the air of Paris, obtained a variation of 20.999 to 20.913; country air varied from 20.903 to 21.000; while air taken from over the sea showed

an extreme variation of 20.940 to 20.850. Angus Smith determined London air to vary in oxygen content from 20.857 to 20.95, the air in parks and open spaces showing the higher percentage; Glasgow air showed similar results, varying from 20.887 in the streets to 20.929 in open spaces.

In addition to nitrogen and oxygen, there are a number of other gases and vapours generally present in the atmosphere. Of these, argon and its allies were the last to be definitely isolated. Carbon dioxide is invariably present, as was inferred by Dr David Macbride (1726-1778) of Dublin in 1764, but in a proportion which is not absolutely constant; it tends to increase at night, and during dry winds and fogs, and it is greater in towns than in the country and on land than on the sea. Water vapour is always present; the amount is determined by instruments termed hygrometers (*q.v.*). Ozone (*q.v.*) occurs, in an amount supposed to be associated with the development of atmospheric electricity (lightning, &c.); this amount varies with the seasons, being a maximum in spring, and decreasing through summer and autumn to a minimum in winter. Hydrogen dioxide occurs in a manner closely resembling ozone. Nitric acid and lower nitrogen oxides are present, being formed by electrical discharges, and by the oxidation of atmospheric ammonia by ozone. The amount of nitric acid varies from place to place; rain-water, collected in the country, has been found to contain an average of 0.5 parts in a million, but town rain-water contains more, the greater amounts being present in the more densely populated districts. Ammonia is also present, but in very varying amounts, ranging from 135 to 0.1 parts (calculated as carbonate) in a million parts of air. Ammonia is carried back to the soil by means of rain, and there plays an important part in providing nitrogenous matter which is afterwards assimilated by vegetable life.

The average volume composition of the gases of the atmosphere may be represented (in parts per 10,000) as follows:—

Oxygen	2065.94	Ozone	0.015
Nitrogen	7711.60	Aqueous vapour	140.00
Argon (about)	79.00	Nitric acid	0.08
Carbon dioxide	3.36	Ammonia	0.005

In addition to these gases, there are always present in the atmosphere many micro-organisms or bacteria (see Bacteriology); another invariable constituent is dust (*q.v.*), which plays an important part in meteorological phenomena.

Reference should be made to the articles Barometer, Climate and Meteorology for the measurement and variation of the pressure of the atmosphere, and the discussion of other properties.

ATMOSPHERIC ELECTRICITY. 1. It was not until the middle of the 18th century that experiments due to Benjamin Franklin showed that the electric phenomena of the atmosphere are not fundamentally different from those produced in the laboratory. For the next century the rate of progress was slow, though the ideas of Volta in Italy and the instrumental devices of Sir Francis Ronalds in England merit recognition. The invention of the portable electrometer and the water-dropping electrograph by Lord Kelvin in the middle of the 19th century, and the greater definiteness thus introduced into observational results, were notable events. Towards the end of the 19th century came the discovery made by W. Linss (**6**)[1] and by J. Elster and H. Geitel (**7**) that even the most perfectly insulated conductors lose their charge, and that this loss depends on atmospheric conditions. Hard on this came the recognition of the fact that freely charged positive and negative ions are always present in the atmosphere, and that a radioactive emanation can be collected. Whilst no small amount of observational work has been done in these new branches of atmospheric electricity, the science has still not developed to a considerable extent beyond preliminary stages. Observations have usually been limited to a portion of the year, or to a few hours of the day, whilst the results from different stations differ much in details. It is thus difficult to form a judgment as to what has most claim to acceptance as the general law, and what may be regarded as local or exceptional.

2. *Potential Gradient.*—In dry weather the electric potential in the atmosphere is normally positive relative to the earth, and increases with the height. The existence of *earth currents* (*q.v.*) shows that the earth, strictly speaking, is not all at one potential, but the natural differences of potential between points on the earth's surface a mile apart are insignificant compared to the normal potential difference between the earth and a point one foot above it. What is aimed at in ordinary observations of atmospheric potential is the measurement of the difference of potential between the earth and a point a given distance above it, or of the difference of potential between two points in the same vertical line a given distance apart. Let a conductor, say a metallic sphere, be supported by a metal rod of negligible electric capacity whose other end is earthed. As the whole conductor must be at zero (*i.e.* the earth's) potential, there must be an induced charge on the sphere, producing at its centre a potential equal but of opposite sign to what would exist at the same spot in free air. This neglects any charge in the air displaced by the sphere, and assumes a statical state of conditions and that the conductor itself exerts no disturbing influence. Suppose now that the sphere's earth connexion is broken and that it is carried without loss of charge inside a building at zero potential. If its potential as observed there is −V (volts), then the potential of the air at the spot occupied by the sphere was +V. This method in one shape or another has been often employed. Suppose next that a fixed insulated conductor is somehow kept at the potential of the air at a given point, then the measurement of its potential is equivalent to a measurement of that of the air. This is the basis of a variety of methods. In the earliest the conductor was represented by long metal wires, supported by silk or other insulating material, and left to pick up the air's potential. The addition of sharp points was a step in advance; but the method hardly became a quantitative one until the sharp points were replaced by a flame (fuse, gas, lamp), or by a liquid jet breaking into drops. The matter leaving the conductor, whether the products of combustion or the drops of a liquid, supplies the means of securing equality of potential between the conductor and the air at the spot where the matter quits electrical connexion with the conductor. Of late years the function of the collector is discharged in some forms of apparatus by a salt of radium. Of flame collectors the two best known are Lord Kelvin's portable electrometer with a fuse, or F. Exner's gold leaf electroscope in conjunction with an oil lamp or gas flame. Of liquid collectors the representative is Lord Kelvin's water-dropping electrograph; while Benndorf's is the form of radium collector that has been most used. It cannot be said that any one form of collector is superior all round. Flame collectors blow out in high winds, whilst water-droppers are apt to get frozen in winter. At first sight the balance of advantages seems to lie with radium. But while gaseous products and even falling water are capable of modifying electrical conditions in their immediate neighbourhood, the "infection" produced by radium is more insidious, and other drawbacks present themselves in practice. It requires a radium salt of high radioactivity to be at all comparable in effectiveness with a good water-dropper. Experiments by F. Linke (**8**) indicated that a water-dropper having a number of fine holes, or having a fine jet under a considerable pressure, picks up the potential in about a tenth of the time required by the ordinary radium preparation protected by a glass tube. These fine jet droppers with a mixture of alcohol and water have proved very effective for balloon observations.

Table I.—*Annual Variation Potential Gradient.*

Place and Period.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Karasjok (**10**), 1903-1904	143	150	137	94	74	65	70	67	67	87	120	126
Sodankylä (**31**), 1882-1883	94	133	148	155	186	93	53	77	47	72	71	71
Potsdam (**9**), 1904	167	95	118	88	93	72	73	65	97	101	108	123
Kew (**12**), 1898-1904	127	141	113	87	77	70	61	72	76	96	126	153
Greenwich (**13**), 1893-1894, 1896	110	112	127	107	83	71	76	84	83	104	104	139
Florence (**14**), 1883-1886	132	110	98	84	86	81	77	90	89	99	129	125
Perpignan (**15**), 1886-1888	121	112	108	89	91	92	89	82	74	99	122	121
Lisbon (**16**), 1884-1886	104	105	104	92	91	93	87	92	100	99	115	117
Tokyo (**17**), 1897-1898, 1900-1901	165	145	117	86	62	58	41	59	59	97	134	176
Batavia (**18**)(2 m.), 1887-1890	97	115	155	127	129	105	79	62	69	79	90	93
Batavia (7.8 m.) 1890-1895	100	89	103	120	98	103	85	99	73	101	117	112

3. Before considering observational data, it is expedient to mention various sources of uncertainty. Above the level plain of absolutely

smooth surface, devoid of houses or vegetation, the equipotential surfaces under normal conditions would be strictly horizontal, and if we could determine the potential at one metre above the ground we should have a definite measure of the potential gradient at the earth's surface. The presence, however, of apparatus or observers upsets the conditions, while above uneven ground or near a tree or a building the equipotential surfaces cease to be horizontal. In an ordinary climate a building seems to be practically at the earth's potential; near its walls the equipotential surfaces are highly inclined, and near the ridges they may lie very close together. The height of the walls in the various observatories, the height of the collectors, and the distance they project from the wall vary largely, and sometimes there are external buildings or trees sufficiently near to influence the potential. It is thus futile to compare the absolute voltages met with at two stations, unless allowance can be made for the influence of the environment. With a view to this, it has become increasingly common of late years to publish not the voltages actually observed, but values deduced from them for the potential gradient in the open in volts per metre. Observations are made at a given height over level open ground near the observatory, and a comparison with the simultaneous results from the self-recording electrograph enables the records from the latter to be expressed as potential gradients in the open. In the case, however, of many observatories, especially as regards the older records, no data for reduction exist; further, the reduction to the open is at best only an approximation, the success attending which probably varies considerably at different stations. This is one of the reasons why in the figures for the annual and diurnal variations in Tables I., II. and III., the potential has been expressed as percentages of its mean value for the year or the day. In most cases the environment of a collector is not absolutely invariable. If the shape of the equipotential surfaces near it is influenced by trees, shrubs or grass, their influence will vary throughout the year. In winter the varying depth of snow may exert an appreciable effect. There are sources of uncertainty in the instrument itself. Unless the insulation is perfect, the potential recorded falls short of that at the spot where the radium is placed or the water jet breaks. The action of the collector is opposed by the leakage through imperfect insulation, or natural dissipation, and this may introduce a fictitious element into the apparent annual or diurnal variation. The potentials that have to be dealt with are often hundreds and sometimes thousands of volts, and insulation troubles are more serious than is generally appreciated. When a water jet serves as collector, the pressure under which it issues should be practically constant. If the pressure alters as the water tank empties, a discontinuity occurs in the trace when the tank is refilled, and a fictitious element may be introduced into the diurnal variation. When rain or snow is falling, the potential frequently changes rapidly. These changes are often too rapid to be satisfactorily dealt with by an ordinary electrometer, and they sometimes leave hardly a trace on the photographic paper. Again rain dripping from exposed parts of the apparatus may materially affect the record. It is thus customary in calculating diurnal inequalities either to take no account of days on which there is an appreciable rainfall, or else to form separate tables for "dry" or "fine" days and for "all" days. Speaking generally, the exclusion of days of rain and of negative potential comes pretty much to the same thing, and the presence or absence of negative potential is not infrequently the criterion by reference to which days are rejected or are accepted as normal.

4. The potential gradient near the ground varies with the season of the year and the hour of the day, and is largely dependent on the weather conditions. It is thus difficult to form even a rough estimate of the mean value at any place unless hourly readings exist, extending over the whole or the greater part of a year. It is even somewhat precipitate to assume that a mean value deduced from a single year is fairly representative of average conditions. At Potsdam, G. Lüdeling (**9**) found for the mean value for 1904 in volts per metre 242. At Karasjok in the extreme north of Norway G.C. Simpson (**10**) in 1903-1904 obtained 139. At Kremsmünster for 1902 P.B. Zölss(**11**) gives 98. At Kew (**12**) the mean for individual years from 1898 to 1904 varied from 141 in 1900 to 179 in 1899, the mean from the seven years combined being 159. The large difference between the means obtained at Potsdam and Kremsmünster, as compared to the comparative similarity between the results for Kew and Karasjok, suggests that the mean value of the potential gradient may be much more dependent on local conditions than on difference of latitude.

At any single station potential gradient has a wide range of values. The largest positive and negative values recorded are met with during disturbed weather. During thunderstorms the record from an electrograph shows large sudden excursions, the trace usually going off the sheet with every flash of lightning when the thunder is near. Exactly what the potential changes amount to under such circumstances it is impossible to say; what the trace shows depends largely on the type of electrometer. Large rapid changes are also met with in the absence of thunder during heavy rain or snow fall. In England the largest values of a sufficiently steady character to be shown correctly by an ordinary electrograph occur during winter fogs. At such times gradients of +400 or +500 volts per metre are by no means unusual at Kew, and voltages of 700 or 800 are occasionally met with.

5. Annual Variation.—Table I. gives the annual variation of the potential gradient at a number of stations arranged according to latitude, the mean value for the whole year being taken in each case as 100. Karasjok as already mentioned is in the extreme north of Norway (69° 17′ N.); Sodankylä was the Finnish station of the international polar year 1882-1883. At Batavia, which is near the equator (6° 11′ S.) the annual variation seems somewhat irregular. Further, the results obtained with the water-dropper at two heights—viz. 2 and 7.8 metres—differ notably. At all the other stalions the difference between summer and winter months is conspicuous. From the European data one would be disposed to conclude that the variation throughout the year diminishes as one approaches the equator. It is decidedly less at Perpignan and Lisbon than at Potsdam, Kew and Greenwich, but nowhere is the seasonal difference more conspicuous than at Tokyo, which is south of Lisbon.

TABLE II.—*Diurnal Variation Potential Gradient.*

Station.	Karasjok.	Sodankylä.	Kew(**19**, **12**).		Greenwich.	Florence.	Perpignan.	Lisbon.	Tokyo.	Batavia.		Cape Horn(**20**).
Period.	1903-4.	1882-83.	1862-1864.	1898-1904.	1893-96.	1883-85.	1886-88.	1884-86.	1897-98 1900-1.	1887-1890.	1890-1895.	1882-83.
Days.		All.	All.	Quiet.	All.	All.	Fine.	All.	All.	Dry.	Dry.	Pos.
h		3.0	3.5	3.35	3.0		8.4	3.0	1.7			3.5
l	5.5	2.5	1.0	1.3	1.8		1.5	0.5	2.0	2	7.8	2.0
Hour.												
1	83	91	87	93	97	92	78	84	101	147	125	82
2	73	85	79	88	89	83	72	80	98	141	114	73
3	66	82	74	84	87	77	71	78	97	135	109	85
4	63	84	72	83	86	75	72	81	99	128	102	81
5	60	89	71	85	86	74	77	83	121	127	101	85
6	68	91	77	93	92	82	92	92	154	137	117	95
7	81	97	92	103	100	100	107	101	167	158	147	106
8	87	100	106	112	102	112	114	105	149	104	119	118
9	94	98	107	115	100	113	111	104	117	67	82	119
10	101	102	100	112	101	107	100	104	87	42	55	123
11	99	98	90	101	96	100	96	102	70	35	46	123
Noon.	103	102	92	94	97	95	99	108	61	30	43	115
1	106	105	90	89	96	92	99	111	54	30	42	112
2	108	107	91	87	94	90	97	114	49	30	43	94
3	108	108	92	88	95	89	99	109	53	33	46	89
4	109	108	98	93	97	89	105	108	61	41	53	88
5	110	108	108	99	102	94	113	108	76	67	73	84
6	119	110	121	108	108	113	126	111	95	91	108	110
7	129	102	134	115	111	121	131	116	107	120	145	107
8	136	111	139	118	115	129	129	114	114	137	155	123
9	139	111	138	119	117	132	120	109	119	146	155	112
10	133	104	128	115	117	127	109	102	120	148	147	99
11	121	108	113	108	111	114	97	92	119	151	143	85
12	102	93	99	99	104	100	86	85	112	147	130	98

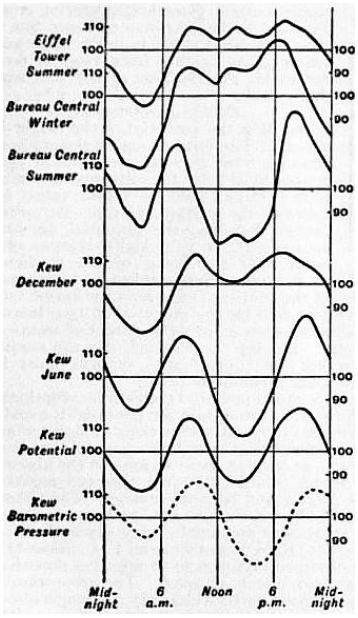
TABLE III.—*Diurnal Variation Potential Gradient.*

Station.	Karasjok.		Sodankylä.		Kew.			Greenwich.		Bureau Central (**21**).		Eiffel Tower (**21**).	Perpignan (**21**).		Batavia. (2 m.)	
Period.	1903-4.		1882-83.		1898-1904.			1894 and '96.		1894-99.		1896-98.	1885-95.		1887-90.	
	Winter.	Summer.	Winter.	Summer.	Winter.	Equinox.	Summer.	Winter.	Summer.	Winter.	Summer.	Summer.	Winter.	Summer.	Winter.	Summer.
Hour.																
1	76	104	90	99	91	93	96	87	110	79	102	90	72	88	145	149
2	66	96	79	84	86	88	90	84	101	71	92	83	67	83	139	142
3	57	89	78	90	82	85	85	76	98	70	88	79	66	81	137	135
4	55	83	74	99	81	84	84	77	96	69	84	76	67	83	131	127
5	50	79	74	111	82	87	90	78	94	75	94	78	72	92	132	123
6	61	83	80	114	86	97	101	82	101	83	106	87	84	107	138	136
7	78	89	86	117	95	109	113	94	107	98	118	97	104	114	166	153
8	82	93	95	122	104	118	120	97	111	111	120	103	122	108	118	92
9	90	93	91	109	111	119	119	98	102	113	106	110	126	100	74	64
10	104	93	106	101	114	110	110	102	98	111	94	109	114	93	43	40
11	102	92	98	97	107	95	97	103	86	108	84	107	98	90	35	36
Noon.	119	90	98	100	102	86	87	107	94	106	77	104	99	95	31	30
1	116	94	116	97	99	81	80	107	85	112	79	107	96	93	29	33
2	118	97	113	97	97	80	76	109	82	112	81	110	94	90	28	32
3	119	100	121	93	99	82	76	111	78	111	78	107	95	88	24	41
4	115	99	111	96	103	88	80	116	81	113	80	105	102	92	30	49
5	120	106	105	106	108	96	87	112	93	120	85	106	115	98	60	74
6	131	104	115	92	111	109	98	114	98	124	97	109	128	110	88	94
7	136	110	118	102	114	120	111	117	99	124	123	113	133	122	119	122
8	134	113	117	106	112	124	123	113	108	116	134	110	131	127	138	135
9	137	125	115	90	111	123	129	111	118	104	130	109	124	125	145	147
10	125	135	112	90	108	118	125	110	124	97	122	105	111	117	148	148
11	114	126	113	103	103	109	116	102	120	90	115	101	96	108	149	152
12	96	111	95	85	96	99	105	93	116	83	108	94	83	95	148	146

At the temperate stations the maximum occurs near midwinter; in the Arctic it seems deferred towards spring. 863

6. *Diurnal Variation.*—Table II. gives the mean diurnal variation for the whole year at a number of stations arranged in order of latitude, the mean from the 24 hourly values being taken as 100. The data are some from "all" days, some from "quiet," "fine" or "dry" days. The height, *h*, and the distance from the wall, *l*, were the potential is measured are given in metres when known. In most cases two distinct maxima and minima occur in the 24 hours. The principal maximum is usually found in the evening between 8 and 10 P.M., the principal minimum in the morning from 3 to 5 A.M. At some stations the minimum in the afternoon is indistinctly shown, but at Tokyo and Batavia it is much more conspicuous than the morning minimum.

7. In Table III. the diurnal inequality is shown for "winter" and "summer" respectively. In all cases the mean value for the 24 hours is taken as 100. By "summer" is meant April to September at Sodankylä, Greenwich and Batavia; May to August at Kew, Bureau Central (Paris), Eiffel Tower and Perpignan; and May to July at Karasjok. "Winter" includes October to March at Sodankylä, Greenwich and Batavia; November to February at Kew and Bureau Central; November to January at Karasjok, and December and January at Perpignan. Mean results from March, April, September and October at Kew are assigned to "Equinox."



At Batavia the difference between winter and summer is comparatively small. Elsewhere there is a tendency for the double period, usually so prominent in summer, to become less pronounced in winter, the afternoon minimum tending to disappear. Even in summer the double period is not prominent in the arctic climate of Karasjok or on the top of the Eiffel Tower. The diurnal variation in summer at the latter station is shown graphically in the top curve of fig. 1. It presents a remarkable resemblance to the adjacent curve, which gives the diurnal variation at mid-winter at the Bureau Central. The resemblance between these curves is much closer than that between the Bureau Central's own winter and summer curves. All three Paris curves show three peaks, the first and third representing the ordinary forenoon and afternoon maxima. In summer at the Bureau Central the intermediate peak nearly disappears in the profound afternoon depression, but it is still recognizable. This three-peaked curve is not wholly peculiar to Paris, being seen, for instance, at Lisbon in summer. The December and June curves for Kew are good examples of the ordinary nature of the difference between midwinter and midsummer. The afternoon minimum at Kew gradually deepens as midsummer approaches. Simultaneously the forenoon maximum occurs earlier and the afternoon maximum later in the day. The two last curves in the diagram contrast the diurnal variation at Kew in potential gradient and in barometric pressure for the year as a whole. The somewhat remarkable resemblance between the diurnal variation for the two elements, first remarked on by J.D. Everett (**19**), is of interest in connexion with recent theoretical conclusions by J.P. Elster and H.F.K. Geitel and by H. Ebert.

In the potential curves of the diagram the ordinates represent the hourly values expressed—as in Tables II. and III.—as percentages of the mean value for the day. If this be overlooked, a wrong impression may be derived as to the absolute amplitudes of the changes. The Kew curves, for instance, might suggest that the range (maximum less minimum hourly value) was larger in June than in December. In reality the December range was 82, the June only 57 volts; but the mean value of the potential was 243 in December as against 111 in June. So again, in the case of the Paris curves, the absolute value of the diurnal range in summer was much greater for the Eiffel Tower than for the Bureau Central, but the mean voltage was 2150 at the former station and only 134 at the latter.

8. *Fourier Coefficients.*—Diurnal inequalities such as those of Tables II. and III. and intended to eliminate irregular changes, but they also to some extent eliminate regular changes if the hours of maxima and minima or the character of the diurnal variation alter throughout the year. The alteration that takes place in the regular diurnal inequality throughout the year is best seen by analysing it into a Fourier series of the type

$$c_1 \sin(t + a_1) + c_2 \sin(2t + a_2) + c_3 \sin(3t + a_3) + c_4 \sin(4t + a_4) + \ldots$$

where t denotes time counted from (local) midnight, c_1, c_2, c_3, C_4, ... are the amplitudes of the component harmonic waves of periods 24, 12, 8 and 6 hours; a_1, a_2, a_3, a_4, are the corresponding phase angles. One hour of time t is counted as 15°, and a delay of one hour in the time of maximum answers to a diminution of 15° in a_1, of 30° in a_2, and so on. If a_1, say, varies much throughput the year, or if the ratios of c_2, c_3, c_4, ... to c_1, vary much, then a diurnal inequality derived from a whole year, or from a season composed of several months, represents a mean curve arising from the superposition of a number of curves, which differ in shape and in the positions of their maxima and minima. The result, if considered alone, inevitably leads to an underestimate of the average amplitude of the regular diurnal variation.

It is also desirable to have an idea of the size of the irregular changes which vary from one day to the next. On stormy days, as already mentioned, the irregular changes hardly admit of satisfactory treatment. Even on the quietest days irregular changes are always numerous and often large.

Table IV. aims at giving a summary of the several phenomena for a single station, Kew, on electrically quiet days. The first line gives the mean value of the potential gradient, the second the mean excess of the largest over the smallest hourly value on individual days. The hourly values are derived from smoothed curves, the object being to get the mean ordinate for a 60-minute period. If the actual crests of the excursions had been measured the figures in the second line would have been even larger. The third line gives the range of the *regular* diurnal inequality, the next four lines the amplitudes of the first four Fourier waves into which the regular diurnal

inequality has been analysed. These mean values, ranges and amplitudes are all measured in volts per metre (in the open). The last four lines of Table IV. give the phase angles of the first four Fourier waves.

TABLE IV.—*Absolute Potential Data at Kew* (**12**).

		Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Mean Potential Gradient		201	224	180	138	123	111	98	114	121	153	200	243
Mean of individual daily ranges		203	218	210	164	143	143	117	129	141	196	186	213
Range in Diurnal inequality		73	94	83	74	71	57	55	60	54	63	52	82
Amplitudes of Fourier waves	c_1	22	22	17	13	18	9	6	6	9	7	14	30
	c_2	21	33	34	31	22	23	24	26	23	30	17	21
	c_3	7	10	5	5	3	1	3	2	3	6	5	7
	c_4	2	3	5	6	4	1	4	3	4	3	2	3
		°	°	°	°	°	°	°	°	°	°	°	°
Phase angles of Fourier waves	a_1	206	204	123	72	86	79	48	142	154	192	202	208
	a_1	170	171	186	193	188	183	185	182	199	206	212	175
	a_3	11	9	36	96	100	125	124	107	16	18	38	36
	a_1	235	225	307	314	314	277	293	313	330	288	238	249

It will be noticed that the difference between the greatest and least hourly values is, in all but three winter months, actually larger than the mean value of the potential gradient for the day; it bears to the range of the regular diurnal inequality a ratio varying from 2.0 in May to 3.6 in November.

At midwinter the 24-hour term is the largest, but near midsummer it is small compared to the 12-hour term. The 24-hour term is very variable both as regards its amplitude and its phase angle (and so its hour of maximum). The 12-hour term is much less variable, 864
especially as regards its phase angle; its amplitude shows distinct maxima near the equinoxes. That the 8-hour and 6-hour waves, though small near midsummer, represent more than mere accidental irregularities, seems a safe inference from the regularity apparent in the annual variation of their phase angles.

TABLE V.—*Fourier Series Amplitudes and Phase Angles.*

Place.	Period.	Winter.				Summer.			
		c1.	c2.	a1.	a2.	c1.	c2.	a1.	a2.
				°	°			°	°
Kew	1862-64	0.283	0.160	184	193	0.127	0.229	111	179
”	1898-1904	.102	.103	206	180	.079	.213	87	186
Bureau Central	1894-98	.220	.104	223	206	.130	.200	95	197
Eiffel Tower	1896-98	..	..	..	..	.133	.085	216	171
Sonnblick (**22**)	1902-03	..	..	..	..	.208	.120	178	145
Karasjok	1903-04	.356	.144	189	155	.165	.093	141	144
Kremsmünster (**23**)	1902	.280	.117	224	194	.166	.153	241	209
Potsdam	1904	.269	.101	194	185	.096	.152	343	185

9. Table V. gives some data for the 24-hour and 12-hour Fourier coefficients, which will serve to illustrate the diversity between different stations. In this table, unlike Table IV., amplitudes are all expressed as decimals of the mean value of the potential gradient for the corresponding season. “Winter” means generally the four midwinter, and “summer” the four midsummer, months; but at Karasjok three, and at Kremsmünster six, months are included in each season. The results for the Sonnblick are derived from a comparatively small number of days in August and September. At Potsdam the data represent the arithmetic means derived from the Fourier analysis for the individual months comprising the season. The 1862-1864 data from Kew—due to J.D. Everett (**19**)—are based on “all” days; the others, except Karasjok to some extent, represent electrically quiet days. The cause of the large difference between the two sets of data for c_1 at Kew is uncertain. The potential gradient is in all cases lower in summer than winter, and thus the reduction in c_1 in summer would appear even larger than in Table V. if the results were expressed in absolute measure. At Karasjok and Kremsmünster the seasonal variation in a_1 seems comparatively small, but at Potsdam and the Bureau Central it is as large as at Kew. Also, whilst the winter values of a_1 are fairly similar at the several stations the summer values are widely different. Except at Karasjok, where the diurnal changes seem somewhat irregular, the relative amplitude of the 12-hour term is considerably greater in summer than in winter. The values of a_2 at the various stations differ comparatively little, and show but little seasonal change. Thus the 12-hour term has a much greater uniformity than the 24-hour term. This possesses significance in connexion with the view, supported by A.B. Chauveau (**21**), F. Exner (**24**) and others, that the 12-hour term is largely if not entirely a local phenomenon, due to the action of the lower atmospheric strata, and tending to disappear even in summer at high altitudes. Exner attributes the double daily maximum, which is largely a consequence of the 12-hour wave, to a thin layer near the ground, which in the early afternoon absorbs the solar radiation of shortest wave length. This layer he believes specially characteristic of arid dusty regions, while comparatively non-existent in moist climates or where foliage is luxuriant. In support of his theory Exner states that he has found but little trace of the double maximum and minimum in Ceylon and elsewhere. C. Nordmann (**25**) describes some similar results which he obtained in Algeria during August and September 1905. His station, Philippeville, is close to the shores of the Mediterranean, and sea breezes persisted during the day. The diurnal variation showed only a single maximum and minimum, between 5 and 6 P.M. and 4 and 5 A.M. respectively. So again, a few days’ observations on the top of Mont Blanc (4810 metres) by le Cadet (**26**) in August and September 1902, showed only a single period, with maximum between 3 and 4 P.M., and minimum about 3 A.M. Chauveau points to the reduction in the 12-hour term as compared to the 24-hour term on the Eiffel Tower, and infers the practical disappearance of the former at no great height. The close approach in the values for c_1 in Table V. from the Bureau Central and the Eiffel Tower, and the reduction of c_2 at the latter station, are unquestionably significant facts; but the summer value for c_2 at Karasjok—a low level station—is nearly as small as that at the Eiffel Tower, and notably smaller than that at the Sonnblick (3100 metres). Again, Kew is surrounded by a large park, not devoid of trees, and hardly the place where Exner’s theory would suggest a large value for c_2, and yet the summer value of c_2 at Kew is the largest in Table V.

10. Observations on mountain tops generally show high potentials near the ground. This only means that the equipotential surfaces are crowded together, just as they are near the ridge of a house. To ascertain how the increase in the voltage varies as the height in the free atmosphere increases, it is necessary to employ kites or balloons. At small heights Exner (**27**) has employed captive balloons, provided with a burning fuse, and carrying a wire connected with an electroscope on the ground. He found the gradient nearly uniform for heights up to 30 to 40 metres above the ground. At great heights free balloons seem necessary. The balloon carries two collectors a given vertical distance apart. The potential difference between the two is recorded, and the potential gradient is thus found. Some of the earliest balloon observations made the gradient increase with the height, but such a result is now regarded as abnormal. A balloon may leave the earth with a charge, or become charged through discharge of ballast. These possibilities may not have been sufficiently realized at first. Among the most important balloon observations are those by le Cadet (**1**) F. Linke (**28**) and H. Gerdien (**29**). The following are samples from a number of days’ results, given in le Cadet’s book. h is the height in metres, P the gradient in volts per metre.

Aug. 9, 1893	*h*	824	830	1060	1255	1290	1745	1940	2080	2310	2520
	P	37	43	43	41	42	34	25	21	18	16
Sep. 11, 1897	*h*	1140	1378	1630	1914	237	2786	3136	3364	3912	4085
	P	43	38	33	25	22	21	19	19	14	13

The ground value on the last occasion was 150. From observations during twelve balloon ascents, Linke concludes that below the 1500-metre level there are numerous sources of disturbance, the gradient at any given height varying much from day to day and hour to hour; but at greater heights there is much more uniformity. At heights from 1500 to 6000 metres his observations agreed well with the

formula

$$dV/dh = 34 - 0.006\ h,$$

V denoting the potential, h the height in metres. The formula makes the gradient diminish from 25 volts per metre at 1500 metres height to 10 volts per metre at 4000 metres. Linke's mean value for dV/dh at the ground was 125. Accepting Linke's formula, the potential at 4000 metres is 43,750 volts higher than at 1500 metres. If the mean of the gradients observed at the ground and at 1500 metres be taken as an approximation to the mean value of the gradient throughout the lowest 1500 metres of the atmosphere, we find for the potential at 1500 metres level 112,500 volts. Thus at 4000 metres the potential seems of the order of 150,000 volts. Bearing this in mind, one can readily imagine how close together the equipotential surfaces must lie near the summit of a high sharp mountain peak.

11. At most stations a negative potential gradient is exceptional, unless during rain or thunder. During rain the potential is usually but not always negative, and frequent alternations of sign are not uncommon. In some localities, however, negative potential gradient is by no means uncommon, at least at some seasons, in the absence of rain. At Madras, Michie Smith (**30**) often observed negative potential during bright August and September days. The phenomenon was quite common between 9.30 A.M. and noon during westerly winds, which at Madras are usually very dry and dusty. At Sodankylä, in 1882-1883, K.S. Lemström and F.C. Biese (**31**) found that out of 255 observed occurrences of negative potential, 106 took place in the absence of rain or snow. The proportion of occurrences of negative potential under a clear sky was much above its average in autumn. At Sodankylä rain or snowfall was often unaccompanied by change of sign in the potential. At the polar station Godthaab (**32**) in 1882-1883, negative potential seemed sometimes associated with aurora (see AURORA POLARIS).

Lenard, Elster and Geitel, and others have found the potential gradient negative near waterfalls, the influence sometimes extending to a considerable distance. Lenard (**33**) found that when pure water falls upon water the neighbouring air takes a negative charge. Kelvin, Maclean and Gait (**34**) found the effect greatest in the air near the level of impact. A sensible effect remained, however, after the influence of splashing was eliminated. Kelvin, Maclean and Galt regard this property of falling water as an objection to the use of a water-dropper indoors, though not of practical importance when it is used out of doors.

12. Elster and Geitel (**35**) have measured the charge carried by raindrops falling into an insulated vessel. Owing to observational difficulties, the exact measure of success attained is a little difficult to gauge, but it seems fairly certain that raindrops usually carry a charge. Elster and Geitel found the sign of the charge often fluctuate repeatedly during a single rain storm, but it seemed more often than not opposite to that of the simultaneous potential gradient. Gerdien has more recently repeated the experiments, employing an apparatus devised by him for the purpose. It has been found by C.T.R. Wilson (**36**) that a vessel in which freshly fallen rain or snow has been evaporated to dryness shows radioactive properties lasting for a few hours. The results obtained from equal weights of rain and snow seem of the same order.

13. W. Linss (**6**) found that an insulated conductor charged either positively or negatively lost its charge in the free atmosphere; the potential V after time t being connected with its initial value V_0 by a formula of the type $V = V_0 e^{-at}$ where a is constant. This was confirmed by Elster and Geitel (**7**), whose form of dissipation apparatus has been employed in most recent work. The percentage of the charge which is dissipated per minute is usually denoted by a_+ or a_- according to its sign. The mean of a_+ and a_- is usually denoted by $a_\pm$ or simply by a, while q is employed for the ratio a_-/a_+. Some observers when giving mean values take $\Sigma(a_-/a_+)$ as the mean value of q, while others take $\Sigma(a_-)/\Sigma(a_+)$. The Elster and Geitel apparatus is furnished with a cover, serving to protect the dissipator from the direct action of rain, wind or sunlight. It is usual to observe with this cover on, but some observers, *e.g.* A. Gockel, have made long series of observations without it. The loss of charge is due to more than one cause, and it is difficult to attribute an absolutely definite meaning even to results obtained with the cover on. Gockel (**37**) says that the results he obtained without the cover when divided by 3 are fairly comparable with those obtained under the usual conditions; but the appropriate divisor must vary to some extent with the climatic conditions. Thus results obtained for a_+ or a_- without the cover are of doubtful value for purposes of comparison with those found elsewhere with it on. In the case of q the uncertainty is much less.

TABLE VI.—*Dissipation. Mean Values.*

Place.	Period.	Season.	Observer or Authority.	a_+	q
Karasjok	1903-4	Year	Simpson (**10**)	3.57	1.15
Wolfenbüttel		Year	Elster and Geitel (**39**)	1.33	1.05
Potsdam	1904	Year	Lüdeling (**40**)	1.13	1.33
Kremsmüster	1902	Year	Zölss (**42**)	1.32	1.18
”	1903	Year	Zölss (**41**)	1.35	1.14
Freiburg		Year	Gockel (**43**)	..	1.41
Innsbruck	1902		Czermak (**44**)	1.95	0.94
”	1905	Jan. to June	Defant (**45**)	1.47	1.17
Mattsee (Salzburg)	1905	July to Sept.	von Schweidler (**46**)	..	0.99
Seewalchen	1904	July to Sept.	von Schweidler (**38**)	..	1.18
Trieste	1902-3	Year	Mazelle (**47**)	0.58	1.09
Misdroy	1902		Lüdeling (**40**)	1.09	1.58
Swinemünde	1904	Aug. and Sept.	Lüdeling (**40**)	1.23	1.37
Heligoland (sands)	1903	Summer	Elster and Geitel (**40**)	1.14	1.71
Heligoland plateau	”	”	Elster and Geitel (**40**)	3.07	1.50
Juist (Island)		”	Elster and Geitel (**48**)	1.56	1.56
Atlantic and German Ocean	1904	August	Boltzmann (**49**)	1.83	2.69
Arosa (1800 m.)	1903	Feb. to April	Saake (**50**)	1.79	1.22
Rothhorn (2300 m.)	1903	September	Gockel (**43**)	..	5.31
Sonnblick (3100 m.)	1903	September	Conrad (**22**)	..	1.75
Mont Blanc (4810 m.)	1902	September	le Cadet (**43**)	..	10.3

Table VI. gives the mean values of $a_\pm$ and q found at various places. The observations were usually confined to a few hours of the day, very commonly between 11 A.M. and 1 P.M., and in absence of information as to the diurnal variation it is impossible to say how much this influences the results. The first eight stations lie inland; that at Seewalchen (**38**) was, however, adjacent to a large lake. The next five stations are on the coast or on islands. The final four are at high levels. In the cases where the observations were confined to a few months the representative nature of the results is more doubtful.

On mountain summits q tends to be large, *i.e.* a negative charge is lost much faster than a positive charge. Apparently q has also a tendency to be large near the sea, but this phenomenon is not seen at Trieste. An exactly opposite phenomenon, it may be remarked, is seen near waterfalls, q becoming very small. Only Innsbruck and Mattsee give a mean value of q less than unity. Also, as later observations at Innsbruck give more normal values for q, some doubt may be felt as to the earlier observations there. The result for Mattsee seems less open to doubt, for the observer, von Schweidler, had obtained a normal value for q during the previous year at Seewalchen. Whilst the average q in at least the great majority of stations exceeds unity, individual observations making q less than unity are not rare. Thus in 1902 (**51**) the percentage of cases in which q fell short of 1 was 30 at Trieste, 33 at Vienna, and 35 at Kremsmünster; at Innsbruck q was less than 1 on 58 days out of 98.

In a long series of observations, individual values of q show usually a wide range. Thus during observations extending over more than a year, q varied from 0.18 to 8.25 at Kremsmünster and from 0.11 to 3.00 at Trieste. The values of a_+, a_- and $a_\pm$ also show large variations. Thus at Trieste a_+ varied from 0.12 to 4.07, and a_- from 0.11 to 3.87; at Vienna a_+ varied from 0.32 to 7.10, and a_- from 0.78 to 5.42; at Kremsmünster $a_\pm$ varied from 0.14 to 5.83.

14. *Annual Variation.*—When observations are made at irregular hours, or at only one or two fixed hours, it is doubtful how representative they are. Results obtained at noon, for example, probably differ more from the mean value for the 24 hours at one season than at another. Most dissipation results are exposed to considerable uncertainty on these grounds. Also it requires a long series of years to give thoroughly representative results for any element, and few stations possess more than a year or two's dissipation data. Table VII. gives comparative results for winter (October to March) and summer at a few stations, the value for the season being

the arithmetic mean from the individual months composing it. At Karasjok (**10**), Simpson observed thrice a day; the summer value there is nearly double the winter both for a_+ and a_-. The Kremsmünster (**42**) figures show a smaller but still distinct excess in the summer values. At Trieste (**47**), Mazelle's data from all days of the year show no decided seasonal change in a_+ or a_-; but when days on which the wind was high are excluded the summer value is decidedly the higher. At Freiburg (**43**), q seems decidedly larger in winter than in summer; at Karasjok and Trieste the seasonal effect in q seems small and uncertain.

TABLE VII.—*Dissipation.*

Place	Winter				Summer			
	a_+	a_-	$a_\pm$	q	a_+	a_-	$a_\pm$	q
Karasjok 1903-1904	2.28	2.69	2.49	1.18	4.38	4.94	4.65	1.13
Kremsmüster 1903	1.14	1.30	1.22	1.14	1.38	1.56	1.47	1.12
Freiburg	..	..	..	1.57	..	..	..	1.26
Trieste 1902-1903	0.56	0.59	0.58	1.07	0.55	0.61	0.58	1.13
Trieste calm days	..	..	0.35	..	..	..	0.48	..

15. *Diurnal Variation.*—P.B. Zölss (**41**, **42**) has published diurnal variation data for Kremsmünster for more than one year, and independently for midsummer (May to August) and midwinter (December to February). His figures show a double daily period in both a_+ and a_-, the principal maximum occurring about 1 or 2 P.M. The two minima occur, the one from 5 to 7 A.M., the other from 7 to 8 P.M.; they are nearly equal. Taking the figures answering to the whole year, May 1903 to 1904, a_+ varied throughout the day from 0.82 to 1.35, and a_- from 0.85 to 1.47. At midsummer the extreme hourly values were 0.91 and 1.45 for a_+, 0.94 and 1.60 for a_-. The corresponding figures at midwinter were 0.65 and 1.19 for a_+, 0.61 and 1.43 for a_-. Zölss' data for q show also a double daily period, but the apparent range is small, and the hourly variation is somewhat irregular. At Karasjok, Simpson found a_+ and a_- both larger between noon and 1 P.M. than between either 8 and 9 A.M. or 6 and 7 P.M. The 6 to 7 P.M. values were in general the smallest, especially in the case of a_+; the evening value for q on the average exceeded the values from the two earlier hours by some 7%.

Summer observations on mountains have shown diurnal variations very large and fairly regular, but widely different from those observed at lower levels. On the Rothhorn, Gockel (**43**) found a_+ particularly variable, the mean 7 A.M. value being 4½ times that at 1 P.M. q (taken as $\Sigma(a_-/a_+)$ varied from 2.25 at 5 A.M. and 2.52 at 9 P.M. to 7.82 at 3 P.M. and 8.35 at 7 P.M. On the Sonnblick, in early September, V. Conrad (**22**) found somewhat similar results for q, the principal maximum occurring at 1 P.M., with minima at 9 P.M. and 6 A.M.; the largest hourly value was, however, scarcely double the least. Conrad found a_- largest at 4 A.M. and least at 6 P.M., the largest value being double the least; a_+ was largest at 5 A.M. and least at 2 P.M., the largest value being fully 2½ times the least. On Mont Blanc, le Cadet (**43**) found q largest from 1 to 3 P.M., the value at either of these hours being more than double that at 11 A.M. On the Patscherkofel, H. von Ficker and A. Defant (**52**), observing in December, found q largest from 1 to 2 P.M. and least between 11 A.M. and noon, but the largest value was only 1½ times the least. On mountains much seems to depend on whether there are rising or falling air currents, and results from a single season may not be fairly representative.

16. Dissipation seems largely dependent on meteorological conditions, but the phenomena at different stations vary so much as to suggest that the connexion is largely indirect. At most stations a_+ and a_- both increase markedly as wind velocity rises. From the observations at Trieste in 1902-1903 E. Mazelle (**47**) deduced an increase of about 3% in a_+ for a rise of 1 km. per hour in wind velocity. The following are some of his figures, the velocity v being in kilometres per hour:—

v	0 to 4.	20 to 24.	40 to 49.	60 to 69.
a	0.33	0.64	1.03	1.38
q	1.13	1.19	1.00	0.96

For velocities from 0 to 24 km. per hour q exceeded unity in 74 cases out of 100; but for velocities over 50 km. per hour q exceeded unity in only 40 cases out of 100. Simpson got similar results at Karasjok; the rise in a_+ and a_- with increased wind velocity seemed, however, larger in winter than in summer. Simpson observed a fall in q for wind velocities exceeding 2 on Beaufort's scale. On the top of the Sonnblick, Conrad observed a *slight* increase of $a_\pm$ as the wind velocity increased up to 20 km. per hour, but for greater velocities up to 80 km. per hour no further decided rise was observed.

At Karasjok, treating summer and winter independently, Simpson (**10**) found a_+ and a_- both increase in a nearly linear relation with temperature, from below −20° to +15° C. For example, when the temperature was below −20° mean values were 0.76 for a_+ and 0.91 for a_-; for temperatures between -10° and -5° the corresponding means were 2.45 and 2.82; while for temperatures between +10° and +15° they were 4.68 and 5.23. Simpson found no certain temperature effect on the value of q. At Trieste, from 470 days when the wind velocity did not exceed 20 km. per hour, Mazelle (**47**) found somewhat analogous results for temperatures from 0° to 30° C.; a_-, however, increased faster than a_+, *i.e.* q increased with temperature. When he considered all days irrespective of wind velocity, Mazelle found the influence of temperature obliterated. On the Sonnblick, Conrad (**22**) found $a_\pm$ increase appreciably as temperature rose up to 4° or 5° C.; but at higher temperatures a decrease set in.

Observations on the Sonnblick agree with those at low-level stations in showing a diminution of dissipation with increase of relative humidity. The decrease is most marked as saturation approaches. At Trieste, for example, for relative humidities between 90 and 100 the mean $a_\pm$ was less than half that for relative humidities under 40. With certain dry winds, notably Föhn winds in Austria and Switzerland, dissipation becomes very high. Thus at Innsbruck Defant (**45**) found the mean dissipation on days of Föhn fully thrice that on days without Föhn. The increase was largest for a_+, there being a fall of about 15% in q. In general, a_+ and a_- both tend to be less on cloudy than on bright days. At Kiel (**53**) and Trieste the average value of q is considerably less for wholly overcast days than for bright days. At several stations enjoying a wide prospect the dissipation has been observed to be specially high on days of great visibility when distant mountains can be recognized. It tends on the contrary to be low on days of fog or rain.

The results obtained as to the relation between dissipation and barometric pressure are conflicting. At Kremsmünster, Zölss (**42**) found dissipation vary with the absolute height of the barometer, $a_\pm$ having a mean value of 1.36 when pressure was below the normal, as against 1.20 on days when pressure was above the normal. He also found $a_\pm$ on the average about 10% larger when pressure was falling than when it was rising. On the Sonnblick, Conrad (**22**) found dissipation increase decidedly as the absolute barometric pressure was larger, and he found no difference between days of rising and falling barometer. At Trieste, Mazelle (**47**) found no certain connexion with absolute barometric pressure. Dissipation was above the average when cyclonic conditions prevailed, but this seemed simply a consequence of the increased wind velocity. At Mattsee, E.R. von Schweidler (**46**) found no connexion between absolute barometric pressure and dissipation, also days of rising and falling pressure gave the same mean. At Kiel, K. Kaehler (**53**) found a_+ and a_- both greater with rising than with falling barometer.

V. Conrad and M. Topolansky (**54**) have found a marked connexion at Vienna between dissipation and ozone. Regular observations were made of both elements. Days were grouped according to the intensity of colouring of ozone papers, 0 representing no visible effect, and 14 the darkest colour reached. The mean values of a_+ and a_- answering to 12 and 13 on the ozone scale were both about double the corresponding values answering to 0 and 1 on that scale.

17. A charged body in air loses its charge in more than one way. The air, as is now known, has always present in it ions, some carrying a positive and others a negative charge, and those having the opposite sign to the charged body are attracted and tend to discharge it. The rate of loss of charge is thus largely dependent on the extent to which ions are present in the surrounding air. It depends, however, in addition on the natural mobility of the ions, and also on the opportunities for convection. Of late years many observations have been made of the ionic charges in air. The best-known apparatus for the purpose is that devised by Ebert. A cylinder condenser has its inner surface insulated and charged to a high positive or negative potential. Air is drawn by an aspirator between the surfaces, and the ions having the opposite sign to the inner cylinder are deposited on it. The charge given up to the inner cylinder is known from its loss of potential. The volume of air from which the ions have been extracted being known, a measure is obtained of the total charge on the ions, whether positive or negative. The conditions must, of course, be such as to secure that no ions shall escape, otherwise there is an underestimate. I+ is used to denote the charge on positive ions, I- that on negative ions. The unit to which they are ordinarily referred is 1 electrostatic unit of electricity per cubic metre of air. For the ratio of the mean value of I_+ to the mean value

of I_, the letter Q is employed by Gockel (**55**), who has made an unusually complete study of ionic charges at Freiburg. Numerous observations were also made by Simpson (**10**)—thrice a day—at Karasjok, and von Schweidler has made a good many observations about 3 P.M. at Mattsee (**46**) in 1905, and Seewalchen (**38**) in 1904. These will suffice to give a general idea of the mean values met with.

Station.	Authority.	I_+	I_	Q
Freiburg	Gockel	0.34	0.24	1.41
Karasjok	Simpson	0.38	0.33	1.17
Mattsee	von Schweidler	0.35	0.29	1.19
Seewalchen	von Schweidler	0.45	0.38	1.17

Gockel's mean values of I_+ and Q would be reduced to 0.31 and 1.38 respectively if his values for July—which appear abnormal—were omitted. I_+ and I_ both show a considerable range of values, even at the same place during the same season of the year. Thus at Seewalchen in the course of a month's observations at 3 P.M., I_+ varied from 0.31 to 0.67, and I_ from 0.17 to 0.67.

There seems a fairly well marked annual variation in ionic contents, as the following figures will show. Summer and winter represent each six months and the results are arithmetic means of the monthly values.

	Freiburg.			Karasjok.		
	I_+	I_	Q	I_+	I_	Q
Winter	0.29	0.21	1.49	0.33	0.27	1.22
Summer	0.39	0.28	1.34	0.44	0.39	1.13

If the exceptional July values at Freiburg were omitted, the summer values of I_+ and Q would become 0.33 and 1.25 respectively.

18. *Diurnal Variation.*—At Karasjok Simpson found the mean values of I_+ and I_ throughout the whole year much the same between noon and 1 P.M. as between 8 and 9 A.M. Observations between 6 and 7 P.M. gave means slightly lower than those from the earlier hours, but the difference was only about 5% in I_+ and 10% in I_. The evening values of Q were on the whole the largest. At Freiburg, Gockel found I_+ and I_ decidedly larger in the early afternoon than in either the morning or the late evening hours. His greatest and least mean hourly values and the hours of their occurrence are as follows:—

Winter.				Summer.			
I_+		I_		I_+		I_	
Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
0.333	0.193	0.242	0.130	0.430	0.244	0.333	0.192
2 PM	7 PM	2 PM	8 PM	4 PM	9 to 10 PM	4 PM	9 to 10 PM

Gockel did not observe between 10 P.M. and 7 A.M.

19. Ionization seems to increase notably as temperature rises. Thus at Karasjok Simpson found for mean values:—

Temp. less than −20°	−10° to −5°	10° to 15°
$I_+ = 0.18$, I_ = 0.36	$I_+ = 0.36$, I_ = 0.30	$I_+ = 0.45$, I_ = 0.43

Simpson found no clear influence of temperature on Q. Gockel observed similar effects at Freiburg—though he seems doubtful whether the relationship is direct—but the influence of temperature on I+ seemed reduced when the ground was covered with snow. Gockel found a diminution of ionization with rise of relative humidity. Thus for relative humidities between 40 and 50 mean values were 0.306 for I_+ and 0.219 for I_; whilst for relative humidities between 90 and 100 the corresponding means were respectively 0.222 and 0.134. At Karasjok, Simpson found a slight decrease in I_ as relative humidity increased, but no certain change in I_+. Specially large values of I_+ and I_ have been observed at high levels in balloon ascents. Thus on the 1st of July 1901, at a height of 2400 metres, H. Gerdien (**29**) obtained 0.86 for I_+ and 1.09 for I_.

20. In 1901 Elster and Geitel found that a radioactive emanation is present in the atmosphere. Their method of measuring the radioactivity is as follows (**48**): A wire not exceeding 1 mm. in diameter, charged to a negative potential of at least 2000 volts, is supported between insulators in the open, usually at a height of about 2 metres. After two hours' exposure, it is wrapped round a frame supported in a given position relative to Elster and Geitel's dissipation apparatus, and the loss of charge is noted. This loss is proportional to the length of the wire. The radioactivity is denoted by A, and A=1 signifies that the potential of the dissipation apparatus fell 1 volt in an hour per metre of wire introduced. The loss of the dissipation body due to the natural ionization of the air is first allowed for. Suppose, for instance, that in the absence of the wire the potential falls from 264 to 255 volts in 15 minutes, whilst when the wire (10 metres long) is introduced it falls from 264 to 201 volts in 10 minutes, then

$$10A = (254 - 201) \times 6 - (264 - 255) \times 4 = 342; \text{ or } A = 34.2.$$

The values obtained for A seem largely dependent on the station. At Wolfenbüttel, a year's observations by Elster and Geitel (**56**) made A vary from 4 to 64, the mean being 20. In the island of Juist, off the Friesland coast, from three weeks' observations they obtained only 5.2 as the mean. On the other hand, at Altjoch, an Alpine station, from nine days' observations in July 1903 they obtained a mean of 137, the maximum being 224, and the minimum 92. At Freiburg, from 150 days' observations near noon in 1903-1904, Gockel (**57**) obtained a mean of 84, his extreme values being 10 and 420. At Karasjok, observing several times throughout the day for a good many months, Simpson (**10**) obtained a mean of 93 and a maximum of 432. The same observer from four weeks' observations at Hammerfest got the considerably lower mean value 58, with a maximum of 252. At this station much lower values were found for A with sea breezes than with land breezes. Observing on the pier at Swinemünde in August and September 1904, Lüdeling (**40**) obtained a mean value of 34.

Elster and Geitel (**58**), having found air drawn from the soil highly radioactive, regard ground air as the source of the emanation in the atmosphere, and in this way account for the low values they obtained for A when observing on or near the sea. At Freiburg in winter Gockel (**55**) found A notably reduced when snow was on the ground, I_+ being also reduced. When the ground was covered by snow the mean value of A was only 42, as compared with 81 when there was no snow.

J.C. McLennan (**59**) observing near the foot of Niagara found A only about one-sixth as large as at Toronto. Similarly at Altjoch, Elster and Geitel (**56**) found A at the foot of a waterfall only about one-third of its normal value at a distance from the fall.

21. *Annual and Diurnal Variations.*—At Wolfenbüttel, Elster and Geitel found A vary but little with the season. At Karasjok, on the contrary, Simpson found A much larger at midwinter—notwithstanding the presence of snow—than at midsummer. His mean value for November and December was 129, while his mean for May and June was only 47. He also found a marked diurnal variation, A being considerably greater between 3 and 5 A.M. or 8.30 to 10.30 P.M. than between 10 A.M. and noon, or between 3 and 5 P.M.

At all seasons of the year Simpson found A rise notably with increase of relative humidity. Also, whilst the mere absolute height of the barometer seemed of little, if any, importance, he obtained larger values of A with a falling than with a rising barometer. This last result of course is favourable to Elster and Geitel's views as to the source of the emanation.

22. For a wire exposed under the conditions observed by Elster and Geitel the emanation seems to be almost entirely derived from radium. Some part, however, seems to be derived from thorium, and H.A. Bumstead (**60**) finds that with longer exposure of the wire the relative importance of the thorium emanation increases. With three hours' exposure he found the thorium emanation only from 3 to 5% of the whole, but with 12 hours' exposure the percentage of thorium emanation rose to about 15. These figures refer to the state of the wire immediately after the exposure; the rate of decay is much more rapid for the radium than for the thorium emanation.

23. The different elements—potential gradient, dissipation, ionization and radioactivity—are clearly not independent of one another. The loss of a charge is naturally largely dependent on the richness of the surrounding air in ions. This is clearly shown by the following results obtained by Simpson (**10**) at Karasjok for the mean values of $a_\pm$ corresponding to certain groups of values of $I_\pm$. To eliminate the

disturbing influence of wind, different wind strengths are treated separately.

TABLE VIII.—*Mean Values of* $a_{\pm}$.

Wind Strength.	$I_{\pm}$0 to 0.1.	0.1 to 0.2	0.2 to 0.3	0.3 to 0.4	0.4 to 0.5
0 to 1	0.45	0.60	1.26	2.04	3.03
1 to 2	0.65	1.08	1.85	2.92	3.83
2 to 3	..	..	2.70	3.88	5.33

Simspon concluded that for a given wind velocity dissipation is practically a linear function of ionization.

24. Table IX. will give a general idea of the relations of potential gradient to dissipation and ionization.

TABLE IX.—*Potential, Dissipation, Ionization.*

Potential gradients volts per metre.	*q*			Karasjok (Simpson (**10**)).				
	Kremsmünster (**41**).	Freiburg (**43**).	Rothhorn (**43**).	a_+	a_-	I_+	I_-	Q
0 to 50	..	1.12	..	..	..	..	..	..
50 to 100	1.14	1.31	..	4.29	4.67	0.43	0.39	1.11
100 to 150	1.24	1.69	..	3.38	3.93	0.37	0.32	1.15
150 to 200	1.48	1.84	..	1.85	2.58	0.36	0.28	1.28
200 to 300	..	..	3.21	1.37	1.58	0.26	0.19	1.42
300 to 400	..	..	4.33	0.60	0.85	..	..	..
400 to 500	..	..	5.46	..	..	..	..	..
500 to 700	..	..	8.75	..	..	..	..	..

If we regard the potential gradient near the ground as representing a negative charge on the earth, then if the source of supply of that charge is unaffected the gradient will rise and become high when the operations by which discharge is promoted slacken their activity. A diminution in the number of positive ions would thus naturally be accompanied by a rise in potential gradient. Table IX. associates with rise in potential gradient a reduced number of both positive and negative ions and a diminished rate of dissipation whether of a negative or a positive charge. The rise in *q* and Q indicates that the diminished rate of dissipation is most marked for positive charges, and that negative ions are even more reduced then positive.

At Kremsmünster Zölss (**41**) finds a considerable similarity between the diurnal variations in *q* and in the potential gradient, the hours of the forenoon and afternoon maxima being nearly the same in the two cases.

No distinct relationship has yet been established between potential gradient and radioactivity. At Karasjok Simpson (**10**) found fairly similar mean values of A for two groups of observations, one confined to cases when the potential gradient exceeded +400 volts, the other confined to cases of negative gradient.

At Freiburg Gockel (**55**, **57**) found that when observations were grouped according to the value of A there appeared a distinct rise in both a_- and I_+ with increasing A. For instance, when A lay between 100 and 150 the mean value of a- was 1.27 times greater than when A lay between 0 and 50; while when A lay between 120 and 150 the mean value of I+ was 1.53 times larger than when A lay between 0 and 30. These apparent relationships refer to mean values. In individual cases widely different values of a_- or I_+ are associated with the same value of A.

25. If V be the potential, ρ the density of free electricity at a point in the atmosphere, at a distance r from the earth's centre, then assuming statical conditions and neglecting variation of V in horizontal directions, we have

$$r^{-2}(d/dr)(r^2\, dV/dr) + 4\pi\rho = 0.$$

For practical purposes we may treat r^2 as constant, and replace d/dr by d/dh, where h is height in centimetres above the ground.

We thus find

$$\rho = -(1/4\pi)\, d^2V/dh^2.$$

If we take a tube of force 1 sq. cm. in section, and suppose it cut by equipotential surfaces at heights h_1 and h_2 above the ground, we have for the total charge M included in the specified portion of the tube

$$4\pi M = (dV/dh)h_1 - (dV/dh)h_2.$$

Taking Linke's (**28**) figures as given in § 10, and supposing $h_1 = 0$, $h_2 = 15 \times 10^4$, we find for the charge in the unit tube between the ground and 1500 metres level, remembering that the centimetre is now the unit of length, $M = (1/4\pi)\ (125 - 25)/100$. Taking 1 volt equal $\frac{1}{300}$ of an electrostatic unit, we find M = 0.000265. Between 1500 and 4000 metres the charge inside the unit tube is much less, only 0.000040. The charge on the earth itself has its surface density given by $\sigma = -(1/4\pi) \times 125$ volts per metre, = 0.000331 in e ectrostatic units. Thus, on the view now generally current, in the circumstances answering to Linke's experiments we have on the ground a charge of -331×10^{-6} C.G.S. units per sq. cm. Of the corresponding positive charge, 265×10^{-6} lies below the 1500 metres level, 40×10^{-6} between this and the 4000 metres level, and only 26×10^{-6} above 4000 metres.

There is a difficulty in reconciling observed values of the ionization with the results obtained from balloon ascents as to the variation of the potential with altitude. According to H. Gerdien (**61**), near the ground a mean value for d^2V/dh^2 is $-(\frac{1}{10})$ volt/(metre)^2. From this we deduce for the charge ρ per cubic centimetre $(1/4\pi) \times 10^{-5}$ (volt/cm^2), or 2.7×10^{-9} electrostatic units. But taking, for example, Simpson's mean values at Karasjok, we have observed

$$\rho \equiv I_+ - I_1 = 0.05 \times (\text{cm./metre})^3 = 5 \times 10^{-8},$$

and thus (calculated ρ)/(observed ρ) = 0.05 approximately. Gerdien himself makes $I_+ - I_-$ considerably larger than Simpson, and concludes that the observed value of ρ is from 30 to 50 times that calculated. The presumption is either that d^2V/dh^2 near the ground is much larger numerically than Gerdien supposes, or else that the ordinary instruments for measuring ionization fail to catch some species of ion whose charge is preponderatingly negative.

26. Gerdien (**61**) has made some calculations as to the probable average value of the vertical electric current in the atmosphere in fine weather. This will be composed of a conduction and a convection current, the latter due to rising or falling air currents carrying ions. He supposes the field near the earth to be 100 volts per metre, or $\frac{1}{300}$ electrostatic units. For simplicity, he assumes I_+ and I_- each equal 0.25×10^{-6} electrostatic units. The specific velocities of the ions—*i.e.* the velocities in unit field—he takes to be 1.3×300 for the positive, and 1.6×300 for the negative. The positive and negative ions travel in opposite directions, so the total current is $(\frac{1}{300})(0.25 \times 10^{-6})(1.3 \times 300 + 1.6 \times 300)$, or 73×10^{-8} in electrostatic measure, otherwise 2.4×10^{-16} amperes per sq. cm. As to the convection current, Gerdien supposes—as in § 25—$\rho = 2.7 \times 10^{-9}$ electrostatic units, and on fine days puts the average velocity of rising air currents at 10 cm. per second. This gives a convection current of 2.7×10^{-8} electrostatic units, or about $\frac{1}{27}$ of the conduction current. For the total current we have approximately 2.5×10^{-16} amperes per sq. cm. This is insignificant compared to the size of the currents which several authorities have calculated from considerations as to terrestrial magnetism (*q.v.*). Gerdien's estimate of the convection current is for fine weather conditions. During rainfall, or near clouds or dust layers, the magnitude of this current might well be enormously increased; its direction would naturally vary with climatic conditions.

27. H. Mache (**62**) thinks that the ionization observed in the atmosphere may be wholly accounted for by the radioactive emanation. If this is true we should have $q = \alpha n^2$, where q is the number of ions of one sign made in 1 cc. of air per second by the emanation, α the constant of recombination, and n the number of ions found simultaneously by, say, Ebert's apparatus. Mache and R. Holfmann, from

observations on the amplitude of saturation currents, deduce q = 4 as a mean value. Taking for α Townsend's value 1.2×10^{-6}, Mache finds n = 1800. The charge on an ion being 3.4×10^{-10} Mache deduces for the ionic charge, I_+ or I_-, per cubic metre $1800 \times 3.4 \times 10^{-10} \times 10^6$, or 0.6. This is at least of the order observed, which is all that can be expected from a calculation which assumes I_+ and I_- equal. If, however, Mache's views were correct, we should expect a much closer connexion between I and A than has actually been observed.

28. C.T.R. Wilson (**63**) seems disposed to regard the action of rainfall as the most probable source of the negative charge on the earth's surface. That great separation of positive and negative electricity sometimes takes place during rainfall is undoubted, and the charge brought to the ground seems preponderatingly negative. The difficulty is in accounting for the continuance in extensive fine weather districts of large positive charges in the atmosphere in face of the processes of recombination always in progress. Wilson considers that convection currents in the upper atmosphere would be quite inadequate, but conduction may, he thinks, be sufficient alone. At barometric pressures such as exist between 18 and 36 kilometres above the ground the mobility of the ions varies inversely as the pressure, whilst the coefficient of recombination α varies approximately as the pressure. If the atmosphere at different heights is exposed to ionizing radiation of uniform intensity the rate of production of ions per cc., q, will vary as the pressure. In the steady state the number, n, of ions of either sign per cc. is given by $n = \sqrt{(q/\alpha)}$, and so is independent of the pressure or the height. The conductivity, which varies as the product of n into the mobility, will thus vary inversely as the pressure, and so at 36 kilometres will be one hundred times as large as close to the ground. Dust particles interfere with conduction near the ground, so the relative conductivity in the upper layers may be much greater than that calculated. Wilson supposes that by the fall to the ground of a preponderance of negatively charged rain the air above the shower has a higher positive potential than elsewhere at the same level, thus leading to large conduction currents laterally in the highly conducting upper layers.

29. *Thunder*.—Trustworthy frequency statistics for an individual station are obtainable only from a long series of observations, while if means are taken from a large area places may be included which differ largely amongst themselves. There is the further complication that in some countries thunder seems to be on the increase. In temperate latitudes, speaking generally, the higher the latitude the fewer the thunderstorms. For instance, for Edinburgh (**64**) (1771 to 1900) and London (**65**) (1763 to 1896) R.C. Mossman found the average annual number of thunderstorm days to be respectively 6.4 and 10.7; while at Paris (1873-1893) E. Renou (**66**) found 27.3 such days. In some tropical stations, at certain seasons of the year, thunder is almost a daily occurrence. At Batavia (**18**) during the epoch 1867-1895, there were on the average 120 days of thunder in the year.

As an example of a large area throughout which thunder frequency appears fairly uniform, we may take Hungary (**67**). According to the statistics for 1903, based on several hundred stations, the average number of days of thunder throughout six subdivisions of the country, some wholly plain, others mainly mountainous, varied only from 21.1 to 26.5, the mean for the whole of Hungary being 23.5. The antithesis of this exists in the United States of America. According to A.J. Henry (**68**) there are three regions of maximum frequency: one in the south-east, with its centre in Florida, has an average of 45 days of thunder in the year; a second including the middle Mississippi valley has an average of 35 days; and a third in the middle Missouri valley has 30. With the exception of a narrow strip along the Canadian frontier, thunderstorm frequency is fairly high over the whole of the United States to the east of the 100th meridian. But to the west of this, except in the Rocky Mountain region where storms are numerous, the frequency steadily diminishes, and along the Pacific coast there are large areas where thunder occurs only once or twice a year.

30. The number of thunderstorm days is probably a less exact measure of the relative *intensity* of thunderstorms than statistics as to the number of persons killed annually by lightning per million of the population. Table X. gives a number of statistics of this kind. The letter M stands for "Midland."

TABLE X.—*Deaths by Lightning, per annum, per million Inhabitants.*

Hungary	7.7	Upper Missouri and Plains	15
Netherlands	2.8	Rocky Mountains and Plateau	10
England, N. M.	1.8	South Atlantic	8
" E.	1.3	Central Mississippi	7
" S. M.	1.2	Upper "	7
" York and W. M.	1.1	Ohio Valley	7
" N.	1.0	Middle Atlantic	6
Wales	0.9	Gulf States	5
England, S. E.	0.8	New England	4
" N. W.	0.7	Pacific Coast	<1*
" S. W.	0.6	North and South Dakota	20
London	0.1	California	0

* Note in case of Pacific coast, Table X., "<1" means "less than 1."

The figure for Hungary is based on the seven years 1897-1903; that for the Netherlands, from data by A.J. Monné (**69**) on the nine years 1882-1890. The English data, due to R. Lawson (**70**), are from twenty-four years, 1857-1880; those for the United States, due to Henry (**68**), are for five years, 1896-1900. In comparing these data allowance must be made for the fact that danger from lightning is much greater out of doors than in. Thus in Hungary, in 1902 and 1903, out of 229 persons killed, at least 171 were killed out of doors. Of the 229 only 67 were women, the only assignable explanation being their rarer employment in the fields. Thus, *ceteris paribtis*, deaths from lightning are much more numerous in a country than in an industrial population. This is well brought out by the low figure for London. It is also shown conspicuously in figures given by Henry. In New York State, where the population is largely industrial, the annual deaths per million are only three, but of the agricultural population eleven. In states such as Wyoming and the Dakotas the population is largely rural, and the deaths by lightning rise in consequence. The frequency and intensity of thunderstorms are unquestionably greater in the Rocky Mountain than in the New England states, but the difference is not so great as the statistics at first sight suggest.

TABLE XI.—*Annual Variation of Thunderstorms.*

	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Ediburgh	1.8	1.4	1.4	3.8	12.3	20.8	28.2	19.1	7.0	2.3	1.1	0.8
London	0.6	0.5	1.6	6.6	12.7	18.3	25.5	19.2	9.3	3.1	1.7	0.9
Paris	0.2	0.4	2.3	7.5	14.9	21.6	22.0	17.0	9.9	3.5	0.4	0.4
Netherlands	2.2	1.8	3.7	6.5	14.0	14.7	15.6	14.7	10.3	10.1	3.8	2.5
France	2.2	2.8	4.1	8.4	13.8	18.7	14.6	13.5	10.0	6.3	3.1	2.4
Switzerland	0.2	0.3	0.5	4.9	11.9	22.9	29.9	18.0	9.8	1.1	0.3	0.2
Hungary (*a*)	0.0	0.1	1.6	5.7	20.9	25.0	23.2	15.9	5.7	1.3	0.4	0.2
Hungary (*b*)	0.0	0.0	1.0	3.2	11.8	20.6	30.7	25.3	6.9	0.5	0.0	0.0
United States	0.1	0.1	1.2	4.0	14.3	25.0	27.2	20.4	5.8	1.4	0.3	0.1
Hong-Kong	0.0	2.1	4.3	8.5	12.8	23.4	14.9	21.3	10.6	2.1	0.0	0.0
Trevandrum	3.2	3.8	13.1	20.9	18.6	4.9	1.2	3.5	2.5	12.9	12.0	3.3
Batavia	10.4	9.2	11.1	10.5	7.9	5.5	4.3	3.8	5.4	8.8	12.2	10.9

31. Even at the same place thunderstorms vary greatly in intensity and duration. Also the times of beginning and ending are difficult to define exactly, so that several elements of uncertainty exist in data as to the seasonal or diurnal variation. The monthly data in Table XI. are percentages of the total for the year. In most cases the figures are based on the number of days of thunder at a particular station, or at the average station of a country; but the second set for Hungary relates to the number of lightning strokes causing fire, and the figures for the United States relate to deaths by lightning. The data for Edinburgh, due to R.C. Mossman (**64**), refer to 130 years, 1771 to 1900. The data for London (1763-1896) are also due to Mossman (**65**); for Paris (1873-1893) to Renou (**66**); for the Netherlands (1882-1900) to A.J. Monné (**69**); for France(**71**) (1886-1899) to Frou and Hann; for Switzerland to K. Hess (**72**); for Hungary (**67**) (1896-1903) to L. von Szalay and others; for the United States (1890-1900) to A.J. Henry (**68**); for Hong-Kong (**73**) (1894-1903) to W. Doberck. The Trevandrum (**74**) data (1853-1864) were due originally to A. Broun; the Batavia data (1867-1895) are from the Batavia *Observations*, vol. xviii.

Most stations in the northern hemisphere have a conspicuous maximum at midsummer with little thunder in winter. Trevandrum (8° 31′ N.) and Batavia (6° 11′ S.), especially the former, show a double maximum and minimum.

TABLE XII.—*Diurnal Variation of Thunderstorms.*

Hour.	0-2.	2-4.	4-6.	6-8.	8-10.	10-12.	0′-2′.	2′-4′.	4′-6′.	6′-8′.	8′-10′.	10′-12′.
Finland (**76**)	2.3	2.0	2.2	3.0	4.6	12.1	18.9	19.2	16.1	10.1	6.1	3.4
Edinburgh (**64**)	1.7	2.0	1.4	1.7	4.7	14.2	22.4	23.7	11.9	9.2	5.1	2.0
Belgium (**77**)	3.0	2.9	1.7	1.8	2.0	6.4	12.9	21.6	19.4	15.8	8.4	4.1
Brocken (**78**)	1.6	2.5	1.3	1.3	4.2	3.1	12.1	28.6	22.4	10.1	7.2	5.6
Switzerland (**72**)	3.1	2.3	2.1	1.6	2.0	7.3	13.8	20.9	20.8	14.6	8.0	3.5
Italy (**77**)	1.3	1.6	1.4	2.0	3.0	8.5	19.5	26.5	16.6	9.8	8.3	1.5
Hungary (i.) (**67**)	2.1	1.9	1.9	2.1	2.9	11.5	18.1	22.0	17.9	10.7	6.2	2.8
Hungary (ii.) (**67**)	6.9	4.2	2.3	2.0	2.0	5.0	9.9	16.9	18.2	10.7	11.7	10.0
Hungary (iii.) (**75**)	2.3	1.9	2.0	2.4	2.7	7.9	16.1	22.1	19.1	12.7	7.6	3.2
Hungary (iv.) (**75**)	2.6	2.2	1.9	1.9	3.6	13.3	19.9	20.7	15.2	9.2	6.2	3.3
Trevandrum (**74**)	5.6	4.9	4.3	1.3	1.4	2.0	13.3	24.5	15.9	13.3	7.6	5.9
Agustia (**74**)	2.9	2.9	0.3	0.0	1.7	2.9	15.1	36.1	22.2	9.3	4.6	2.0

32. *Daily Variation.*—The figures in Table XII. are again percentages. They are mostly based on data as to the hour of commencement of thunderstorms. Data as to the hour when storms are most severe would throw the maximum later in the day. This is illustrated by the first two sets of figures for Hungary (**67**). The first set relate as usual to the hour of commencement, the second to the hours of occurrence of lightning causing fires. Of the two other sets of figures for Hungary (**75**), (iii.) relates to the central plain, (iv.) to the mountainous regions to north and south of this. The hour of maximum is earlier for the mountains, thunder being more frequent there than in the plains between 8 A.M. and 4 P.M., but less frequent between 2 and 10 P.M. Trevandrum (8° 31′ N., 76° 59′ E., 195 ft. above sea-level) and Agustia (8° 37′ N., 77° 20′ E., 6200 ft. above sea-level) afford a contrast between low ground and high ground in India. In this instance there seems little difference in the hour of maximum, the distinguishing feature being the great concentration of thunderstorm occurrence at Agustia between noon and 6 P.M.

TABLE XIII.

Year.	Nether-lands.	France.	Hungary.	U.S.A.	Year.	Nether-lands.	France.	Hungary.	U.S.A.
1882	98	..	141	..	1893	102	288	233	209
1883	117	..	195	..	1894	111	300	333	336
1884	95	..	229	..	1895	119	309	280	426
1885	93	..	192	..	1896	109	266	299	341
1886	102	251	319	..	1897	119	297	350	362
1887	78	292	236	..	1898	95	299	386	367
1888	94	286	232	..	1899	112	299	368	563
1889	126	294	258	..	1900	108	..	401	713
1890	93	299	265	..	1901	..	..	502	..
1891	98	317	302	204	1902	..	..	322	..
1892	86	324	350	251	1903	..	..	256	..

33. Table XIII. gives some data as to the variability of thunder from year to year. The figures for the Netherlands (**69**) and France (**71**) are the number of days when thunder occurred somewhere in the country. Its larger area and more varied climate give a much larger number of days of thunder to France. Notwithstanding the proximity of the two countries, there is not much parallelism between the data. The figures for Hungary (**67**) give the number of lightning strokes causing fire; those for the United States (**68**) give the number of persons killed by lightning. The conspicuous maximum in 1901 and great drop in 1902 in Hungary are also shown by the statistics as to the number of days of thunder. This number at the average station of the country fell from 38.4 in 1901 to 23.1 in 1902. On the whole, however, the number of destructive lightning strokes and of days of thunder do not show a close parallelism.

TABLE XIV.

Decade ending	1810.	1820.	1830.	1840.	1850.	1860.	1870.	1880.	1890.	1900.
Edinburgh	4.9	5.7	7.7	6.7	5.7	6.5	5.4	10.6	9.4	9.2
London	9.5	8.3	11.5	11.8	10.5	11.9	9.6	15.7	13.0	..
Tilsit	..	..	12.5	12.1	16.1	15.3	11.9	17.6	21.8	..
Germany, South	..	..	..	..	..	49	66	91	143	175
” West	..	..	..	..	..	92	106	187	244	331
” North	..	..	..	..	..	124	135	245	288	352
” East	..	..	..	..	..	102	143	186	210	273
” Whole	..	..	..	..	..	90	116	189	254	318

34. Table XIV. deals with the variation of thunder over longer periods. The data for Edinburgh (**64**) and London (**65**) due to Mossman, and those for Tilsit, due to C. Kassner (**79**), represent the average number of days of thunder per annum. The data for Germany, due to O. Steffens (**80**), represent the average number of houses struck by lightning in a year per million houses; in the first decade only seven years (1854-1860) are really included. Mossman thinks that the apparent increase at Edinburgh and London in the later decades is to some extent at least real. The two sets of figures show some corroborative features, notably the low frequency from 1860 to 1870. The figures for Germany—representing four out of six divisions of that country—are remarkable. In Germany as a whole, out of a million houses the number struck per annum was three and a half times as great in the decade 1890 to 1900 as between 1854 and 1860. Von Bezold (**81**) in an earlier memoir presented data analogous to Steffens', seemingly accepting them as representing a true increase in thunderstorm destructiveness. Doubts have, however, been expressed by others—*e.g.* A. Gockel, *Das Gewitter*, p. 106—as to the real significance of the figures. Changes in the height or construction of buildings, and a greater readiness to make claims on insurance offices, may be contributory causes.

35. The fact that a considerable number of people sheltering under trees are killed by lightning is generally accepted as a convincing proof of the unwisdom of the proceeding. When there is an option between a tree and an adjacent house, the latter is doubtless the safer choice. But when the option is between sheltering under a tree and remaining in the open it is not so clear. In Hungary (**67**), during the three years 1901 to 1903, 15% of the total deaths by lightning occurred under trees, as against 57% wholly in the open. In the United States (**68**) in 1900, only 10% of the deaths where the precise conditions were ascertained occurred under trees, as against 52% in the open. If then the risk under trees exceeds that in the open in Hungary and the United States, at least five or six times as many people must remain in the open as seek shelter under trees. An isolated tree occupying an exposed position is, it should be remembered, much more likely to be struck than the average tree in the midst of a wood. A good deal also depends on the species of tree. A good many years' data for Lippe (**82**) in Germany make the liability to lightning stroke as follows—the number of each species being supposed the same:—Oak 57, Fir 39, Pine 5, Beech 1. In Styria, according to K. Prohaska (**83**), the species most liable to be struck are oaks, poplars and pear trees; beech trees again are exceptionally safe. It should, however, be borne in mind that the apparent differences between different species may be partly a question of height, exposure or proximity to water. A good deal may also depend on the soil. According to Hellmann, as quoted by Henry (**82**), the liability to lightning stroke in Germany may be put at chalk 1, clay 7, sand 9, loam 22.

36. Numerous attempts have been made to find periodic variations in thunderstorm frequency. Among the periods suggested are the 11-year sun-spot period, or half this (cf. v. Szalay (**67**)). Ekholm and Arrhenius (**84**) claim to have established the existence of a tropical lunar period, and a 25.929-day period; while P. Polis (**85**) considers a synodic lunar period probable. A.B. MacDowall (**86**) and others have advanced evidence in favour of the view that thunderstorms are most frequent near new moon and fewest near full moon. Much more evidence would be required to produce a general acceptance of any of the above periods.

37. *St Elmo's Fire.*—Luminous discharges from masts, lightning conductors, and other pointed objects are not very infrequent, especially during thunderstorms. On the Sonnblick, where the phenomenon is common, Elster and Geitel (**87**) have found St Elmo's fire to answer to a discharge sometimes of positive sometimes of negative electricity. The colour and appearance differ in the two cases, red predominating in a positive, blue in a negative discharge. The differences characteristic of the two forms of discharge are described and illustrated in Gockel's *Das Gewitter*. Gockel states (l.c. p. 74) that during snowfall the sign is positive or negative according as the flakes are large or are small and powdery. The discharge is not infrequently accompanied by a sizzling sound.

38. Of late years many experiments have been made on the influence of electric fields or currents on plant growth. S. Lemström (**88**), who was a pioneer in this department, found an electric field highly beneficial in some but not in all cases. Attempts have been made to apply electricity to agriculture on a commercial scale, but the exact measure of success attained remains somewhat doubtful. Lemström believed atmospheric electricity to play an important part in the natural growth of vegetation, and he assigned a special rôle to the needles of fir and pine trees.

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Lists of original authorities:—(**4**) F. Exner, *M.Z.*, vol. 17, 1900, p. 529 (especially pp. 542-3); (**5**) G.C. Simpson, *Q.J.R. Met. Soc.*, vol. 31, 1905, p. 295 (especially pp. 305-6). References in the text:—(**6**) *M.Z.*, vol. 4, 1887, p. 352; (**7**) *T.M.*, vol. 4, 1899, p. 213; (**8**) *P.Z.*, vol. 4, p. 661; (**9**) *M.Z.*, vol. 23, 1906, p. 114; (**10**) *P.T.*, vol. 205 A, 1906, p. 61; (**11**) *P.Z.*, vol. 5, p. 260; (**12**) C. Chree, *P.T.*, vol. 206 A, p. 299; (**13**) Annual volumes, *Greenwich Magnetical and Meteorological Observations*; (**14**) *M.Z.*, vol. 8, 1891, p. 357; (**15**) *M.Z.*, vol. 7, 1890, p. 319 and vol. 8, 1891, p. 113; (**16**) Annual volumes, *Annaes do Obs. do Infante D. Luiz*; (**17**) *Annual Reports*, Central Meteorological Observatory of Japan; (**18**) *Observations made at the Mag. and Met. Obs. at Batavia*, vol. 18, 1895; (**19**) J.D. Everett, *P.T.*, vol. 158, 1868, p. 347; (**20**) *M.Z.*, vol. 6, 1889, p. 95; (**21**) A.B. Chauveau, *Ann. bureau central météorologique, Paris, année 1900*, "Mémoires," p. C1; (**22**) V. Conrad, S., 113, p. 1143; (**23**) P.B. Zölss, *P.Z.*, vol. 5, p. 260; (**24**) *T.M.*, vol. 7, 1902, p. 89; (**25**) *Revue générale des sciences*, 1906, p. 442; (**26**) *T.M.*, vol. 8, 1903, p. 86. and vol. 9, 1904, p. 147; (**27**) *S.*, 93, p. 222; (**28**) *M.Z.*, vol. 22, 1905, p. 237; (**29**) *P.Z.*, vol. 4, p. 632; (**30**) *Phil. Mag.*, vol. 20, 1885, p. 456; (**31**) *Expédition polaire finlandaise*, vol. 3 (Helsingfors, 1898); (**32**) A. Paulsen, *Bull. de l'Acad. ... de Danemarke*, 1894, p. 148; (**33**) *Wied. Ann.*, vol. 46, 1892, p. 584; (**34**) *P.T.*, vol. 191 A, p. 187; (**35**) *M.Z.*, vol. 5, 1888, p. 95; *S.*, 99, p. 421; *T.M.*, vol. 4, 1899, p. 15; (**36**) *Camb. Phil. Soc. Proc.*, vol. 11, p. 428, and vol. 12, pp. 17 and 85; (**37**) *P.Z.*, vol. 4, pp. 267 and 873; (**38**) E.R. v. Schweidler, *S.*, 113, p. 1433; (**39**) *S.*, 111, July 1902; (**40**) *Veröffentl. des Kg. Preuss. Met. Inst.*, 1904; (**41**) *P.Z.*, vol. 5, p. 106; (**42**) *S.*, 114, p. 198; (**43**) *P.Z.*, vol. 4, p. 871; (**44**) *P.Z.*, vol. 4, p. 93; (**45**) *M.Z.*, vol. 23, 1906, p. 229; (**46**) *S.*, 114, p. 1705; (**47**) *S.*, 114, p. 399; (**48**) *P.Z.*, vol. 4, p. 522; (**49**) *S.*, 113, p. 1455; (**50**) *P.Z.*, vol. 4, p. 627; (**51**) *P.Z.*, vol. 4, p. 90; (**52**) *S.*, 114, p. 151; (**53**) *M.Z.*, vol. 23, 1906, p. 253; (**54**) *P.Z.*, vol. 5, p. 749; (**55**) *M.Z.*, vol. 23, 1906, pp. 53 and 339; (**56**) *P.Z.*, vol. 5, p. 11; (**57**) *P.Z.*, vol. 5, p. 591; (**58**) *T.M.*, vol. 9, 1904, p. 49; (**59**) *P.Z.*, vol. 4, p. 295; (**60**) *P.Z.*, vol. 5, p. 504; (**61**) *T.M.*, vol. 10, 1905, p. 65; (**62**) *S.*, 114, p. 1377; (**63**) *Camb. Phil. Soc. Proc.*, vol. 13, p. 363; (**64**) *Trans. R.S. Edin.*, vol. 39, p. 63, and vol. 40, p. 484; (**65**) *Q.J.R. Met. Soc.*, vol. 24, 1898, p. 31; (**66**) *M.Z.*, vol. 11, 1894, p. 277; (**67**) *Jahrbücher der Konigl. Ung. Reichsanstalt für Met. und Erdmag.*, vol. 33, 1903, III. Theil with appendix by L. von Szalay; (**68**) U.S. Dept. of Agriculture, *Weather Bureau Bulletin*, No. 30, 1901; (**69**) *M.Z.*, vol. 19, 1902, p. 297; (**70**) *Q.J.R. Met. Soc.*, vol. 15, 1889, p. 140; (**71**) *M.Z.*, vol. 20, 1903, p. 227; (**72**) *M.Z.*, vol. 20, 1903, p. 522; (**73**) *M.Z.*, vol. 23, 1906, p. 367; (**74**) *M.Z.*, vol. 22, 1905, p. 175; (**75**) J. Hegyfoky, *M.Z.*, vol. 20, 1903, p. 218; (**76**) *M.Z.*, vol. 22, 1905, p. 575; (**77**) S. Arrhenius, *M.Z.*, vol. 5, 1888, p. 348; (**78**) G. Hellmann, *M.Z.*, vol. 22, 1905, p. 223; (**79**) *M.Z.*, vol. 11, 1894, p. 239; (**80**) *M.Z.*, vol. 23, 1906, p. 468; (**81**) *Berlin Sitz.*, 1889, No. 16; (**82**) A.J. Henry, *U.S. Dept. of Agriculture Bull.*, No. 26, 1899; (**83**) *M.Z.*, vol. 16, 1899, p. 128; (**84**) *K. Sven. Vet. Akad. Hand.*, Bd. 19, No. 8, Bd. 20, No. 6, Bd. 31, Nos. 2 and 3; (**85**) *M.Z.*, vol. 11, 1894, p. 230; (**86**) *Nature*, vol. 65, 1902, p. 367; (**87**) *M.Z.*, vol. 8, 1891, p. 321; (**88**) *Brit. Assoc. Report* for 1898, p. 808, also *Electricity in Agriculture and Horticulture* (London, 1904).

(C. Ch.)

1 see *Authorities* below.

ATMOSPHERIC RAILWAY. About 1840-1845 great interest was excited by a method of propelling railway trains through the agency of atmospheric pressure. Various inventors worked at the realization of this idea. On the system worked out in England by Jacob Samuda and S. Clegg, a continuous pipe or main was laid between the rails, and in it a partial vacuum was maintained by means of air pumps. A piston fitting closely in it was connected to the leading vehicle of the train by an iron plate which passed through a longitudinal groove or aperture running the whole length of the pipe. This aperture was covered by a valve consisting of a continuous strip of leather, strengthened on each side with iron plates; one edge was fastened, while the other was free to rise, and was closed against a composition of beeswax and tallow placed in the groove, the surface of which was slightly melted by a heater, carried on each train, in order to secure an air-tight joint. Connected behind the piston was a frame carrying four wheels which lifted and sustained the continuous valve for a distance of about 15 ft. Thus the piston having atmospheric pressure on one side of it and a vacuum equal to 15 or 16 in. of mercury on the other, was forced along the tube, taking the train with it. Various advantages were claimed by the advocates of the system, including cheapness of operation as compared with steam locomotives, and safety from collision, because the main was divided into sections by separating valves and only one train could be in each section at a given time. It was installed on about 2 m. of line between Kingstown and Dalkey (Ireland) in 1843 and worked till 1855; it was also tried on the London and Croydon and on the South Devon lines, but was soon abandoned. The same principle is applied in the system of pneumatic despatch (*q.v.*) to the transmission of small parcels in connexion with postal and telegraph work.

For further particulars see three papers by J. Samuda, P.W. Barlow and G. Berkeley, with reports of the discussions upon them, in *Proc. Inst. C.E.*, 1844 and 1845.

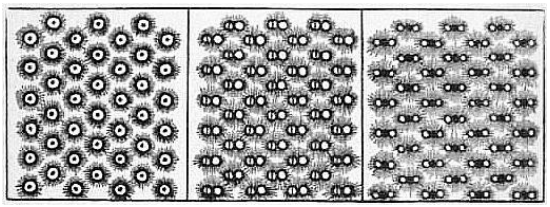
ATOLL (native name *atollon* in the Maldive Islands), a horse-shoe or ring shaped coral reef enclosing a lagoon. The usual shape is that of a partly submerged dish with a broken edge, forming the ring of islands, standing upon a conical pedestal. The dish is formed of coral rock and the shells of various reef-dwelling mollusca, covered, especially at the seaward edges, with a film of living coral polyps that continually extend the fringe, and enlarge the diameter of the atoll. The lagoon tends to deepen when the land is stationary by the death of the coral animals in the still water, and the patchy disintegration of the "hard" coral, while waves and storms tear off blocks of rock and pile them up at the margin, increasing the height of the islands, which become covered by vegetation. The lagoon entrance in the open part of the horse-shoe is always to leeward of prevailing winds, since the coral growth is there slower than where the waves constantly renew the polyps' food supply. The conical pedestal rising from the depths is frequently a submarine volcanic cone or island, though any submerged peak may be crowned by an atoll. For the theory of atoll formation see Coral-reefs.

ATOM (Gr. ἄτομος, indivisible, from ἀ- privative, and τέμνειν, to cut), the term given in physical science to the ultimate indivisible particle of matter, and so by analogy to something minutely small in size. If we examine such a substance as sugar we find that it can be broken up into fine grains, and these again into finer, the finest particles still appearing to be of the same nature as sugar. The same is true in the case of a liquid such as water; it can be divided into drops and these again into smaller drops, or into the finest spray the particles of which are too small to be detected by our unaided vision. In fact, so far as the direct evidence of our senses tells us, matter appears to be indefinitely divisible. Moreover, small particles do not seem to exist in the water until it is broken up; so far as we can see, the material of the water is continuous not granular. This conception of matter, *as infinitely divisible and continuous*, was taught by Anaxagoras more than four centuries before the Christian era, and in the philosophy of Aristotle the same ideas are found. But some 871

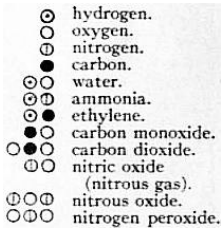
Theories of matter.

phenomena are difficult to reconcile with this view; for example, a cubic foot of air can be compressed into less than one five-hundredth of a cubic foot, or, if allowed to expand, the air originally occupying the cubic foot can be made to fill, apparently uniformly, a space of a million cubic feet or more. This enormous capacity for expansion and contraction is astonishing if we believe matter to be continuous, but if we imagine air to be made up of little particles separated by relatively large empty spaces the changes in volume are more easily conceivable. Moreover, if we attribute such a structure to gases, we are led to attribute it to liquids and to solids also, since gases can be liquefied without any abrupt change, and many substances usually solid can be converted into gases by heating them. This conception of the *grained* structure of matter is very ancient; traces of it are to be found in Indian philosophy, perhaps twelve centuries before the Christian era, and the Greek philosophers Democritus and Epicurus, in the 3rd and 4th centuries B.C., taught it very definitely. Their view was that "matter is not indefinitely divisible, but that all substances are formed of indivisible particles or atoms which are eternal and unchangeable, that the atoms are separated from one another by void, and that these atoms, by their combinations, form the matter we are conscious of." The Roman poet Lucretius (*De Rerum Natura*) was an eloquent exponent of this theory, but throughout the middle ages, indeed until the 17th century, it was eclipsed by the prestige of Aristotle. In the time, however, of Boyle[1] and Newton, we again find an atomic theory of matter; Newton[2] regarded a gas as consisting of small separate particles which repelled one another, the tendency of a gas to expand being attributed to the supposed repulsion between the particles.

Let us consider some common phenomena in the light of these rival theories as to the nature of matter. When a few lumps of sugar are added to a glass of water and stirred, the sugar soon disappears and we are left with a uniform liquid resembling water, except that it is sweet. What has become of the sugar? Does it still exist? The atomist would say, "Yes, it is broken up into its atoms, and these are distributed throughout the spaces between the particles of water." The rival philosopher, who believes water to be continuous and without spaces between its particles, has a greater difficulty in accounting for the disappearance of the sugar; he would probably say that the sugar, and the water also, had ceased to exist, and that a new continuous substance had been formed from them, but he could offer no picture of how this change had taken place. Or consider a well-marked case of what we are in the habit of calling *chemical combination*. If 127 parts of iodine, which is an almost black solid, and 100 parts of mercury, which is a white liquid metal, be intimately mixed by rubbing them together in a mortar, the two substances wholly disappear, and we obtain instead a brilliant red powder quite unlike the iodine or the mercury; almost the only property that is unchanged is the weight. The question again arises, what has become of the original substances? The atomist has an easy answer; he says that the new body is made up by the juxtaposition of the atoms of iodine and mercury, which still exist in the red powder. His opponent would be disposed to say that the iodine and the mercury ceased to exist when the red powder was formed, that they were *components* but not *constituents* of it. The fact that the two components can be recovered from the compound by destroying it does not decide the question. It is remarkable that pure chemistry, even to-day, has no very conclusive arguments for the settlement of this controversy; but the sister science of physics is steadily accumulating evidence in favour of the atomic conception.



From Dalton's *New System of Chemical Philosophy.*
Hydrogen Gas. Nitrous Gas. Carbonic Acid Gas.



Until the time of John Dalton, the atomic conception remained purely qualitative, and until then it does not appear to have advanced chemistry or to have found further confirmation in the facts of chemistry. Dalton (1803) gave the atomic theory a quantitative form, and showed that,

Dalton.

by means of it, a vast number of the facts of chemistry could be predicted or explained. In fact, he did so much to make the atomic theory of matter probable that he is popularly regarded as its originator. Dalton lived in a period marked by great advances in experimental chemistry. Rather before the commencement of the 19th century the work of Lavoisier had rendered it very probable that chemical changes are not accompanied by any change in weight, and this principle of the conservation of matter was becoming universally accepted; chemists were also acquiring considerable skill in chemical analysis, that is, in the determination of the nature and relative amounts of the elements contained in compounds. But Sir H.E. Roscoe and A. Harden, *New View of the Atomic Theory* (1896), have shown, from a study of Dalton's manuscript notes, that we do not owe his atomic theory to such experiments. If their view is correct, the theory appears to be a remarkable example of deductive reasoning. Dalton, who was a mathematical physicist even more than a chemist, had given much thought to the study of gases. Following Newton, he believed a gas to be made up of particles or atoms, separated from one another by considerable spaces. Certain difficulties that he met with in his speculations led him to the conclusion that the particles of any one kind of gas, though all of them alike, must differ from those of another gas both in *size* and *weight*. He thus arrived at the conception of a definite atomic weight peculiar to the particles of each gas, and he thought that he could determine these atomic weights, in terms of one of them, by means of the quantitative analysis of compounds. The conclusion that each element had a definite atomic weight, peculiar to it, was the new idea that made his speculations fruitful, because it allowed of quantitative deduction and verification. He drew simple diagrams, three of which, taken from Dalton's *New System of Chemical Philosophy*, part ii. (1810), are reproduced here, in which gases are represented as composed of atoms. Knowing that the gas which he called "nitrous gas" was composed of oxygen and nitrogen, and believing it to be the simplest compound of these two elements, he naturally represented its atom as formed of an atom of oxygen and an atom of nitrogen in juxtaposition. When two elements form more than one compound, as is the case with oxygen and carbon, he assigned to the compound which he thought the more complex an atom made up of two atoms of the one element and one atom of the other; the diagram for carbonic acid illustrates this, and an extension of the same plan enabled him to represent any compound, however complex its structure. The table here given contains some of Dalton's diagrams of atoms. They are not all considered to be correct at the present time; for example, we now think that the ultimate particle of water is made up of two atoms of hydrogen and one of oxygen, and that that of ammonia contains three atoms of hydrogen to one of nitrogen. But these differences between Dalton's views and our present ones do not impair the accuracy of the arguments which follow. The diagrams show that Dalton formed a very definite conception of the nature of chemical combination; it was the union of a small 872 number of atoms of one kind with a small number of another kind to form a compound atom, or as we now say a "molecule," this identical process being repeated millions of times to form a perceptible amount of a compound. The conceptions of "element," "compound" and "mixture" became more precise than they had been hitherto; in an element all the atoms are alike, in a compound all the molecules are alike, in a mixture there are different kinds of molecules. If we accept the hypothesis that each kind of atom has a specific and invariable weight, we can, with the aid of the above theory, make most important inferences concerning the proportions by weight in which substances combine to form compounds. These inferences are often summarized as the laws of *constant, multiple and reciprocal proportions*.

The law of *constant proportions* asserts that *when two elements unite to form a compound the weights that combine are in an invariable ratio, a ratio that is characteristic of that compound.* Thus if Dalton's diagram for the molecule, or compound atom, of water be correct, it follows that in all samples of water the total number of the hydrogen atoms is equal to that of the oxygen atoms; consequently, the ratio of the weight of oxygen to that of hydrogen in water is the

Law of constant

proportions. same as the ratio of the weights of an oxygen and a hydrogen atom, and *this is invariable*. Different samples of water cannot therefore differ ever so little in percentage composition, and the same must be true for every compound as distinguished from a mixture. Apart from the atomic theory there is no obvious reason why this should be so. We give the name bread to a substance containing variable proportions of flour and water. Similarly the substance we call wine is undeniably variable in composition. Why should not the substance we call water also vary more or less? The Aristotelian would find no difficulty in such a variability; it is only the disciple of Dalton to whom it seems impossible. It is evident that we have in this law a definite prediction that can be tested by experiment.

The law of *multiple proportions* asserts that *if two elements form more than one compound, then the weights of the one element which are found combined with unit weight of the other in the different compounds, must be in the ratio of two or more whole numbers*. If we compare Dalton's diagrams of the two oxides of carbon or of the three oxides of nitrogen that are given in the preceding table, we at once see the necessity of this law; for the more complex molecule has to be formed from the simpler one by the addition of one or more whole atoms. In the oxides of carbon the same weight of carbon must be combined with weights of oxygen that are as 1 : 2, and in the oxides of nitrogen a fixed weight of nitrogen must be in union with weights of oxygen that are as 1 : 2 : ½, which are the same ratios as 2 : 4 : 1. This law has been abundantly verified by experiment; for example, five oxides of nitrogen are known, and independent analyses show that, if we consider the same weight of nitrogen in every case, the weights of oxygen combined with it are to one another as 1 : 2 : 3 : 4 : 5. The discovery of this law is due to Dalton; it is a direct deduction from his atomic theory. Here again, apart from this theory, there is no obvious reason why the composition of different substances should be related in so simple a way. As Dalton said, "The doctrine of definite proportions appears mysterious unless we adopt the atomic hypothesis." "It appears like the mystical ratios of Kepler which Newton so happily elucidated." The chemists of Dalton's time were not unanimous in accepting these laws; indeed C.L. Berthollet (*Essai de statique chimique*, 1803) expressly controverted them. He maintained that, under varying conditions, two substances could combine in an indefinitely large number of different ratios, that there could in fact be a continuous variation in the combining ratio. This view is clearly inconsistent with the atomic theory, which requires that when the combining ratio of two substances changes it should do so, *per saltum*, to quite another value.

Law of multiple proportions.

The law of *reciprocal proportions*, or, as it might well be named, the law of *equivalence*, cannot be adequately enunciated in a few words. The following gives a partial statement of it. *If we know the weights a and b of two elements that are found in union with unit weight of a third element, then we can predict the composition of the compounds which the first two elements can form with each other; either the weights a and b will combine exactly, or if not, these weights must be multiplied by integers to obtain the composition of a compound.* To see how this law follows from Dalton's theory let us consider his diagrams for the molecules of water, ethylene and the oxides of carbon. In water and in ethylene experiment shows that 8 parts by weight of oxygen and 6 parts of carbon, respectively, are in union with one part of hydrogen; also, if the diagrams are correct, these numbers must be in the ratio of the atomic weights of oxygen and carbon. We can therefore predict that all oxides of carbon will have compositions represented by the ratio of 8m parts of oxygen to 6n parts of carbon, where m and n are whole numbers. This prediction is verified by the result of analysis. Similarly, if we know by experiment the composition of water and of ammonia, we can predict the probable composition of the oxides of nitrogen. Experiment shows that, in water and ammonia, we have, respectively, 8 parts of oxygen and 4.67 parts of nitrogen in union with one part of hydrogen; we can therefore infer that the oxides of nitrogen will all have the composition of 8m parts of oxygen to 4.67n parts of nitrogen. Experiment alone can tell us the values of m and n; all that the theory tells us is that they are whole numbers. In this particular case, n turns out to be 3, and m has in succession the values 1, 2, 3, 4, 5.

Law of reciprocal proportions.

It is evident that these laws all follow from the idea that a compound molecule can only alter through the addition or subtraction of one or more complete atoms, together with the idea that all the molecules in a pure substance are alike. Fortunately, the compounds at first examined by the chemists engaged in verifying these laws were comparatively simple, so that the whole numbers referred to above were small. The astonishing variety of ratios in which carbon and hydrogen combine was not at first realized. Otherwise Berthollet's position would have been a much stronger one, and the atomic theory might have had to wait a long while for acceptance. Even at the present time, it would be too much to say that all the complex organic substances have been proved by analysis to obey these laws; all we can assert is that their composition and properties can be satisfactorily explained on the assumption that they do so.

The above statement does not by any means exhaust the possible predictions that can be made from the atomic theory, but it shows how to test the theory. If chemical compounds can be proved by experiment to obey these laws, then the atomic theory acquires a high degree of probability; if they are contradicted by experiment then the atomic theory must be abandoned, or very much modified. Dalton himself made many analyses with the purpose of establishing his views, but his skill as an analyst was not very great. It is in the work of the great Swedish chemist J.J. Berzelius, and somewhat later, in the experiments of the Belgian chemist J.S. Stas, that we find the most brilliant and vigorous verification of these laws, and therefore of the atomic theory.

We shall now give an outline of the experimental evidence for the truth of these laws.

Experimental evidence.

The law of the conservation of matter, an important element in the atomic theory, has been roughly verified by innumerable analyses, in which, a given weight of a substance having been taken, each ingredient in it is isolated and its weight separately determined; the total weight of the ingredients is always found to be very nearly equal to the weight of the original substance. But on account of experimental errors in weighing and measuring, and through loss of material in the transfer of substances from one vessel to another, such analyses are rarely trustworthy to more than one part in about 500; so that small changes in weight consequent on the chemical change could not with certainty be proved or disproved. A few 873
experimenters have carried the verification much further. Stas, in his syntheses of silver iodide, weighed the silver and the iodine separately, and after converting them into the compound he weighed this also. In each of a number of experiments he found that the weight of the silver iodide did not differ by one twenty-thousandth of the whole from the sum of the weights of the silver and the iodine used. His analyses of another compound, silver iodate, confirm the law to one part in 78,000. In E.W. Morley's experiments on the synthesis of water the hydrogen, the oxygen and the water that had been formed were separately determined; taking the mean of his results, the sum of the weights of the ingredients is not found to differ from the weight of the product by one part in 10,000. It is evident that if our experiments are solely directed to the verification of this law, they should, if possible, be carried out in a hermetically closed vessel, the vessel and its contents being weighed before and after the chemical change. The extremely careful experiments of this kind, by H. Landolt and others, made it at first appear that the change in weight, if there is any, consequent on a chemical change can rarely exceed one-millionth of the weight of the reacting substances, and that it must often be much less. The small discrepancies found are so easily accounted for by attributing them to experimental errors that, until recently, every chemist would have regarded the law as sufficiently verified. Landolt's subsequent experiments showed, what was already noticed in the earlier ones, that these minute changes in weight are nearly always losses, the products weigh less than the components, while if they had been purely experimental errors, due to weighing, they might have been expected to be as frequently gains as losses. Landolt was disposed to attribute these losses in weight to the containing vessel, which was of glass or quartz, not being absolutely impervious, but in 1908 he showed that, by making allowance for the moisture adsorbed on the vessel, the errors were both positive and negative, and were less than one in ten million. He concluded that *no change of weight can be detected.* Modern researches (see Radioactivity) on the complex nature of the atom have a little shaken the belief in the absolute permanence of matter. But it seems pretty clear that if there is any change in weight consequent on chemical change, it is *too minute to be of importance to the chemist*, though the methods of modern physics may settle the question. (See Element.)

The law of constant proportions is easily verified to a moderate degree of accuracy by such experiments as the following. We can prepare, in the laboratory, a white powder that proves to be calcium carbonate, that is, it appears to be wholly composed of carbon dioxide and lime. We find in nature two other unlike substances, marble and Iceland spar, each of which is wholly composed of carbon dioxide and lime. Thus these three substances, unlike in appearance and origin, are composed of the same ingredients: if small variations in the combining ratio of the components were possible, we might expect to find them in such a case as this. But analysis has failed to find such differences; the ratio of the weights of lime and carbon dioxide is found to be the same in all three substances. Such analyses, which do not always admit of great accuracy, have been confirmed by a few carefully planned experiments in which two components were brought together under very varied conditions, and the resulting compound analysed. Stas carried out such experiments on the composition of silver chloride and of ammonium chloride, but he never found a variation of one part in 10,000 in the composition of the substances.

The two laws discussed above were more or less accepted before the promulgation of the atomic theory, but the law of multiple

proportions is the legitimate offspring of this theory. Berzelius saw at once that it afforded an admirable test for the correctness of Dalton's views, and he made numerous experiments expressly designed to test the law. One of these experiments may be described. Two chlorides of copper are known, one a highly coloured substance, the other quite white. Berzelius took 8 grams of copper, converted it into the coloured chloride, and sealed up the whole of this in solution, together with a weighed strip of copper. After some time the colour entirely disappeared; the strip of copper was then taken out and reweighed, and it was found to have lost 8.03 grams. Thus the chlorine, which in the coloured compound was in union with 8 grams of copper, appears, in the colourless chloride, to be combined with 16.03 grams, or almost exactly double the amount. It is easy to verify this result. In a series of repetitions of the experiment, by different observers, the following numbers were obtained for the ratio of the copper in the two chlorides: 1.98, 1.97, 2.03, 2.003, the mean value being 1.996. It will be noticed that the ratio found is sometimes above and sometimes below the number 2, which is required by the atomic theory, and therefore the deviations may not unreasonably be attributed to experimental errors. Such experiments—and numerous ones of about this degree of accuracy have been made on a variety of substances—give a high degree of probability to the law, but leave it an open question whether it has the exactitude of the law of the conservation of matter, or whether it is only approximately true. The question is, however, vital to the atomic theory. It is, therefore, worth while to quote a verification of great exactitude from the work of Stas and J.B.A. Dumas[3] on the composition of the two oxides of carbon. From their work it follows that the ratio of the weights of oxygen combined with unit weight of carbon in the two oxides is 1.99995, or with somewhat different data, 1.9996.

The law of reciprocal proportion, of which some examples have been already given, is part of a larger law of equivalence that underlies most of our chemical methods and calculations. One section of the law expresses the fact that the weights of two substances, not necessarily elements, that are equivalent in one reaction, are often found to be equivalent in a number of other reactions. The neutralization of acids by bases affords many illustrations, known even before the atomic theory, of the truth of the statement. It is universally found that the weights of two bases which neutralize the same weight of one acid are equivalent in their power of neutralizing other acids. Thus 5 parts by weight of soda, 7 of potash and 3.5 of quicklime will each neutralize 4.56 parts of hydrochloric acid or 7.875 of nitric or 6.125 parts of sulphuric acid; these weights, in fact, are mutually equivalent to one another. The Daltonian would say that each of these weights represents a certain group of atoms, and that these groups can replace, or combine with, each other, to form new molecules. The change from a binary compound, that is, one containing two elements, to a ternary compound in which these two elements are associated with a third, sometimes affords a very good test for the theory. The atomic theory can picture the change from the binary to the ternary compound simply as the addition of one or more atoms of the third element to the previously existing molecule; in such a case the combining ratio of the first two elements should be absolutely the same in both compounds. Berzelius tested this prediction. He showed that lead sulphide, a black substance containing only lead and sulphur, could be *converted* by oxidation into lead sulphate, a white compound containing oxygen as well as lead and sulphur. The whole of the lead and sulphur of the sulphide was found to be present in the sulphate; in other words, the combining ratio of the lead and sulphur was not altered by the addition of the oxygen. This is found to be a general rule. It was verified very exactly by Stas's experiments, in which he removed the oxygen from the ternary compound silver iodate and found that the whole of the silver and the iodine remained in combination with each other as silver iodide; his results prove, to one part in ten millions, that the combining ratio of the silver and the iodine is unaltered by the removal of the oxygen.

The above gives some idea of the evidence that has been accumulated in favour of the laws of chemical combination, laws which can be deduced from the atomic theory. Whenever any of these laws, or indeed any prediction from the theory, can be tested it has so far proved to be in harmony with experiment. The existence of the periodic law (see Element), and the researches of physicists on the constitution of matter (*q.v.*), also furnish very strong support to the theory.

Atomic weight.

Dalton was of the opinion that it was possible to determine the weights of the elementary atoms in terms of any one by the analysis of compounds. It is evident that this is practicable if the number and kind of atoms contained in the molecule of a compound can be determined. To take the simplest possible case, if Dalton had been correct in assuming that the molecule of water was made up of one atom of oxygen and one of hydrogen, then the experimental fact that water contains eight parts by weight of oxygen to one part of hydrogen, would at once show that the atom of oxygen is eight times as heavy as the atom of hydrogen, or that, taking the atomic weight of hydrogen as the unit, the atomic weight of oxygen is 8. Similarly, Dalton's diagram for ammonia, together with the fact that ammonia contains 4.67 parts of nitrogen to one of hydrogen, at once leads to the conclusion that the atomic weight of nitrogen is 4.67. But, unfortunately, the assumption as to the number of atoms in the molecules of these two compounds was an arbitrary one, based on no valid evidence. It is now agreed that the molecule of water contains two atoms of hydrogen and one of oxygen, so that the atomic weight of oxygen becomes 16, and similarly that the molecule of ammonia contains three atoms of hydrogen and one of nitrogen, and that consequently the atomic weight of nitrogen is 14. On account of this difficulty, the atomic weights published by Dalton, and the more accurate ones of Berzelius, were not always identical with the values now accepted, but were often simple multiples or submultiples of these.

Formulae.

The "symbols" for the elements used by Dalton, apparently suggested by those of the alchemists, have been rejected in favour of those which were introduced by Berzelius. The latter employed the first letter, or the first two letters, of the name of an element as its symbol. The symbol, like that of Dalton, always stands for the atomic weight of the element, that is, while H stands for one part by weight of hydrogen, O stands for 16 parts of oxygen, and so on. The symbols of compounds become very concise, as the number of atoms of one kind in a molecule can be expressed by a sub-index. Thus the symbol or formula H_2O for water expresses the view that the molecule of water consists of one atom of oxygen and two of hydrogen; and if we know the atomic weights of oxygen and hydrogen, it also tells us the composition of water by weight. Similarly, the modern formula for ammonia is NH_3.

The superiority of this notation over that of Dalton is not so obvious when we consider such simple cases as the above, but chemists are now acquainted with very complex molecules containing numerous atoms; cane sugar, for example, has the formula $C_{12}H_{22}O_{11}$. It would be a serious business to draw a Daltonian diagram for such a molecule.

Dalton believed that the molecules of the elementary gases consisted each of one atom; his diagram for hydrogen gas makes the point clear. We now believe that the molecule of an element is frequently made up of two or more atoms; thus the formulae for the gases hydrogen, oxygen and nitrogen are H_2, O_2, N_2, while gaseous phosphorus and sulphur are probably P_4 and S_6, and gaseous mercury is Hg_1,—that is, the molecule of this element is monatomic. This view, as to the frequently complex nature of the elementary molecule, is logically and historically connected with the striking hypothesis of Amadeo Avogadro and A.M. Ampère. These natural philosophers suggested that equal volumes of all gaseous substances must contain, at the same temperature and pressure, the same number of molecules. Their hypothesis explains so many facts that it is now considered to be as well established as the parts of the theory due to Dalton.[4] This principle at once enables the weights of molecules to be compared even when their composition is unknown; it is only necessary to determine the specific gravities of the various gases referred to some one of them, say hydrogen; the numbers so obtained giving the weights of the molecules referred to that of the hydrogen molecule.

Present position of the atomic theory.

The atomic theory has been of priceless value to chemists, but it has more than once happened in the history of science that a hypothesis, after having been useful in the discovery and the co-ordination of knowledge, has been abandoned and replaced by one more in harmony with later discoveries. Some distinguished chemists have thought that this fate may be awaiting the atomic theory, and that in future chemists may be able to obtain all the guidance they need from the science of the transformations of energy. But modern discoveries in radioactivity[5] are in favour of the existence of the atom, although they lead to the belief that the atom is not so eternal and unchangeable a thing as Dalton and his predecessors imagined, and in fact, that the atom itself may be subject to that eternal law of growth and decay of which Lucretius speaks.

(F. H. Ne.)

1 Robert Boyle, *The Sceptical Chymist* (1661); *The Usefulness of Natural Philosophy* (1663).

2 Sir Isaac Newton, *Principia*, bk. ii. prop. 23.

3 Freund, *The Study of Chemical Composition*.

4 It will be seen that in the three gas diagrams of Dalton that are reproduced above, equal numbers of molecules are contained in equal volumes, but if Dalton held this view at one time he certainly afterwards abandoned it.

5 Rutherford, *Radioactivity*.

ATONEMENT and **DAY OF ATONEMENT.** "Atone" (originally—see below—"at one") and "atonement" terms ordinarily used as practically synonymous with satisfaction, reparation, compensation, with a view to reconciliation. As the English technical terms representing a theological doctrine which plays an important part not only in Christianity but in most religions, the underlying ideas require more detailed analysis. A doctrine of atonement makes the following presuppositions. (*a*) There is a natural relation between God and man in which God looks favourably upon man. (*b*) This relation has been disturbed so that God regards man's character and conduct with disapproval, and inflicts suffering upon him by way of punishment. In the higher religions the disturbance is due, as just implied, to unsatisfactory conduct on man's part, *i.e.* sin. (*c*) The normal relation may be restored, *i.e.* sin may be forgiven; and this restoration is the atonement.

The religious doctrine.

The problem of the atonement is the means or condition of the restoration of man to God's favour; this has been variously found (*a*) in the endurance of punishment; (*b*) in the payment of compensation for the wrong done, the compensation consisting of sacrifices and other offerings; (*c*) in the performance of magical or other ritual, the efficacy of the ritual consisting in its being pleasing to or appointed by God, or even in its having a coercive power over the deity; (*d*) in repentance and amendment of life. Most theories of atonement would combine two or more of these, and would include repentance and amendment. Some or all of the conditions of atonement may be fulfilled, according to various views, either by the sinner or vicariously on his behalf by some kinsman; or by his family, clan or nation; or by some one else.

In the Old Testament, "atonement," "make an atonement" represent the Hebrew *kippur* and its derivatives. It is doubtful whether this root meant originally to "cover" or "wipe out"; but probably it is used as a technical term without any consciousness of its etymology. The Old Testament presents very varied teaching on this subject without attempting to co-ordinate its doctrines in a harmonious system. In some cases there is no suggestion of any forgiveness; sinners are "cut off" from the chosen people; individuals and nations perish in their iniquity.[1] Some passages refer exclusively to the endurance of punishment as a condition of pardon;[2] others to the penitence and amendment of the sinner.[3] In Ezekiel xxxvi. 25-31, repentance is called forth by the divine forgiveness.

Old Testament.

Sacrifice and other rites are also spoken of as conditions of the restoration of man to happy relations with God. The Priestly Code (Leviticus and allied passages) seems to confine the efficacy of sacrifice to ritual, venial and involuntary sins,[4] and requires that the sacrifices should be offered at Jerusalem by the Aaronic priests; but these limitations did not belong to the older religion; and even in later times popular faith ascribed a larger efficacy to sacrifice. On the other hand, other passages protest against the ascription of great importance to sacrifice; or regard the rite as a consequence rather than a cause of forgiveness.[5] The Old Testament has no theory of sacrifice; in connexion with sin the sacrifice was popularly regarded as payment of penalty or compensation. Lev. xvii. 11 suggests a mystic or symbolic explanation by its statement "the life of the flesh is in the blood; and I have given it to you upon the altar to make atonement for your lives:[6] for it is the blood that maketh atonement by reason of the life." The Old Testament nowhere explains why this importance is attached to the blood, but the passage is often held to mean that the life of the victim represented the forfeited life of the offerer.

The atoning ritual reached its climax on the Day of Atonement יום הכפורים ἡμέρα ἐξιλασμοῦ, in the Mishna simply "the Day," (*Yōmā*), observed annually on the 10th day of the 7th month (Tisri), in the autumn, about October, shortly before the Feast of Tabernacles or vintage festival. At one time the year began in Tisri. The laws of the Day of Atonement belong to the Priestly Code.[7] There is no trace of this function before the exile; the earliest reference to any such special time of atonement being the proposal of Ezek. xlv. 18-20 to establish two days of atonement, in the first and seventh months.[8] No doubt, however, both the principles and ritual are partly derived from earlier times. The object of the observances was to cleanse the sanctuary, the priesthood and the people from all their sins, and to renew and maintain favourable relations between Yahweh and Israel. The ritual includes features found on other holy days, sacrifices, abstinence from work, &c.; and also certain unique acts. The Day of Atonement is the only fast provided in the Law; it is only on this occasion that (*a*) the Jews are required to "afflict their souls," (*b*) the High Priest enters the Holy of Holies, (*c*) the High Priest offers incense before the mercy seat and sprinkles it with blood, and (*d*) the scapegoat or Azazel is sent away into the wilderness, bearing upon him all the iniquities of the people. In later Judaism, especially from about 100 B.C., great stress was laid on the Day of Atonement, and it is now the most important religious function of the Jews. On that day many attend the synagogues who are seldom or never seen in them at other times.

Jewish day of atonement.

The idea of vicarious atonement appears in the Old Testament in different forms. The nation suffers for the sin of the individual;[9] and the individual for the sin of his kinsfolk[10] or of the nation.[11] Above all the Servant of Yahweh[12] appears as atoning for sinners by his sufferings and death. Again, the Old Testament speaks of the restoration of heathen nations, and of the salvation of the heathen;[13] but does not formulate any theory of atonement in this connexion. The Old Testament, however, only prepares the way for the Christian doctrine of the atonement; this is clear, inasmuch as its teaching is largely concerned with the nation, and hardly touches on the future life. Moreover, it could not define the relation of Christ to the atonement. Later Judaism emphasized the idea of vicarious atonement for Israel through the sufferings of the righteous, especially the martyrs; but it is very doubtful whether the idea of the atonement through the death of the Messiah is a pre-Christian Jewish doctrine.[14]

In the New Testament, the English version uses "atonement" once, Rom. v. 11, for καταλλαγή (R.V. here and elsewhere "reconciliation"). This Greek word corresponds to the idea suggested by the etymology of at-one-ment, the re-uniting in amity of those at variance, a sense which the word had in the 17th century but has since lost. But the idea which is now usually expressed by "atonement" is rather represented in the New Testament by ἱλασμός and its cognates, *e.g.* 1 John ii. 2 R.V., "He (Jesus) is the propitiation (ἱλασμός) for our sins." But these words are rare, and we read more often of "salvation" (σωτηρία) and "being saved," which includes or involves that restoration to divine favour which is called atonement. The leading varieties of teaching, the Sayings of Jesus, Paul, the Johannine writings, the Epistle to the Hebrews, connect the atonement with Christ especially with His death, and associate it with faith in Him and with repentance and amendment of life.[15]

New Testament.

These ideas are also common to Christian teaching generally. The New Testament, however, does not indicate that its writers were agreed as to any formal dogma of the atonement, as regards the relation of the death of Christ to the sinner's restoration to God's favour; but various suggestions are made as to the solution of the problem. St Paul's teaching connects with the Jewish doctrine of vicarious suffering, represented in the Old Testament by Is. liii., and probably, though not expressly, with the ritual sacrifices. Christ suffering on behalf of sinners satisfies the divine righteousness, which was outraged by their sin.[16] His work is an expression of God's love to man;[17] the redeeming power of Christ's death is also explained by his solidarity with humanity as the second Adam,[18]—the redeemed sinner has "died with Christ."[19] Some atoning virtue seems also attributed to the Resurrection;[20] Christ's sayings connect admission to the kingdom of God with susceptibility to the influence of His personality, faith in Himself and His mission, and the loyalty that springs from faith.[21] In John, Christ is a "propitiation" (ἱλασμός) provided by the love of God that man may be cleansed from sin; He is also their advocate (Παράκλητος) with God that they may be forgiven, for His name's sake.[22] *Hebrews* speaks of Christ as transcending the rites and officials of the law; He accomplishes the realities which they could only foreshadow; in relation to the perfect, heavenly sacrifice which atones for sin, He is both priest and victim.[23]

The subsequent development of the Christian doctrine has chiefly shaped itself according to the Pauline formula of vicarious atonement; the sufferings of Christ were accepted as a substitute for the punishment which men deserved, and so the divine righteousness was satisfied—a formula, however, which left much room for controversy. The creeds and confessions are usually vague. Thus the Apostles' Creed, "I believe in the forgiveness of sins"; the Nicene Creed, "I believe in one Lord Jesus Christ ... who for us men and for our salvation came down from heaven ... I acknowledge one baptism for the remission of sins"; the Athanasian Creed, "Who (Christ) suffered for our salvation." In the Thirty-nine Articles of the Church of England we have (ii.) "Christ suffered ... to reconcile his Father to us, and to be a sacrifice, not only for original guilt, but also for all actual sins of men"; and (xxxi.) "The offering of Christ once made is that perfect redemption, propitiation, and satisfaction, for all the sins of the whole world." The council of Trent declared that "*Christus ... nobis sua sanctissima passione ligno crucis justificationem meruit et pro nobis deo patri satisfecit,*" "Christ earned our justification by His most holy passion and satisfied God the Father for us." The Confession of Augsburg uses words equivalent to the Articles quoted above which were based upon it. The

Later interpretation.

Westminster Confession declares: "The Lord Jesus Christ, by His perfect obedience and sacrifice of Himself, which He through the Eternal Spirit once offered up to God, hath fully satisfied the justice of His Father, and purchased not only reconciliation, but an everlasting inheritance in the kingdom of heaven, for all those whom the Father hath given unto Him."

Individual theologians have sought to define more exactly the points on which the standards are vague. For instance, how was justice satisfied by Christ? The early Fathers, from Irenaeus (d. *c.* 200) to Anselm (d. 1109),[24] held, *inter alia*, that Christ paid a ransom to Satan to induce him to release men from his power. Anselm and the scholastics regarded the atonement as an offering to God of such infinite value as to outweigh men's sins, a view sometimes styled the "Commerical Theory."[25] The leading reformers emphasized the idea that Christ bore the punishment of sin, sufferings equivalent to the punishments deserved by men, a view maintained later on by Jonathan Edwards junior. But the intellectual activity of the Reformation also developed other views; the Socinians, with their humanitarian theory of the Person of Christ, taught that He died only to assure men of God's forgiving love and to afford them an example of obedience—"Forgiveness is granted upon the ground of repentance and obedience."[26] Grotius put forward what has been called the *Governmental* Theory, viz. that the atonement took place not to satisfy the wrath of God, but in the practical interests of the divine government of the world, "The sufferings and death of the Son of God are an exemplary exhibition of God's hatred of moral evil, in connexion with which it is safe and prudent to remit that penalty, which so far as God and the divine attributes are concerned, might have been remitted without it."[27]

Modern views.

The formal legal view continued to be widely held, though it was modified in many ways by various theologians. For instance, it has been held that Christ atoned for mankind not by enduring the penalty of sin, but by identifying Himself with the sinner in perfect sympathy, and feeling for him an "equivalent repentance" for his sin. Thus McLeod Campbell (*q.v.*) held that Christ atoned by offering up to God a perfect confession of the sins of mankind and an adequate repentance for them, with which divine justice is satisfied, and a full expiation is made for human guilt. A similar view was held by F.D. Maurice.[28] Others hold that the effect of the atoning death of Christ is not to propitiate God, but to reconcile man to God; it manifests righteousness, and thus reveals the heinousness of sin; it also reveals the love of God, and conveys the assurance of His willingness to forgive or receive the sinner; thus it moves men to repentance and faith, and effects their salvation; so substantially Ritschl.[29] In England much influence has been exerted by Dr R.W. Dale's *Atonement* (1875), the special point of which is that the death of Christ is not required by the personal demand of God to be propitiated, but by the necessity of honouring an ideal law of righteousness; thus, "the death of Christ is the objective ground on which the sins of men are remitted, because it was an act of submission to the righteous authority of the law by which the human race was condemned ... and because in consequence of the relation between Him and us—His life being our own—His submission is the expression of ours, and carries ours with it ... (and) because in His submission to the awful penalty of sin ... there was a revelation of the righteousness of God, which must otherwise have been revealed in the infliction of the penalties of sin on the human race."[30] This view, however, leads to a dilemma; if the law of righteousness is simply an expression of the divine will, satisfaction to law is equivalent to propitiation offered to God; if the law has an independent position, the view is inconsistent with pure monotheism.

The present position may be illustrated from a work representing the more liberal Anglican theology. Bishop Lyttelton in *Lux Mundi*[31] stated that the death of Christ is propitiatory towards God because it expressed His perfect obedience, it manifested God's righteous wrath against sin, and in virtue of Christ's human nature involved man's recognition of the righteousness of God's condemnation of sin; also because in some mysterious way death has a propitiatory value; and finally because Christ is the representative of the human race. Towards man, the death of Christ has atoning efficacy because it delivers from sin, bestows the divine gift of life and conveys the assurance of pardon. The benefits of the atonement are appropriated by "the acceptance of God's forgiveness in Christ, our self-identification with Christ's atoning attitude, and then working out, by the power of the life bestowed upon us, all the (moral and spiritual) consequence of forgiveness."

At present the belief in an objective atonement is still widely held; whether in the form of penal theories—the old forensic view that the death of Christ atones by paying the penalty of man's sin—or in the form of governmental theories; that the Passion fulfilled a necessity of divine government by expressing and vindicating God's righteousness. But there is also a widespread inclination to minimize, ignore or deny the objective aspect of the atonement, the effect of the death of Christ on God's attitude towards men; and to follow the moral theories in emphasizing the subjective aspect of the atonement, the influence of the Passion on man. There is a tendency to eclectic views embracing the more attractive features of the various theories; and attempts are made to adapt, interpret and qualify the imagery and language of older formulae, in order so to speak, to issue them afresh in new editions, compatible with modern natural science, psychology and historical criticism. Such attempts are necessary in a time of transition, but they involve a measure of obscurity and ambiguity.

Bibliography.—Atonement: H. Bushnell, *Vicarious Sacrifice* (1871); J. McLeod Campbell, *Nature of the Atonement* (1869); T.J. Crawford, *Doctrine of the Holy Spirit respecting the Atonement* (1871); R.W. Dale, *Atonement* (1875); J. Denney, *Death of Christ, Atonement and the Modern Mind* (1903); A. Lyttelton, *Lux Mundi*, pp. 201 ff. (Atonement), (1889); R. Moberly, *Atonement and Personality*; A. Ritschl, *Die christliche Lehre van der Rechtfertigung und Versohnung* (1870-1874); G.B. Stevens, *Christian Doctrine of Salvation* (1905).

Day of Atonement: articles in Hastings' *Bible Dictionary*, and in the *Encyclopaedia Biblica*.

(W. H. Be.)

1 Cf. Exodus xii. 15, &c.; Josh. vii. 24 (Achan); Jer. li. 62 (Babylon).

2 2 Sam. xii. 13, 14 (David); Isaiah xl. 2 (Jerusalem): in such cases, however, the context implies repentance.

3 Ezek. xviii., Micah vi.

4 Lev. iv. 2, "sin unwittingly," *bishegagā*, *c.* 450 B.C., &c.

5 Psalm l. 10, li. 16-19; Isaiah i. 11; Micah vi. 6-8.

6 Heb. *nephesh*, also translated "soul."

7 Lev. xvi., xxiii. 27-32; Numb. xxix. 7-11.

8 So Davidson, &c. with LXX. The A.V. with Hebrew text has "seventh day of the month."

9 *e.g.* Achan, Josh. vii. 10-15.

10 2 Sam. xxi. 1-9; Deut. v. 9, 10.

11 Ezek. xxi. 3, 4.

12 Isaiah liii.

13 Isaiah xix. 25, xlix. 6.

14 Köberle, *Sunde und Gnade*, pp. 592 ff.

15 Mark x. 45; Matt. xxvi. 28; 1 Cor. xv. 3; John xi. 48-52; Heb. ii. 9.

16 Rom. iii. 25.

17 Rom. v. 8.

18 Rom. v. 15-19.

19 Rom. vi. 8.

20 Rom. iv. 25.

21 Matt. xxv. 34 f.; Mark viii. 34 ff., ix. 36 f., x. 21.

22 1 John ii. 1, 2, 12, iii. 5, 8, iv. 10.

23 Heb. ii. 17, ix. 14.

24 Stevens, *Christian Doctrine of Salvation*, p. 138.

25 *Ibid.* p. 151.

26 Shedd, *Hist. of Christ. Doctr.* ii. 385 ff.; cf. van Oosterzee, *Christ. Dogmatics*, 611.

27 Shedd ii. 358 f.

28 Crawford, *Scripture Doctrine of the Atonement*, pp. 327 ff.

29 Orr, *Ritschlian Theology*, pp. 149 ff.

30 Dale, *Atonement*, pp. 430 ff.

31 Pp. 209, 212, 214, 216, 219, 221, 225.

ATRATO, a river of western Colombia, South America, rising on the slopes of the Western Cordilleras, in 5° 36′ N. lat., and flowing almost due north to the Gulf of Uraba, or Darien, where it forms a large delta. Its length is about 400 m., but owing to the heavy rainfall of this region it discharges no less than 175,000 cub. ft. of water per second, together with a very large quantity of sediment, which is rapidly filling the gulf. The river is navigable to Quibdo (250 m.), and for the greater part of its course for large vessels, but the bars at its mouth prevent the entrance of sea-going steamers. Flowing through the narrow valley between the Cordillera and coast range, it has only short tributaries, the principal ones being the Truando, Sucio and Murri. The gold and platinum mines of Choco were on some of its affluents, and the river sands are auriferous. The Atrato at one time attracted considerable attention as a feasible route for a trans-isthmian canal, which, it was estimated, could be excavated at a cost of £11,000,000.

ATREK, a river which rises in 37° 10′ N. lat. and 59° E., in the mountains of the north-east of the Persian province of Khorasan, and flows west along the borders of Persia and the Russian Transcaspian province, till it falls, after a course of 350 m., into the south-eastern corner of the Caspian, a short distance north-north-west of Astarabad.

ATREUS, in Greek legend, son of Pelops and Hippodameia, and elder brother of Thyestes. Having murdered his stepbrother Chrysippus, Atreus fled with Thyestes to Mycenae, where he succeeded Eurystheus in the sovereignty. His wife Aërope was seduced by Thyestes, who was driven from Mycenae. To avenge himself, Thyestes sent Pleisthenes (Atreus' son whom Thyestes had brought up as his own) to kill Atreus, but Pleisthenes was himself slain by his own father. After this Atreus, apparently reconciled to his brother, recalled him to Mycenae and invited him to a banquet to eat of his son, whom Atreus had slain. Thyestes fled in horror. Subsequently 877
Atreus married the daughter of Thyestes, Pelopia, who had by her own father a son, Aegisthus, who was adopted by Atreus. Thyestes was found by Agamemnon and Menelaus, the sons of Atreus, and imprisoned at Mycenae. Aegisthus being sent to murder Thyestes, mutual recognition took place, and Atreus was slain by the father and son, who seized the throne, and drove Agamemnon and Menelaus out of the country (Thucydides i. 9; Hyginus, *Fabulae*; Apollodorus). Homer does not speak of the horrors of the story, which are first found in the tragedians; he merely states (*Iliad*, ii. 105) that Atreus at his death left the kingdom to Thyestes.

See T. Voigt in *Dissert. philol. Halenses*. vi. (1886).

ATRI, a town of the Abruzzi, Italy, in the province of Teramo, 6 m. W. of the station of that name on the railway from Ancona to Foggia, and 18 m. due E.S.E. of Teramo, on the site of the ancient *Hadria* (*q.v.*). Pop. (1901) 13,448. Its Gothic cathedral (1285-1305) is remarkably fine; and the interior, though spoilt by restoration in 1657, contains some important frescoes of the end of the 15th century by Andrea di Lecce and his pupils. The crypt was originally a cistern of the Roman period. The palace of the Acquaviva family, who were dukes of Atri from 1398 to 1775, is a massive building situated in the principal square.

ATRIUM (either from *ater*, black, referring to the blackening of the walls from the smoke of the hearth, or from the Greek αἴθριον, open to the sky, or from an Etruscan town, Atria, where the style of building is supposed to have originated), the principal entrance hall or court of a Roman dwelling, giving access and light to the rooms round it. The centre of the roof over the atrium was open to the sky and called the *compluvium*; the rain-water from the roof collected in the gutters was discharged into a marble tank underneath, which was known as the *impluvium*. In the early periods of Roman civilization the atrium was the common public apartment, and was used for the reception of visitors and clients, and for ordinary domestic purposes, as cooking and dining. In it were placed the ancestral pictures, the marriage-couch, the hearth and generally a small altar. At a somewhat later period, and among the wealthy, separate apartments were built for kitchens and dining-rooms, and the atrium was kept as a general reception-room for clients and visitors. There were many varieties of the atrium, depending on the way in which the roof was carried. These are described by Vitruvius under the title of *cavaedium*.

Other buildings, both consecrated and unconsecrated, were called by the term (corresponding to the English "hall"), such as the Atrium Vestae, where the vestal virgins lived, and the Atrium Libertatis, the residence of the censor, where Asinius Pollio established the first public library at Rome.

The word *atrium* in Rome had a second signification, being given to an open court with porticos round, sometimes placed in front of a temple. A similar arrangement was adopted by the early Christians with relation to the Basilica, in front of which there was an open court surrounded by colonnades or arcades. The church of San Clemente at Rome, that of Sant' Ambrogio at Milan and the cathedral of Parenzo in Istria still retain their atria.

ATROPHY (Gr. ἀ- priv., τροφή, nourishment), a term in medicine used to describe a state of wasting due to some interference with the function of healthy nutrition (see Pathology). In the living organism there are always at work changes involving the waste of its component tissues, which render necessary, in order to maintain and preserve life, the supply and proper assimilation of nutritive material. It is also essential for the maintenance of health that a due relation exist between these processes of waste and repair, so that

the one may not be in excess of the other. When the appropriation of nutriment exceeds the waste, hypertrophy (*q.v.*) or increase in bulk of the tissues takes place. When, on the other hand, the supply of nutritive matter is suspended or diminished, or when the power of assimilation is impaired, atrophy or wasting is the result. Thus the whole body becomes atrophied in many diseases; and in old age every part of the frame, with the single exception of the heart, undergoes atrophic change. Atrophy may, however, affect single organs or parts of the body, irrespective of the general state of nutrition, and this may be brought about in a variety of ways. One of the most frequently observed of such instances is atrophy from disuse, or cessation of function. Thus, when a limb is deprived of the natural power of motion, either by paralysis or by painful joint disease, the condition of exercise essential to its nutrition being no longer fulfilled, atrophy of all its textures sooner or later takes place. The brain in imbeciles is frequently observed to be shrivelled, and in many cases of blindness there is atrophy of the optic nerve and optic tract. This form of atrophy is likewise well exemplified in the case of those organs and structures of the body which subserve important ends during foetal life, but which, ceasing to be necessary after birth, undergo a sort of natural atrophy, such as the thymus gland, and certain vessels specially concerned in the foetal circulation. The uterus after parturition undergoes a certain amount of atrophy, and the ovaries, after the child-bearing period, become shrunken. Atrophy of a part may also be caused by interruption to its normal blood-supply, as in the case of the ligature or obstruction of an artery. Again, long-standing disease, by affecting the nutrition of an organ and by inducing the deposit of morbid products, may result in atrophy, as frequently happens in affections of the liver and kidneys. Parts that are subjected to continuous pressure are liable to become atrophied, as is sometimes seen in internal organs which have been pressed upon by tumours or other morbid growths, and is well illustrated in the Chinese practice of foot-binding. Atrophy may manifest itself simply by loss of substance; but, on the other hand, it is often found to co-exist with degenerative changes in the textures affected and the formation of adventitious growth, so that the part may not be reduced in bulk although atrophied as regards its proper structure. Thus, in the case of the heart, when affected with fatty degeneration, there is atrophy of the proper muscular texture, but as this is largely replaced by fatty matter, the organ may undergo no diminution in volume, but may, on the contrary, be increased in size. Atrophy is usually a gradual and slow process, but sometimes it proceeds rapidly. In the disease known by the name of *acute yellow atrophy of the liver*, that organ undergoes such rapidly destructive change as results in its shrinking to half, or one-third, of its normal size in the course of a few days. The term *progressive muscular atrophy* (synonyms, *wasting* or *creeping palsy*) is applied to an affection of the muscular system, which is characterized by the atrophy and subsequent paralysis of certain muscles, or groups of muscles, and is associated with morbid changes in the anterior roots of the nerves of the spinal cord. This disease begins insidiously, and is often first observed to affect the muscles of one hand, generally the right. The attention of the sufferer is first attracted by the power of the hand becoming weakened, and then there is found to be a wasting of certain of its muscles, particularly those of the ball of the thumb. Gradually other muscles in the arms and legs become affected in a similar manner, their atrophy being attended with a corresponding diminution in power. Although sometimes arrested, this disease tends to progress, until in course of time the greater part of the muscular system is implicated and a fatal result ensues.

ATROPOS, in Greek mythology, the eldest of the three Fates (see Fate). Her name, the "Unalterable" (ἀ- privative, and τρέπειν, to turn), indicates her function, that of rendering the decisions of her sisters irreversible or immutable. Atropos is most frequently represented with scales, a sun-dial or a cutting instrument, the "abhorred shears," with which she slits the thin-spun thread of life that has been placed on the spindle by Clotho and drawn off by Lachesis.

ATTA, TITUS QUINCTIUS, or Quinticius (d. 77 B.C.), Roman comedy writer, was, like Titinius and Afranius, distinguished as a writer of *fabulae togatae*, national comedies. He had the reputation of being a vivid delineator of character, especially female. He also seems to have published a collection of epigrams. The scanty fragments contain many archaisms, but are lively in style. According to Horace (*Epistles*, ii 1. 79) the plays of Atta were still put on the stage in his time.

Aulus Gellius vii. 9; fragments in Neukirch, *De fabula togata Romanorum* (1833); Ribbeck, *Comicorum Latinorum reliquiae* (1855).

ATTACAPA (Choctaw for "cannibal"), a tribe of North-American Indians, whose home was in south-west Louisiana; they are now practically extinct.

ATTACHMENT,[1] in law, a process from a court of record, awarded by the justices at their discretion, on a bare suggestion, or on their own knowledge, and properly grantable in cases of contempt. It differs from arrest (*q.v.*), in that he who arrests a man carries him to a person of higher power to be forthwith disposed of; but he that attaches keeps the party attached, and presents him in court at the day assigned, as appears by the words of the writ. Another difference is, that arrest is only upon the body of a man, whereas an attachment is often upon his goods. It is distinguished from distress in not extending to lands, as the latter does; nor does a distress touch the body, as an attachment does. Every court of record has power to fine and imprison for contempt of its authority. Attachment being merely a process to bring the defendant before the court, is not necessary in cases of contempt in the presence of the court itself. Attachment will be granted in England against peers and members of parliament only for such gross contempts as rescues, disobedience to the sovereign's writs and the like. Attachment will not lie against a corporation. The county courts in this respect are regulated by acts of 1846 and 1849. They can only punish for contempts committed in presence of the court (see Contempt of Court). Attachments are granted on a rule in the first instance to show cause, which must be personally served before it can be made absolute, except for non-payment of costs on a master's allocatur, and against a sheriff for not obeying a rule to return a writ or to bring in the body. The offender is then arrested, and when committed will be compelled to answer interrogatories, exhibited against him by the party at whose instance the proceedings have been had; and the examination when taken is referred to the master, who reports thereon, and on the contempt being reported, the court gives judgment according to its discretion, in the same manner as upon a conviction for a misdemeanour at common law. Sir W. Blackstone observes that "this method of making the defendant answer upon oath to a criminal charge is not agreeable to the genius of the common law in any other instance"; and the elasticity of the legal definitions of contempt of court, especially with respect to comments on judicial proceedings, is the subject of much complaint.

Attachment of Debts.—It was suggested by the common law commissioners in 1853 that a remedy analogous to that of Foreign Attachment (see below) might be made available to creditors, after judgment, against debts due to their debtors. Accordingly, the Common Law Procedure Act 1854 enacted that any creditor, having obtained judgment in the superior courts, should have an order that the judgment debtor might be examined as to any debts due and owing to him before a master of the court. The rules and regulations under the Judicature Act 1873 retained the process for attachment of debts as established by the Procedure Act of 1854. On affidavit that the judgment was still unsatisfied, and that any other person within the jurisdiction was indebted to the judgment debtor, the judge was empowered to attach all debts due from such third person (called the *garnishee*) to the judgment debtor, to answer the judgment debt. This order binds the debts in the hands of the garnishee, and if he does not dispute his liability execution issues against him at once. If he disputes his liability the question must be tried. Payment by the garnishee or execution against him is

a complete discharge as against the judgment debtor. These provisions were, by an order in council of the 18th of November 1867, extended to the county courts. By the Wages Attachment Abolition Act 1870 it is enacted that no order for the attachment of the wages of any servant, labourer or workman shall be made by the judge of any court of record or inferior court, and by the Merchant Shipping Act 1894 it is enacted that the wages of a seaman or apprentice are not subject to attachment.

In the United States attachment of debts is a statutory remedy accorded in most of the states in certain circumstances for the security of creditors, by the seizure by the sheriff of the debtor's goods or the imposition of a lien upon his land, before judgment, and sometimes at the very commencement of the action. In some states it is only allowed in special cases, as when the debtor has absconded, or is a non-resident or guilty of fraud; in a few it may be had, as of right, at the commencement of ordinary actions. The common-law courts of the United States (by act of Congress) follow the practice in this regard of the state in which they sit. Such attachments (on mesne process) can generally be dissolved by the substitution of a bond with surety. The body can also be attached in most states on civil actions of tort (for a wrongful or negligent act to the damage of another), but not in actions on contract.

Foreign Attachment is an important custom prevailing in the city of London, whereby a creditor may attach money owing to his debtor, or property belonging to him in the possession of third parties. The person holding the property or owing the money must be within the city at the time of being served with the process, but all persons are entitled to the benefit of the custom. The plaintiff having commenced his action, and made a satisfactory affidavit of his debt, is entitled to issue attachment, which thereupon affects all the money or property of the defendant in the hands of the third party, the garnishee. The garnishee, of course, has as against the attachment all the defences which would be available to him against the defendant, his alleged creditor. The garnishee may plead payment under the attachment, if there has been no fraud or collusion, in bar to an action by the defendant for his debt or property. The court to which this process belongs is the mayor's court of London, the procedure in which is regulated by the Mayor's Court of London Procedure Act 1857. This custom, and all proceedings relating thereto, are expressly exempted from the operation of the Debtor's Act 1869. Similar customs exist in Bristol and a few other towns in England and also in Scotland.

A Writ of Attachment enforces answers and obedience to decrees and orders of the High Court of Justice, and is made out without order upon an affidavit of the due service of the process, &c., with whose requirements compliance is sought. A corporation, however, is proceeded against by distringas and not by attachment. It was formerly competent to the plaintiff to compel the appearance of a defendant in chancery by attachment, but the usual course was to enter appearance for him in case of default. It is one of the modes of execution allowed for the recovery of property other than land or money.

Attachment of the Forest was the proceeding in the courts of attachments, Woodmote, or Forty Days' courts. These courts have fallen into desuetude. They were held before the verderers of the royal forests in different parts of the kingdom once in every forty days, for the purpose of inquiring into all offences against "vert (greensward) and venison." The attachment was by the bodies of the offenders, if taken in the very act of killing venison, or stealing wood, or preparing so to do, or by fresh and immediate pursuit after the act was done; else they must be attached by their goods. These attachments were received by the verderers and enrolled, and certified under their seals to the Swainmote, or Court of Justice-seat, which was the superior of the forest courts.

1 "To attach" is first used in English in the legal sense of arrest or seizure, and the sense of "fasten to" is comparatively late. The Old French *atachier*, modern *attacher*, from which the English "attach" is derived, is from a word for a peg or nail, in English "tack," which is found in many forms in Scandinavian and Celtic languages, and is ultimately connected with the root seen in Latin *tangere*, to touch. The Italian *attacare*, especially in the phrase *attacare battaglia*, to join battle, gave the French *attaquer*, whence the English "attack," which is therefore by origin a doublet of "attach."

ATTAINDER (from the O. Fr. *ataindre, ateindre*, to attain, *i.e.* to strike, accuse, condemn; Lat. *attingere, tangere*, to touch; the meaning has been greatly affected by the confusion with Fr. *taindre, teindre*, to taint, stain, Lat. *tingere*, to dye), in English law, was 879
the immediate and inseparable consequence from the common law upon the sentence of death. When it was clear beyond all dispute that the criminal was no longer fit to live he was called *attaint*, and could not, before the Evidence Act 1843, be a witness in any court. This attainder took place after judgment of death, or upon such circumstances as were equivalent to judgment of death, such as judgment of outlawry on a capital crime, pronounced for absconding from justice. Conviction without judgment was not followed by attainder. The consequences of attainder were (1) forfeiture, (2) corruption of blood. On attainder for treason, the criminal forfeited to the crown his lands, rights of entry on lands, and any interest he might have in lands for his own life or a term of years. For murder, the offender forfeited to the crown the profit of his freeholds during life, and in the case of lands held in fee-simple, the lands themselves for a year and a day; subject to this, the lands escheated to the lord of the fee. These forfeitures related back to the time of the offence committed. Forfeitures of goods and chattels ensued not only on attainder, but on conviction for a felony of any kind, or on flight from justice, and had no relation backwards to the time of the offence committed. By *corruption of blood*, "both upwards and downwards," the attainted person could neither inherit nor transmit lands. The lands escheated to the lord of the fee, subject to the crown's right of forfeiture. The doctrine of attainder has, however, ceased to be of much importance. The Forfeiture Act 1870 enacted that henceforth no confession, verdict, inquest, conviction or judgment of or for any treason or felony, or *felo de se*, should cause any attainder or corruption of blood, or any forfeiture or escheat. Sentence of death, penal servitude or imprisonment with hard labour for more than twelve months, after conviction for treason or felony, disqualifies from holding or retaining a seat in parliament, public offices under the crown or otherwise, right to vote at elections, &c., and such disability is to remain until the punishment has been suffered or a pardon obtained. Provision was made for the due administration of convicts' estates, in the interests of themselves and their families. Forfeiture consequent on outlawry was exempted from the provisions of the act. The United States constitution (Art. III. s. 3) says: "The Congress shall have power to declare the punishment of treason, but no attainder of treason shall work corruption of blood, or forfeiture except during the life of the person attainted."

Bills of Attainder, in English legal procedure, were formerly a parliamentary method of exercising judicial authority. They were ordinarily initiated in the House of Lords and the proceedings were the same as on other bills, but the parties against whom they were brought might appear by counsel and produce witnesses in both Houses. In the case of an impeachment (*q.v.*), the House of Commons was prosecutor and the House of Lords judge; but such bills being *legislative* in form, the consent of crown, lords and commons was necessary to pass them. Bishops, who do not exercise but who claim the right to vote in cases of impeachment (*q.v.*), have a right to vote upon bills of attainder, but their vote is not conclusive in passing judgment upon the accused. First passed in 1459, such bills were employed, more particularly during the reigns of the Tudor kings, as a species of extrajudicial procedure, for the direct punishment of political offences. Dispensing with the ordinary judicial forms and precedents, they took away from the accused whatever advantages he might have gained in the courts of law; such evidence only was admitted as might be necessary to secure conviction; indeed, in many cases bills of attainder were passed without any evidence being produced at all. In the reign of Henry VIII. they were much used, through a subservient parliament, to punish those who had incurred the king's displeasure; many distinguished victims who could not have been charged with any offence under the existing laws being by this means disposed of. In the 17th century, during the disputes with Charles I., the Long Parliament made effective use of the same procedure, forcing the sovereign to give his consent. After the Restoration it became less frequent, though the Jacobite movement in Scotland produced several instances of attainder, without, however, the infliction of the extreme penalty of death. The last bill of attainder passed in England was in the case of Lord Edward Fitzgerald, one of the Irish rebel leaders of 1798.

A bill for reversing attainder took a form contrary to the usual rule. It was first signed by the sovereign and presented by a peer to the House of Lords by command of the crown, then passed through the ordinary stages and on to the commons, to whom the sovereign's assent was communicated before the first reading was taken, otherwise the whole proceedings were null and void.

A *Bill of Pains and Penalties* resembles a bill of attainder in object and procedure, but imposes a lesser punishment than death. The most notable instances of the passing of a bill of pains and penalties are those of Bishop Atterbury in 1722, and of Queen Caroline, wife of George IV., in 1820.

The constitution of the United States declares that "no bill of attainder or *ex post facto* law shall be passed."

ATTAINT, WRIT OF, an obsolete method of procedure in English law, for inquiring by a jury of twenty-four whether a false verdict had been given in a trial before an ordinary jury of twelve. If it were found that an erroneous judgment had been given, the wrong was redressed and the original jury incurred infamy, with imprisonment and forfeiture of their goods, which punishments were, however, commuted later for a pecuniary penalty. In criminal cases a writ of attaint was issued at suit of the king, and in civil cases at the suit of either party. In criminal cases it appears to have become obsolete by the end of the 15th century. Procedure by attaint in civil cases had also been gradually giving place to the practice of granting new trials, and after the decision in Bushell's case in 1670 (see JURY) it became obsolete, and was finally abolished by the Juries Act 1825, except as regards jurors guilty of embracery (*q.v.*).

ATTALIA, an ancient city of Pamphylia, which derived its name from Attalus II., king of Pergamum; the modern Adalia (*q.v.*). It was important as the nearest seaport to the rich districts of south-west Phrygia. A much-frequented "half-sea" route led through it to the Lycus and Maeander valleys, and so to Ephesus and Smyrna. This was the natural way from any part of central Asia Minor to Syria and Egypt, and accordingly we hear of Paul and Barnabas taking ship at Attalia for Antioch. Originally the port of Perga, Attalia eclipsed the old Pamphylian capital in early Christian times and became the metropolis. There are extensive remains of the ancient walls, including some portions which go back to the foundation of the Pergamenian city. The most conspicuous monument is the triple Gate of Hadrian, flanked by a tower built by the empress Julia. This lies about half-way round the *enceinte* and formerly admitted the road from Perga.

ATTAR [or OTTO] **OF ROSES** (Pers. *'aṭar*, essence), a perfume consisting of essential oil of roses, prepared by distilling, or, in some districts, by macerating the flowers. The manufacture is chiefly carried out in India, Persia and the Balkans; the last named supplying the bulk of the European demand. It is used by perfumery manufacturers as an ingredient. The genuine attar of roses is costly and it is frequently adulterated.

ATTEMPT (Lat. *adtemptare, attentare*, to try), in law, an act done with intent to commit a crime, and forming one of a series of acts which would constitute its actual commission if it were not interrupted. An attempt must proceed beyond mere preparation, but at the same time it must fall short of the ultimate purpose in any part of it. The actual point, however, at which an act ceases to be an attempt, and becomes criminal, depends upon the circumstances of each particular case. A person may be guilty of an attempt to commit a crime, even if its commission in the manner proposed was impossible. Every attempt to commit a treason, felony or indictable misdemeanour is in itself an indictable misdemeanour, punishable by fine or imprisonment, unless the attempt to commit is specifically punishable by statute as a felony, or in a defined manner as a misdemeanour; and a person who has been indicted for a felony or misdemeanour may, if the evidence so warrants, be found guilty only of the attempt, provided that it too is a misdemeanour.

ATTENTION (from Lat. *ad-tendo*, await, expect; the condition of being "stretched" or "tense"), in psychology, the concentration of consciousness upon a definite object or objects. The result is brought about, not by effecting any change in the perceptions themselves, but simply by isolating them from other objects. Since all consciousness involves this isolation, attention may be defined generally as the necessary condition of consciousness. Such a definition, however, throws no light upon the nature of the psychological process, which is partly explained by the general law that the greater the number of objects on which attention is concentrated the less will each receive ("pluribus intentus, minor est ad singula sensus"), and conversely. There are also special circumstances which determine the amount of attention, *e.g.* influences not subject to the will, such as the vividness of the impression (*e.g.* in the case of a shock), strong change in pleasurable or painful sensations. Secondly, an exercise of volition is employed in fixing the mind upon a definite object. This is a purely voluntary act, which can be strengthened by habit and is variable in different individuals; to it the name "attention" is sometimes restricted. The distinction is expressed by the words "reflex" or "passive," and "volitional" or "active." It is important to notice that in every case of attention to an object, there must be in consciousness an implicit apprehension of surrounding objects from which the particular object is isolated. These objects are known as the "psychic fringe," and are essential to the systematic unity of the attention-process. Attempts have been made to examine the attention-process from the physiological standpoint by investigating the muscular and neural changes which accompany it, and even to assign to it a specific local centre. It has, for example, been remarked that uniformity of environment, resulting in practically automatic activity, produces mental equilibrium and the comparative disappearance of attention-processes; whereas the necessity of adapting activity to abnormal conditions produces a comparatively high degree of attention. In other words, attention is absent where there is uniformity of activity in accordance with uniform, or uniformly changing, environment. In spite of the progress made in this branch of study, it has to be remembered that all psycho-physical experiments are to some extent vitiated by the fact that the phenomena can scarcely remain normal under inspection.

See G.F. Stout, *Analytic Psychology* (London, 1896), especially part ii. chap. 2; also PSYCHOLOGY, BRAIN, &c.

ATTERBOM, PER DANIEL AMADEUS (1790-1855), Swedish poet, son of a country parson, was born in the province of Östergötland on the 19th of January 1790. He studied in the university of Upsala from 1805 to 1815, and became professor of philosophy there in 1828. He was the first great poet of the romantic movement which, inaugurated by the critical work of Lorenzo Hammerskköld, was to revolutionize Swedish literature. In 1807, when in his seventeenth year, he founded at Upsala an artistic society, called the Aurora League, the members of which included V.F. Palmblad, A.A. Grafström (d. 1870), Samuel Hedborn (d. 1849), and other youths whose names were destined to take a foremost rank in the literature of their generation. Their first newspaper, *Polyfem*, was a crude effort, soon abandoned, but in 1810 there began to appear a journal, *Fosforos*, edited by Atterbom, which lasted for three years and finds a place in classic Swedish literature. It consisted entirely of poetry and aesthetico-polemical essays; it introduced the study of the newly arisen Romantic school of Germany, and formed a vehicle for the early works, not of Atterbom only, but of Hammerskköld, Dahlgren, Palmblad and others. Later, the members of the Aurora League established the *Poetisk Kalender* (1812-1822), in which their poems appeared, and a new critical organ, *Svensk Litteraturtidning* (1813-1824). Among Atterbom's independent works the most celebrated is *Lycksalighetens Ö* (*The Fortunate Island*), a romantic drama of extraordinary beauty, published in 1823. Before

this he had published a somewhat in the manner of Novalis. Of a dramatized fairy tale, *Fågel blå* (*The Blue Bird*), only a fragment, which is among the most exquisite of his writings, is preserved. As a purely lyrical poet he has not been excelled in Sweden, but his more ambitious works are injured by his weakness for allegory and symbolism, and his consistent adoption of the mannerisms of Tieck and Novalis. In his later years he became less violent in literary controversy. He became in 1835 professor of aesthetics and literature at Upsala, and four years later he was admitted to the Swedish Academy. He died on the 21st of July 1855. His *Svenska Siare och Skalder* (6 vols., 1841-1855, supplement, 1864) consists of a series of biographies of Swedish poets and men of letters, which forms a valuable history of Swedish letters down to the end of the "classical" period. Atterbom's works were collected (13 vols., Örebro) in 1854-1870.

ATTERBURY, FRANCIS (1662-1732), English man of letters, politician and bishop, was born in the year 1662, at Milton or Middleton Keynes in Buckinghamshire, a parish of which his father was rector. He was educated at Westminster school and at Christ Church, Oxford, where he became a tutor. In 1682 he published a translation of *Absalom and Ahithophel* into Latin verse; but neither the style nor the versification was that of the Augustan age. In English composition he succeeded much better. In 1687 he published *An Answer to some Considerations on the Spirit of Martin Luther and the Original of the Reformation*, a reply to Obadiah Walker, who, elected master of University College in 1676, had printed in a press set up by him there an attack on the Reformation, written by Abraham Woodhead. Atterbury's treatise, though highly praised by Bishop Burnet, is perhaps more distinguished for the vigour of his rhetoric than for the soundness of his arguments, and the Papists were so much galled by his sarcasms and invectives that they accused him of treason, and of having, by implication, called King James a Judas.

After the Revolution, Atterbury, though bred in the doctrines of non-resistance and passive obedience, readily swore fealty to the new government. He had taken holy orders in 1687, preached occasionally in London with an eloquence which raised his reputation, and was soon appointed one of the royal chaplains. But he ordinarily resided at Oxford, where he was the chief adviser and assistant of Dean Aldrich, under whom Christ Church was a stronghold of Toryism. Thus he became the inspirer of his pupil, Charles Boyle, in the attack (1698) on the Whig scholar, Richard Bentley (*q.v.*), arising out of Bentley's impugnment of the genuineness of the *Epistles of Phalaris*. He was figured by Swift in the *Battle of the Books* as the Apollo who directed the fight, and was, no doubt, largely the author of Boyle's essay. Bentley spent two years in preparing his famous reply, which proved not only that the letters ascribed to Phalaris were spurious, but that all Atterbury's wit, eloquence and skill in controversial fence was only a cloak for an audacious pretence of scholarship.

Atterbury was soon occupied, however, in a dispute about matters still more important and exciting. The rage of religious factions was extreme. High Church and Low Church divided the nation. The great majority of the clergy were on the High Church side; the majority of King William's bishops were inclined to latitudinarianism. In 1700 Convocation, of which the lower house was overwhelmingly Tory, had not been suffered to meet for ten years. This produced a lively controversy, into which Atterbury threw himself with characteristic energy, publishing a series of treatises written with much wit, audacity and acrimony. By the mass of the clergy he was regarded as the most intrepid champion that had ever defended their rights against the oligarchy of Erastian prelates. In 1701 he was rewarded with the archdeaconry of Totnes and a prebend in Exeter cathedral. The lower house of Convocation voted him thanks for his services; the university of Oxford created him a doctor of divinity; and in 1704, soon after the accession of Anne, while the Tories still had the chief weight in the government, he was promoted to the deanery of Carlisle.

Soon after he had obtained this preferment the Whig party came into power. From that party he could expect no favour. Six years elapsed before a change of fortune took place. At length, in the year 1710, the prosecution of Sacheverell produced a formidable explosion of High Church fanaticism. At such a moment Atterbury could not fail to be conspicuous. His inordinate zeal for the body to which he belonged, his turbulent and aspiring temper, his rare talents for agitation and for controversy, were again signally displayed. He bore a chief part in framing that artful and eloquent speech which the accused divine pronounced at the bar of the Lords, and which presents a singular contrast to the absurd and scurrilous sermon which had very unwisely been honoured with impeachment. During the troubled and anxious months which followed the trial, Atterbury was among the most active of those pamphleteers who inflamed the nation against the Whig ministry and the Whig parliament. When the ministry had been changed and the parliament dissolved, rewards were showered upon him. The lower house of Convocation elected him prolocutor, in which capacity he drew up, in 1711, the often-cited *Representation of the State of Religion*; and, in August 1711, the queen, who had selected him as her chief adviser in ecclesiastical matters, appointed him dean of Christ Church on the death of his old friend and patron Aldrich.

At Oxford he was as conspicuous a failure as he had been at Carlisle, and it was said by his enemies that he was made a bishop because he was so bad a dean. Under his administration Christ Church was in confusion, scandalous altercations took place, and there was reason to fear that the great Tory college would be ruined by the tyranny of the great Tory doctor. In 1713 he was removed to the bishopric of Rochester, which was then always united with the deanery of Westminster. Still higher dignities seemed to be before him. For, though there were many able men on the episcopal bench, there was none who equalled or approached him in parliamentary talents. Had his party continued in power it is not improbable that he would have been raised to the archbishopric of Canterbury. The more splendid his prospects the more reason he had to dread the accession of a family which was well known to be partial to the Whigs, and there is every reason to believe that he was one of those politicians who hoped that they might be able, during the life of Anne, to prepare matters in such a way that at her decease there might be little difficulty in setting aside the Act of Settlement and placing the Pretender on the throne. Her sudden death confounded the projects of these conspirators, and, whatever Atterbury's previous views may have been, he acquiesced in what he could not prevent, took the oaths to the house of Hanover, and did his best to ingratiate himself with the royal family. But his servility was requited with cold contempt; and he became the most factious and pertinacious of all the opponents of the government. In the House of Lords his oratory, lucid, pointed, lively and set off with every grace of pronunciation and of gesture, extorted the attention and admiration even of a hostile majority. Some of the most remarkable protests which appear in the journals of the peers were drawn up by him; and, in some of the bitterest of those pamphlets which called on the English to stand up for their country against the aliens who had come from beyond the seas to oppress and plunder her, critics easily detected his style. When the rebellion of 1715 broke out, he refused to sign the paper in which the bishops of the province of Canterbury declared their attachment to the Protestant succession, and in 1717, after having been long in indirect communication with the exiled family, he began to correspond directly with the Pretender.

In 1721, on the discovery of the plot for the capture of the royal family and the proclamation of King James, Atterbury was arrested with the other chief malcontents, and in 1722 committed to the Tower, where he remained in close confinement during some months. He had carried on his correspondence with the exiled family so cautiously that the circumstantial proofs of his guilt, though sufficient to produce entire moral conviction, were not sufficient to justify legal conviction. He could be reached only by a bill of pains and penalties. Such a bill the Whig party, then decidedly predominant in both Houses, was quite prepared to support, and in due course a bill passed the Commons depriving him of his spiritual dignities, banishing him for life, and forbidding any British subject to hold intercourse with him except by the royal permission. In the Lords the contest was sharp, but the bill finally passed by eighty-three votes to forty-three.

Atterbury took leave of those whom he loved with a dignity and tenderness worthy of a better man, to the last protesting his innocence with a singular disingenuousness. After a short stay at Brussels he went to Paris, and became the leading man among the Jacobite refugees there. He was invited to Rome by the Pretender, but Atterbury felt that a bishop of the Church of England would be out of place at the Vatican, and declined the invitation. During some months, however, he seemed to stand high in the good graces of James. The correspondence between the master and the servant was constant. Atterbury's merits were warmly acknowledged, his advice was respectfully received, and he was, as Bolingbroke had been before him, the prime minister of a king without a kingdom. He soon, however, perceived that his counsels were disregarded, if not distrusted. His proud spirit was deeply wounded. In 1728 he quitted Paris, fixed his residence at Montpelier, gave up politics, and devoted himself entirely to letters. In the sixth year of his exile he had so severe an illness that his daughter, Mrs Morice, herself very ill, determined to run all risks that she might see him once more. She met him at Toulouse, received the communion from his hand, and died that night.

Atterbury survived the severe shock of his daughter's death two years. He even returned to Paris and to the service of the Pretender,

who had found out that he had not acted wisely in parting with one who, though a heretic, was the most able man of the Jacobite party. In the ninth year of his banishment he published a luminous, temperate and dignified vindication of himself against John Oldmixon, who had accused him of having, in concert with other Christ Church men, garbled the new edition of Clarendon's *History of the Rebellion*. The charge, as respected Atterbury, had not the slightest foundation; for he was not one of the editors of the *History*, and never saw it till it was printed. A copy of this little work he sent to the Pretender, with a letter singularly eloquent and graceful. It was impossible, the old man said, that he should write anything on such a subject without being reminded of the resemblance between his own fate and that of Clarendon. They were the only two English subjects who had ever been banished from their country and debarred from all communication with their friends by act of parliament. But here the resemblance ended. One of the exiles had been so happy as to bear a chief part in the restoration of the royal house. All that the other could now do was to die asserting the rights of that house to the last. A few weeks after this letter was written Atterbury died, on the 22nd of February 1732. His body was brought to England, and laid, with great privacy, under the nave of Westminster Abbey. No inscription marks his grave.

It is agreeable to turn from Atterbury's public to his private life. His turbulent spirit, wearied with faction and treason, now and then required repose, and found it in domestic endearments, and in the society of the most illustrious literary men of his time. Of his wife, Katherine Osborn, whom he married while at Oxford, little is known; but between him and his daughter there was an affection singularly close and tender. The gentleness of his manners when he was in the company of a few friends was such as seemed hardly credible to those who knew him only by his writings and speeches. Though Atterbury's classical attainments were not great, his taste in English literature was excellent; and his admiration of genius was so strong that it overpowered even his political and religious antipathies. His fondness for Milton, the mortal enemy of the Stuarts and of the Church, was such as to many Tories seemed a crime; and he was the close friend of Addison. His favourite companions, however, were, as might have been expected, men whose politics had at least a tinge of Toryism. He lived on friendly terms with Swift, Arbuthnot and Gay. With Prior he had a close intimacy, which some misunderstanding about public affairs at last dissolved. Pope found in Atterbury not only a warm admirer, but a most faithful, fearless and judicious adviser.

See F. Williams, *Memoirs and Correspondence of Atterbury with Notes*, &c. (1869); *Stuart Papers*, vol. i.: *Letters of Atterbury to the Chevalier St George*, &c. (1847); J. Nichols, *Epistolary Correspondence*, &c. (1783-1796); and H.C. Beeching, *Francis Atterbury*, (1909).

ATTESTATION (Lat. *adtestare, attestare*, to bear witness, *testis*, a witness), the verification of a deed, will or other instrument by the signature to it of a witness or witnesses, who endorse or subscribe their names under a memorandum, to the effect that it was signed or executed in their presence. The essence of attestation is to show that at the execution of the document there was present some disinterested person capable of giving evidence as to what took place. The clause at the end of the instrument, immediately preceding the signatures of the witnesses to the execution, and stating that they have witnessed it, is known as the attestation clause. In Scots law, the corresponding clause is called the testing-clause (see Deed; Will or Testament; Witness).

ATTHIS (an adjective meaning "Attic"), the name given to a monograph or special treatise on the religious and political history, antiquities and topography of Attica and Athens. During the 4th and 3rd centuries B.C., a class of writers arose, who, making these subjects their particular study, were called atthidographi, or compilers of atthides. The first of these was Clidemus or Clitodemus (about 378 B.C.); the last, Ister of Cyrene (died 212 B.C.); the most important was Philochorus (first half of the 3rd century B.C.), of whose work considerable fragments have been preserved. The names of the other atthidographi known to us are Phanodemus, Demon, Androtion, Andron, Melanthius. They laid no claim to literary skill; their style was monotonous and soon became wearisome. They were in fact chroniclers or annalists—not historians. Their only object was to set down, in plain and simple language, all that seemed worthy of note in reference to the legends, history, constitution, religion and civilization of Attica. They followed the order of the olympiads and archons, and their work was supported by the authority of original documents, monuments and inscriptions. Their writings were much used by historians, as well as by the scholiasts and grammarians.

Fragments in Müller, *Fragmenta Historicorum Graecorum*, i.

ATTIC (*i.e.* "in the Attic style"), an architectural term given to the masonry rising above the main cornice of a building, the earliest example known being that of the monument of Thrasyllus at Athens. It was largely employed by the Romans, who in their arches of triumph utilized it for inscriptions or for bas-relief sculpture. It was used also to increase the height of enclosure walls such as those of the Forum of Nerva. By the Italian revivalists it was utilized as a complete storey, pierced with windows, as found in Palladio's work at Vicenza and in Greenwich hospital. The largest attic in existence is that which surmounts the entablature of St Peter's at Rome, which measures 39 ft. in height. The term is also employed in modern terminology to designate an upper storey in a roof, and the feature is sometimes introduced to hide a roof behind.

ATTICA, a district of ancient Greece, triangular in shape, projecting in a south-easterly direction into the Aegean Sea, the base line being formed by the continuous chain of Mounts Cithaeron and Parnes, the apex by the promontory of Sunium. It was washed on two sides by the sea, and the coast is broken up into numerous small bays and harbours, which, however, are with few exceptions exposed to the south wind. The surface of Attica, as of the rest of Greece, is very mountainous, and between the mountain chains lie several plains of no great size, open on one side to the sea. On the west its natural boundary is the Corinthian Gulf, so that it would include Megaris; indeed, before the Dorian invasion, which resulted in the foundation of Megara, the whole country was politically one, in the hands of the Ionian race. This is proved by the column which, as we learn from Strabo, once stood on the Isthmus of Corinth, bearing on one side in Greek the inscription, "This land is Peloponnesus, not Ionia," and on the other, "This land is not Peloponnesus, but Ionia."

The position of Attica was one main cause of its historical importance. Hence in part arose the maritime character of its inhabitants; and when they had once taken to the sea, the string of neighbouring islands, Ceos, Cythnos and others, some of which lay within sight of their coasts, and from one to another of which it was possible to sail without losing sight of land, served to tempt them on to further enterprises. Similarly on land, the post it occupied between northern Greece and the Peloponnese materially influenced its relation to other states, both in respect of its alliances, such as that with Thessaly, towards which it was drawn by mutual hostility to Boeotia, which lay between them; and also in respect of offensive combinations of other powers, as that between Thebes and Sparta, which throughout an important part of Greek history were closely associated in their politics, through mutual dread of their powerful neighbour.

The mountains of Attica, which form its most characteristic feature, are a continuation of that chain which, starting from Tymphrestus at the southern extremity of Pindus, passes through Phocis and Boeotia under the names of Parnassus and Helicon; from

Mountains. this proceeds the range which, as Cithaeron in its western and Parnes in its eastern portion, separates Attica from Boeotia, throwing off spurs southward towards the Saronic Gulf in Aegaleos and Hymettus, which bound the plain of Athens. Again, the eastern extremity of Parnes is joined by another line of hills, which, separating from Mount Oeta, skirts the Euboic Gulf, and, after entering Attica, throws up the lofty pyramid of Pentelicus, overlooking the plain of Marathon, and then sinks towards the sea at Sunium to rise once more in the outlying islands. Finally, at the extreme west of the whole district, Cithaeron is bent round at right angles in the direction of the isthmus, at the northern approach to which it abuts against the mighty mass of Mount Geraneia, which is interposed between the Corinthian and the Saronic Gulf. Both Cithaeron and Parnes are about 4600 ft. high, Pentelicus 3635, and Hymettus 3370, while Aegaleos does not rise higher than 1534 ft. At the present day they are extremely bare, and in this respect almost repellent; but the lack of colour is compensated by the delicacy of the outlines, the minute articulation of the minor ridges and valleys, and the symmetrical grouping of the several mountains.

Soil. The soil is light and thin, and requires very careful agriculture not only on the rocky mountain sides but to some extent also in the maritime plains. This fact had considerable influence on the inhabitants, both by enforcing industrious habits and by leading them at an early period to take to the sea. Still, the level ground was sufficiently fertile to form a marked contrast to the rest of the district. Thucydides attributes to the nature of the soil (i. 2 τὸ λεπτόγεων), which presented no attraction to invaders, the permanence of the same inhabitants in the country, whence arose the claim to indigenousness on which the Athenians so greatly prided themselves; while at the same time the richer ground fostered that fondness for country life, which is proved by the enthusiastic terms in which it is always spoken of by Aristophanes. That we are not justified in judging of the ancient condition of the soil by, the aridity which prevails at the present day, is shown by the fact that out of the 182 demes (see Cleisthenes) into which Attica was divided, one-tenth were named from trees or plants.

Climate. The climate of Attica has always been celebrated. In approaching Attica from Boeotia a change of temperature is felt as soon as a person descends from Cithaeron or Parnes, and the sea breeze, which in modern times is called ὁ ἐμβάτης, or that which sets towards shore, moderates the heat in summer. The Attic comedians and Plato speak with enthusiasm of their native climate, and the fineness of the Athenian intellect was attributed to the clearness of the Attic atmosphere. It was in the neighbourhood of Athens itself that the air was thought to be purest. So Euripides describes the inhabitants as "ever walking gracefully through the most luminous ether" (*Med.* 829); and Milton— 883

> "Where, on the Aegean shore, a city stands,
> Built nobly, pure the air, and light the soil—
> Athens, the eye of Greece."

Or again Xenophon says "one would not err in thinking that this city is placed near the centre of Greece—nay, of the civilized world—because, the farther removed persons are from it, the severer is the cold or heat they meet with" (*Vectigal.* i. 6). The air is so clear that one can see from the Acropolis the lines of white marble that streak the sides of Pentelicus. The brilliant colouring which is so conspicuous in an Athenian sunset is due to the same cause. The epithet "violet-crowned," used of Athens by Pindar, is due either to the blue haze on the surrounding hills, or to the use of violets (or irises) for festal wreaths. This otherwise perfect climate is slightly marred by the prevalence of the north wind. This is expressed on the Horologium of Andronicus Cyrrhestes, called the Temple or Tower of the Winds, at Athens, where Boreas is represented as a bearded man of stern aspect, thickly clad, and wearing strong buskins; he blows into a conch shell, which he holds in his hand as a sign of his tempestuous character.

Vegetation. Of the flora of Attica, the olive is the most important. This tree, we learn from Herodotus (v. 82), was thought at one time to have been found in that country only; and the enthusiastic praises of Sophocles (*Oed. Col.* 700) teach us that it was the land in which it flourished best. So great was the esteem in which it was held, that in the early legend of the struggle between the gods of sea and land, Poseidon and Athena, for the patronage of the country, the sea-god is represented as having to retire vanquished before the giver of the olive; and at a later period the evidences of this contention were found in an ancient olive tree in the Acropolis, together with three holes in the rock, said to have been made by the trident of Poseidon, and to be connected with a salt well hard by. The fig also found its favourite home in this country, for Demeter was said to have bestowed it as a gift on the Eleusinian Phytalus, *i.e.* "the gardener." Both Cithaeron and Parnes must have been wooded in former times; for on the former are laid the picturesque silvan scenes in the *Bacchae* of Euripides, and it was from the latter that the wood came which caused the neighbouring deme of Acharnae to be famous for its charcoal—the ἄνθρακες Παρνήσιοι of the *Acharnians* of Aristophanes (348).

Minerals. From the thymy slopes of Hymettus came the famous Hymettian honey. Among the other products we must notice the marble—both that of Pentelicus, which afforded a material of unrivalled purity and whiteness for building the Athenian temples, and the blue marble of Hymettus—the *trabes Hymettiae* of Horace—which used to be transported to Rome for the construction of palaces. But the richest of all the sources of wealth in Attica was the silver mines of Laurium, the yield of which was so considerable as to render silver the principal medium of exchange in Greece, so that "a silver piece" (ἀργύριον) was the Greek equivalent term for money. Hence Aeschylus speaks of the Athenians as possessing a "fountain of silver" (*Pers.* 235), and Aristophanes makes his chorus of birds promise the audience that, if they show him favour, owls from Laurium (*i.e.* silver pieces with the emblem of Athens) shall never fail them (*Birds*, 1106). The reputation of these coins for purity of metal and accuracy of weight was so great that they had a very wide circulation, and in consequence it was thought undesirable to make any alteration in the types lest their genuineness should be doubted. This accounts for the somewhat inartistic character which the Athenian coins maintained to the last (see further Numismatics: *Greek*, § Athens). In Strabo's time, though the mines had almost ceased to yield, silver was obtained in considerable quantities from the scoriae; and at the present day a large amount of lead is got in the same way, the work being chiefly carried on by two companies, one of which is French and the ether Greek. In the ancient workings, many of which are in the same condition as they were left 1800 years ago, there are in all 2000 shafts and galleries.

Plain of Megara. It has been already mentioned that the base line of Attica is formed by the chain of Cithaeron and Parnes, running from west to east; and that from this transverse chains run southward, dividing Attica into a succession of plains. The westernmost of these, which is separated from the innermost bay of the Corinthian Gulf, called the Mare Alcyonium, by an offshoot of Cithaeron, and is bounded on the east by a ridge which ends towards the Saronic Gulf in a striking two-horned peak called Kerata, is the plain of Megara. It is only for geographical purposes that we include this district under Attica, for both the Dorian race of the inhabitants, and its dangerous proximity to Athens, caused it to be at perpetual feud with that city; but its position as an outpost for the Peloponnesians, together with the fact of its having once been Ionian soil, sufficiently explains the bitter hostility of the Athenians towards the Megarians. The great importance of Megara arose from its commanding all the passes into the Peloponnese. These were three in number: one along the shores of the Corinthian Gulf, which, owing to the nature of the ground, makes a long detour; the other two starting from Megara, and passing, the one by a lofty though gradual route over the ridge of Geraneia, the other along the Saronic Gulf, under the dangerous precipices of the Scironian rocks.

Plain of Eleusis. To the east of the plain of Megara lies that of Eleusis, bounded on the one side by the chain of Kerata, and on the other by that of Aegaleos, through a depression in which was the line of the sacred way, where the torchlight processions from Athens used to descend to the coast, the "brightly gleaming shores" (λαμπάδες ἀκταί) of Sophocles (*Oed. Col.* 1049). The deep bay which here runs into the land is bounded on its southern side by the rocky island of Salamis, which was at all times an important possession to the Athenians on account of its proximity to their city; and the winding channel which separates that island from the mainland in the direction of the Peiraeus was the scene of the battle of Salamis, while on the last declivities of Mt. Aegaleos, which here descends to the sea, was the spot where, as Byron wrote—

> "A king sate on the rocky brow
> Which looks o'er sea-born Salamis."

The eastern portion of the plain of Eleusis was called the Thriasian plain, and the city itself was situated in the recesses of the bay just mentioned.

Plain of Athens. Next in order to the plain of Eleusis came that of Athens, which is the most extensive of all, reaching from the foot of Parnes to the sea, and bounded on the west by Aegaleos, and on the east by Hymettus. Its most conspicuous feature is the broad line of dark green along its western side, formed by the olive-groves of Colonus and the gardens of the Academy, which owe their fertility to the waters of the Cephisus. This river is fed by copious sources on the side of Mt. Parnes, and thus,

unlike the other rivers of Attica, has a constant supply of water, which was diverted in classical times, as it still is, into the neighbouring plantations (cf. Sophocles, *Oed. Col.* 685). The position of Colonus itself is marked by two bare knolls of light-coloured earth, which caused the poet in the same chorus to apply the epithet "white" (ἀργῆτα) to that place. On the opposite side of the plain runs the other river, the Ilissus, which rises from two sources on the side of Mt. Hymettus, and skirts the eastern extremity of the city of Athens; but this, notwithstanding its celebrity, is a mere brook, which stands in pools a great part of the year, and in summer is completely dry. The situation of Athens relatively to the surrounding objects is singularly harmonious; for, while it forms a central point, so as to be the eye of the plain, and while the altar-rock of the Acropolis and the hills by which it is surrounded are conspicuous from every point of view, there is no such exactness in its position as to give formality, since it is nearer to the sea than to Parnes, and nearer to Hymettus than to Aegaleos. The most striking summit in the neighbourhood of the city is that of Lycabettus, on the north-eastern side; and the variety is still further increased by the continuation of the ridge which it forms for some distance northwards through the plain. Three roads lead to Athens from the Boeotian frontier over the intervening mountain barrier—the easternmost over Parnes, from Delium and Oropus by Decelea, which was the usual route of the invading Lacedaemonians during the Peloponnesian War; the westernmost over Cithaeron, by the pass of Dryoscephalae, or the "Oakheads," leading from Thebes by Plataea to Eleusis, and so to Athens, which we hear of in connexion with the battle of Plataea, and with the escape of the Plataeans at the time of the siege of that city in the Peloponnesian War; the third, midway between the two, by the pass of Phyle, near the summit of which, on a rugged height overlooking the Athenian plain, is the fort occupied by Thrasybulus in the days of the Thirty Tyrants. On the sea-coast to the south-west of Athens rises the hill of Munychia, a mass of rocky ground, forming the acropolis of the town of Peiraeus. It was probably at one time an island; this was Strabo's opinion, and at the present day the ground which joins it to the mainland is low and swampy, and seems to have been formed by alluvial soil brought down by the Cephisus. On one side of this, towards Hymettus, lay the open roadstead of Phalerum, on the other the harbour of Peiraeus, a completely land-locked inlet, safe, deep and spacious, the approach to which was still further narrowed by moles. The eastern side of the hill was further indented by two small but commodious havens, which were respectively called Zea and Munychia. 884

Eastern Attica.

The north-eastern boundary of the plain of Athens is formed by the graceful pyramid of Pentelicus, which received its name from the deme of Pentele at its foot, but was far more commonly known as Brilessus in ancient times. This mountain did not form a continous chain with Hymettus, for between them intervenes a level space of ground 2 m. in width, which formed the entrance to the Mesogaea, an elevated undulating plain in the midst of the mountains, reaching nearly to Sunium. At the extremity of Hymettus, where it projects into the Saronic Gulf, was the promontory of Zoster ("the Girdle"), which was so called because it girdles and protects the neighbouring harbour; but in consequence of the name, a legend was attached to it, to the effect that Latona had loosed her girdle there. From this promontory to Sunium there runs a lower line of mountains, and between these and the sea a fertile strip of land intervenes, which was called the Paralia. Beyond Sunium, on the eastern coast, were two safe ports, that of Thoricus, which is defended by the island of Helene, forming a natural breakwater in front of it, and that of Prasiac, now called Porto Raphti ("the Tailor"), from a statue at the entrance to which the natives have given that name. In the north-east corner is the little plain of Marathon (*q.v.*), the scene of the battle against the Persians (490 B.C.). It lies between Parnes, Pentelicus and the sea. The bay in front is sheltered by Euboea, and on the north by a projecting tongue of land, called Cynosura. The mountains in the neighbourhood were the home of the Diacrii or Hyperacrii, who, being poor mountaineers, and having nothing to lose, were the principal advocates of political reform; while, on the other hand, the Pedieis, or inhabitants of the plains, being wealthy landholders, formed the strong conservative element, and the Parali, or occupants of the sea-coast, representing the mercantile interest, held an intermediate position between the two (see CLEISTHENES). Finally, there was one district of Attica, the territory of Oropus, which properly belonged to Boeotia, as it was situated to the north of Parnes; but on this the Athenians always endeavoured to retain a firm hold, because it facilitated their communications with Euboea. The command of that island was of the utmost importance to them; for, if Aegina could rightly be called "the eyesore of the Peiraeus," Euboea was quite as truly a thorn in the side of Attica; for we learn from Demosthenes (*De Cor.* p. 307) that at one period the pirates that made it their headquarters so infested the neighbouring sea as to prevent all navigation.

Excavations.

The place in Attica which has been the chief scene of excavations (independently of Athens and its vicinity) is Eleusis (*q.v.*), where the remains of the sanctuary of Demeter, the home of the Eleusinian Mysteries, together with other buildings in its neighbourhood, were cleared by the Greek Archaeological Society in 1882-1887 and 1895-1896. Of the other classical ruins in Attica the best-known is the temple of Athena at Sunium, which forms a conspicuous object on the headland, to which it gave the name of Cape Colonnae, still used by the peasants. It is in the Doric style, of white marble, and eleven columns of the peristyle and one of the pronaos are now standing. At Thoricus there is a theatre, which was cleared of earth by the archaeologists of the American School in 1886. In the neighbourhood of Rhamnus are the remains of two temples that stood side by side, the larger of which was dedicated to Nemesis, the smaller probably to Themis, of which goddess a fine statue was discovered in its ruins in the course of the excavations of the Greek Archaeological Society in 1890. The same Society, in 1884,1886 and 1887, excavated the sanctuary of Amphiaraus, 4 m. from Oropus; in ancient times this was the resort of numerous invalids, who came thither to consult the healing divinity. Within it were found a temple of Amphiaraus, a large altar, and a long colonnade, which may have been the dormitory where the patients slept in hope of obtaining counsel in dreams. There were also baths and a small theatre, and numerous inscriptions relating to the arrangement and observances of the sanctuary and oracle. The walls and towers also of the city of Eleutherae and the fortress of Phyle are fine specimens of Hellenic fortifications.

Of the condition of Attica in medieval and modern times little need be said, for it has followed for the most part the fortunes of Athens. The population, however, has undergone a great change, independently of the large admixture of Slavonic blood that has affected the Greeks of the mainland generally, by the immigration of Albanian colonists, who now occupy a great part of the country. The district formed part of the *nome* (administrative division) of Boeotia and Attica until 1899, when it became a separate *nome*.

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(H. F. T.)

ATTIC BASE, the term given in architecture to the base of the Roman Ionic order, consisting of an upper and lower torus, separated by a scotia (*q.v.*) and fillets. It was the favourite base of the Romans, and was employed by them for columns of the Corinthian and Composite orders, and in Byzantine and Romanesque work would seem to have been generally adopted as a model.

ATTICUS, TITUS POMPONIUS (109-32 B.C.), Roman patron of letters, was born at Rome three years before Cicero, with whom he and the younger Marius were educated. His name was Titus Pomponius, that of Atticus, by which he is known, being given him afterwards from his long residence in Athens (86-65) and his intimate acquaintance with the Greek literature and language. His family is said to have been of noble and ancient descent; his father belonged to the equestrian order, and was very wealthy. When Pomponius was still a young man his father died, and he at once took the prudent resolution of transferring himself and his fortune to Athens, in order to escape the dangers of the civil war, in which he might have been involved through his connexion with the murdered tribune, Sulpicius Rufus. Here he lived in retirement, devoting himself entirely to study. On his return to Rome, he took possession of an inheritance left him by his uncle and assumed the name of Quintus Caecilius Pomponianus. From this time he kept aloof from political strife, attaching himself to no particular party, and continuing on intimate terms with men so opposed as Caesar and Pompey, Antony and Octavian. His most intimate friend, however, was Cicero, whose correspondence with him extended over many years, and who seems to have found his prudent counsel and sympathy a remedy for all his many troubles. His private life was tranquil and happy. He 885

did not marry till he was fifty-three years of age, and his only child became the wife of Marcus Vipsanius Agrippa, the distinguished minister of Augustus. In 32, being seized with an illness believed to be incurable, he starved himself to death. Of his writings none is extant, but mention is made of two: a Greek history of Cicero's consulship, and some annals, in Latin, an epitome of the events of Roman history down to the year 54. His most important work was his edition of the letters addressed to him by Cicero. He also formed a large library at Athens, and engaged a staff of slaves to make copies of valuable works.

See Life by Cornelius Nepos; Berwick, *Lives of Messalla Corvinus and T.P.A.* (1813); Fialon, *Thesis in T.P.A.* (1861); Boissier, *Cicéron et ses amis* (1888: Eng. trans. A.D. Jones, 1897); Peter, *Historicorum Romanorum Fragmenta.*

ATTICUS HERODES, TIBERIUS CLAUDIUS (*c.* A.D. 101-177), Greek rhetorician, was born at Marathon in Attica. He belonged to a wealthy and distinguished family, and received a careful education under the most distinguished masters of the time, especially in rhetoric and philosophy. His talents gained him the favourable notice of Hadrian, who appointed him praefect of the free towns in the province of Asia (125). On his return to Athens, he attained great celebrity as an orator and teacher of rhetoric, and was elected to the office of archon. In 140 he was summoned by Antoninus Pius to undertake the education of Marcus Aurelius and Lucius Verus, and received many marks of favour, amongst them the consulship (143). He is principally celebrated, however, for the vast sums he expended on public purposes. He built at Athens a great race-course of Pentelic marble, and a splendid musical theatre, called the Odeum in memory of his wife Regilla, which still exists. At Corinth he built a theatre, at Delphi a stadium, at Thermopylae hot baths, at Canusium in Italy an aqueduct. He even contemplated cutting a canal through the Isthmus of Corinth, but was afraid to carry out his plan because the same thing had been unsuccessfully attempted before by the emperor Nero. Many of the partially ruined cities of Greece were restored by Atticus, and numerous inscriptions testify their gratitude to their benefactor. His latter years were embittered by family misfortune, and having incurred the enmity of the Athenians, he withdrew from Athens to his villa near Marathon, where he died. He enjoyed a very high reputation amongst his contemporaries, and wrote numerous works, of which the only one to come down to us is a rhetorical exercise *On the Constitution* (ed. Hass, 1880), advocating an alliance of the Thebans and Peloponnesians against Archelaus, king of Macedonia. The genuineness of this speech, which is of little merit, has been disputed.

Philostratus, *Vit. Soph.* ii. 1; Fiorillo, *Herodis Attici quae supersunt* (1801); *A Biographical Notice of A.H.* (London, 1832), privately printed; Fuelles, *De Herodis Attici Vita* (1864); Vidal-Lablache, *Hérode Atticus* (1871).

ATTILA (d. 453), king of the Huns, became king in 433, along with his brother Bleda, on the death of his uncle Roua. We hear but little as to Bleda, who died about 445, possibly slain by his brother's orders. In the first eight years of his reign Attila was chiefly occupied in the wars with other barbarian tribes, by which he made himself virtually supreme in central Europe. His own special kingdom comprised the countries which are now called Hungary and Transylvania, his capital being possibly not far from the modern city of Buda-Pest; but having made the Ostrogoths, the Gepidae and many other Teutonic tribes his subject-allies, and having also sent his invading armies into Media, he seems for nearly twenty years to have ruled practically without a rival from the Caspian to the Rhine. Very early in his reign, Honoria, grand-daughter of the emperor Theodosius II., being subjected to severe restraint on account of an amorous intrigue with one of the chamberlains of the palace, sent her ring to the king of the Huns and called on him to be her husband and her deliverer. Nothing came of the proposed engagement, but the wrongs of Honoria, his affianced wife, served as a convenient pretext for some of the constantly recurring embassies with which Attila, fond of trampling on the fallen majesty of Rome, worried and bullied the two courts of Constantinople and Ravenna. Another frequent subject of complaint was found in certain sacred vessels which the bishop of Sirmium had sent as a bribe to the secretary of Attila, and which had been by him, fraudulently, as his master contended, pawned to a silversmith at Rome. There were also frequent and imperious demands for the surrender of fugitives who had sought shelter from the wrath of Attila within the limits of the empire. One of the return embassies from Constantinople, that sent in 448, had the great advantage of being accompanied by a rhetorician named Priscus, whose minute journalistic account of the negotiations, including as it does a vivid picture of the great Hun in his banquet-hall, is by far the most valuable source of information as to the court and camp of Attila. What lends additional interest to the story is the fact that in the ambassador's suite there was an interpreter named Vigilas, who for fifty pounds of gold had promised to assassinate Attila. This base design was discovered by the Hunnish king, but had never been revealed to the head of the embassy or to his secretary. The situations created by this strange combination of honest diplomacy and secret villainy are described by Priscus with real dramatic power.

In 450 Theodosius II., the incapable emperor of the East, died, and his throne was occupied by a veteran soldier named Marcian, who answered the insulting message of Attila in a manlier tone than his predecessor. Accordingly the Hun, who had something of the bully in his nature, now turned upon Valentinian III., the trembling emperor of the West, and demanded redress for the wrongs of Honoria, and one-half of Valentinian's dominions as her dowry. Allying himself with the Franks and Vandals, he led his vast many-nationed army to the Rhine in the spring of 451, crossed that river, and sacked, apparently, most of the cities in Belgic Gaul. Most fortunately for Europe, the Teutonic races already settled in Gaul rallied to the defence of the empire against invaders infinitely more barbarous than themselves. Prominent in this new coalition was Theodoric, king of the Visigoths, whose capital city was Toulouse. His firm fighting alliance with the Roman general Aëtius, with whom he had had many a conflict in previous years, was one of the best auguries for the new Europe that was to arise out of the ruins of the Roman empire. Meanwhile Attila had reached the Loire and was besieging the strong city of Orléans. The citizens, under the leadership of their bishop Anianus, made a heroic defence, but the place was on the point of being taken when, on the 24th of June, the allied Romano-Gothic army was seen on the horizon. Attila, who knew the difficulty that he should have in feeding his immense army if his march was further delayed, turned again to the north-east, was persuaded by the venerable bishop Lupus to spare the city of Troyes, but halted near that place in the Catalaunian plains and offered battle to his pursuers Aëtius and Theodoric. The battle which followed—certainly one of the decisive battles of the world—has been well described by the Gothic historian Jordanes as "ruthless, manifold, immense, obstinate." It lasted for the whole day, and the number of the slain is variously stated at 175,000 and 300,000. All such estimates are, of course, untrustworthy, but there is no doubt that the carnage was terrible. The Visigothic king was slain, but the victory, though hardly earned, remained with his people and his allies. Attila did not venture to renew the engagement on the morrow, but retreated, apparently in good order, on the Rhine, recrossed that river and returned to his Pannonian home. From thence in the spring of 452 he again set forth to ravage or to conquer Italy. Her great champion Aëtius showed less energy in her cause than he had shown in his defence of Gaul. After a stubborn contest, Attila took and utterly destroyed Aquileia, the chief city of Venetia, and then proceeded on his destructive course, capturing and burning the cities at the head of the Adriatic, Concordia, Altinum and Patavium (Padua). The fugitives from these cities, but especially from the last, seeking shelter in the lagoons of the Adriatic, laid the foundations of that which was one day to become the glorious city of Venice. Upon Milan and the cities of western Lombardy the hand of Attila seems to have weighed more lightly, plundering rather than utterly destroying; and at last when Pope Leo I., at the head of a deputation of Roman senators, appeared in his camp on the banks of the Mincio, entreating him not to pursue his victorious career to the gates of Rome, he yielded to their entreaties and consented to cross the Alps, with a menace, however, of future return, should the wrongs of Honoria remain unredressed. As he himself jokingly said: he knew how to conquer men, but the Lion and the Wolf (Leo and Lupus) were too strong for him. No further expeditions to Italy were undertaken by Attila, who died suddenly in 453, in the night following a great banquet which celebrated his marriage with a damsel named Ildico. Notwithstanding some rumours of violence it is probable that his death was natural and due to his own intemperate habits.

Under his name of Etzel, Attila plays a great part in Teutonic legend (see Nibelungenlied) and under that of Atli in Scandinavian Saga, but his historic lineaments are greatly obscured in both. He was short of stature, swarthy and broad-chested, with a large head which early turned grey, snub nose and deep-set eyes. He walked with proud step, darting a haughty glance this way and that as if he felt himself lord of all.

The chief authorities for the life of Attila are Priscus, Jordanes, the *Historia Miscella*, Apollonius Sidonius and Gregory of Tours.

(T. H.)

ATTIS, or Atys, a deity worshipped in Phrygia, and later throughout the Roman empire, in conjunction with the Great Mother of the Gods. Like Aphrodite and Adonis in Syria, Baal and Astarte at Sidon, and Isis and Osiris in Egypt, the Great Mother and Attis formed a duality which symbolized the relations between Mother Earth and her fruitage. Their worship included the celebration of mysteries annually on the return of the spring season. Attis was also known as Papas, and the Bithynians and Phrygians, according to evidence of the time of the late Empire, called him Zeus. He was never worshipped independently, however, though the worship of the Great Mother was not always accompanied by his. He was confused with Pan, Sabazios, Men and Adonis, and there were resemblances between the orgiastic features of his worship and that of Dionysus. His resemblance to Adonis has led to the theory that the names of the two are identical, and that Attis is only the Semitic companion of Syrian Aphrodite grafted on to the Phrygian Great Mother worship (Haakh, *Stuttgarter-Philolog.-Vers.*, 1857, 176 ff.). It is likely, however, that Attis, like the Great Mother, was indigenous to Asia Minor, adopted by the invading Phrygians, and blended by them with a deity of their own.

Legends.—According to Pausanias (vii. 17), Attis was a beautiful youth born of the daughter of the river Sangarius, who was descended from the hermaphroditic Agdistis, a monster sprung from the earth by the seed of Zeus. Having become enamoured of Attis, Agdistis struck him with frenzy as he was about to wed the king's daughter, with the result that he deprived himself of manhood and died. Agdistis in repentance prevailed upon Zeus to grant that the body of the youth should never decay or waste. In Arnobius (v. 5-8) Attis emasculates himself under a pine tree, which the Great Mother bears into her cave as she and Agdistis together wildly lament the death of the youth. Zeus grants the petition as in the version of Pausanias, but permits the hair of Attis to grow, and his little finger to move. The little finger, *digitus*, δάκτυλος, is interpreted as the phallus by Georg Kaibel (*Gottinger Nachrichten*, 1901, p. 513). In Diodorus (in. 58, 59) the Mother is the carnal lover of Attis, and, when her father the king discovers her fault and kills her lover, roams the earth in wild grief. In Ovid (*Fasti*, iv. 223 ff.) she is inspired with chaste love for him, which he pledges himself to reciprocate. On his proving unfaithful, the Great Mother slays the nymph with whom he has sinned, whereupon in madness he mutilates himself as a penalty. Another form of the legend (Paus. vii. 17), showing the influence of the Aphrodite-Adonis myth, relates that Attis, the impotent son of the Phrygian Caläust Lydia to institute the worship of the Great Mother, and was there slain by a boar sent by Zeus.

See Great Mother of the Gods; J.G. Frazer, *Adonis, Attis, Osiris* (1906).

(G. Sn.)

ATTLEBOROUGH, a township of Bristol county, in south-east Massachusetts, U.S.A. Pop. (1890) 7577; (1900) 11,335, of whom 3237 were foreign-born; (1910 census) 16,215 It is traversed by the New York, New Haven & Hartford railway, and by inter-urban electric lines. It has an area of 28 sq. m. The population is largely concentrated in and about the village which bears the name of the township. In Attleborough are the Attleborough Home Sanitarium, and a public library (1885). The principal manufactures of the township are jewelry, silverware, cotton goods, cotton machinery, coffin trimmings, and leather. In 1905 the total value of the township's factory products was $10,050,384, of which $5,544,285 was the value of jewelry, Attleborough ranking fourth among the cities of the country in this industry, and producing 10.4% of the total jewelry product of the United States. Attleborough was incorporated in 1694, though settled soon after 1661 (records since 1672) as part of Rehoboth. In 1887 the township was divided in population, wealth and area by the creation of the township of North Attleborough—pop. (1890) 6727; (1900) 7253, of whom 1786 were foreign-born; (1905, state census) 7878. This township produced manufactured goods in 1900 to the value of $3,990,731, jewelry valued at $2,785,567; it maintains the Richards memorial library.

See J. Daggett, *A Sketch of the History of Attleborough to 1887* (Boston, 1894).

ATTOCK, a town and fort of British India, in the Rawalpindi district of the Punjab, 47 m. by rail from Peshawar, and situated on the eastern bank of the Indus. Pop. (1901) 2822. The place is of both political and commercial importance, as the Indus is here crossed by the military and trade route through the Khyber Pass into Afghanistan. Alexander the Great, Tamerlane and Nadir Shah are believed to have successively crossed the Indus at or about this spot in their respective invasions of India. The river runs past Attock in a deep rapid channel about 200 yds. broad, but is easily crossed in boats or on inflated skins of oxen. The rocky gorges through which it flows, with a distant view of the Hindu Kush, form some of the finest scenery in the world. In 1883 an iron girder bridge of five spans was opened, which carries the North-Western railway to Peshawar, and has also a subway for wheeled traffic and foot passengers. The fort of Attock was built by the emperor Akbar in 1581, on a low hillock beside the river. The walls are of polished stone, and the whole structure is handsome; but from a military point of view it is of little importance, being commanded by a hill, from which it is divided only by a ravine. On the opposite side of the river is the village of Khairabad, with a fort, also erected by Akbar according to some, or by Nadir Shah according to others. The military importance of Attock has diminished, but it still has a small detachment of British troops.

ATTORNEY (from O. Fr. *atorné*, a person appointed to act for another, from *atourner*, legal Lat. *attornare*, attorn, literally to turn over to another or commit business to another), in English law, in its widest sense, any substitute or agent appointed to act in "the turn, stead or place of another." Attorneys are of two kinds, attorneys-in-fact and attorneys-at-law. An attorney-in-fact is simply an agent, the extent of whose capacity to act is bounded only by the powers embodied in his authority, his *power of attorney*. An attorney-at-law was a public officer, conducting legal proceedings on behalf of others, known as his clients, and attached to the supreme courts of common law at Westminster. Attorneys-at-law corresponded to the solicitors of the courts of chancery and the proctors of the admiralty, ecclesiastical, probate and divorce courts. Since the passing of the Judicature Act of 1873, however, the designation "attorney" has become obsolete in England, all persons admitted as solicitors, attorneys or proctors of an English court being henceforth called "solicitors of the supreme court" (see Solicitor).

In the United States an attorney-at-law exercises all the functions distributed in England between barristers, attorneys and solicitors, and his full title is "attorney and counsellor-at-law." When acting in a court of admiralty he is styled "proctor" or "advocate." Formerly, in some states, there existed a grade among lawyers of attorneys-at-law, which was inferior to that of counsellors-at-law, and in colonial times New Jersey established a higher rank still—that of serjeant-at-law. Now the term attorney-at-law is precisely equivalent to that of lawyer. Attorneys are admitted by some court to which the legislature confides the power, and on examination prescribed by the court, or by a board of state examiners, as the case may be. The term of study required is generally two or three years, but in some states less. In one no examination is required. College graduates are often admitted to examination after a shorter term of study than that required from those not so educated. In the courts of the United States, admission is regulated by rules of court and based upon a previous admission to the state bar. In almost all states aliens are not admitted as attorneys, and in many states women are ineligible, but during recent years several states have passed statutes permitting them to practise. Since 1879 women have been eligible to practise before the U.S. Supreme Court, if already admitted to practise in some state court, under the same conditions as men. A *state attorney* or *district attorney* is the local public prosecutor. He is either elected by popular vote at the state elections for the district in which he resides and goes out of office with the political party for which he was elected, or he is appointed by the governor of the state

for that district and for the same term. He represents the state in criminal prosecutions and also in civil actions within his district. There is a *United States district attorney* in each federal district, similarly representing the federal government before the courts.

An attorney is an officer of the court which admits him to practise, and he is subject to its discipline. He is liable to his client in damages for failure to exercise ordinary care and skill, and he can bring action for the value of his services. He has a lien on his client's papers, and usually on any judgment in favour of his client to secure the payment of his fees. (See also under BAR, THE.)

ATTORNEY-GENERAL, in England, the chief law officer appointed to manage all the legal affairs and suits in which the crown is interested. He is appointed by letters-patent authorizing him to hold office during the sovereign's pleasure. He is *ex officio* the leader of the bar, and only counsel of the highest eminence are appointed to the office. The origin of the office is uncertain, but as far back as 1277 we find an *attornatus regis* appointed to look after the interests of the crown, in proceedings affecting it before the courts. He has precedence in all the courts, and in the House of Lords he has precedence of the lord advocate, even in Scottish appeals, but unlike the lord advocate and the Irish attorney-general he is not necessarily made a privy councillor. He is a necessary party to all proceedings affecting the crown, and has extensive powers of control in matters relating to charities, lunatics' estates, criminal prosecutions, &c. The attorney-general and the solicitor-general are always members of the House of Commons (except for temporary difficulties in obtaining a seat) and of the ministry, being selected from the party in power, and their advice is at the disposal of the government and of each department of the government, while in the House of Commons they defend the legality of ministerial action if called in question. Previously to 1895 there was no restriction placed on the law officers as to their acceptance of private practice, but since that date this privilege has been withdrawn, and the salary of the attorney-general is fixed at £7000 a year and in addition such fees according to the ordinary professional scales as he may receive for any litigious business he may conduct on behalf of the crown. The crown has also as a legal adviser an attorney-general in Ireland. In Scotland he is called lord advocate (*q.v.*). There is also an attorney-general in almost all the British colonies, and his duties are very similar to those of the same officer in England. In the self-governing colonies he is appointed by the administration of the colony, and in the crown colonies by royal warrant under the signet and sign-manual. There is an attorney-general for the duchy of Cornwall and also one for the duchy of Lancaster, each of whom sues in matters relating to that duchy.

The United States has an officer of this name, who has a seat in the cabinet. His duties are in general to represent the federal government before the United States Supreme Court, to advise the president on questions of law, and to advise similarly the heads of the state departments with reference to matters affecting their department. His opinions are published by the government periodically for the use of its officials and they are frequently cited by the courts. Every state but one or two has a similar officer. He represents the state in important legal matters, and is often required to assist the local prosecutor in trials for capital offences. He appears for the public interest in suits affecting public charities. He is generally elected by the people for the same term as the governor and on the same ticket.

ATTORNMENT (from Fr. *tourner*, to turn), in English real property law, the acknowledgment of a new lord by the tenant on the alienation of land. Under the feudal system, the relations of landlord and tenant were to a certain extent reciprocal. So it was considered unreasonable to the tenant to subject him to a new lord without his own approval, and it thus came about that alienation could not take place without the consent of the tenant. Attornment was also extended to all cases of lessees for life or for years. The necessity for attornment was abolished by an act of 1705. The term is now used to indicate an acknowledgment of the existence of the relationship of landlord and tenant. An attornment-clause, in mortgages, is a clause whereby the mortgagor attorns tenant to the mortgagee, thus giving the mortgagee the right to distrain, as an additional security.

ATTRITION (Lat. *attritio*, formed from *atterere*, to rub away), a rubbing away; a term used in pathology and geology. Theologians have also distinguished "attrition" from "contrition" in the matter of sin, as an imperfect stage in the process of repentance; attrition being due to servile fear of the consequences of sin, contrition to filial fear of God and hatred of sin for His sake. It has been held among the Roman Catholics that in the sacrament of penance attrition becomes contrition.

ATTWOOD, THOMAS (1765-1838), English composer, the son of a coal merchant who had musical tastes, was born in London on the 23rd of November 1765. At the age of nine he became a chorister in the Chapel Royal, where he remained for five years. In 1783 he was sent to study abroad at the expense of the prince of Wales (afterwards George IV.), who had been favourably impressed by his skill at the harpsichord. After spending two years at Naples, Attwood proceeded to Vienna, where he became a favourite pupil of Mozart. On his return to London in 1787 he held for a short time an appointment as one of the chamber musicians to the prince of Wales. In 1796 he was chosen organist of St Paul's, and in the same year he was made composer to the Chapel Royal. His court connexion was further confirmed by his appointment as musical instructor to the duchess of York, and afterwards to the princess of Wales. For the coronation of George IV. he composed the anthem, "The King shall rejoice," a work of high merit. The king, who had neglected him for some years on account of his connexion with the princess of Wales, now restored him to favour, and in 1821 appointed him organist to his private chapel at Brighton. Soon after the institution of the Royal Academy of Music in 1823, Attwood was chosen one of the professors. He was also one of the original members of the Philharmonic Society, founded in 1813. He wrote the anthem, "O Lord, grant the King a Long Life," which was performed at the coronation of William IV., and he was composing a similar work for the coronation of Queen Victoria when he died at his house in Cheyne Walk, Chelsea, on the 24th of March 1838. He was buried under the organ in St Paul's cathedral. His services and anthems were published in a collected form after his death by his pupil Walmisley. Of his secular compositions several songs and glees are well known and popular. The numerous operas which he composed in early life are now practically forgotten. Of his songs the most popular was "The Soldier's Dream," and the best of his glees were "In peace Love tunes the shepherd's reed," and "To all that breathe the air of Heaven." Attwood was a friend of Mendelssohn, for whom he professed an admiration at a time when the young German's talent was little appreciated by the majority of English musicians.

ATTWOOD, THOMAS (1783-1856), English political reformer, was born at Halesowen, Worcestershire, on the 6th of October 1783. In 1800 he entered his father's banking business in Birmingham, where he was elected high bailiff in 1811. He took a leading part in the public life of the city, and became very popular with the artisan class. He is now remembered for his share in the movement which led to the carrying of the Reform Act of 1832. He was one of the founders, in January 1830, of the Political Union, branches of which

were soon formed throughout England. Under his leadership vast crowds of working-men met periodically in the neighbourhood of Birmingham to demonstrate in favour of reform of the franchise, and Attwood used his power over the multitude to repress any action on their part which might savour of illegality. His successful exertions in favour of reform made him a popular hero all over the country, and he was presented with the freedom of the city of London. After the passing of the Reform Act in 1832 he was elected one of the members for the new borough of Birmingham, for which he sat till 1839. He failed in the House of Commons to maintain the reputation which he had made outside it, for in addition to an eager partisanship in favour of every ultra-democratic movement, he was wearisomely persistent in advocating his peculiar monetary theory. This theory, which became with him a monomania, was that the existing currency should be rectified in favour of state-regulated and inconvertible paper-money, and the adoption of a system for altering the standard of value as prices fluctuated. His waning influence with his constituents led him to retire from parliament in 1837, and, though invited to re-enter political life in 1843, he had by that time become a thoroughly spent force. He died at Great Malvern on the 6th of March 1856.

His grandson, C.M. Wakefield, wrote his life “for private circulation” (there is a copy in the British Museum), and his economic theories are set forth in a little book, *Gemini*, by T.B. Wright and J. Harlow, published in 1844.

ATWOOD, GEORGE (1746-1807), English mathematician, was born in the early part of the year 1746. He entered Westminster school, and in 1759 was elected to a scholarship at Trinity College, Cambridge. He graduated in 1769, with the rank of third wrangler and first Smith’s prizeman. Subsequently he became a fellow and a tutor of the college, and in 1776 was elected a fellow of the Royal Society of London. In the year 1784 he left Cambridge, and soon afterwards received from William Pitt the office of a patent searcher of the customs, which required but little attendance, and enabled him to devote a considerable portion of his time to his special studies. He died in July 1807. Atwood’s published works, exclusive of papers contributed to the *Philosophical Transactions*, for one of which he obtained the Copley medal, are as follows:—*Analysis of a Course of Lectures on the Principles of Natural Philosophy* (Cambridge, 1784); *Treatise on the Rectilinear Motion and Rotation of Bodies* (Cambridge, 1784), which gives some interesting experiments, by means of which mechanical truths can be ocularly exhibited and demonstrated, and describes the machine, since called by Atwood’s name, for verifying experimentally the laws of simple acceleration of motion; *Review of the Statutes and Ordinances of Assize which have been established in England from the 4th year of King John, 1202, to the 37th of his present Majesty* (London, 1801), a work of some historical research; *Dissertation on the Construction and Properties of Arches* (London, 1801), with supplement, pt. i., 1801, pt. ii., 1804, an elaborate work, now completely superseded.

AUBADE (a French word from *aube*, the dawn), the dawn-song of the troubadours of Provence, developed by the Minnesingers (*q.v.*) of Germany into the *Tagelied*, the song of the parting at dawn of lovers at the warning of the watchman. In France in modern times the term is applied to the performance of a military band in the early morning in honour of some distinguished person.

AUBAGNE, a town of south-eastern France, in the department of Bouches-du-Rhône on the Huveaune, 11 m. E. of Marseilles by rail. Pop. (1906) 6039. The town carries on the manufacture of earthenware and pottery, leather, &c. and the cultivation of fruit and wine. There is a fountain to the memory of the statesman, F. Barthélemy (d. 1830), born at Aubagne.

AUBE, a department of north-eastern France, bounded N. by the department of Marne, N.W. by Seine-et-Marne, W. by Yonne, S. by Yonne and Cote-d’Or, and E. by Haute-Marne; it was formed in 1790 from Basse-Champagne, and a small portion of Burgundy. Area, 2326 sq. m. Pop. (1906) 243,670. The department belongs to the Seine basin, and is watered chiefly by the Seine and the Aube. These rivers follow the general slope of the department, which is from south-east, where the Bois du Mont (1200 ft.), the highest point, is situated, to north-west. The southern and eastern districts are fertile and well wooded. The remainder of the department, with the exception of a more broken and picturesque district in the extreme north-west, forms part of the sterile and monotonous plain known as Champagne Pouilleuse. The climate is mild but damp. The annual rainfall over the greater part varies from 24 to 28 in.; but in the extreme south-east it at times reaches a height of 36 in. Aube is an agricultural department; more than one third of its surface consists of arable land of which the chief products are wheat and oats, and next to them rye, barley and potatoes; vegetables are extensively cultivated in the valleys of the Seine and the Aube. The vine flourishes chiefly on the hills of the south-east; the wines of Les Riceys, Bar-sur-Aube, Bouilly and Laines-aux-Bois are most esteemed. The river valleys abound in natural pasture, and sainfoin, lucerne and other forage crops are largely grown; cattle-raising is an important source of wealth, and the cheeses of Troyes are well known. There are excellent nurseries and orchards in the neighbourhood of Troyes, Bar-sur-Seine, Méry-sur-Seine and Brienne. Chalk, from which *blanc de Troyes* is manufactured, and clay are abundant; and there are peat workings and quarries of building-stone and limestone. The spinning and weaving of cotton and the manufacture of hosiery, of both of which Troyes is the centre, are the main industries of the department; there are also a large number of distilleries, tanneries, oil works, tile and brick works, flour-mills, saw-mills and dye-works. The Eastern railway has works at Romilly, and there are iron works at Clairvaux and wire-drawing works at Plaines; but owing to the absence of coal and iron mines, metal working is of small importance. The exports of Aube consist of timber, cereals, agricultural products, hosiery, wine, dressed pork, &c.; its imports include wool and raw cotton, coal and machinery, especially looms. The department is served by the Eastern railway, of which the main line to Belfort crosses it. The river Aube is navigable for 28 m. (from Arcis-sur-Aube to its confluence with the Seine); the Canal de la Haute-Seine extends beside the Seine from Bar-sur-Seine to Marcilly (just outside the department) a distance of 46 m.; below Marcilly the Seine is canalized.

Aube is divided into 5 arrondissements with 26 cantons and 446 communes. It falls within the educational circumscription (*académie*) of Dijon and the military circumscription of the XX. army corps; its court of appeal is in Paris. It constitutes the diocese of Troyes and part of the archiepiscopal province of Sens. The capital of the department is Troyes; of the arrondissements the capitals are Troyes, Bar-sur-Aube, Arcis-sur-Aube, Bar-sur-Seine and Nogent-sur-Seine. The architecture of the department is chiefly displayed in its churches, many of which possess stained glass of the 16th century. Besides the cathedral and other churches of Troyes, those of Mussy-sur-Seine (13th century), Chaource (16th century) and Nogent-sur-Seine (15th and 16th centuries), are of note. The abbey buildings of Clairvaux are the type of the Cistercian abbey.

AUBENAS, a town of south-eastern France, in the department of Ardèche, 19 m. S.W. of Privas by road. Pop. (1906) 3976 (town), 7064 (commune). Aubenas is beautifully situated on the slope of a hill, on the right bank of the Ardèche, but its streets generally are

crooked and narrow. It has a castle of the 13th and 16th centuries, now occupied by several of the public institutions of the town. These include a tribunal and chamber of commerce, and a conditioning-house for silk. Iron and coal mines are worked in the vicinity. As the centre of the silk trade of southern France Aubenas is a place of considerable traffic. It has also a large silk spinning and weaving industry, and carries on tanning and various minor industries together with trade in silk. The district is rich in plantations of mulberries and olives.

AUBER, DANIEL FRANÇOIS ESPRIT (1782-1871), French musical composer, the son of a Paris printseller, was born at Caen in Normandy on the 29th of January 1782. Destined by his father to the pursuits of trade, he was allowed, nevertheless, to indulge his fondness for music, and learnt to play at an early age on several instruments, his first teacher being the Tirolean composer, I.A. Ladurner. Sent at the age of twenty to London to complete his business training, he was obliged to leave England in consequence of the breach of the treaty of Amiens (1804). He had already attempted musical composition, and at this period produced several *concertos pour basse*, in the manner of the violoncellist, Lamarre, in whose name they were published. The praise given to his concerto for the violin, which was played at the Conservatoire by Mazas, encouraged him to undertake the resetting of the old comic opera, *Julie* (1811). Conscious by this time of the need of regular study of his chosen art, he placed himself under the severe training of Cherubini, by which the special qualities of the young composer were admirably developed. In 1813 he made his *début* in an opera in one act, the *Séjour militaire*, the unfavourable reception of which put an end for some years to his attempts as composer. But the failure in business and death of his father, in 1819, compelled him once more to turn to music, and to make that which had been his pastime the serious employment of his life. He produced another opera, the *Testament et les billets-deux* (1819), which was no better received than the former. But he persevered, and the next year was rewarded by the complete success of his *Bergère châtelaine*, an opera in three acts. This was the first in a long series of brilliant successes. In 1822 began his long association with A.E. Scribe, who shared with him, as librettist, the success and growing popularity of his compositions. The opera of *Leicester*, in which they first worked together (1823), is remarkable also as showing evidences of the influence of Rossini. But his own style was an individual one, marked by lightness and facility, sparkling vivacity, grace and elegance, clear and piquant melody—characteristically French. In *La Muette de Portici*, familiarly known as *Masaniello*, Auber achieved his greatest musical triumph. Produced at Paris in 1828, it rapidly became a European favourite, and its overture, songs and choruses were everywhere heard. The duet, "Amour sacré de la patrie," was welcomed like a new *Marseillaise*; sung by Nourrit at Brussels in 1830, it became the signal for the revolution which broke out there. Of Auber's remaining operas (about 50 in all) the more important are: *Le Maçon* (1825), *La Fiancée* (1829), *Fra Diavolo* (1830), *Lestocq* (1834), *Le Cheval de bronze* (1835), *L'Ambassadrice* (1836), *Le Domino noir* (1837), *Le Lac des fées* (1839), *Les Diamants de la couronne* (1841), *Haydée* (1847), *Marco Spada* (1853), *Manon Lescaut* (1856), and *La Fiancée du roi des Garbes* (1864). Official and other dignities testified the public appreciation of Auber's works. In 1829 he was elected member of the Institute, in 1830 he was named director of the court concerts, and in 1842, at the wish of Louis Philippe, he succeeded Cherubini as director of the Conservatoire. He was also a member of the Legion of Honour from 1825, and attained the rank of commander in 1847. Napoleon III. made Auber his Imperial Maître de Chapelle in 1857.

One of Auber's latest compositions was a march, written for the opening of the International Exhibition in London in 1862. His fascinating manners, his witty sayings, and his ever-ready kindness and beneficence won for him a secure place in the respect and love of his fellow-citizens. He remained in his old home during the German siege of Paris, 1870-71, but the miseries of the Communist war which followed sickened his heart, and he died in Paris on the 13th of May 1871.

See Adolph Kohut, "Auber," vol. xvii. of *Musiker Biographien* (Leipzig, 1895).

AUBERGINE (diminutive of Fr. *auberge*, a variant of *alberge*, a kind of peach), or Egg Plant (*Solanum melongena*, var. *ovigerum*), a tender annual widely cultivated in the warmer parts of the earth, and in France and Italy, for the sake of its fruits, which are eaten as a vegetable. The seed should be sown early in February in a warm pit, where the plants are grown till shifted into 8-in. or 10-in. pots, in well-manured soil. Liquid manure should be given occasionally while the fruit is swelling; about four fruits are sufficient for one plant. The French growers sow them in a brisk heat in December, or early in January, and in March plant them out four or eight in a hot-bed with a bottom heat of from 60° to 68°, the sashes being gradually more widely opened as the season advances, until at about the end of May they may be taken off. The two main branches which are allowed are pinched to induce laterals, but when the fruits are set all young shoots are taken off in order to increase their size. The best variety is the large purple, which produces oblong fruit, sometimes reaching 6 or 7 in. in length and 10 or 12 in. in circumference. The fruit of the ordinary form almost exactly resembles the egg of the domestic fowl. It is also grown as an ornamental plant, for covering walls or trellises; especially the black-fruited kind.

AUBERVILLIERS, or Aubervilliers-les-Vertus, a town of northern France, in the department of Seine, on the canal St Denis, 2 m. from the right bank of the Seine and 1 m. N. of the fortifications of Paris. Pop. (1906) 33,358. Its manufactures include cardboard, glue, oils, colours, fertilizers, chemical products, perfumery, &c. During the middle ages and till modern times Aubervilliers was the resort of numerous pilgrims, who came to pay honour to Notre Dame des Vertus. In 1814 the locality was the scene of a stubborn combat between the French and the Allies.

AUBIGNAC, FRANÇOIS HÉDELIN, Abbé d' (1604-1676), French author, was born at Paris on the 4th of August 1604. His father practised at the Paris bar, and his mother was a daughter of the great surgeon Ambroise Paré. François Hédelin was educated for his father's profession, but, after practising for some time at Nemours he abandoned law, took holy orders, and was appointed tutor to one of Richelieu's nephews, the duc de Fronsac. This patronage secured for him the abbey of Aubignac and of Mainac. The death of the duc de Fronsac in 1646 put an end to hopes of further preferment, and the Abbé d'Aubignac retired to Nemours, occupying himself with literature till his death on the 25th of July 1676. He took an energetic share in the literary controversies of his time. Against Gilles Ménage he wrote a *Térence justifié* (1656); he laid claim to having originated the idea of the "*Carte de tendre*" of Mlle de Scudéry's *Clélie*; and after being a professed admirer of Corneille he turned against him because he had neglected to mention the abbé in his *Discours sur le poème dramatique*. He was the author of four tragedies: *La Cyminde* (1642), *La Pucelle d'Orléans* (1642), *Zénobie* (1647) and *Le Martyre de Sainte Catherine* (1650). *Zénobie* was written with the intention of affording a model in which the strict rules of the drama, as understood by the theorists, were observed. In the choice of subjects for his plays, he seems to have been guided by a desire to illustrate the various kinds of tragedy—patriotic, antique and religious. The dramatic authors whom he was in the habit of criticizing were not slow to take advantage of the opportunity for retaliation offered by the production of these mediocre plays. It is as a theorist that D'Aubignac still arrests attention. It has been proved that to Jean Chapelain belongs the credit of having been the first to establish as a practical law the convention of the unities that plays so large a part in the history of the French stage; but the laws of dramatic method and construction generally were codified by d'Aubignac in his *Pratique du théâtre.* The book was only published in 1657, but had been begun at the desire of Richelieu as early as 1640. His *Conjectures académiques sur l'Iliade d'Homère*, which was

not published until nearly forty years after his death, threw doubts on the existence of Homer, and anticipated in some sense the conclusions of Friedrich August Wolf in his *Prolegomena ad Homerum* (1795).

The contents of the *Pratique du théâtre* are summarized by F. Brunetière in his notice of Aubignac in the *Grande Encydopédie*. See also G. Saintsbury, *Hist. of Criticism*, bk. v., and H. Rigault, *Hist. de la querelle des anciens et modernes.* (1859).

AUBIGNÉ, CONSTANT D' [Baron de Surineau] (*c.* 1584-1647), French adventurer, was the son of Théodore Agrippa d'Aubigné, and the father of Madame de Maintenon. Born a Protestant, he became by turns Catholic or Protestant as it suited his interests. He betrayed the Protestants in 1626, revealing to the court, after a voyage to England, the projects of the English upon La Rochelle. He was renounced by his father; then imprisoned by Richelieu's orders at Niort, where he was detained ten years. After having tried his fortunes in the Antilles, he died in Provence, leaving in destitution his wife, Jeanne de Cardillac, whom he had married in 1627. He had two children, Charles, father of the duchess of Noailles, and Françoise, known in history as Madame de Maintenon.

See T. Lavallée, *La Famille d'Aubigné et l'enfance de Madame de Maintenon* (Paris, 1863).

AUBIGNÉ, JEAN HENRI MERLE D' (1794-1872), Swiss Protestant divine and historian, was born on the 16th of August 1794, at Eaux Vives, near Geneva. The ancestors of his father, Aimé Robert Merle d'Aubigné (1755-1799), were French Protestant refugees. Jean Henri was destined by his parents to a commercial life; but at college he decided to be ordained. He was profoundly influenced by Robert Haldane, the Scottish missionary and preacher who visited Geneva. When in 1817 he went abroad to further his education, Germany was about to celebrate the tercentenary of the Reformation; and thus early he conceived the ambition to write the history of that great epoch. At Berlin he received stimulus from teachers so unlike as J.A.W. Neander and W.M.L. de Wette. After presiding for five years over the French Protestant church at Hamburg, he was, in 1823, called to become pastor of a congregation in Brussels and preacher to the court. He became also president of the consistory of the French and German Protestant churches. At the Belgian revolution of 1830 he thought it advisable to undertake pastoral work at home rather than to accept an educational post in the family of the Dutch king. The Evangelical Society had been founded with the idea of promoting evangelical Christianity in Geneva and elsewhere, but it was found that there was also needed a theological school for the training of pastors. On his return to Switzerland, d'Aubigné was invited to become professor of church history in an institution of the kind, and continued to labour in the cause of evangelical Protestantism. In him the Evangelical Alliance found a hearty promoter. He frequently visited England, was made a D.C.L. by Oxford University, and received civic honours from the city of Edinburgh. He died suddenly in 1872.

His principal works are—*Discours sur l'étude de l'histoire de Christianisme* (Geneva, 1832); *Le Luthéranisme et la Réforme* (Paris, 1844); *Germany, England and Scotland, or Recollections of a Swiss Pastor* (London, 1848); *Trois siècles de lutte en Écosse, ou deux rois et deux royaumes; Le Protecteur ou la république d'Angleterre aux jours de Cromwell* (Paris, 1848); *Le Concile et l'infaillibilité* (1870); *Histoire de la Réformation au XVI*^{ième} *siècle* (Paris, 1835-1853; new ed:, 1861-1862, in 5 vols.); and *Histoire de la Réformation en Europe au temps de Calvin* (8 vols., 1862-1877).

The first portion of his *Histoire de la Réformation*, which was devoted to the earlier period of the movement in Germany, gave him at once a foremost place amongst modern French ecclesiastical historians, and was translated into most European tongues. The second portion, dealing with reform in the time of Calvin, was not less thorough, and had a subject hitherto less exhaustively treated, but it did not meet with the same success. This part of the subject, with which he was most competent to deal, was all but completed at the time of his death. Among his minor treatises, the most important are the vindication of the character and aims of Oliver Cromwell, and the sketch of the contendings of the Church of Scotland.

Indefatigable in sifting original documents, Aubigné had amassed a wealth of authentic information; but his desire to give in all cases a full and graphic picture, assisted by a vivid imagination, betrayed him into excess of detail concerning minor events, and in a few cases into filling up a narrative by inference from later conditions. Moreover, in his profound sympathy with the Reformers, he too frequently becomes their apologist. But his work is a monument of painstaking sincerity, and brings us into direct contact with the spirit of the period.

AUBIGNÉ, THÉODORE AGRIPPA D' (1552-1630), French poet and historian, was born at St Maury, near Pons, in Saintonge, on the 8th of February 1552. His name Agrippa (*aegre partus*) was given him through his mother dying in childbirth. In his childhood he showed a great aptitude for languages; according to his own account he knew Latin, Greek and Hebrew at six years of age; and he had translated the *Crito* of Plato before he was eleven. His father, a Huguenot who had been one of the conspirators of Amboise, strengthened his Protestant sympathies by showing him, while they were passing through that town on their way to Paris, the heads of the conspirators exposed upon the scaffold, and adjuring him not to spare his own head in order to avenge their death. After a brief residence he was obliged to flee from Paris to avoid persecution, but was captured and threatened with death. Escaping through the intervention of a friend, he went to Montargis. In his fourteenth year he was present at the siege of Orléans, at which his father was killed. His guardian sent him to Geneva, where he studied for a considerable time under the direction of Beza. In 1567 he made his escape from tutelage, and attached himself to the Huguenot army under the prince of Condé. Subsequently he joined Henry of Navarre, whom he succeeded in withdrawing from the corrupting influence of the house of Valois (1576), and to whom he rendered valuable service, both as a soldier and as a counsellor, in the wars that issued in his elevation to the throne as Henry IV. After a furious battle at Casteljaloux, and suffering from fever from his wounds, he wrote his *Tragiques* (1571). He was in the battle of Coutras (1587), and at the siege of Paris (1590). His career at camp and court, however, was a somewhat chequered one, owing to the roughness of his manner and the keenness of his criticisms, which made him many enemies and severely tried the king's patience. In his *tragédie-ballet Circe* (1576) he did not hesitate to indulge in the most outspoken sarcasm against the king and other members of the royal family. Though he more than once found it expedient to retire into private life he never entirely lost the favour of Henry, who made him governor of Maillezais. After the conversion of the king to Roman Catholicism, d'Aubigné remained true to the Huguenot cause, and a fearless advocate of the Huguenot interests. The first two volumes of the work by which he is best known, his *Histoire universelle depuis 1550 jusqu'à l'an 1601*, appeared in 1616 and 1618 respectively. The third volume was published in 1619, but, being still more free and personal in its satire than those which had preceded it, it was immediately ordered to be burned by the common hangman. The work is a lively chronicle of the incidents of camp and court life, and forms a very valuable source for the history of France during the period it embraces. In September 1620 its author was compelled to take refuge in Geneva, where he found a secure retreat for the last ten years of his life, though the hatred of the French court showed itself in procuring a sentence of death to be recorded against him more than once. He devoted the period of his exile to study, and the superintendence of works for the fortifications of Bern and Basel which were designed as a material defence of the cause of Protestantism. He died at Geneva on the 29th of April 1630.

A complete edition of his works according to the original MSS. was begun by E. Réaume and F. de Caussade (1879). It contains all the literary works, the *Aventures du baron de Faeneste* (1617), and the *Mémoires* (6 vols., 1873-1892). The best edition of the *Histoire universelle* is by A. de Ruble. The *Mémoires* were edited by L. Lalanne (1854).

AUBIN, a town of southern France, in the department of Aveyron on the Enne, 30 m. N.W. of Rodez. In 1906 the urban population was 2229, the communal population 9986. Aubin is the centre of important coal-mines worked in the middle ages, and also has iron-mines, the product of which supplies iron works close to the town. Sheep-breeding is important in the vicinity. The church dates from the 12th century.

AUBREY, JOHN (1626-1697), English antiquary, was born at Easton Pierse or Percy, near Malmesbury, Wiltshire, on the 12th of March 1626, his father being a country gentleman of considerable fortune. He was educated at the Malmesbury grammar school under Robert Latimer, who had numbered Thomas Hobbes among his earlier pupils, and at his schoolmaster's house Aubrey first met the philosopher about whom he was to leave so many curious and interesting details. He entered Trinity College, Oxford, in 1642, but his studies were interrupted by the Civil War. In 1646 he became a student of the Middle Temple, but was never called to the bar. He spent much of his time in the country, and in 1649 he brought into notice the megalithic remains at Avebury. His father died in 1652, leaving to Aubrey large estates, and with them, unfortunately, complicated lawsuits. Aubrey, however, lived gaily, and used his means to gratify his passion for the company of celebrities and for every sort of knowledge to be gleaned about them. Anthony à Wood prophesied that he would one day break his neck while running downstairs after a retreating guest, in the hope of extracting a story from him. He took no active share in the political troubles of the time, but from his description of a meeting of the Rota Club, founded by James Harrington, the author of *Oceana*, he appears to have been a theorizing republican. His reminiscences on this subject date from the Restoration, and are probably softened by considerations of expediency. In 1663 he became a member of the Royal Society, and in the next year he met Joan Somner, "in an ill hour," he tells us. This connexion did not end in marriage, and a lawsuit with the lady complicated his already embarrassed affairs. He lost estate after estate, until in 1670 he parted with his last piece of property, Easton Pierse. From this time he was dependent on the hospitality of his numerous friends. In 1667 he had made the acquaintance of Anthony à Wood at Oxford, and when Wood began to gather materials for his invaluable *Athenae Oxonienses*, Aubrey offered to collect information for him. From time to time he forwarded memoranda to him, and in 1680 he began to promise the "Minutes for Lives," which Wood was to use at his discretion. He left the task of verification largely to Wood. As a hanger-on in great houses he had little time for systematic work, and he wrote the "Lives" in the early morning while his hosts were sleeping off the effects of the dissipation of the night before. He constantly leaves blanks for dates and facts, and many queries. He made no attempt at a fair copy, and, when fresh information occurred to him, inserted it at random. He made some distinction between hearsay and authentic information, but had no pretence to accuracy, his retentive memory being the chief authority. The principal charm of his "Minutes" lies in the amusing details he has to recount about his personages, and in the plainness and truthfulness that he permits himself in face of established reputations. In 1592 he complained bitterly that Wood had destroyed forty pages of his MS., probably because of the dangerous freedom of Aubrey's pen. Wood Was prosecuted eventually for insinuations against the judicial integrity of the earl of Clarendon. One of the two statements called in question was certainly founded on information provided by Aubrey. This perhaps explains the estrangement between the two antiquaries and the ungrateful account that Wood gives of the elder man's character. "He was a shiftless person, roving and magotic-headed, and sometimes little better than crased. And being exceedingly credulous, would stuff his many letters sent to A.W. with follies and misinformations, which sometimes would guide him into the paths of error."[1] In 1673 Aubrey began his "Perambulation" or "Survey" of the county of Surrey, which was the result of many years' labour in collecting inscriptions and traditions in the country. He began a "History of his Native District of Northern Wiltshire," but, feeling that he was too old to finish it as he would wish, he made over his material, about 1695, to Thomas Tanner, afterwards bishop of St Asaph. In the next year he published his only completed, though certainly not his most valuable work, the *Miscellanies*, a collection of stories on ghosts and dreams. He died at Oxford in June 1697, and was buried in the church of St Mary Magdalene.

Beside the works already mentioned, his papers included: "Architectonica Sacra," notes on ecclesiastical antiquities; and "Life of Thomas Hobbes of Malmesbury," which served as the basis of Dr Blackburn's Latin life, and also of Wood's account. His survey of Surrey was incorporated in R. Rawlinson's *Natural History and Antiquities of Surrey* (1719); his antiquarian notes on Wiltshire were printed in *Wiltshire; the Topographical Collections of John Aubrey*, corrected and enlarged by J.E. Jackson (Devizes, 1862); part of another MS. on "The Natural History of Wiltshire" was printed by John Britton in 1847 for the Wiltshire Topographical Society; the *Miscellanies* were edited in 1890 for the *Library of Old Authors*; the "Minutes for Lives" were partially edited in 1813. A complete transcript, *Brief Lives chiefly of Contemporaries set down by John Aubrey between the Years 1669 and 1696*, was edited for the Clarendon Press in 1898 by the Rev. Andrew Clark from the MSS. in the Bodleian, Oxford.

See also John Britton, *Memoir of John Aubrey* (1845); David Masson, in the *British Quarterly Review*, July 1856; Émile Montégut, *Heures de lecture d'un critique* (1891); and a catalogue of Aubrey's collections in *The Life and Times of Anthony Wood* ..., by Andrew Clark (Oxford, 1891-1900, vol. iv. pp. 191-193), which contains many other references to Aubrey.

1 "Life of Anthony à Wood written by Himself" (*Athen. Oxon.*, ed. Bliss).

AUBURN, a city and the county-seat of Androscoggin county, Maine, U.S.A., on the Androscoggin river, opposite Lewiston (with which it practically forms an industrial unit), in the S.W. part of the state. Pop. (1890) 11,250; (1900) 12,951, of whom 2076 were foreign-born; (1910, census) 15,064. It is served by the Grand Trunk and the Maine Central railways. The river furnishes abundant water-power, and the city ranked fourth in the state as a manufacturing centre in 1905. Boots and shoes are the principal products; in 1905 seven-tenths of the city's wage-earners were engaged in their manufacture, and Auburn's output ($4,263,162 = 66.5% of the total factory product of the city) was one-third of that of the whole state. Other manufactures are butter, bread and other bakery products, cotton goods, furniture and leather. The municipality owns and operates its waterworks. Auburn was first settled in 1786, and was incorporated in 1842, but the present charter dates only from 1869.

AUBURN, a city and the county-seat of Cayuga county, New York, U.S.A., 25 m. S.W. of Syracuse, on an outlet of Owasco Lake. Pop. (1890) 25,858; (1900) 30,345, of whom 5436 were foreign-born, 2084 being from Ireland and 1023 from England; (1910) 34,668. It is served by the Lehigh Valley and the New York Central & Hudson River railways, and by inter-urban electric lines. The city is attractively situated amidst a group of low hills in the heart of the lake country of western New York; the streets are wide, with a profusion of shade trees. Auburn has a city hall, the large Burtis Auditorium, the Auburn hospital, two orphan asylums, and the Seymour library in the Case Memorial building. There is a fine bronze statue of William H. Seward, who made his home here after 1823, and was buried in Fort Hill Cemetery. In Auburn are the Auburn (State) prison (1816), in connexion with which there is a women's prison; the Auburn Theological Seminary (Presbyterian), founded in 1819, chartered in 1820, and opened for students in 1821; the Robinson school for girls; and the Women's Educational and Industrial Union, for the education of working girls, with a building erected in 1907. The city owns its water-supply system, the water being pumped from Owasco Lake, about 2½ m. S.S.E. of the city. There is a good water-power, and the city has important manufacturing interests. The principal manufactures are cordage and twine, agricultural implements, engines, pianos, boots and shoes, cotton and woollen goods, carpets and rugs, rubber goods, flour and machinery. The total factory product in 1905 was valued at $13,420,863; of this $2,890,301 was the value of agricultural implements, in the manufacture of which Auburn ranked fifth among the cities of the United States. There are a number of grey and blue limestone quarries, one of which is owned and operated by the municipality.

Settled soon after the close of the War of Independence, Auburn was laid out in 1793 by Captain John L. Hardenburgh, a veteran of

the war, and for some years was known as Hardenburgh's Corners. In 1805, when it was made the county-seat, it was renamed Auburn. It was incorporated in 1814, and was chartered as a city in 1848.

See C. Hawley, *Early Chapters of Cayuga History* (Auburn, 1879).

AUBURN (from the Low Lat. *alburnus*, whitish, light-coloured), ruddy-brown; the meaning has changed from the original one of brownish-white or light yellow (*citrinus*, in *Promptorium Parvulorum*), probably through the intensification of the idea of brown caused by the early spelling "abron" or "abrown."

AUBUSSON, PIERRE D' (1423-1503), grand-master of the order of St John of Jerusalem, and a zealous opponent of the Turks, was born in 1423. He belonged to a noble French family, and early devoted himself to the career of a soldier in the service of the emperor Sigismund. Under the archduke Albert of Austria he took part in a campaign against the Turks, and on his return to France sided with the Armagnacs against the Swiss, greatly distinguishing himself at the battle of St Jacob in 1444. He then joined the order of the knights of Rhodes, and successfully conducted an expedition against the pirates of the Levant and an embassy to Charles VII. He soon rose to the most important offices in the order, and in 1476 was elected grand-master. It was the period of the conquests of Mahommed II., who, supreme in the East, now began to threaten Europe. In December 1479 a large Turkish fleet appeared in sight of Rhodes; a landing was effected, and a vigorous attack made upon the city. But in July of the next year, being reinforced from Spain, the knights forced the Mussulmans to retire, leaving behind them 9000 dead. The siege, in which d'Aubusson was seriously wounded, enhanced his renown throughout Europe. Mahommed was furious, and would have attacked the island again but for his death in 1481. His succession was disputed between his sons Bayezid and Jem. The latter, after his defeat by Bayezid, sought refuge at Rhodes under a safe-conduct from the grand-master and the council of the knights. What followed remains a stain on d'Aubusson's memory. Rhodes not being considered secure, Jem with his own consent was sent to France. Meanwhile, in spite of the safe-conduct, d'Aubusson accepted an annuity of 45,000 ducats from the sultan; in return for which he undertook to guard Jem in such a way as to prevent his design of appealing to the Christian powers to aid him against his brother. For six years Jem, in spite of frequent efforts to escape, was kept a close prisoner in various castles of the Rhodian order in France, until in 1489 he was handed over to Pope Innocent VIII., who had been vying with the kings of Hungary and Naples for the possession of so valuable a political weapon. D'Aubusson's reward was a cardinal's hat (1489), and the power to confer all benefices connected with the order without the sanction of the papacy; the order of St John received the wealth of the suppressed orders of the Holy Sepulchre and St Lazarus. The remaining years of his life d'Aubusson spent in the attempt to restore discipline and zeal in his order, and to organize a grand international crusade against the Turks. The age of the Renaissance, with Alexander Borgia on the throne of St Peter, was, however, not favourable to such an enterprise; the death of Jem in 1495 had removed the most formidable weapon available against the sultan; and when in 1501 d'Aubusson led an expedition against Mytilene, dissensions among his motley host rendered it wholly abortive. The old man's last years were embittered by chagrin at his failure, which was hardly compensated by his success in extirpating Judaism in Rhodes, by expelling all adult Jews and forcibly baptizing their children. In the summer of 1503 he died.

See P. Bouhours, *Hist, de Pierre d'Aubusson* (Paris, 1676; Hague, 1793; abridged ed. Bruges, 1887); G.E. Streck, *Pierre d'Aubusson, Grossmeister*, &c. (Chemnitz, 1873); J.B. Bury in *Cambridge Mod. Hist.* vol. i. p. 85, &c. (for relations with Jem).

AUBUSSON, a town of France, capital of an arrondissement in the department of Creuse, picturesquely situated on the river Creuse 24 m. S.E. of Guéret by rail. Pop. (1906) 6475. It has celebrated manufactories of carpets, &c., employing about 2000 workmen, the artistic standard of which is maintained by a national school of decorative arts, founded in 1869. Nothing certain is known as to the foundation of this industry, but it was in full activity at least as far back as 1531. From the 10th to the 13th century Aubusson was the centre of a viscounty, and the viscountess Marguerite, wife of Rainaud VI., was sung by many a troubadour. After the death of the viscount Guy II. (a little later than 1262) Aubusson was incorporated in the countship of La Marche by Hugh XII. of Lusignan, and shared in its fortunes. Louis XIV. revived the title of viscount of Aubusson in favour of François, first marshall de la Feuillade (1686). From the family of the old viscounts was descended Pierre d'Aubusson (*q.v.*). Admiral Sallandrouze de Lamornaix (1840-1902) belonged to a family of tapestry manufacturers established at Aubusson since the beginning of the 19th century. Aubusson was also the native place of the novelists Leonard Sylvain, Julien Sandeau and Alfred Assollant (1827-1886).

See Le Père Anselme, *Hist. généalogique de la maison de France*, vol. v. pp. 318 et seq.; P. Mignaton, *Hist. de la maison d'Aubusson* (Paris, 1886); Cyprien Pérathon, *Hist. d'Aubusson* (Limoges, 1886).

(A. T.)

AUCH, a city of south-western France, capital of the department of Gers, 55 m. W. of Toulouse on the Southern railway. Pop. (1906) 9294. Auch is built on the summit and sides of a hill at the foot of which flow the yellow waters of the Gers. It consists of a lower and upper quarter united in several places by flights of steps. The streets are in general steep and narrow, but there is a handsome promenade in the upper town, laid out in the 18th century by the *intendant* Antoine Mégret d'Etigny. Three bridges lead from the left to the right bank of the Gers, on which the suburb of Patte d'Oie is situated. The most interesting part of the town lies in the old quarter around the Place Salinis, a spacious terrace which commands an extensive view over the surrounding country. On its eastern side it communicates with the left bank of the river by a handsome series of steps; on its north side rises the cathedral of Sainte-Marie. This church, built from 1489 to 1662, belongs chiefly to the Gothic style, of which it is one of the finest examples in southern France. The façade, however, with its two square and somewhat heavy flanking towers dates from the 17th century, and is Greco-Roman in architecture. Sainte-Marie contains many artistic treasures, the chief of which are the magnificent stained-glass windows of the Renaissance which light the apsidal chapels, and the 113 choir-stalls of carved oak, also of Renaissance workmanship. The archbishop's palace adjoins the cathedral; it is a building of the 18th century with a Romanesque hall and a tower of the 14th century. Opposite the south side of the cathedral stands the lycée on the site of a former Jesuit college. Only scanty remains are left of the once celebrated abbey of St Orens. The ecclesiastical seminary contains an important library with a collection of manuscripts, and there is a public library in the Carmelite chapel, a building of the 17th century. The former palace of the *intendants* of Gascony is now used as the *préfecture*. Auch is the seat of an archbishopric, a prefect and a court of assizes, and has tribunals of first instance and of commerce, a chamber of commerce, a lycée, training-colleges, a school of design, a branch of the Bank of France and an important lunatic asylum. The manufactures include agricultural implements, leather, vinegar and plaited sandals, and there is a trade in brandy, wine, cattle, poultry and wool; there are quarries of building-stone in the neighbourhood.

Auch (Elimberris) was the capital of a Celtiberian tribe, the Ausci, and under the Roman domination was one of the most important cities in Gaul. In the 4th century this importance was increased by the foundation of its bishopric, and after the destruction of Eauze in the 9th century it became the metropolis of Novempopulana. Till 732, Auch stood on the right bank of the Gers, but in that year the

ravages of the Saracens drove the inhabitants to take refuge on the left bank of the river, where a new city was formed. In the 10th century Count Bernard of Armagnac founded the Benedictine abbey of St Orens, the monks of which, till 1308, shared the jurisdiction over Auch with the archbishops—an arrangement which gave rise to constant strife. The counts of Armagnac possessed a castle in the city, which was the capital of Armagnac in the middle ages. During the Religious Wars of the 16th century Auch remained Catholic, except for a short occupation in 1569 by the Huguenots under Gabriel, count of Montgomery. In the 18th century it was capital of Gascony, and seat of a generality. Antoine Mégret d'Etigny, intendant from 1751 to 1767, did much to improve the city and its commerce.

AUCHMUTY, SIR SAMUEL (1756-1822), British general, was born at New York in 1756, and served as a loyalist in the American War of Independence, being given an ensigncy in the royal army in 1777, and in 1778 a lieutenancy in the 45th Foot, without purchase. When his regiment returned to England after the war, having neither private means nor influence, he exchanged into the 52nd, in order to proceed to India. He took part in the last war against Hyder Ali; he was given a staff appointment by Lord Cornwallis in 1790, served in the operations against Tippoo Sahib, and continued in various staff appointments up to 1797, when he returned to England a brevet lieut.-colonel. In 1800 he was made lieut.-colonel and brevet colonel; and in the following year, as adjutant-general to Sir David Baird in Egypt, took a distinguished share in the march across the desert and the capture of Alexandria. On his return to England in 1803 he was knighted, and three years later he went out to the River Plate as a brigadier-general. Auchmuty was one of the few officers who came out of the disastrous Buenos Aires expedition of 1806-7 with enhanced reputation. While General Whitelocke, the commander, was cashiered, Auchmuty was at once re-employed and promoted major-general, and was sent out in 1810 to command at Madras. In the following year he commanded the expedition organized for the conquest of Java, which the governor-general, Lord Minto, himself accompanied. The storming of the strongly fortified position of Meester Cornelis (28th August 1811), stubbornly defended by the Dutch garrison under General Janssens, practically achieved the conquest of the island, and after the action of Samarang (September 8th) Janssens surrendered. Auchmuty received the thanks of parliament and the order of K.C.B. (G.C.B. in 1815), and in 1813, on his return home, was promoted to the rank of lieut.-general. In 1821 he became commander-in-chief in Ireland, and a member of the Irish privy council. He died suddenly on the 11th of August 1822.

AUCHTERARDER (Gaelic, "upper high land"), a police burgh of Perthshire, Scotland, 13¾ m. S.W. of Perth by the Caledonian railway. Pop. (1901) 2276. It is situated on Ruthven Water, a right-hand tributary of the Earn. The chief manufactures are those of tartans and other woollens, and of agricultural implements. At the beginning of the 13th century it obtained a charter from the earl of Strathearn, afterwards became a royal burgh for a period, and was represented in the Scottish parliament. Its castle, now ruinous, was built as a hunting-lodge for Malcolm Canmore, but of the abbey which it possessed as early as the reign of Alexander II. (1198-1249) no remains exist. The ancient church of St Mungo, now in ruins, was a building in the Norman or Early Pointed style. The town was almost entirely burned down by the earl of Mar in 1716 during the abortive Jacobite rising. It was in connexion with this parish that the ecclesiastical dispute arose which led to the disruption in the Church of Scotland in 1843. The estate of Kincardine, 1 m. south, gives the title of earl of Kincardine to the duke of Montrose. The old castle, now in ruins, was dismantled in 1645 by the marquis of Argyll in retaliation for the destruction of Castle Campbell in Dollar Glen on the south side of the Ochils. The old ruined castle of Tullibardine, 2 m west of the burgh, once belonged to the Murrays of Tullibardine, ancestors of the duke of Atholl, who derives the title of marquis of Tullibardine from the estate. The ancient chapel adjoining, also ruinous, was a burial-place of the Murrays.

AUCHTERMUCHTY (Gaelic, "the high ground of the wild sow"), a royal and police burgh of Fifeshire, Scotland, built on an elevation about 9 m. W. by S. of Cupar, with a station on a branch of the North British railway from Ladybank to Mawcarse Junction. Pop. 1387. The rapid Loverspool Burn divides the town. The principal industries include the weaving of linen and damasks, bleaching, distilling and malting. John Glas, founder of the sect known as Glassites or Sandemanians, was a native of the town. A mile and a half to the south-west is the village of Strathmiglo (pop. 966), on the river Eden, with a linen factory and bleaching works.

AUCKLAND, GEORGE EDEN, Earl of (1784-1849), English statesman, was the second son of the 1st Baron Auckland. He completed his education at Oxford, and was admitted to the bar in 1809. His elder brother was drowned in the Thames in the following year; and in 1814, on the death of his father, he took his seat in the House of Lords as Baron Auckland. He supported the Reform party steadily by his vote, and in 1830 was made president of the Board of Trade and master of the Mint. In 1834 he held office for a few months as first lord of the admiralty, and in 1835 he was appointed governor-general of India. He proved himself to be a painstaking and laborious legislator, and devoted himself specially to the improvement of native schools, and the expansion of the commercial industry of the nation committed to his care. These useful labours were interrupted in 1838 by complications in Afghanistan, which excited the fears not only of the Anglo-Indian government but of the home authorities. Lord Auckland resolved to enter upon a war, and on the 1st of October 1838 published at Simla his famous manifesto dethroning Dost Mahommed. The early operations were crowned with success, and the governor-general received the title of earl of Auckland. But reverses followed quickly, and in the ensuing campaigns the British troops suffered the most severe disasters. Lord Auckland had the double mortification of seeing his policy a complete failure and of being superseded before his errors could be rectified. In the autumn of 1841 he was succeeded in office by Lord Ellenborough, and returned to England in the following year. In 1846 he was made first lord of the admiralty, which office he held until his death, on the 1st of January 1849. He died unmarried, and the earldom became extinct, the barony (see below) passing to his brother Robert.

See S.J. Trotter, *The Earl of Auckland* ("Rulers of India" series), 1893.

AUCKLAND, WILLIAM EDEN, 1st Baron (1745-1814), English statesman, son of Sir Robert Eden, 3rd Bart., of Windlestone Hall, Durham, and of Mary, daughter of William Davison, was born in 1745, educated at Eton and Christ Church, Oxford, and called to the bar at the Middle Temple in 1768. In 1771 he published *Principles of Penal Law*, and was early recognized as an authority on commercial and economic questions, and in 1772 he was appointed an under secretary of state. He represented New Woodstock in the parliaments of 1774 and 1780, and Heytesbury in those of 1784 and 1790. In 1776 he was appointed a commissioner on the board of trade and plantations. In 1778 he carried an act for the improvement of the treatment of prisoners, and accompanied the earl of Carlisle as a commissioner to North America on an unsuccessful mission to settle the disputes with the colonists. On his return in 1779

he published his widely read *Four Letters to the Earl of Carlisle*, and in 1780 became chief secretary for Ireland. He was elected to the Irish House of Commons as member for Dungannon in 1781 and sworn of the Irish privy council, and while in Ireland established the National Bank. He advised the increase of the secret service fund, and was reputed, according to Lord Charlemont (a political opponent), as especially skilful in the arts of corruption and in overcoming political prejudices. He resigned in 1782, but in the following year he took office again as vice-treasurer of Ireland under the coalition ministry, which he had been instrumental in arranging, and was included in the privy council, resigning with the government in December. He opposed strongly Pitt's propositions for free trade between England and Ireland in 1785, but took office with Pitt as a member of the committee on trade and plantations, and negotiated in 1786 and 1787 Pitt's important commercial treaty with France, and agreements concerning the East India Companies and Holland. In 1787 he published his *History of New Holland*. Next year he was sent as ambassador to Spain, and after his return was created (September 1789) Baron Auckland in the Irish peerage. The same year he was sent on a mission to Holland, and represented English interests there with great zeal and prudence during the critical years of 1790 to 1793, obtaining the assistance of the Dutch fleet in 1790 on the menace of a war with Spain, signing the convention relating to the Netherlands the same year, and in 1793 attending the congress at Antwerp. He retired from the public service in the latter year, received a pension of £2300, and was created Baron Auckland of West Auckland, Durham, in the English peerage. During his retirement in the country at Beckenham, he continued his intimacy with Pitt, his nearest neighbour at Holwood, who at one time had thoughts of marrying his daughter; and with Pitt's sanction he published his *Remarks on the Apparent Cicumstances of the War* in 1795, to prepare public opinion for a peace. In 1798 he was included in Pitt's government as joint postmaster-general, and supported strongly the income tax and the Irish Union, assisting in drawing up the act embodying the latter. In 1799 he brought in a bill to check adultery by preventing the marriage of the guilty parties, and the same year took a mischievous part in the cabal against Sir Ralph Abercromby. He severely criticized Pitt's resignation in 1801, from which he had endeavoured to dissuade him, and retained office under Addington. This terminated his friendship with Pitt, who excluded him from his administration in 1804 though he increased his pension. Auckland was included in Granville's ministry of "All the Talents" as president of the board of trade in 1806. He held the appointments of auditor and director of Greenwich hospital, recorder of Grantham, and chancellor of the Marischal College in Aberdeen. He died on the 28th of May 1814.

He had married in 1776 Eleanor, sister of the first Lord Minto, and had a large family. Emily Eden (1797-1869), the novelist, was one of his daughters. On the death of his son George, 2nd baron and earl of Auckland (*q.v.*), the barony passed to the 1st baron's younger son Robert John (1790-1870), bishop of Bath and Wells, from whom the later barons were descended, and who was also the father of Sir Ashley Eden (1831-1887), lieutenant-governor of Bengal. The 1st baron had two distinguished brothers—Morton Eden (1752-1830), a diplomatist, who married Lady Elizabeth Henley, and in 1799 was created 1st Baron Henley (his family, from 1831, taking the name of Henley instead of Eden); and Sir Robert Eden, governor of Maryland, whose son, Sir Frederic Morton Eden (1766-1809), was a well-known economist.

Lord Auckland's *Journal and Correspondence*, published in 1861-1862, throws much light on the political history of the time.

AUCKLAND, a city and seaport on the east coast of North Island, New Zealand, in Eden county; capital of the province of its name, and the seat of a bishop. Pop. (1906) 37,736; including suburbs, 82,101. It is situated at the mouth of an arm of Hauraki Gulf, and is only 6 m. distant from the head of Manukau harbour on the western coast. The situation is extremely beautiful. The Hauraki Gulf, a great square inlet opening northward, is studded with islands of considerable elevation; Rangitoto, which protects the harbour, is a volcanic cone reaching nearly 1000 ft. The isthmus on which the town stands (which position has caused it to be likened to Corinth) can be crossed without surmounting any great elevation, and offers a feasible canal route. A number of small extinct volcanoes, however, appear in all directions. To the west the Titirangi hills exceed 1400 ft. Some of the volcanic soil is barren, but much of the district is clothed in luxuriant vegetation.

Auckland harbour, one of the best in New Zealand, is approachable by the largest vessels at the lowest tide. There are two graving docks. Queen Street, the principal thoroughfare, leads inland from the main dock, and contains the majority of the public buildings. There is a small government house, standing in beautiful grounds, adjoining Albert Park, with plantations of oaks and pines. The government offices, art gallery and exchange, with St Mary's cathedral (Anglican), a building in a combination of native timbers, St Paul's and St Patrick's cathedral (Roman Catholic), are noteworthy buildings. The art gallery and free library contain excellent pictures, and valuable books and MSS. presented by Sir G. Grey. The museum contains one of the best existing collections of Maori art. There are an opera-house and an academy of music. The Auckland University College and the grammar school are the principal educational establishments. The parks are the Domain, with a botanical garden, the Albert Park near the harbour, with a bronze statue of Queen Victoria, the extensive grounds at One Tree Hill on the outskirts, and Victoria Park on Freeman's Bay. The principal thoroughfares are served by electric tramway. Of the suburbs, Newton, Parnell and Newmarket are in reality outlying parts of the town itself. Devonport, Birkenhead and Northcote are beautifully situated on the north shore of the inlet, and are served by steam-ferries. Several other residential suburbs lie among the hills on the mainland, such as Mount Albert, Mount Eden and Epsom. Onehunga is a small port on Manukau harbour, served by rail. In Parnell is the former residence of Bishop Selwyn, who, arriving in the colony in 1842, assisted to draw up the constitution of the Anglican church. There are many associations with his name in the neighbourhood. The prospect over the town and its environs from Mount Eden is justly famous. The hill is terraced with former native fortifications.

Auckland has industries of sugar-refining, ship-building and paper-, rope- and brick-making, and timber is worked. The town was founded as capital of the colony in 1840 by Governor Hobson. There is communication both south and north by rail, and regular steamers serve the ports of the colony, the principal Pacific Islands, Australia, &c. From 1853 to 1876 Auckland was the seat of the provincial government, and until 1865 that of the central government, which was then transferred to Wellington. The first session of the general assembly took place here in 1854. Auckland is under municipal government.

AUCKLAND ISLANDS, a group in the Pacific Ocean, discovered in 1806 by Captain Briscoe, of the English whaler "Ocean," in 50° 24′ S., 166° 7′ E. The islands, of volcanic origin, are very fertile, and are covered with forest. They were granted to the Messrs Enderby by the British government as a whaling station, but the establishment was abandoned in 1852. The islands belong politically to New Zealand.

AUCTION PITCH, a card game which is a popular variation of All Fours (*q.v.*). The name is derived from the rule that the first card played, or *pitched*, is the trump suit, and that the eldest hand has the privilege of pitching it or of selling out to the highest bidder. A full pack is used, and the cards rank as in All Fours, namely from ace down to 2, ace being highest in cutting also. From four to seven may play, each player being provided with seven white counters, and also with red counters in case stakes are played for. Each player receives six cards in every deal, three at a time, no trump being turned. The object is to get rid of the white counters, one of which may be put into the pool either (1) for holding the highest trump played; (2) for having the lowest trump dealt to one; (3) for taking the Jack (knave) of trumps; or (4) for winning the *game*, namely the greatest number of pips that count. In case of a tie of pips no game is scored. If the eldest hand decides to pitch and not to sell out, he may do so, but is obliged to make four points or be set back that number. If he decides to sell, he says "I pass," and the player at his left bids for the privilege of pitching the trump or passes, &c. When a bid has been made the rest must pass or bid higher, and the eldest hand must either accept a bid or undertake to make as many points as the bidder. If no bid is made he pitches the trump himself, without the obligation of making anything. The first card played is

the trump suit, the winner of the trick leading again. In trumps a player must follow suit if he can, and the same rule applies in plain suits, excepting that a trump may be played at any time ("follow suit or trump"). In play the highest card wins the trick unless trumped. When the hand is played out each player puts a white counter into the pool for every point won, and the first player to get rid of all his seven white counters wins the pool and takes from it all the red counters, which represent cash. This ends the game. In case two players count out during the same deal, the bidder has the first right to the pool, the rule being "bidder counts out first." If the two players who count out are neither of them bidder, then they go out in regular order, *i.e.* high first, then low, Jack and game. If a bidder fails to make his points he is set back that number. A revoke is punished by the offender being set back the number of points bid and forfeiting a red counter to the pool.

AUCTIONS and **AUCTIONEERS.** An auction (Lat. *auctio*, increase) is a proceeding at which people are invited to compete for the purchase of property by successive offers of advancing sums. The advantages of conducting a sale in this way are obvious, and we naturally find that auctions are of great antiquity. Herodotus describes a custom which prevailed in Babylonian villages of disposing of the maidens in marriage by delivering them to the highest bidders in an assembly annually held for the purpose (Book i. 196). So also among the Romans the quaestor sold military booty and captives in war by auction—*sub hasta*—the spear being the symbol of quiritarian ownership. The familiarity of such proceedings is forcibly suggested by the conduct of the Praetorian Guard when Sulpicianus was treating for the imperial dignity after the murder of Pertinax. Apprehending that they would not obtain a sufficient price by private contract, the Praetorians proclaimed from their ramparts that the Roman world was to be disposed of by public auction to the best bidder. Thereupon Julian proceeded to the foot of the ramparts and outbid his competitor (Gibbon, vol. i. ch. v.). Though, however, auctions were undoubtedly common among the Romans both in public and private transactions, the rules whereby they were governed are by no means clearly enunciated in the *Corpus Juris Civilis*.

In England the method of conducting auctions has varied. In some places it has been usual to set up an inch of lighted candle, the person making the last bid before the fall of the wick becoming the purchaser. By an act of William III. (1698), this method of sale was prescribed for goods and merchandise imported from the East Indies. Lord Eldon speaks of "candlestick biddings," where the several bidders did not know what the others had offered. A "dumb bidding" was the name given to a proceeding at which a price was put by the owner under a candlestick with a stipulation that no bidding should avail if not equal to it. In a "Dutch auction" property is offered at a certain price and then successively at lower prices until one is accepted.

According to the practice now usual in England, a proposed auction is duly advertised, and a printed catalogue in the case of chattels, or particulars of sale in the case of land, together with conditions of sale, are circulated. Sometimes, in sales of goods, the conditions are merely suspended in the auction room. At the appointed time and place, the auctioneer, standing in a desk or rostrum, "puts up" the several lots in turn by inviting biddings from the company present. He announces the acceptance of the last bid by a tap with his hammer and so "knocks down" the lot to the person who has made it. Sometimes property is offered on lease to the highest bidder. "Roup" is the Scottish term for an auction. A bid in itself is only an offer, and may accordingly be retracted at any time before its acceptance by the fall of the hammer or otherwise. Puffing is unlawful. Unless a right to bid is expressly reserved on behalf of the vendor, he must neither bid himself nor employ any one else to bid. When a right to bid has been expressly reserved, the seller or any one person (but no more) on his behalf may bid at the auction. If it is simply announced that the sale is to be subject to a reserved or upset price, no bidding by or on behalf of the seller is permissible: it is only lawful to declare by some appropriate terms that the property is withdrawn. Where a sale is expressed to be without reserve, or where an upset price has been reached, the auctioneer must, after the lapse of a reasonable interval, accept the bid of the highest *bona fide* bidder. By not doing so he would render the vendor liable in damages. The auctioneer must not make a pretence of receiving bids which are not in fact made, as it would be fraudulent to run up the price by such an artifice. A "knock-out" is a combination of persons to prevent competition between themselves at an auction by an arrangement that only one of their number shall bid, and that anything obtained by him shall be afterwards disposed of privately among themselves. Such a combination is not illegal. A "mock auction" is a proceeding at which persons conspire by artifice to make it appear, contrary to the fact, that a *bona fide* sale is being conducted, and so attempt to induce the public to purchase articles at prices far above their value. Those who invite the public to enter the room where the supposed auction is proceeding, or otherwise endeavour to attract bidders, are called "barkers." A conspiracy to defraud in this way is an indictable offence.

American law is in general the same as the English law with regard to auctions. As to bidding by the vendor, however, it is less stringent. For, though puffing or by-bidding, as it is often called, will, under both systems alike, render an auction sale voidable at the option of a purchaser when it amounts to fraud, the weight of authority in the United States is in favour of the view that an owner may, without notice, employ a person to bid for him, if he does so with no other purpose than to prevent a sacrifice of the property under a given price.

By a charter of Henry VII., confirmed by Charles I., the business of selling by auction was confined to an officer called an *outroper*, and all other persons were prohibited from selling goods or merchandise by public claim or outcry (see Henry Blackstone's *Reports*, vol. ii. p. 557). The only qualification now required by an auctioneer is a licence on which a duty of £10 has to be paid, and which must be renewed before the 5th of July in each year. A liability to a penalty of £100 is incurred by acting as an auctioneer without being duly licensed. The duty formerly imposed upon the purchase-money payable by virtue of a sale at auction was abolished by an act of 1845. An auctioneer is bound under a penalty of £20 to see that his full name and address are displayed before the commencement of an auction and during its continuance in the place where he conducts it. He is the agent of the vendor only, except in so far that, after he has knocked down a lot to the highest bidder, he has authority to affix the name of the latter to a memorandum of the transaction, so as to render the contract of sale enforceable where written evidence is necessary. An auctioneer does not, by merely announcing that a sale of certain articles will take place, render himself liable to those who, in consequence, attend at the time and place advertised, if the sale is not in fact proceeded with, provided he acts in good faith. One of the chief risks run by an auctioneer is that of being held liable for the conversion of goods which he has sold upon the instructions of a person whom he believed to be the owner, but who in fact had no right to dispose of them.

The number of auctioneers' licences issued during the year ended the 31st of March 1908 was in England 6639, in Scotland 760, and in Ireland 839. A central organization having its headquarters in London, the Auctioneers' Institute of the United Kingdom, was founded in 1886, in order to elevate the status and further the interests of auctioneers, estate agents and valuers. It has nearly 2000 members.

(H. Ha.)

AUCUBA, the Japanese name for a small genus of the Dogwood order (Cornaceae). The familiar Japanese laurel of gardens and shrubberies is *Aucuba japonica*. It bears male and female flowers on distinct plants; the red berries often last till the next season's flowers appear. There are numerous varieties in cultivation, differing in the variegation of their leaves.

AUDAEUS, or Audius, a church reformer of the 4th century, by birth a Mesopotamian. He suffered much persecution from the Syrian clergy for his fearless censure of their irregular lives, and was expelled from the church, thereupon establishing an episcopal monastic community. He was afterwards banished into Scythia, where he worked successfully among the Goths, not living to see the destruction

of his labours by Athanaric. The Audaeans celebrated the feast of Easter on the same day as the Jewish Passover, and they were also charged with attributing to the Deity a human shape, an opinion which they appear to have founded on Genesis i. 26. Theodoret groundlessly accuses them of Manichean tendencies.

The main source of information is Epiphanius (*Haer.* 70).

AUDE, a river of south-western France, rising in the eastern Pyrenees and flowing into the Golfe du Lion. Rising in a small lake a short distance east of the Puy de Carlitte, it soon takes a northerly direction and flows for many miles through deep gorges of great beauty as far as the plain of Axat. Beyond Axat its course again lies through defiles which become less profound as the river nears Carcassonne. Below that town it receives the waters of the Fresquel and turns abruptly east. From this point to its junction with the Cesse its course is parallel with that of the Canal du Midi. The river skirts the northern spurs of the Corbières, some distance below which it is joined by the Orbieu and the Cesse. It then divides into two branches, the northernmost of which, the Aude proper, runs east and empties into the Mediterranean some 12 m. east-north-east of Narbonne, while the other branch, the Canal de la Robine, turning south, traverses that town, below which its course to the sea lies between two extensive lagoons, the Étang de Bages et de Sigean and the Étang de Gruissan. The Aude has a length of 140 m. and a basin 2061 sq. m. in extent. There is practically no traffic upon it.

AUDE, a maritime department of southern France, formed in 1790 from part of the old province of Languedoc. Area, 2448 sq. m. Pop. (1906) 308,327. It is bounded E. by the Mediterranean, N. by the departments of Hérault and Tarn, N.W. by Haute-Garonne, W. by Ariège, and S. by Pyrénées-Orientales. The department is traversed on its western boundary from S. to N. by a mountain range of medium height, which unites the Pyrenees with the southern Cévennes; and its northern frontier is occupied by the Montagne Noire, the most westerly portion of the Cévennes. The Corbières, a branch of the Pyrenees, run in a south-west and north-east direction along the southern district. The Aude (*q.v.*), its principal river, has almost its entire length in the department, and its lower course, together with its tributary the Fresquel, forms the dividing line between the Montagne Noire and the Pyrenean system.

The lowness of the coast causes a series of large lagoons, the chief of which are those of Bages et Sigean, Gruissan, Lapalme and Leucate. The climate is warm and dry, but often sudden in its alterations. The wind from the north-west, known as the *cers*, blows with great violence, and the sea-breeze is often laden with pestilential effluvia from the lagoons. The agriculture of the department is in a flourishing condition. The meadows are extensive and well watered, and are pastured by numerous flocks and herds. The grain produce, consisting mainly of wheat, oats, rye and Indian corn, exceeds the consumption, and the vineyards yield an abundant supply of both white and red wines, those of Limoux and the Narbonnais being most highly esteemed. Truffles are abundant. The olive and chestnut are the chief fruits. Mines of iron, manganese, and especially of mispickel, are worked, and there are stone-quarries and productive salt-marshes. Brewing, distilling, cooperage, iron-founding, hat-making and machine construction are carried on, and there are flour-mills, brick-works, saw-mills, sulphur refineries and leather and paper works. The formerly flourishing textile industries are now of small importance. The department imports coal, lime, stone, salt, raw sulphur, skins and timber and exports agricultural and mineral products, bricks and tiles, and other manufactured goods. It is served by the Southern railway. The Canal du Midi, following the courses of the Fresquel and the Aude, traverses it for 76 m.; and a branch, the Canal de la Robine, which passes through Narbonne to the sea, has a length of 24 m. The capital is Carcassonne, and the department is divided into the four arrondissements of Carcassonne, Limoux, Narbonne and Castelnaudary, with 31 cantons and 439 communes. It belongs to the 16th military region, and to the académie (educational division) of Montpellier, where also is its court of appeal. It forms the diocese of Carcassonne, and part of the province of the archbishop of Toulouse. Carcassonne, Narbonne and Castelnaudary are the principal towns. At Alet, which has hot springs of some note, there are ruins of a fine Romanesque cathedral destroyed in the religious wars of the 16th century. The extensive buildings of the Cistercian abbey of Fontfroide, near Bizanet, include a Romanesque church, a cloister, dormitories and a refectory of the 12th century. A curious polygonal church of the 11th century at Rieux-Minervois, the abbey-church at St Papoul, with its graceful cloister of the 14th century, and the remains of the important abbey of St Hilaire, founded in the 6th century and rebuilt from the 12th to the 15th century, are also of antiquarian interest. Rennes-les-Bains has mineral springs of repute.

AUDEBERT, JEAN BAPTISTE (1759-1800), French artist and naturalist, was born at Rochefort in 1759. He studied painting and drawing at Paris, and gained considerable reputation as a miniature-painter. Employed in preparing plates for the *Histoire des coléoptères* of G.A. Olivier (1756-1814), he acquired a taste for natural history. In 1800 appeared his first original work, *L'Histoire naturelle des singes, des makis et des galéopithèques*, illustrated by sixty-two folio plates, drawn and engraved by himself. The colouring in these plates was unusually beautiful, and was applied by a method devised by himself. Audebert died in Paris in 1800, leaving complete materials for another great work, *Histoire des colibris, des oiseaux-mouches, des jacamars et des promérops*, which was published in 1802. Two hundred copies were printed in folio, one hundred in large quarto, and fifteen were printed with the whole text in letters of gold. Another work, left unfinished, was also published after the author's death, *L'Histoire des grimpereaux et des oiseaux de paradis*. The last two works also appeared together in two volumes, *Oiseaux dorés ou à reflets métalliques* (1802).

AUDEFROI LE BATARD, French *trouvère*, flourished at the end of the 12th century and was born at Arras. Of his life nothing is known. The seigneur de Nesles, to whom some of his songs are addressed, is probably the châtelain of Bruges who joined the crusade of 1200. Audefroi was the author of at least five lyric romances: *Argentine, Belle Idoine, Belle Isabeau, Belle Emmelos* and *Béatrix*. These romances follow older *chansons* in subject, but the smoothness of the verse and beauty of detail hardly compensate for the spontaneity of the shorter form.

See A. Jeanroy, *Les Origines de la poésie lyrique en France au moyen âge* (Paris, 1889).

AUDIENCE (from Lat. *audire*, to hear), the act or state of hearing, the term being therefore transferred to those who hear or listen, as in a theatre, at a concert or meeting. In a more technical sense, the term is applied to the right of access to the sovereign enjoyed by the peers of the realm individually and by the House of Commons collectively. More particularly it means the ceremony of the admission of ambassadors, envoys or others to an interview with a sovereign or an important official for the purpose of presenting their credentials. In France, *audience* is the term applied to the sitting of a law court for hearing actions. In Spain, *audiencia* is the name given to certain tribunals which try appeals from minor courts. The Spanish judges were originally known as *oidores*, hearers, from the

Spanish *oir*, to hear; but they are now called *ministros*, or *magistrados togados*, robed judges, as the gown of the Spanish judge is called a *toga*. The *audiencia pretorial*, *i.e.* of the praetor, was a court in Spanish America from which there was no appeal to the viceroy, but only to the council of the Indies in Spain. It is not the custom in Spain to speak of *audiencias reales*, royal courts, but of the *audiencias del Reino*, courts of the kingdom.

In England the *Audience-court* was an ecclesiastical court, held by the archbishops of Canterbury and York, in which they once exercised a considerable part of their jurisdiction, dealing with such matters as they thought fit to reserve for their own hearing. It has been long disused and is now merged in the court of arches.

AUDIFFRET-PASQUIER, EDMÉ ARMAND GASTON, Duc d' (1823-1905), French statesman, was the grand-nephew and adopted son of Baron Etienne Denis Pasquier. He was created duke in 1844, and became auditor at the council of state in 1846. After the revolution of 1848 he retired to private life. Under the empire he was twice an unsuccessful candidate for the legislature, but was elected in February 1871 to the National Assembly, and became president of the right centre in 1873. After the fall of Thiers, he directed the negotiations between the different royalist parties to establish a king in France, but as he refused to give up the tricolour for the flag of the old *régime*, the project failed. Yet he retained the confidence of the chamber, and was its president in 1875 when the constitutional laws were being drawn up. Nominated senator under the new constitution, he likewise was president of the senate from March 1876 to 1879 when his party lost the majority. Henceforth he was less prominent in politics. He was distinguished by his moderation and uprightness; and he did his best to dissuade MacMahon from taking violent advisers. In 1878 he was elected to the French Academy, but never published anything.

AUDIT and **AUDITOR.** An audit is the examination of the accounts kept by the financial officers of a state, public corporations and bodies, or private persons, and the certifying of their accuracy. In the United Kingdom the public accounts were audited from very early times, though, until the reign of Queen Elizabeth, in no very systematic way. Prior to 1559 this duty was carried out, sometimes by auditors specially appointed, at other times by the auditors of the land revenue, or by the auditor of the exchequer, an office established as early as 1314. But in 1559 an endeavour was made to systematize the auditing of the public accounts, by the appointment of two auditors of the imprests. These officers were paid by fee and did their work by deputy, but as the results were thoroughly unsatisfactory the offices were abolished in 1785. An audit board, consisting of five commissioners, was appointed in their place, but in order to concentrate under one authority the auditing of the accounts of the various departments, some of which had been audited separately, as the naval accounts, the Exchequer and Audit Act of 1866 was passed. This statute, which sets forth at length the duties of the audit office, empowered the sovereign to appoint a "comptroller and auditor-general," with the requisite staff to examine and verify the accounts prepared by the different departments of the public service. In examining accounts of the appropriation of the several supply grants, the comptroller and auditor-general "ascertains first whether the payments which the account department has charged to the grant are supported by vouchers or proofs of payments; and second, whether the money expended has been applied to the purpose or purposes for which such grant was intended to provide." The treasury may also submit certain other accounts to the audit of the comptroller-general. All public moneys payable to the exchequer (*q.v.*) are paid to the "account of His Majesty's exchequer" at the Bank of England, and daily returns of such payments are forwarded to the comptroller. Quarterly accounts of the income and charge of the consolidated fund are prepared and transmitted to him, and in case of any deficiency in the consolidated fund, he may certify to the bank to make advances.

In the United States the auditing of the Federal accounts is in the charge of the treasury department, under the supervision of the comptroller of the treasury, under whom are six auditors, (1) for the treasury department, (2) for the war, (3) for the interior, (4) for the navy, (5) for the state, &c., (6) for the post office, as well as a register and assistant register, who keep all general receipt and expenditure ledgers; there are official auditors in most of the states and in many cities. In practically all European countries there is a department of the administration, charged with the auditing of the public accounts, as the *cour des comptes* in France, the *Rechnungshof des deutschen Reiches* in Germany, &c. All local boards, large cities, corporations, and other bodies have official auditors for the purpose of examining and checking their accounts and looking after their expenditure. So far as regards the work which auditors discharge in connexion with the accounts of joint-stock companies, building societies, friendly societies, industrial and provident societies, savings banks, &c., the word auditor is now almost synonymous with "skilled accountant," and his duties are discussed in the article Accountants.

In Scotland there is an "auditor" who is an official of the court of session, appointed to tax costs in litigation, and who corresponds to the English taxing-master. In France there are legal officers, called auditors, attached to the *Conseil d'État*, whose duties consist in drawing up briefs and preparing documents. On the continent of Europe, lawyers skilled in military law are called "auditors" (see Military Law).

Auditor is also the designation of certain officials of the Roman curia. The *auditores Rotae* are the judges of the court of the Rota (so called, according to Hinschius, probably from the form of the panelling in the room where they originally met). These were originally ecclesiastics appointed to *hear* particular questions in dispute and report to the pope, who retained the decision in his own hands. In the *Speculum juris* of Durandus (published in 1272 and re-edited in 1287 and 1291) the *auditores palatii domini papae* are cited as permanent officials appointed to instruct the pope on questions as they arose. The court of the Rota appears for the first time under this name in the bull *Romani Pontificis* of Martin V. in 1422, and the auditores by this time had developed into a permanent tribunal to which the definitive decision of certain disputes, hitherto relegated to a commission of cardinals or to the pope himself, was assigned. From this time the powers of the auditores increased until the reform of the curia by Sixtus V., when the creation of the congregations of cardinals for specific purposes tended gradually to withdraw from the Rota its most important functions. It still, however, ranks as the supreme court of justice in the papal curia, and, as members of it, the auditores enjoy special privileges. They are prelates, and, besides the rights enjoyed by these, have others conceded by successive popes, *e.g.* that of holding benefices in plurality, of non-residence, &c. When the pope says mass pontifically the subdeacon is always an auditor. The auditores must be in priest's or deacon's orders, and have always been selected—nominally at least—after severe tests as to their moral and intellectual qualifications. They are twelve in number, and, by the constitution of Pius IV., four of them were to be foreigners; one French, one Spanish, one German and one Venetian; while the nomination of others was the privilege of certain, cities. No bishop, unless *in partibus* (see Bishop), may be an auditor. On the other hand, from the auditores, as the intellectual *élite* of the curia, the episcopate, the nunciature and the cardinalate are largely recruited. The *auditor camerae* (*uditore generale della reverenda camera apostolica*) is an official formerly charged with important executive functions. In 1485, by a bull of Innocent VIII., he was given extensive jurisdiction over all civil and criminal causes arising in the curia, or appealed to it from the papal territories. In addition he received the function of watching over the execution of all sentences passed by the curia. This was extended later, by Pius IV., to a similar executive function in respect of all papal bulls and briefs, wherever no special executor was named. This right was confirmed by Gregory XVI. in 1834, and the auditor may still in principle issue letters monitory. In practice, however, this function was at all times but rarely exercised, and, since 1847, has fallen to a prelate *locum tenens*, who also took over the auditor's jurisdiction in the papal states (Hinschius, *Kathol. Kirchenrecht*, i. 409, &c.).

Auditores (listeners), in the early Church, was another name. for catechumens (*q.v.*).

AUDLEY, or Audeley, **SIR JAMES** (*c.* 1316-1386), one of the original knights, or founders, of the order of the Garter, was the eldest son of Sir James Audley of Stratton Audley in Oxfordshire. When the order of the Garter was founded, he was instituted as one of the first founders, and his stall in St George's chapel, Windsor, was the eleventh on the side of Edward, the Black Prince. He appears to have served in France in 1346, and in August 1350 took part in the naval fight off Sluys. When hostilities were renewed between England and France in 1354 Sir James was in constant attendance upon the Black Prince, and earned a great reputation for valour. At the battle of Poitiers on the 19th of September 1356 he took his stand in front of the English army, and after fighting for a long time was severely wounded and carried from the fight. After the victory, the prince inquired for Sir James, who was brought to the royal tent, where Edward told him he had been the bravest knight on his side, and granted him an annuity of five hundred marks. Sir James made over this gift to the four esquires who had attended him during the battle, and received from the prince a further pension of six hundred marks. In 1359 he was one of the leaders of an expedition into France, in 1360 he took the fortress of Chaven in Brittany, and was present at Calais when peace was made between England and France in October 1360. He was afterwards governor of Aquitaine and great seneschal of Poitou, and took part in the capture of the town of La Roche-sur-Yon by Edmund, earl of Cambridge. He died in 1386 at Fontenay-le-Comte, where he had gone to reside, and was buried at Poitiers.

See Jean Froissart, *Chronigues*, translated by T. Johnes (Hafod, 1810); G.F. Beltz, *Memorials of the Most Noble Order of the Garter* (London, 1841).

AUDLEY, THOMAS AUDLEY, Baron (*c.* 1488-1544), lord chancellor of England, whose parentage is unknown, is believed to have studied at Buckingham College, Cambridge. He was educated for the law, entered the Middle Temple (becoming autumn reader in 1526), was town clerk of Colchester, and was on the commission of the peace for Essex in 1521. In 1523 he was returned to parliament for Essex, and represented this constituency in subsequent parliaments. In 1527 he was groom of the chamber, and became a member of Wolsey's household. On the fall of the latter in 1529, he was made chancellor of the duchy of Lancaster, and the same year speaker of the House of Commons, presiding over the famous assembly styled the Black or Long Parliament of the Reformation, which abolished the papal jurisdiction. The same year he headed a deputation of the Commons to the king to complain of Bishop Fisher's speech against their proceedings. He interpreted the king's "moral" scruples to parliament concerning his marriage with Catherine, and made himself the instrument of the king in the attack upon the clergy and the preparation of the act of supremacy. In 1531 he had been made a serjeant-at-law and king's serjeant; and on the 20th of May 1532 he was knighted, and succeeded Sir Thomas More as lord keeper of the great seal, being appointed lord chancellor on the 26th of January 1533. He supported the king's divorce from Catherine and the marriage with Anne Boleyn; and presided at the trial of Fisher and More in 1535, at which his conduct and evident intention to secure a conviction has been generally censured. Next year he tried Anne Boleyn and her lovers, was present on the scaffold at the unfortunate queen's execution, and recommended to parliament the new act of succession. In 1537 he condemned to death as traitors the Lincolnshire and the Yorkshire rebels. On the 29th of November 1538 he was created Baron Audley of Walden; and soon afterwards presided as lord steward at the trials of Henry Pole, Lord Montacute, and of the unfortunate marquess of Exeter. In 1539, though inclining himself to the Reformation, he made himself the king's instrument in enforcing religious conformity, and in the passing of the Six Articles Act. On the 24th of April 1540 he was made a knight of the Garter, and subsequently managed the attainder of Thomas Cromwell, earl of Essex, and the dissolution of Henry's marriage with Anne of Cleves. In 1542 he warmly supported the privileges of the Commons in the case of George Ferrers, member for Plymouth, arrested and imprisoned in London, but his conduct was inspired as usual by subservience to the court, which desired to secure a subsidy, and his opinion that the arrest was a flagrant contempt has been questioned by good authority. He resigned the great seal on the 21st of April 1544, and died on the 30th, being buried at Saffron Walden, where he had prepared for himself a splendid tomb. He received several grants of monastic estates, including the priory of Christ Church in London and the abbey of Walden in Essex, where his grandson, Thomas Howard, earl of Suffolk, built Audley End, doubtless named after him. In 1542 he re-endowed and re-established Buckingham College, Cambridge, under the new name of St Mary Magdalene, and ordained in the statutes that his heirs, "the possessors of the late monastery of Walden," should be visitors of the college *in perpetuum*. *A Book of Orders for the Warre both by Sea and Land* (Harleian MS. 297, f. 144) is attributed to his authorship. He married (1) Christina, daughter of Sir Thomas Barnardiston, and (2) Elizabeth, daughter of Thomas Grey, marquess of Dorset, by whom he had two daughters. His barony became extinct at his death.

AUDOUIN, JEAN VICTOR (1797-1841), French naturalist, was born at Paris on the 27th of April 1797. He began the study of law, but was diverted from it by his strong predilection for natural history, and entered the medical profession. In 1824 he was appointed assistant to P.A. Latreille (1762-1833) in the entomological chair at the Paris museum of natural history, and succeeded him in 1833. In 1838 he became a member of the Academy of Sciences. He died in Paris on the 9th of November 1841. His principal work, *Histoire des insectes nuisibles à la vigne* (1842), was completed after his death by Henry Milne-Edwards and Émile Blanchard. His papers mostly appeared in the *Annales des sciences naturelles*, which, with A.T. Brongniart and J.B.A. Dumas, he founded in 1824, and in the proceedings of the Société Entomologique de France, of which he was one of the founders in 1832.

AUDRAN, the name of a family of French artists and engravers. The first who devoted himself to the art of engraving was Claude Audran, born 1597, and the last was Benoit, Claude's great-grandson, who died in 1772. The two most distinguished members of the family are Gérard and Jean.

Gérard, or Girard, Audran, the most celebrated French engraver, was the third son of Claude Audran, and was born at Lyons in 1640. He was taught the first principles of design and engraving by his father; and, following the example of his brother, went to Paris to perfect himself in his art. He there, in 1666, engraved for Le Brun "Constantine's Battle with Maxentius," his "Triumph," and the "Stoning of Stephen," which gave great satisfaction to the painter, and placed Audran in the very first rank of engravers at Paris. Next year he set out for Rome, where he resided three years, and engraved several fine plates. That great patron of the arts, J.B. Colbert, was so struck with the beauty of Audran's works, that he persuaded Louis XIV. to recall him to Paris. On his return he applied himself assiduously to engraving, and was appointed engraver to the king, from whom he received great encouragement. In the year 1681 he was admitted to the council of the Royal Academy. He died at Paris in 1703. His engravings of Le Brun's "Battles of Alexander" are regarded as the best of his numerous works. "He was," says the Abbé Fontenay, "the most celebrated engraver that ever existed in the historical line. We have several subjects, which he engraved from his own designs, that manifested as much taste as character and facility. But in the 'Battles of Alexander' he surpassed even the expectations of Le Brun himself." Gérard published in 1683 a work entitled *Les Proportions du corps humain mesurées sur les plus belles figures de l'antiquité*.

Jean Audran, nephew of Gérard, was born at Lyons in 1667. After having received instructions from his father, he went to Paris to perfect himself in the art of engraving under his uncle, next to whom he was the most distinguished member of his family. At the age of twenty his genius began to display itself in a surprising manner; and his subsequent success was such, that in 1707 he obtained the title of engraver to the king, Louis XIV., who allowed him a pension, with apartments in the Gobelins; and the following year he was made a member of the Royal Academy. He was eighty years of age before he quitted the graver, and nearly ninety when he died. The best prints of this artist are those which appear not so pleasing to the eye at first sight. In these the etching constitutes a great part; and he has finished them in a bold, rough style. The "Rape of the Sabines," after Poussin, is considered his masterpiece.

AUDRAN, EDMOND (1842-1901), French musical composer, was born at Lyons on the 11th of April 1842. He studied music at the École Niedermeyer, where he won the prize for composition in 1859. Two years later he accepted the post of organist of the church of St Joseph at Marseilles. He made his first appearance as a dramatic composer at Marseilles with *L'Ours et le Pacha* (1862), a musical version of one of Scribe's vaudevilles. This was followed by *La Chercheuse d'Esprit* (1864), a comic opera, also produced at Marseilles. Audran wrote a funeral march on the death of Meyerbeer, which was performed with some success, and made various attempts to win fame as a writer of sacred music. He produced a mass (Marseilles, 1873), an oratorio, *La Sulamite* (Marseilles, 1876), and numerous minor works, but he is known almost entirely as a composer of the lighter forms of opera. His first Parisian success was made with *Les Noces d'Olivette* (1879), a work which speedily found its way to London and (as *Olivette*) ran for more than a year at the Strand theatre (1880-1881). Audran's music has, in fact, met with as much favour in England as in France, and all save a few of his works have been given in a more or less adapted form in London theatres. Besides those already mentioned, the following have been the most undeniably successful of Audran's many comic operas: *Le Grand Mogol* (Marseilles, 1876; Paris, 1884; London, as *The Grand Mogul*, 1884), *La Mascotte* (Paris, 1880; London, as *The Mascotte*, 1881), *Gillette de Narbonne* (Paris, 1882; London, as *Gillette*, 1883), *La Cigale et la Fourmi* (Paris, 1886; London, as *La Cigale*, 1890), *Miss Hélyett* (Paris, 1890; London, as *Miss Decima* 1891), *La Poupée* (Paris, 1896; London, 1897). Audran was one of the best of the successors of Offenbach. He had little of Offenbach's humour, but his music is distinguished by an elegance and a refinement of manner which lift it above the level of opéra bouffe to the confines of genuine opéra comique. He was a fertile if not a very original melodist, and his orchestration is full of variety, without being obtrusive or vulgar. Many of his operas, *La Mascotte* in particular, reveal a degree of musicianship which is rarely associated with the ephemeral productions of the lighter stage. He died in Paris on the 16th of August 1901.

AUDREHEM, ARNOUL D' (*c.* 1305-1370), French soldier, was born at Audrehem, in the present department of Pas de Calais, near St Omer. Nothing is known of his career before 1332, when he is heard of at the court of the king of France. Between 1335 and 1342 he went three times to Scotland to aid King David Bruce in his wars. In 1342 he became captain for the king of France in Brittany; then he seems to have served in the household of the duke of Normandy, and in 1346, as one of the main defenders of Calais, was taken as a prisoner to England by Edward III. From 1349 he holds an important place in the military history of France, first as captain in Angoulême, and from June 1351, in succession to the lord of Beaujeu, as marshal of France. In March 1352 he was appointed lieutenant for the king in the territory between the Loire and the Dordogne, in June 1353 in Normandy, and in 1355 in Artois, Picardy and the Boulonnais. It was Audrehem who arrested Charles the Bad, king of Navarre, and his partisans, at the banquet given by the dauphin at Rouen in 1356. At Poitiers he was one of those who advised King John to attack the English, and, charging in the front line of the French army, was slightly wounded and taken prisoner. From England he was several times given safe-conducts to France, and he took an active part in the negotiations for the treaty of Bretigny, recovering his liberty the same time as King John. In 1361, as the king's lieutenant in Languedoc, he prevented the free companies from seizing the castles, and negotiated the treaty with their chiefs under which they followed Henry, count of Trastamara (later Henry II. of Castile), into Spain. In 1365 he himself joined du Guesclin in the expedition to Spain, was taken prisoner with him by the Black Prince at the battle of Najera (1367), and was unable to pay his ransom until 1369. In 1368, on account of his age, he was relieved of the office of marshal, being appointed bearer of the oriflamme, with a pension of 2000 livres. He was sent to Spain in 1370 by Charles V., to urge his friend du Guesclin to return to France, and in spite of his age he took part in the battle of Pontvallain (December 1370), but fell ill and died, probably at Saumur, in the latter part of December 1370.

See Émile Molinier, "Étude sur la vie d'Arnoul d'Audrehem, maréchal de France," in *Mémoires présentés par divers savants à l'académie des inscriptions et belles-lettres*, 2^{e} série, iv. (1883).

AUDUBON, JOHN JAMES (1780-1851), American naturalist, is said to have been born on the 5th of May 1780 in Louisiana, his father being a French naval officer and his mother a Spanish Creole. He was educated in Paris, where he had lessons from the painter, J.L. David. Returning to America in 1798 he settled on a farm near Philadelphia, and gave himself up to the study of natural history, and especially to drawing birds. In 1826 he went to England in the hope of getting his drawings published, and by the following year he had obtained sufficient subscribers to enable him to begin the publication of his *Birds of America*, which on its completion in 1838 consisted of 435 coloured plates, containing 1055 figures of birds the size of life. Cuvier called it "le plus magnifique monument que l'art ait encore élevé à la nature." The descriptive matter to accompany the plates appeared at Edinburgh in 5 vols. from 1831 to 1839 under the title of *American Ornithological Biography.* During the publication of these works Audubon divided his time between Great Britain and America, devoting his leisure to expeditions to various parts of the United States and Canada for the purpose of collecting new material. In 1842 he bought an estate on the Hudson, now Audubon Park in New York City. In 1844 he published in America a popular octavo edition of his *Birds of America.* He also took up the preparation of a new work, *The Quadrupeds of America*, with the collaboration of John Bachman, the publication of which was begun in New York in 1846 and finished in 1853-1854. He died at New York on the 27th of January 1851.

See Ornithology; also *Audubon and his Journals* (1897), by his grand-daughter Maria R. Audubon, with notes by Elliot Coues.

AUE, a town of Germany, in the kingdom of Saxony, at the confluence of the Mulde and Schwarzwasser, 21 m. S.W. from Chemnitz on the railway to Adorf. It has a school of lace-making, foundries, and manufactures of machinery, tin-plate and cotton goods. Pop. (1905) 17,102.

AUERBACH, BERTHOLD (1812-1882), German novelist, was born on the 28th of February 1812 at Nordstetten in the Württemberg Black Forest. His parents were Jews, and he was intended for the ministry; but after studying philosophy at Tübingen, Munich and Heidelberg, and becoming estranged from Jewish orthodoxy by the study of Spinoza, he devoted himself to literature. He made a fortunate beginning in a romance on the life of Spinoza (1837), so interesting in itself, and so close in its adherence to fact, that it may be read with equal advantage as a novel or as a biography. *Dichter und Kaufmann* followed in 1839, and a translation of Spinoza's works in 1841, when Auerbach turned to the class of fiction which has made him famous, the *Schwarzwälder Dorfgeschichten* (1843), stories of peasant life in the Black Forest. In these, as well as in *Barfüssele* (1856), *Edelweiss* (1861), and other novels of greater compass, he depicts the life of the south German peasant as "Jeremias Gotthelf" (Albrecht Bitzius) had painted the peasantry of Switzerland, but in a less realistic spirit. When this vein was exhausted Auerbach returned to his first phase as a philosophical novelist, producing *Auf der Höhe* (1865), *Das Landhaus am Rhein* (1869), and other romances of profound speculative tendencies, turning on plots invented by himself. With the exception of *Auf der Höhe*, these works did not enjoy much popularity, and suffer from lack of form and concentration. Auerbach's fame continues to rest upon his *Dorfgeschichten*, although the celebrity of even these has been impaired by the growing demand for a more uncompromising realism. Auerbach died at Cannes on the 8th of February 1882.

The first collected edition of Auerbach's *Schriften* appeared in 22 vols. in 1863-1864; the best edition is in 18 vols. (1892-1895). Auerbach's *Briefe an seinen Freund J. Auerbach* (with a preface by F. Spielhagen) were published in 2 vols. (1884). See E. Zabel, *B. Auerbach* (1882); and E. Lasker, *B. Auerbach, ein Gedenkblatt* (1882).

AUERSPERG, ANTON ALEXANDER, Graf von (1806-1876), Austrian poet, who wrote under the pseudonym of Anastasius Grün, was born on the 11th of April 1806, at Laibach, the capital of the Austrian duchy of Carniola, and was head of the Thurn-am-Hart branch of the Carniolan cadet line of the house of Auersperg. He received his university education first at Graz and then at Vienna, where he studied jurisprudence. In 1830 he succeeded to his ancestral property, and in 1832 appeared as a member of the estates of Carniola on the *Herrenbank* of the diet at Laibach. Here he distinguished himself by his outspoken criticism of the Austrian government, leading the opposition of the duchy to the exactions of the central power. In 1832 the title of "imperial chamberlain" was conferred upon him, and in 1839 he married Maria, daughter of Count Attems. After the revolution of 1848 at Vienna he represented the district of Laibach at the German national assembly at Frankfort-on-the-Main, to which he tried in vain to persuade his Slovene compatriots to send representatives. After a few months, however, disgusted with the violent development of the revolution, he resigned his seat, and again retired into private life. In 1860 he was summoned to the remodelled *Reichsrat* by the emperor, who next year nominated him a life member of the Austrian upper house (*Herrenhaus*), where, while remaining a keen upholder of the German centralized empire, as against the federalism of Slavs and Magyars, he greatly distinguished himself as one of the most intrepid and influential supporters of the cause of liberalism, in both political and religious matters, until his death at Graz on the 12th of September 1876.

Count Auersperg's first publication, a collection of lyrics, *Blätter der Liebe* (1830), showed little originality; but his second production, *Der letzte Ritter* (1830), brought his genius to light. It celebrates the deeds and adventures of the emperor Maximilian I. (1493-1519) in a cycle of poems written in the strophic form of the *Nibelungenlied*. But Auersperg's fame rests almost exclusively on his political poetry; two collections entitled *Spaziergänge eines Wiener Poeten* (1831) and *Schutt* (1835) created a sensation in Germany by their originality and bold liberalism. These two books, which are remarkable not merely for their outspoken opinions, but also for their easy versification and powerful imagery, were the forerunners of the German political poetry of 1840-1848. His *Gedichte* (1837), if anything, increased his reputation; his epics, *Die Nibelungen im Frack* (1843) and *Der Pfaff vom Kahlenberg* (1850), are characterized by a fine ironic humour. He also produced masterly translations of the popular Slovenic songs current in Carniola (*Volkslieder aus Krain*, 1850), and of the English poems relating to "Robin Hood" (1864).

Anastasius Grün's *Gesammelte Werke* were published by L.A. Frankl in 5 vols. (Berlin, 1877); his *Briefwechsel mit L.A. Frankl* (Berlin, 1897). A selection of his *Politische Reden und Schriften* has been published by S. Hock (Vienna, 1906). See P. von Radics, *Anastasius Grün* (2nd ed., Leipzig, 1879).

AUFIDENA, an ancient city of the Samnites Caraceni, the site of which is just north of the modern Alfedena,[1] Italy, a station on the railway between Sulmona and Isernia, 37 m. from the latter. Its remains are fully and accurately described by L. Mariani in *Monumenti dei Lincei* (1901), 225 seq.: cf. *Notizie degli scavi*, 1901, 442 seq.; 1902, 516 seq. The ancient city occupied two hills, both over 3800 ft. above sea-level (in the valley between were found the supposed remains of the later forum), and the walls, of rough Cyclopean work, were over a mile in length. A fortified outpost lay on a still higher hill to the north. Not very much is as yet known of the city itself (though one public building of the 5th century B.C. was excavated in 1901, and a small sanctuary in 1902), attention having been chiefly devoted to the necropolis which lay below it; 1400 tombs had already been examined in 1908, though this number is conjectured to be only a sixteenth of the whole. They are all inhumation burials, of the advanced iron age, and date from the 7th to the 4th century B.C., falling into three classes—those without coffin, those with a coffin formed of stone slabs, and those with a coffin formed of tiles. The objects discovered are preserved in a museum on the spot. In the Roman period we find Aufidena figuring as a post station on the road between Sulmo and Aesernia, which, however, runs past Castel di Sangro, crossing the river by an ancient bridge some 5 m. to the north-east. Castel di Sangro has remains of ancient walls, but these are attributed to a road by Mariani, and in any case the fortified area there was quite small, only one-sixteenth the size of Aufidena. The attempted identification of Castel di Sangro with Aufidena must therefore be rejected, though we must allow that it was probably the Roman post station; the ancient city, since its capture by the Romans in the 3rd century B.C., having lost something of its importance.

(T. As.)

1 Two churches here contain paintings of interest in the history of Abruzzese art, and one of them, the Madonna del Campo, contained fragments of a temple of considerable size.

AUGEAS, or Augeias, in Greek legend, a son of Helios, the sun-god, and king of the Epeians in Elis. He possessed an immense wealth of herds, including twelve bulls sacred to Helios, and white as swans. Eurystheus imposed upon Heracles the task of clearing out all his stalls unaided in one day. This he did by turning the rivers Alpheus and Peneus through them. Augeas had promised him a tenth of the herd, but refused this, alleging that Heracles had acted only in the service of Eurystheus. Heracles thereupon sent an army against him, and, though at first defeated, finally slew Augeas and his sons.

Apollodorus ii. 5, 7; Pindar, *Olympia*, xi, 24; Diodorus iv. 13; Theocritus, *Idyll* 25.

AUGER (from the O. Eng. *nafu-gár*, nave-borer; the original initial *n* having been lost, as in "adder," through a confusion in the case of a preceding indefinite article), a tool for boring (*q.v.*) or drilling.

AUGEREAU, PIERRE FRANÇOIS CHARLES, duke of Castiglione (1757-1816), marshal of France, was born in Paris in a humble station of life. At the age of seventeen he enlisted in the carabineers and thereafter came into note as a duellist. Having drawn his sword upon an officer who insulted him, he fled from France and roamed about in the Levant. He served in the Russian army against the Turks; but afterwards escaped into Prussia and enlisted in the guards. Tiring of this, he deserted with several others and reached the Saxon frontier. Service in the Neapolitan army and a sojourn in Portugal filled up the years 1788-1791; but the events of the French Revolution brought him back to his native land. He served with credit against the Vendeans and then joined the troops opposing the Spaniards in the south. There he rose rapidly, becoming general of division on the 23rd of December 1793. His division distinguished itself even more when transferred to the army of Italy; and under Bonaparte he was largely instrumental in gaining the battle of

Millesimo and in taking the castle of Cosseria and the camp of Ceva. At the battle of Lodi (May 10, 1796), the turning movement of Augereau and his division helped to decide the day. But it was at Castiglione that he rendered the most signal services. Marbot describes him as encouraging even Bonaparte himself in the confused situation that prevailed before that battle, and, though this is exaggerated, there is no doubt that Augereau largely decided the fortunes of those critical days. Bonaparte thus summed up his military qualities: "Has plenty of character, courage, firmness, activity; is inured to war; is well liked by the soldiery; is fortunate in his operations." In 1797 Bonaparte sent him to Paris to encourage the Jacobinical Directors, and it was Augereau and the troops led by him that coerced the "moderates" in the councils and carried through the *coup d'état* of 18 Fructidor (4th of September) 1797. He was then sent to lead the united French forces in Germany; but peace speedily ensued; and he bore a grudge against the Directors and Bonaparte for their treatment of him at that time. He took no part in the *coup d'état* of Brumaire 1799, and did not distinguish himself in the Rhenish campaign which ensued. Nevertheless, owing to his final adhesion to Bonaparte's fortunes, he received a marshal's baton at the beginning of the Empire (May 19, 1804). In the campaign of 1805 he did good service around Constance and Bregenz, and at Jena (October 14, 1806) his corps distinguished itself. Early in 1807 he fell ill of a fever, and at the battle of Eylau he had to be supported on his horse, but directed the movements of his corps with his wonted bravery. His corps was almost annihilated and the marshal himself received a wound from which he never quite recovered. When transferred to Catalonia, he gained some successes but tarnished his name by cruelty. In the campaign of 1812 in Russia and in the Saxon campaign of 1813 his conduct was little more than mediocre. Before the battle of Leipzig (October 16, 18, 19, 1813), Napoleon reproached him with not being the Augereau of Castiglione; to which he replied, "Give me back the old soldiers of Italy, and I will show you that I am." In 1814 he had command of the army of Lyons, and his slackness exposed him to the charge of having come to an understanding with the Austrian invaders. Thereafter he served Louis XVIII., but, after reviling Napoleon, went over to him during the Hundred Days. The emperor repulsed him and charged him with being a traitor to France in 1814. Louis XVIII., when restored to the throne, deprived him of his military title and pension. He died at his estate of La Houssaye on the 12th of June 1816. In person he was tall and commanding, but his loud and vulgar behaviour frequently betrayed the soldier of fortune.

As authorities consult: Kock's *Mémoires de Masséna*; Bouvier, *Bonaparte en Italie*; Count A.F. Andréossi, *La Campagne sur le Mein, 1800-1801*; Baron A. Ducasse, *Précis de la campagne de l'armée de Lyon en 1814*; and the *Memoirs* of Marbot.

(J. Hl. R.)

AUGHRIM, or Aghrim, a small village in Co. Galway, Ireland, 4 m. W. by S. of Ballinasloe. It is rendered memorable by the decisive victory gained here on the 12th of July 1691 by the forces of William III. under General Ginkel, over those of James II. under the French general St Ruth, who fell in the fight. The Irish numbering 25,000, and strongly posted behind marshy ground, at first maintained a vigorous resistance; but Ginkel having penetrated their line of defence, and their general being struck down by a cannon ball at this critical moment, they were at length overcome and routed with terrible slaughter. The loss of the English did not exceed 700 killed and 1000 wounded; while the Irish, in their disastrous flight, lost about 7000 men, besides the whole material of the army. This defeat rendered the adherents of James in Ireland incapable of further efforts, and was speedily followed by the complete submission of the country.

AUGIER, GUILLAUME VICTOR ÉMILE (1820-1889), French dramatist, was born at Valence, Drôme, on the 17th of September 1820. He was the grandson of Pigault Lebrun, and belonged to the well-to-do *bourgeoisie* in principles and in thought as well as by actual birth. He received a good education and studied for the bar. In 1844 he wrote a play in two acts and in verse, *La Ciguë*, refused at the Théâtre Français, but produced with considerable success at the Odéon. This settled his career. Thenceforward, at fairly regular intervals, either alone or in collaboration with other writers—Jules Sandeau, Eugène-Marie Labiche, Éd. Foussier—he produced plays which were in their way eventful. *Le Fils de Giboyer* (1862)—which was regarded as an attack on the clerical party in France, and was only brought out by the direct intervention of the emperor—caused some political excitement. His last comedy, *Les Fourchambault*, belongs to the year 1879. After that date he wrote no more, restrained by an honourable fear of producing inferior work. The Academy had long before, on the 31st of March 1857, elected him to be one of its members. He died in his house at Croissy on the 25th of October 1889. Such, in briefest outline, is the story of a life which Augier himself describes as "without incident"—a life in all senses honourable. Augier, with Dumas *fils* and Sardou, may be said to have held the French stage during the Second Empire. The man respected himself and his art, and his art on its ethical side—for he did not disdain to be a teacher—has high qualities of rectitude and self-restraint. Uprightness of mind and of heart, generous honesty, as Jules Lemaitre well said, constituted the very soul of all his dramatic work. *L'Aventurière* (1848), the first of Augier's important works, already shows a deviation from romantic models; and in the *Mariage d'Olympe* (1855) the courtesan is shown as she is, not glorified as in Dumas's *Dame aux Camélias*. In *Gabrielle* (1849) the husband, not the lover, is the sympathetic, poetic character. In the *Lionnes pauvres* (1858) the wife who sells her favours comes under the lash. Greed of gold, social demoralization, ultramontanism, lust of power, these are satirized in *Les Effrontés* (1861), *Le Fils de Giboyer* (1862), *Contagion*, first announced under the title of *Le Baron d'Estrigaud* (1866), *Lions et renards* (1869)—which, with *Le Gendre de M. Poirier* (1854), written in collaboration with Jules Sandeau, reach the high-water mark of Augier's art; in *Philiberte* (1853) he produced a graceful and delicate drawing-room comedy; and in *Jean de Thommeray*, acted in 1873 after the great reverses of 1870, the regenerating note of patriotism rings high and clear. His last two dramas, *Madame Caverlet* (1876) and *Les Fourchambault* (1879), are problem plays. But it would be unfair to suggest that Émile Augier was a preacher only. He was a moralist in the great sense, the sense in which the term can be applied to Molière and the great dramatists—a moralist because of his large and sane outlook on life. Nor does the interest of his dramas depend on elaborate plot. It springs from character and its evolution. His men and women move as personality, that mysterious factor, dictates. They are real, several of them typical. Augier's first drama, *La Ciguë*, belongs to a time (1844) when the romantic drama was on the wane; and his almost exclusively domestic range of subject scarcely lends itself to lyric outbursts of pure poetry. But his verse, if not that of a great poet, has excellent dramatic qualities, while the prose of his prose dramas is admirable for directness, alertness, sinew and a large and effective wit. Perhaps it wanted these qualities to enlist laughter on his side in such a war as he waged against false passion and false sentiment.

(F. T. M.)

AUGITE, an important member of the pyroxene (*q.v.*) group of rock-forming minerals. The name (from αὐγή, lustre) has at various times been used in different senses; it is now applied to aluminous pyroxenes of the monoclinic series which are dark-greenish, brownish or black in colour. Like the other pyroxenes it is characterized crystallographically by its distinct cleavages parallel to the prism-faces (M), the angle between which is 87°. A typical crystal is represented in fig. 1, whilst fig. 2 shows a crystal twinned on the orthopinacoid (r′). Such crystals, of short prismatic habit and black in colour, are common as phenocrysts in many basalts, and are hence known as "basaltic augite"; when the containing rock weathers to a clayey material the augite is left as black isolated crystals, and such specimens, usually from Bohemia, are represented in all mineral collections. Though typical of basaltic rocks, augite is also an important constituent of many other kinds of igneous rocks, and a rock composed almost wholly of augite is known as augitite. It also occurs in metamorphic rocks; for example, in the crystalline limestones of the Fassathal in Tirol, where the variety known as fassaite is found as pistachio-green crystals resembling epidote in appearance.

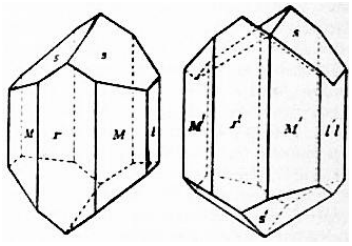


FIG. 1. FIG. 2.

Chemically, augite resembles diopside in consisting mainly of $CaMgSi_2O_6$, but it contains in addition alumina and ferric iron as (Mg, Fe″) (Al, Fe‴)$_2$ SiO_6; the acmite ($NaFe'''Si_2O_6$,) and jadeite ($NaAlSi_2O_6$) molecules are also sometimes present. Variations in the amount of iron in mixtures of these isomorphous molecules are accompanied by variations in the optical characters of the augite. 902

(L. J. S.)

AUGMENT (Lat. *augere*, to increase), in Sanskrit and Greek grammar the vowel prefixed to indicate the past tenses of a verb; in Greek grammar it is called *syllabic*, when only the ε is prefixed; *temporal*, when it causes an initial vowel in the verb to become a diphthong or long vowel.

AUGMENTATION, or enlargement, a term in heraldry for an addition to a coat of arms; in music, for the imitation in longer notes of an original theme; in biology, an addition to the normal number of parts; in Scots law, an increase of a minister's stipend by an action called "Process of Augmentation." The "Court of Augmentation" in Henry VIII.'s time was established to try cases affecting the suppression of monasteries, and was dissolved in Mary's reign.

AUGSBURG, a city and episcopal see of Germany, in the kingdom of Bavaria, chief town of the district of Swabia. Pop. (1885) 65,905; (1900) 89,109; (1905) 93,882. It lies on a high plateau, 1500 ft. above the sea, between the rivers Wertach and Lech, which unite below the city, 39 m. W.N.W. from Munich, with which, as with Regensburg, Ingolstadt and Ulm, it is connected by main lines of railway. It consists of an upper and a lower town, the old Jakob suburb and various modern suburbs. Its fortifications were dismantled in 1703 and have since been converted into public promenades. Maximilian Street is remarkable for its breadth and architectural beauty. One of its most interesting edifices is the Fugger Haus, of which the entire front is painted in fresco. Among the public buildings of Augsburg most worthy of notice is the town-hall in Renaissance style, one of the finest in Germany, built by Elias Holl in 1616-1620. One of its rooms, called the "Golden Hall," from the profusion of its gilding, is 113 ft. long, 59 broad and 53 high. The palace of the bishops, where the memorable Confession of Faith was presented to Charles V., is now used for government offices. Among the seventeen Reman Catholic churches and chapels, the cathedral, a basilica with two Romanesque towers, dates in its oldest portions from the 10th century. The church of St Ulrich and St Afra, built 1474-1500, is a Late Gothic edifice, with a nave of magnificent proportions and a tower 300 ft. high. The church stands on the spot where the first Christians of the district suffered martyrdom, and where a chapel was erected in the 6th century over the grave of St Afra. There are also a Protestant church, St Anne's, a school of arts, a polytechnic institution, a picture gallery in the former monastery of St Catherine, a museum, observatory, botanical gardens, an exchange, gymnasium, deaf-mute institution, orphan asylum, several remarkable fountains dating from the 16th century, &c. Augsburg is particularly well provided with special and technical schools. The newer buildings, all in the modern west quarter of the city, include law courts, a theatre, and a municipal library with 200,000 volumes. The "Fuggerei," built in 1519 by the brothers Fugger, is a miniature town, with six streets or alleys, three gates and a church, and consists of a hundred and six small houses let to indigent Roman Catholic citizens at a nominal rent. The manufactures of Augsburg are of great importance. It is the chief seat of the textile industry in south Germany, and its cloth, cotton goods and linen manufactories employ about 10,000 hands. It is also noted for its bleach and dye works, its engine works, foundries, paper factories, and production of silk goods, watches, jewelry, mathematical instruments, leather, chemicals, &c. Augsburg is also the centre of the acetylene gas industry of Germany. Copper-engraving, for which it was formerly noted, is no longer carried on; but printing, lithography and publishing have acquired a considerable development, one of the best-known Continental newspapers being the *Allgemeine Zeitung* or *Augsburg Gazette*. On the opposite side of the river, which is here crossed by a bridge, lies the township of Lechhausen.

Augsburg (the *Augusta Vindelicorum* of the Romans) derives its name from the Roman emperor Augustus, who, on the conquest of Rhaetia by Drusus, established here a Roman colony about 14 B.C. In the 5th century it was sacked by the Huns, and afterwards came under the power of the Frankish kings. It was almost entirely destroyed in the war of Charlemagne against Tassilo III., duke of Bavaria; and after the dissolution and division of that empire, it fell into the hands of the dukes of Swabia. After this it rose rapidly into importance as a manufacturing and commercial town, becoming, after Nuremberg, the centre of the trade between Italy and the north of Europe; its merchant princes, the Fuggers and Welsers, rivalled the Medici of Florence; but the alterations produced in the currents of trade by the discoveries of the 15th and 16th centuries occasioned a great decline. In 1276 it was raised to the rank of a free imperial city, which it retained, with many changes in its internal constitution, till 1806, when it was annexed to the kingdom of Bavaria. Meanwhile, it was the scene of numerous events of historical importance. It was besieged and taken by Gustavus Adolphus in 1632, and in 1635 it surrendered to the imperial forces; in 1703 it was bombarded by the electoral prince of Bavaria, and forced to pay a contribution of 400,000 dollars; and in the war of 1803 it suffered severely. Of its conventions the most memorable are those which gave birth to the Augsburg confession (1530) and to the Augsburg alliance (1686).

See Wagenseil, *Geschichte der Stadt Augsburg* (Augs., 1820-1822); Werner, *Geschichte der Stadt Augsburg* (1899); Roth, *Augsburg's Reformationsgeschichte* (1902).

AUGSBURG, CONFESSION OF, the most important Protestant statement of belief drawn up at the Reformation. In summoning a diet for April 1530, Charles V. offered a fair hearing to all religious parties in the Empire. Luther, Justus Jonas, Melanchthon and Johann Bugenhagen were appointed to draw up a statement of the Saxon position. These "Torgau Articles" (March 1530) tell merely why Saxony had abolished certain ecclesiastical abuses. Melanchthon, however, soon found that, owing to attacks by Johann Eck of Ingolstadt ("404 Articles"), Saxony must state its position in doctrinal matters as well. Taking the Articles of Marburg (see MARBURG, COLLOQUY OF) and of Schwabach as the point of departure, he repudiated all connexion with heretics condemned by the ancient church. On the 11th of May he sent the draft to Luther, who approved it, adding that he himself "could not tread so softly and gently." On the

23rd of June the Confession, originally intended as the statement of Electoral Saxony alone, was discussed and signed by a number of other Protestant princes and cities, and read before the diet on the 25th of June. Articles 1-21 attempt to show that the Evangelicals had deviated from current doctrine only in order to restore the pure and original teaching of the church. In spite of significant omissions (the sole authority of scripture; rejection of transubstantiation), the Confession contains nothing contradictory to Luther's position, and in its emphasis on justification by faith alone enunciates a cardinal concept of the Evangelical churches. Articles 22-28 describe and defend the reformation of various "abuses." On the 3rd of August, shorn of much of its original bitterness, the so-called *Confutatio pontificia* was read; it well expresses the views approved in substance by the emperor and all the Catholic party. In answer, Melanchthon was ordered to prepare an Apology of the Confession, which the emperor refused to receive; so Melanchthon enlarged it and published the *editio princeps* of both Confession and Apology in 1531.

As he felt free to make slight changes, the first edition does not represent the exact text of 1530; the edition of 1533 was further improved, while that of 1540, rearranged and in part rewritten, is known as the *Variata*. Dogmatic changes in this seem to have drawn forth no protest from Luther or Brenz, so Melanchthon made fresh alterations in 1542. Later, the *Variata* of 1540 became the creed of the Melanchthonians and even of the Crypto-calvinists; so the framers of the Formula of Concord, promulgated in 1580, returned to the text handed in at the Diet. By mistake they printed from a poor copy and not from the original, from which their German text varies at over 450 places. Their Latin text, that of Melanchthon's *editio princeps*, is more nearly accurate. The *textus receptus* is that of the Formula of Concord, the divergent Latin and German forms being equally binding.

Acceptance of the Confession and Apology was made a condition of membership in the Schmalkalden League. The Wittenberg Concord (1536) and the Articles of Schmalkalden (1537) reaffirmed them. The Confession was the ultimate source of much of the Thirty-nine Articles. The Religious Peace of Augsburg (1555) recognized no Protestants save adherents of the Confession; this was modified in 1648. To-day the *Invariata* is of symbolical authority among Lutherans generally, while the *Variata* is accepted by the Reformed churches of certain parts of Germany (see Löber, pp. 79-83.)

Editions of the received text: J.T. Müller, *Die symbolischen Bücher der evangelisch-lutherischen Kirche* (10th ed., Gütersloh, 1907), with a valuable historical introduction by Th. Kolde; Theodor Kolde, *Die Augsburgische Konfession* (Gotha, 1896), (contains also the Marburg, Schwabach and Torgau Articles, the *Confutatio* and the *Variata* of 1540). For translations of these, as well as of Zwingli's Reckoning of his Faith, and of the Tetrapolitan Confession, see H.E. Jacobs, *The Book of Concord* (Philadelphia, 1882-83). The texts submitted to the emperor, lost before 1570, are reconstructed and compared with the *textus receptus* by P. Tschackert, *Die unveranderte Augsburgische Konfession* (Leipzig, 1901). For the genesis of the Confession, see Th. Kolde, *Die alteste Redaktion der Augsburger Konfession* (Gütersloh, 1906), also Kolde's article, "Augsburger Bekenntnis," in Herzog-Hauck, *Realencyklopädie* (3rd ed., vol. ii., Leipzig, 1897). The standard commentary is still G.L. Plitt, *Einleitung in die Augustana* (Erlangen, 1867 ff.); compare also J. Ficker, *Die Konfutation des Augsburgischen Bekenntnisses in ihrer ersten Gestalt* (Leipzig, 1891); also A. Petzold, *Die Konfutation des Vierstädtebekenntnisses* (Leipzig, 1900). On its present use see G. Löber, *Die im evangelischen Deutschland geltenden Ordinationsverpflichtungen geschichtlich geordnet* (Leipzig, 1905), 79 ff.

(W. W. R.*)

AUGSBURG, WAR OF THE LEAGUE OF, the name applied to the European war of 1688-1697. The league of Augsburg was concluded on the 9th of July 1686 by the emperor, the elector of Brandenburg and other princes, against the French. Spain, Sweden, England and other non-German states joined the league, and formed the Grand Alliance by the treaty of Vienna (July 12, 1689). (See Grand Alliance, War of the.)

AUGURS, in ancient Rome, members of a religious college whose duty it was to observe and interpret the signs (auspices) of approval or disapproval sent by the gods in reference to any proposed undertaking. The *augures* were originally called *auspices*, but, while *auspex*[1] fell into disuse and was replaced by *augur*, *auspicium* was retained as the scientific term for the observation of signs.

The early history of the college is obscure. Its institution has been attributed to Romulus or Numa. It probably consisted originally of three members, of whom the king himself was one. This number was doubled by Tarquinius Priscus, but in 300 B.C. it was only four, two places, according to Livy (x. 6), being vacant. The Ogulnian law in the same year increased the number to nine, five plebeian being added to the four patrician members. In the time of Sulla the number was fifteen, which was increased to sixteen by Julius Caesar. This number continued in imperial times; the college itself was certainly in existence as late as the 4th century. The office of augur, which was bestowed only upon persons of distinguished merit and was much sought after by reason of its political importance, was held for life. Vacancies were originally filled by co-optation, but by the Domitian law (104) the selection was made, by seventeen out of the thirty-five tribes chosen by lot, from candidates previously nominated by the college. The insignia of office were the *lituus*, a staff free from knots and bent at the top, and the *trabea*, a kind of toga with bright scarlet stripes and a purple border. The science of augury was contained in various written works, which were consulted as occasion arose: such were the *libri augurum*, a manual of augural ritual, and the *commentarii augurum*, a collection of decrees or answers given by the college to the senate in certain definite cases.

The natural region to look to for signs of the will of Jupiter was the sky, where lightning and the flight of birds seemed directed by him as counsel to men. The latter, however, was the more difficult of interpretation, and upon it, therefore, mainly hinged the system of divination with which the augurs were occupied. It was the duty of the augur, before the auspices properly so called (those from the sky and from birds) were taken, to mark out with his staff the templum or consecrated space within which his observations were intended to be made. The method of procedure was as follows. At midnight, when the sky was clear and there was an absence of wind, the augur, in the presence of a magistrate, took up his position on a hill which afforded a wide view. After prayer and sacrifice, he marked out the templum both in the sky and on the ground and dedicated it. Within its limits he then pitched a tent, in which he sat down with covered head, asked the gods for a sign, and waited for an answer. As the augur looked south he had the east, the lucky quarter, on his left, and therefore signs on the left side were considered favourable, those on the right unfavourable. The practice was the reverse in Greece; the observers of signs looked towards the north, so that signs on the right were regarded as the favourable ones, and this is frequently adopted in the Roman poets. The augur afterwards announced the result of his observations in a set form of words, by which the magistrate was bound. Signs of the will of the gods were of two kinds, either in answer to a request (*auspicia impetrativa*), or incidental (*auspicia oblativa*). Of such signs there were five classes: (1) Signs in the sky (*caelestia auspicia*), consisting chiefly of thunder and lightning, but not excluding falling stars and other phenomena. Lightning from left to right was favourable, from right to left unfavourable; but on its mere appearance, in either direction, all business in the public assemblies was suspended for the day. Since the person charged to take the auspices for a certain day was constitutionally subject to no other authority who could test the truth or falsehood of his statement that he had observed lightning, this became a favourite device for putting off meetings of the public assembly. Restrictions were, however, imposed in later republican times. When a new consul, praetor or quaestor entered on his first day of office and prayed the gods for good omens, it was a matter of custom to report to him that lightning from the left had been seen. (2) Signs from birds (*signa ex avibus*), with reference to the direction of their flight, and also to their singing, or uttering other sounds. To the first class, called *alites*, belonged the eagle and the vulture; to the second, called *oscines*, the owl, the crow and the raven. The mere appearance of certain birds indicated good or ill luck, while others had a reference only to definite persons or events. In matters of ordinary life on which divine counsel was prayed for, it was usual to have recourse to this form of divination. For public affairs it was, by the time of Cicero, superseded by the fictitious observation of lightning. (3) Feeding of birds (*auspicia ex tripudiis*), which consisted in observing whether a bird—usually a fowl—on grain being thrown before it, let fall a particle from its mouth (*tripudium sollistimum*). If it did so, the will of the gods was in favour of the enterprise in question. The simplicity of this ceremony recommended it for very general use, particularly in the army when on service. The fowls were kept in cages by a servant, styled *pullarius*. In imperial times *decuriales pullarii* are mentioned. (4) Signs from animals (*pedestria auspicia*, or *ex quadrupedibus*), *i.e.* observation of the course of, or sounds uttered by, quadrupeds and reptiles within a fixed space, corresponding to the observations of

the flight of birds, but much less frequently employed. It had gone out of use by the time of Cicero. (5) Warnings (*signa ex diris*), consisting of all unusual phenomena, but chiefly such as boded ill. Being accidental in their occurrence, they belonged to the *auguria oblativa*, and their interpretation was not a matter for the augurs, unless occurring in the course of some public transaction, in which case they formed a divine veto against it. Otherwise, reference was made for an interpretation to the pontifices in olden times, afterwards frequently to the Sibylline books, or the Etruscan haruspices, when the incident was not already provided for by a rule, as, for example, that it was unlucky for a person leaving his house to meet a raven, that the sudden death of a person from epilepsy at a public meeting was a sign to break up the assembly.

Among the other means of discovering the will of the gods were the casting of lots, oracles of Apollo (in the hands of the college *sacris faciundis*), but chiefly the examination of the entrails of animals slain for sacrifice (see OMEN). Anything abnormal found there was brought under the notice of the augurs, but usually the Etruscan haruspices were employed for this. The persons entitled to ask for an expression of the divine will on a public affair were the magistrates. To the highest offices, including all persons of consular and praetorian rank, belonged the right of taking *auspicia maxima*; to the inferior offices of aedile and quaestor, the *auspicia minora*; the differences between these, however, must have been small. The subjects for which *auspicia publica* were always taken were the election of magistrates, their entering on office, the holding of a public assembly to pass decrees, the setting out of an army for war. They could only be taken in Rome itself; and in case of a commander having to renew his *auspicia*, he must either return to Rome or select a spot in the foreign country to represent the hearth of that city. The time for observing auspices was, as a rule, between midnight and dawn of the day fixed for any proposed undertaking. In military affairs this course was not always possible, as in the case of taking auspices before crossing a river. The founding of colonies, the beginning of a battle, the calling together an army, the sittings of the senate, decisions of peace or war, were occasions, not always but frequently, for taking auspices. The place where the ceremony was performed was not fixed, but selected with a view to the matter in hand. A spot being selected, the official charged to make the observation pitched his tent there some days before. A matter postponed through adverse signs from the gods could on the following or some future day be again brought forward for the auspices. If an error (*vitium*) occurred in the auspices, the augurs could, of their own accord or at the request of the senate, inform themselves of the circumstances, and decree upon it. A consul could refuse to accept their decree while he remained in office, but on retiring he could be prosecuted. *Auspicia oblativa* referred mostly to the comitia. A magistrate was not bound to take notice of signs reported merely by a private person, but he could not overlook such a report from a brother magistrate. For example, if a quaestor on his entry to office observed lightning and announced it to the consul, the latter must delay the public assembly for the day.

On the subject generally, see A. Bouché-Leclercq, *Histoire de la divination dans l'antiquité* (1879), and his articles, with bibliography, in Daremberg and Saglio's *Dictionnaire des antiquités*, also articles "Augures," "Auspicium," by Wissowa in Pauly's *Realencyclopädie* (II. pt. ii., 1896), and by L.C. Purser (and others) in Smith's *Dictionary of Greek and Roman Antiquities* (3rd ed., 1890). (See also DIVINATION, OMEN, ASTROLOGY, &c.)

1 There is no doubt that *auspex* = *avi-spex* ("observer of birds"), but the derivation of *augur* is still unsettled. The following have been suggested: (1) *augur* (or *augus*) is a substantive originally meaning "increase" (related to *augustus* as *robur* to *robustus*), then transferred to the priest as the giver of increase or blessing; (2) = *avi-gur*, the second part of the word pointing to (*a*) *garrire*, "chatter," or (*b*) *gerere*, the augur being conceived as "carrying" or guiding the flight of the birds; (3) from a lost verb *augo* = "tell," "declare." It is now generally agreed that the science of augury is of Italian, not Etruscan, origin.

AUGUST (originally *Sextilis*), the sixth month in the pre-Julian Roman year, which received its present name from the emperor Augustus. The preceding month, *Quintilis*, had been called "July" after Julius Caesar, and the emperor chose August to be rechristened in his own honour because his greatest good fortune had then happened. In that month he had been admitted to the consulate, had thrice celebrated a triumph, had received the allegiance of the soldiers stationed on the Janiculum, had concluded the civil wars, and had subdued Egypt. As July contained thirty-one days, and August only thirty, it was thought necessary to add another day to the latter month, in order that the month of Augustus might not be in any respect inferior to that of Julius.

AUGUSTA, a city and the county-seat of Richmond county, Georgia, U.S.A., at the head of steamboat navigation on the Savannah river, 132 m. N.W. of Savannah by rail and 240 m. by river course. Pop. (1890) 33,300; (1900) 39,441, of whom 18,487 were negroes and only 995 were foreign-born; (1910 census) 41,040. Augusta is served by the Southern, the Augusta Southern (controlled by the Southern), the Atlantic Coast Line, the Charleston & Western Carolina (controlled by the Atlantic Coast Line), the Georgia and the Central of Georgia railways, by an electric line to Aiken, South Carolina, and by a line of steamers to Savannah. The city extends along the river bank for a distance of more than 3 m., and is connected by a bridge with Hamburg, and with North Augusta, South Carolina, two residential suburbs. Augusta is well known as a winter resort (mean winter temperature, 47° F.), and there are many fine winter homes here of wealthy Northerners. There are good roads, stretching from Augusta for miles in almost every direction. In North Augusta there is a large hotel, and there is another in Summerville (pop. in 1910, 4361), 2½ m. N.W., an attractive residential suburb and winter resort, in which there are a country club and a large United States arsenal, established in 1831. Broad Street is the principal thoroughfare of Augusta, and Greene Street, with a park in the centre and flanking rows of oaks and elms, is the finest residential street. Of historical interest is St Paul's church (Protestant Episcopal); the present building was erected in 1819 and is the third St Paul's church on the same site. The first church was "built by the gentlemen of Augusta" in 1750. In the crypt of the church General Leonidas Polk is buried; and in the churchyard are the graves of George Steptoe Washington, a nephew of George Washington, and of William Longstreet, the inventor. Among the city's principal buildings are the Federal building, the Richmond county court house, the Augusta orphan asylum, the city hospital, the Lamar hospital for negroes, and the buildings of Richmond Academy (incorporated in 1783), of the Academy of the Sacred Heart (for girls), of Paine's Institute (for negroes), of Houghton Institute, endowed in 1852 to be "free to all the children of Augusta," and of the medical school of the university of Georgia, founded in 1829, and a part of the university since 1873. A granite obelisk 50 ft. high was erected in 1861 as a memorial to the signers for Georgia of the Declaration of Independence; beneath it are buried Lyman Hall (1726-1790) and George Walton (1740-1804). There are two Italian marble monuments in honour of Confederate soldiers, and monuments to the Southern poets, Paul Hamilton Hayne and Richard Henry Wilde (1789-1847).

In commerce and manufacturing, Augusta ranks second among the cities of Georgia. As a centre of trade for the "Cotton Belt," it has a large wholesale and retail business; and it is an important cotton market. The principal manufacture is cotton goods; among the other products are lumber, flour, cotton waste, cotton-seed oil and cake, ice, silk, boilers and engines, and general merchandise staples. Water-power for factories is secured by a system of "water-power canals" from a large dam across the Savannah, built in 1847 and enlarged in 1871; the principal canal, owned by the city, is so valuable as nearly to pay the interest on the municipal debt. In 1905 the value of the city's total factory product was $8,829,305, of which $3,832,009, or 43.4%, was the value of the cotton goods. The principal newspaper is the *Augusta Chronicle*, founded in 1785.

Augusta was established in 1735-1736 by James Edward Oglethorpe, the founder of Georgia, and was named in honour of the princess of Wales. The Carolina colonists had a trading post in its vicinity before the settlement by Oglethorpe. The fort, built in 1736, was first named Fort Augusta, and in 1780, at the time of the British occupation, was enlarged and renamed Fort Cornwallis; its site is now marked by a Memorial Cross, erected by the Colonial Dames of Georgia in the churchyard of St Paul's. Tobacco was the principal agricultural product during the 18th century, and for its culture negro slaves were introduced from Carolina, before the restrictions of the Georgia Trustees on slavery were removed. During the colonial period several treaties with Indians were made at Augusta; by the most important, that of 1763, the Choctaws, Creeks, Chickasaws, Cherokees and Catawbas agreed (in a meeting with the governors of North and South Carolina, Virginia and Georgia) to the terms of the treaty of Paris. At the opening of the American War of

Independence, the majority of the people of Augusta were Loyalists. The town was taken by the British under Lieut.-Col. Archibald Campbell (1739-1791) in January 1779, but was evacuated a month later; it was the seat of government of Georgia for almost the entire period from the capture of Savannah in December 1778 until May 1780, and was then abandoned by the Patriots and was occupied chiefly by Loyalists under Lieut.-Col. Thomas Brown. In September 1780 a force of less than 500 patriots under Col. Elijah Clarke marched against the town in three divisions, and while one division, attacking a neighbouring Indian camp, drew off most of the garrison, the other two divisions entered the town; but British reinforcements arrived before Brown could be dislodged from a building in which he had taken refuge, and Clarke was forced to withdraw. A stronger American force, under Lieut.-Col. Henry Lee, renewed the siege in May 1781 and gained possession on the 5th of June. From 1783 until 1795 Augusta was again the seat of the state government. It was the meeting-place of the Land Court which confiscated the property of the Loyalists of Georgia, and of the convention which ratified for Georgia the Constitution of the United States. In 1798 it was incorporated as a town, and in 1817 it was chartered as a city. Augusta was the home of the inventor, William Longstreet (1759-1814), who as early as 1788 received a patent from the state of Georgia for a steamboat, but met with no practical success until 1808; as early as 1801 he had made experiments in the application of steam to cotton gins and saw-mills at Augusta. Near Augusta, on the site now occupied by the Eli Whitney Country Club, Eli Whitney is said to have first set up and operated his cotton gin; he is commemorated by a mural tablet in the court house. The establishment of a steamboat line to Savannah in 1817 aided Augusta's rapid commercial development. There was a disastrous fire in 1829, an epidemic of yellow fever in 1839, and a flood in 1840, but the growth of the city was not seriously checked; the cotton receipts of 1846 were 212,019 bales, and in 1847 a cotton factory was built. During the Civil War Augusta was the seat of extensive military factories, the tall chimney of the Confederate powder mills still standing as a memorial. The economic development has, since the Civil War, been steady and continuous. An exposition was held in Augusta in 1888, and another in 1893.

AUGUSTA, the capital of Maine, U.S.A., and the county-seat of Kennebec county, on the Kennebec river[1] (at the head of navigation), 44 m. from its mouth, 62 m. by rail N.E. of Portland, and 74 m. S.W. of Bangor. Pop. (1890) 10,527; (1900) 11,683, of whom 2131 were foreign-born; (1910, census) 13,211. It is served by the Maine Central railway, by several electric lines, and by steamboat lines to Portland, Boston and several other ports. It is built on a series of terraces, mostly on the west bank of the river, which is spanned here by a bridge 1100 ft. long. The state house, built of granite quarried in the vicinity, occupies a commanding site along the south border of the city, and in it is the state library. The Lithgow library is a city public library. Near the state house is the former residence of James G. Blaine. On the other side of the river, nearly opposite, is the Maine insane hospital. Among other prominent buildings are the court house, the post office and the city hall. In one of the parks is a soldiers' and sailors' monument. By means of a dam across the river, 17 ft. high and nearly 600 ft. long, good water-power is provided, and the city manufactures cotton goods, boots and shoes, paper, pulp and lumber. A leading industry is the printing and publishing of newspapers and periodicals, several of the periodicals published here having an enormous circulation. The total value of the factory products in 1905 was $3,886,833. Augusta occupies the site of the Indian village, Koussinoc, at which the Plymouth Colony established a trading post about 1628. In 1661 Plymouth sold its interests, and soon afterward the four purchasers abandoned the post. In 1754, however, their heirs brought about the erection here of Fort Western, the main building of which is still standing at the east end of the bridge, opposite the city hall. Augusta was originally a part of the township of Hallowell (incorporated in 1771); in 1797 the north part of Hallowell was incorporated as a separate town and named Harrington; and later in the same year the name was changed to Augusta. It became the county-seat in 1799; was chosen by the Maine legislature as the capital of the state in 1827, but was not occupied as such until the completion of the state house in 1831; and was chartered as a city in 1849.

1 The Kennebec was first explored to this point in 1607.

AUGUSTA, a seaport of the province of Syracuse, Sicily, 19 m. N. of it by rail. Pop. (1901) 16,402. It occupies a part of the former peninsula of Xiphonia, now a small island, connected with the mainland by a bridge. It was founded by the emperor Frederick II. in 1232, and almost entirely destroyed by an earthquake in 1693, after which it was rebuilt. The castle is now a large prison. The fortified port, though unfrequented except as a naval harbour of refuge, is a very fine one. There are considerable saltworks at Augusta. To the south, on the left bank of the Molinello. 1½ m. from its mouth, Sicel tombs and Christian catacombs, and farther up the river a cave village of the early middle ages, have been explored (*Notizie degli Scavi*, 1902, 411, 631; *Römische Quartalschrift*, 1902, 205). Whether there was ever a town bearing the name Xiphonia is doubted by E.A. Freeman (*Hist. of Sic.* i. 583); cf., however, E. Pais, *Atakta* (Pisa, 1891), 55, who attributes its foundation, under the name of Tauromenion (which it soon lost), to the Zancleans of Hybla (afterwards Megara Hyblaea).

(T. As.)

AUGUSTA BAGIENNORUM, the chief town of the Ligurian tribe of the Bagienni, probably identical with the modern Bene Vagienna, on the upper course of the Tanaro, about 35 m. due south of Turin. The town retained its position as a tribal centre in the reorganization of Augustus, whose name it bears, and was erected on a systematic plan. Considerable remains of public buildings, constructed in concrete faced with small stones with bands of brick at intervals, an amphitheatre with a major axis of 390 ft. and a minor axis of 305 ft., a theatre with a stage 133 ft. in length, and near it the foundations of what was probably a basilica, an open space (no doubt the forum), an aqueduct, baths, &c., have been discovered by recent excavations, and also one of the city gates, flanked by two towers 22 ft. sq.

See G. Assandria and G. Vacchetta in *Notizie degli Scavi* (1894), 155; (1896), 215; (1897), 441; (1898), 299; (1900), 389; (1901), 413.

(T. As.)

AUGUSTAN HISTORY, the name given to a collection of the biographies of the Roman emperors from Hadrian to Carinus (A.D. 117-284). The work professes to have been written during the reigns of Diocletian and Constantine, and is to be regarded as the composition of six authors,—Aelius Spartianus, Julius Capitolinus, Aelius Lampridius, Vulcacius Gallicanus, Trebellius Pollio and Flavius Vopiscus—known as Scriptores Historiae Augustae, writers of Augustan history. It is generally agreed, however, that there is a large number of interpolations in the work, which are referred to the reign of Theodosius; and that the documents inserted in the lives are almost all forgeries. The more advanced school of critics holds that the names of the supposed authors are purely fictitious, as those of some of the authorities which they profess to quote certainly are. The lives, which (with few exceptions) are arranged in chronological order, are distributed as follows:—To Spartianus: the biographies of Hadrian, Aelius Verus, Didius Julianus, Septimius Severus, Pescennius Niger, Caracallus, Geta (?); to Vulcacius Gallicanus: Avidius Cassius; to Capitolinus: Antoninus Pius, Marcus Aurelius Antoninus, Verus, Pertinax, Clodius Albinus, the two Maximins, the three Gordians, Maximus and Balbinus, Opilius Macrinus (?); to Lampridius: Commodus, Diadumenus, Elagabalus, Alexander Severus; to Pollio: the two Valerians, the Gallieni, the so-called Thirty Tyrants or Usurpers, Claudius (his lives of Philip, Decius, and Gallus being lost); to Vopiscus: Aurelian, Tacitus, Florian, Probus, the

four tyrants (Firmus, Saturninus, Proculus, Bonosus), Carus, Numerian, Carinus.

The importance of the Augustan history as a repertory of information is very considerable, but its literary pretensions are of the humblest order. The writers' standard was confessedly low. "My purpose," says Vopiscus, "has been to provide materials for persons more eloquent than I." Considering the perverted taste of the age, it is perhaps fortunate that the task fell into the hands of no showy declaimer who measured his success by his skill in making surface do duty for substance, but of homely, matter-of-fact scribes, whose sole concern was to record what they knew. Their narrative is unmethodical and inartificial; their style is tame and plebeian; their conception of biography is that of a collection of anecdotes; they have no notion of arrangement, no measure of proportion, and no criterion of discrimination between the important and the trivial; they are equally destitute of critical and of historical insight, unable to sift the authorities on which they rely, and unsuspicious of the stupendous social revolution comprised within the period which they undertake to describe. Their value, consequently, depends very much on that of the sources to which they happen to have recourse for any given period of history, and on the fidelity of their adherence to these when valuable. Marius Maximus and Aelius Junius Cordus, to whose qualifications they themselves bear no favourable testimony, were their chief authorities for the earlier lives of the series. Marius Maximus, who lived about 165-230, wrote biographies of the emperors, in continuation of those of Suetonius, from Nerva to Elagabalus; Junius Cordus dealt with the less-known emperors, perhaps down to Maximus and Balbinus. The earlier lives, however, contain a substratum of authentic historical fact, which recent critics have supposed to be derived from a lost work by a contemporary writer, described by one of these scholars as "the last great Roman historian." For the later lives the Scriptores were obliged to resort more largely to public records, and thus preserved matter of the highest importance, rescuing from oblivion many imperial rescripts and senatorial decrees, reports of official proceedings and speeches on public occasions, and a number of interesting and characteristic letters from various emperors. Their incidental allusions sometimes cast vivid though undesigned light on the circumstances of the age, and they have made large contributions to our knowledge of imperial jurisprudence in particular. Even their trivialities have their use; their endless anecdotes respecting the personal habits of the subjects of their biographies, if valueless to the historian, are most acceptable to the archaeologist, and not unimportant to the economist and moralist. Their errors and deficiencies may in part be ascribed to the contemporary neglect of history as a branch of instruction. Education was in the hands of rhetoricians and grammarians; historians were read for their style, not for their matter, and since the days of Tacitus, none had arisen worth a schoolmaster's notice. We thus find Vopiscus acknowledging that when he began to write the life of Aurelian, he was entirely misinformed respecting the latter's competitor Firmus, and implying that he would not have ventured on Aurelian himself if he had not had access to the MS. of the emperor's own diary in the Ulpian library. The writers' historical estimates are superficial and conventional, but report the verdict of public opinion with substantial accuracy. The only imputation on the integrity of any of them lies against Trebellius Pollio, who, addressing his work to a descendant of Claudius, the successor and probably the assassin of Gallienus, has dwelt upon the latter versatile sovereign's carelessness and extravagance without acknowledgment of the elastic though fitful energy he so frequently displayed in defence of the empire. The caution of Vopiscus's references to Diocletian cannot be made a reproach to him.

No biographical particulars are recorded respecting any of these writers. From their acquaintance with Latin and Greek literature they must have been men of letters by profession, and very probably secretaries or librarians to persons of distinction. There seems no reason to accept Gibbon's contemptuous estimate of their social position. They appear particularly versed in law. Spartianus's reference to himself as "Diocletian's own" seems to indicate that he was a domestic in the imperial household. They address their patrons with deference, acknowledging their own deficiencies, and seem painfully conscious of the profession of literature having fallen upon evil days.

Editio princeps (Milan, 1475); Casaubon (1603) showed great critical ability in his notes, but for want of a good MS. left the restoration of the text to Salmasius (1620), whose notes are a most remarkable monument of erudition, combined with acuteness in verbal criticism and general vigour of intellect. Of recent years considerable attention has been devoted by German scholars to the *History*, especially by Peter, whose edition of the text in the Teubner series (2nd ed., 1884) contains (praef. xxxv.-xxxvii.) a bibliography of works on the subject preceding the publication of his own special treatise. The edition by Jordan-Eyssenhardt (1863) should also be mentioned. Amongst the most recent treatises on the subject are: A. Gemoll, *Die Scriptores Historiae Augustae* (1886); H. Peter, *Die Scriptores Historiae Augustae* (1892); G. Tropea, *Studi sugli Scriptores Historiae Augustae* (1899-1903); J.M. Heer, *Der historische Wert der Vita Commodi in der Sammlung der Scriptores Historiae Augustae* (1901); C. Lécrivain, *Études sur l'histoire Auguste* (1904); E. Kornemann, *Kaiser Hadrian und der letzte grosse Historiker von Rom* (1905), according to whom "the last great historian of Rome" is Lollius Urbicus; O. Schulz, *Das Kaiserhaus der Antonine und der letzte Historiker Roms* (1907). On their style, see C. Paucker, *De Latinitate Scriptorum Historiae Augustae* (1870); special lexicon by C. Lessing (1901-1906). An English translation is included in *The Lives of the Roman Emperors*, by John Bernard (1698). See further ROME: *History* (anc. *ad fin.*), section "Authorities"; M. Schanz, *Geschichte der römischen Litteratur*, iii. p. 69 (for Marius Maximus and Junius Cordus), iv. p. 47; Teuffel-Schwabe, *Hist. of Roman Literature* (Eng. tr.), § 392; H. Peter, bibliography from 1893 to 1905 in Bursian's *Jahresbericht*, cxxix. (1907).

AUGUSTA PRAETORIA SALASSORUM (mod. *Aosta*, *q.v.*), an ancient town of Italy in the district of the Salassi, founded by Augustus about 24 B.C. on the site of the camp of Varro Murena, who subdued this tribe in 25 B.C., and settled with 3000 praetorians. Pliny calls it the last town of Italy on the north-west, and its position at the confluence of two rivers, at the end of the Great and Little St Bernard, gave it considerable military importance, which is vouched for by considerable remains of Roman buildings. The ancient town walls, enclosing a rectangle 793 by 624 yds., are still preserved almost in their entire extent. The walls are 21 ft. high. They are built of concrete faced with small blocks of stone, and at the bottom are nearly 9 ft. thick, and at the top 6 ft. There are towers at the angles of the *enceinte*, and others at intervals, and two at each of the four gates, making a total of twenty towers altogether. They are roughly 32 ft. square, and project 14 ft. from the wall. The Torre del Pailleron on the south and the Torre del Leproso in the west are especially well preserved. The east and south gates exist (the latter, a double gate with three arches flanked by two towers, is the Porta Praetoria, and is especially fine), while the rectangular arrangement of the streets perpetuates the Roman plan, dividing the town into 16 blocks (*insulae*). The main road, 32 ft. wide, divides the city into two equal halves, running from east to west, an arrangement which makes it clear that the guarding of the road was the main *raison d'être* of the city. Some arcades of the amphitheatre (the diameters of which are 282 ft. and 239 ft.), and the south wall of the theatre are also preserved, the latter to a height of over 70 ft., and a market-place some 300 ft. square, surrounded by storehouses on three sides with a temple in the centre, and two on the open (south) side, and the *thermae*, have been discovered. Outside the town is a handsome triumphal arch in honour of Augustus. About 5 m. to the west is a single-arched Roman bridge, the Pondel, which has a closed passage lighted by windows for foot passengers in winter, and above it an open footpath, both being about 3½ ft. in width. There are considerable remains of the ancient road from Eporedia (mod. *Ivrea*) to Augusta Praetoria, up the Valle d' Aosta, which the modern railway follows, notably the Pont St Martin, with a single arch with a span of 116 ft. and a roadway 15 ft. wide, the cutting of Donnaz, and the Roman bridges of Châtillon (Pont St Vincent) and Aosta (Pont de Pierre), &c.

See C. Promis, *Le antichità di Aosta* (Turin, 1862); E. Bérard in *Atti della Società di Archeologia di Torino*, iii. 119 seq.; *Notizie degli Scavi*, passim; A. d'Andrade, *Relazione dell' Ufficio Regionale per la consenazione dei Monumenti del Piemonte e della Liguria* (Turin, 1899), 46 seq.

(T. As.)

AUGUSTI, JOHANN CHRISTIAN WILHELM (1772-1841), German theologian, born at Eschenberga, near Gotha, was of Jewish descent, his grandfather having been a converted rabbi. He was educated at the gymnasium at Gotha and the university of Jena. At Jena he studied oriental languages, of which he became professor there in 1803. Subsequently he became ordinary professor of theology (1812), and for a time rector, at Breslau. In 1819 he was transferred to the university of Bonn, where he was made professor primarius. In 1828 he was appointed chief member of the consistorial council at Coblenz. Here he was afterwards made director of the

consistory. He died at Coblenz in 1841. Augusti had little sympathy with the modern philosophical interpretations of dogma, and although he took up a position of free criticism with regard to the Biblical narratives, he held fast to the traditional faith. His works on 907
theology (*Dogmengeschichte*, 1805; 4th ed., 1835) are simple statements of fact; they do not attempt a speculative treatment of their subjects. In 1809 he published in conjunction with W.M.L. de Wette a new translation of the Old Testament. Mention should also be made of his *Grundriss einer historischkritischen Einleitung ins Alte Testament* (1806), his *Exegetisches Handbuch des Alten Testaments* (1797-1800), and his edition of *Die Apokryphen des A. T.* (1804). In addition to these, his most important writings are the *Denkwürdigkeiten aus der Christlichen Archäologie*, 12 vols. (1817-1831), a partially digested mass of materials, and the *Handbuch der Christ. Archäologie*, 3 vols. (1836-1837), which gives the substance of the larger work in a more compact and systematic form.

AUGUSTINE, SAINT (354-430), one of the four great fathers of the Latin Church. Augustinus—the *praenomen* Aurelius is used indeed by his disciples Orosius and Prosper, and is found in the oldest Augustine MSS., but is not used by himself, nor in the letters addressed to him—was born at Tagaste, a town of Numidia, now Suk Ahras in Constantine, on the 13th of November 354. His father, Patricius, was a burgess of Tagaste and still a pagan at the time of his son's birth. His mother, Monica, was not only a Christian, but a woman of the most tender and devoted piety, whose beautiful faith and enthusiasm and patient prayer for both her husband and son (at length crowned with success in both cases) have made her a type of womanly saintliness for all ages. She early instructed her son in the faith and love of Jesus Christ, and for a time he seems to have been impressed by her teaching. Falling ill, he wished to be baptized; but when the danger was past, the rite was deferred and, in spite of his mother's admonitions and prayers, Augustine grew up without any profession of Christian piety or any devotion to Christian principles.

Inheriting from his father a passionate nature, he formed while still a mere youth an irregular union with a girl, by whom he became the father of a son, whom in a fit of pious emotion he named Adeodatus ("by God given"), and to whom he was passionately attached. In his *Confessions* he afterwards described this period of his life in the blackest colours; for in the light of his conversion he saw behind him only shadows. Yet, whatever his youthful aberrations, Augustine was from the first an earnest student. His father, noticing his early promise, destined him for the brilliant and lucrative career of a rhetorician, for which he spared no expense in training him. Augustine studied at his native town and afterwards at Madaura and Carthage, especially devoting himself to the works of the Latin poets, many traces of his love for which are to be found in his writings. His acquaintance with Greek literature was much more limited, and, indeed, it has been doubted, though without sufficient reason, whether he could use the Greek scriptures in the original. Cicero's *Hortensius*, which he read in his nineteenth year, first awakened in his mind the spirit of speculation and the impulse towards the knowledge of the truth. But he passed from one phase of thought to another, unable to find satisfaction in any. Manichaeism, that mixed product of Zoroastrian and Christian-gnostic elements, first enthralled him. He became a fervent member of the sect, and was admitted into the class of *auditors* or "hearers." Manichaeism seemed to him to solve the mysteries of the world, and of his own experiences by which he was perplexed. His insatiable imagination drew congenial food from the fanciful religious world of the Manichaeans, decked out as this was with the luxuriant wealth of Oriental myth. His strongly developed sense of a need of salvation sought satisfaction in the contest of the two principles of Good and Evil, and found peace, at least for the moment, in the conviction that the portions of light present in him would be freed from the darkness in which they were immersed. The ideal of chastity and self-restraint, which promised a foretaste of union with God, amazed him, bound as he was in the fetters of sensuality and for ever shaking at these fetters. But while his moral force was not sufficient for the attainment of this ideal, gradually everything else which Manichaeism seemed to offer him dissolved before his criticism. Increasingly occupied with the exact sciences, he learnt the incompatibility of the Manichaean astrology with the facts. More and more absorbed in the problems of psychology, he realized the insufficiency of dualism, which did not solve the ultimate questions but merely set them back. The Manichaean propaganda seemed to him invertebrate and lacking in force, and a discussion which he had with Faustus, a distinguished Manichaean bishop and controversialist, left him greatly disappointed.

Meanwhile nine years had passed. Augustine, after finishing his studies, had returned to Tagaste, where he became a teacher of grammar. He must have been an excellent master, who knew how to influence the whole personality of his pupils. It was then that Alypius, who in the later stages of Augustine's life proved a true friend and companion, attached himself to him. He remained in his native town little more than a year, during which time he lived with his mother, who was comforted by the bishop for the estrangement of her son from the Catholic faith ("a son of so many tears cannot be lost": *Confess.* III. xii. § 21), comforted also, and above all, by the famous vision, which Augustine thus describes: "She saw herself standing on a certain wooden rule, and a shining youth coming towards her, cheerful and smiling upon her the while she grieved, and was consumed with grief: and when he had inquired of her the causes of her grief and daily tears (for the sake, as is their wont, of teaching, not of learning) and she had made answer that she was bewailing my perdition, he bade her be at ease, and advised her to look and observe, 'That where she was, there was I also.' And when she looked there, she saw me standing by her on the same rule" (*Confess.* III. xi.). Augustine now returned for a second time to Carthage, where he devoted himself zealously to work. Thence, probably in the spring of 383, he migrated to Rome. His Manichaean friends urged him to take this step, which was rendered easier by the licentious lives of the students at Carthage. His stay at Rome may have lasted about a year, no agreeable time for Augustine, since his patrons and friends belonged to just those Manichaean circles with which he had in the meantime entirely lost all intellectual touch. He, therefore, accepted an invitation from Milan, where the people were in search of a teacher of rhetoric.

At Milan the conflict within his mind in search of truth still continued. It was now that he separated himself openly from the Manichaean sect. As a thinker he came entirely under the influence of the New Academy; he professed the Sceptic philosophy, without being able to find in it the final conclusion of wisdom. He was, however, not far from the decision. Two things determined his further development. He became acquainted with the Neo-Platonic philosophy; its monism replaced the dualism, its intellectualized world of ideas the materialism of Manichaeism. Here he found the admonition to seek for truth outside the material world, and from created things he learnt to recognize the invisible God; he attained the certainty that this God is, and is eternal, always the same, subject to change neither in his parts nor in his motions. And while thus Augustine's metaphysical convictions were being slowly remodelled, he met, in Ambrose, bishop of Milan, a man in whom complete worldly culture and the nobility of a ripe Christian personality were wonderfully united. He heard him preach; but at first it was the orator and not the contents of the sermons that enchained him. He sought an opportunity of conversation with him, but this was not easily found. Ambrose had no leisure for philosophic discussion. He was accessible to all who sought him, but never for a moment free from study or the cares of duty. Augustine, as he himself tells us, used to enter without being announced, as all persons might; but after staying for a while, afraid of interrupting him, he would depart again. He continued, however, to hear Ambrose preach, and gradually the gospel of divine truth and grace was received into his heart. He was busy with his friend Alypius in studying the Pauline epistles; certain words were driven home with irresistible force to his conscience. His struggle of mind became more and more intolerable, the thought of divine purity fighting in his heart with the love of 908
the world and the flesh. That sensuality was his worst enemy he had long known. The mother of his child had accompanied him to Milan. When he became betrothed he dismissed her; but neither the pain of this parting nor consideration for his not yet marriageable bride prevented him from forming a fresh connexion of the same kind. Meanwhile, the determination to renounce the old life with its pleasures of sense, was ever being forced upon him with more and more distinctness. He then received a visit from a Christian compatriot named Pontitian, who told him about St Anthony and the monachism in Egypt, and also of a monastery near Milan. He was shaken to the depths when he learnt from Pontitian that two young officials, like himself betrothed, had suddenly formed a determination to turn their backs upon the life of the world. He could no longer bear to be inside the house; in terrible excitement he rushed into the garden; and now followed that scene which he himself in the *Confessions* has described to us with such graphic realism. He flung himself under a fig tree, burst into a passion of weeping, and poured out his heart to God. Suddenly he seemed to hear a voice bidding him consult the divine oracle: "Take up and read, take up and read." He left off weeping, rose up, sought the volume where Alypius was sitting, and opening it read in silence the following passage from the Epistle to the Romans (xiii. 13, 14): "Not in rioting and drunkenness, not in chambering and wantonness, not in strife and envying. But put ye on the Lord Jesus Christ, and make not provision for the flesh to fulfil the lusts thereof." He adds: "I had neither desire nor need to read further. As I finished the sentence, as though the light of peace had been poured into the heart, all the shadows of doubt dispersed. Thus hast Thou converted me to Thee, so as no longer to seek either for wife or other hope of the world, standing fast in that rule of faith in which Thou so many years before hadst revealed me to my mother" (*in qua me ante lot annos ei revelaveras: Confess.* VIII. xii. § 30).[1]

The conversion of Augustine, as we have been accustomed to call this event, took place in the late summer of 386, a few weeks before the beginning of the vacation. The determination to give up his post was rendered easier by a chest-trouble which was not without danger, and which for months made him incapable of work. He withdrew with several companions to the country estate of Cassisiacum near Milan, which had been lent him by a friend, and announced himself to the bishop as a candidate for baptism. His religious opinions were still to some extent unformed, and even his habits by no means altogether such as his great change demanded. He mentions, for example, that during this time he broke himself of a habit of profane swearing, and in other ways sought to discipline his character and conduct for the reception of the sacred rite. He received baptism the Easter following, in his thirty-third year, and along with him his son Adeodatus and his friend Alypius were admitted to the Church. Monica, his mother, had rejoined him, and at length rejoiced in the fulfilment of her prayers. She died at Ostia, just as they were about to embark for Africa, her last hours being gladdened by his Christian sympathy. In the account of the conversation which he had with his mother before her end, in the narrative of her death and burial (*Confess*. IX. x.-xi., §§ 23-28), Augustine's literary power is displayed at its highest.

The plan of returning home, remained for the present unaccomplished. Augustine stayed for a year in Rome, occupied in literary work, particularly in controversy with Manichaeism. It was not until the autumn of 388 that he returned to Tagaste, probably still accompanied by his son, who, however, must have died shortly afterwards. With some friends, who joined him in devotion, he formed a small religious community, which looked to him as its head. Their mode of life was not formally monastic according to any special rule, but the experience of this time of seclusion was, no doubt, the basis of that monastic system which Augustine afterwards sketched and which derived its name from him (see AUGUSTINIANS). As may be imagined, the fame of such a convert in such a position soon spread, and invitations to a more active ecclesiastical life came to him from many quarters. He shrank from the responsibility, but his destiny was not to be avoided. After two and a half years spent in retirement he went to Hippo, to see a Christian friend, who desired to converse with him as to his design of quitting the world and devoting himself to a religious life. The Christian community there being in want of a presbyter and Augustine being present at the meeting, the people unanimously chose him and he was ordained to the presbyterate. A few years afterwards, 395 or 396, he was made coadjutor to the bishop, and finally became bishop of the see.

Henceforth Augustine's life is filled up with his ecclesiastical labours, and is more marked by the series of his numerous writings and the great controversies in which they engaged him than by anything else. His life was spent in a perpetual strife. During the first half this had been against himself; but even when others stepped into his place, it always seems as though a part of Augustine himself were incarnate in them. Augustine had early distinguished himself as an author. He had written several philosophical treatises, and, as teacher of rhetoric at Carthage, he had composed a work *De pulchro et apto*, which is no longer extant. Whenat Cassisiacum he had combated the scepticism of the New Academy (*Contra Academicos*), had treated of the "blessed life" (*De Vita beata*), of the significance of evil in the order of the world (*De ordine*), of the means for the elucidation of spiritual truths (*Soliloquia*). Shortly before the time of his baptism, he was occupied with the question of the immortality of the soul (*De immortalitate animae*), and in Rome and at Tagaste he was still engaged with philosophical problems, as is evidenced by the writings *De quantitate animae* and *De magistro*. In all these treatises is apparent the influence of the Neo-Platonic method of thought, which for him, as for so many others, had become the bridge to the Christian. While still in Rome, he began to come to a reckoning with the Manichaeans, and wrote two books on the morals of the Catholic Church and of the Manichaeans (*De moribus ecclesiae Catholicae et de moribus Manichaeorum libri duo*). For many years he pursued this controversy in a long series of writings, of which the most conspicuous is the elaborate reply to his old associate and disputant, Faustus of Mileve (*Contra Faustum Manichaeum*, A.D. 400). It was natural that the Manichaean heresy, which had so long enslaved his own mind, should have first exercised Augustine's great powers as a theological thinker and controversialist. He was able from his own experience to give force to his arguments for the unity of creation and of the spiritual life, and to strengthen the mind of the Christian Church in its last struggle with that dualistic spirit which had animated and moulded in succession so many forms of thought at variance with Christianity.

But the time was one of almost universal ecclesiastical and intellectual excitement; and so powerful a mental activity as his was naturally drawn forth in all directions. Following his writings against the Manichaeans came those against the Donatists. The controversy was one which strongly interested him, involving as it did the whole question of the constitution of the Church and the idea of catholic order, to which the circumstances of the age gave special prominence. The Donatist controversy sprang out of the Diocletian persecution in the beginning of the century. A party in the Church of Carthage, fired with fanatic zeal on behalf of those who had courted martyrdom by resistance to the imperial mandates, resented deeply the appointment of a bishop of moderate opinions, whose consecration had been performed, they alleged, by a *traditor*, viz. a bishop who had "delivered" the holy scriptures to the magistrates. They set up, in consequence, a bishop of their own, of the name of Majorinus, succeeded in 315 by Donatus. The party made great pretensions to purity of discipline, and rapidly rose in popular favour, notwithstanding a decision given against them both by the bishop of Rome and by the emperor Cons tan tine. Augustine was strongly moved by the lawlessness of the party and launched forth a series of writings against them, the most important of which survive. Amongst these are "Seven Books on Baptism" (*De baptismo contra Donatistas*, *c.* A.D. 400) and a lengthy answer, in three books, to Petilian, bishop of Cirta, who was the most eminent theologian amongst the Donatist divines. At a later period, about 417, Augustine wrote a treatise concerning the correction of the Donatists (*De correctione Donatistarum*) "for the sake of those," he says in his *Retractations*, "who were not willing that the Donatists should be subjected to the correction of the imperial laws." In these writings, while vigorously maintaining the validity of the Church as it then stood in the Roman world, and the necessity for moderation in the exercise of church discipline, Augustine yet gave currency, in his zeal against the Donatists, to certain maxims as to the duty of the civil power to control schism, which were of evil omen, and have been productive of much disaster in the history of Christianity.

The third controversy in which Augustine engaged was the most important, and the most intimately associated with his distinctive greatness as a theologian. As may be supposed, owing to the conflicts through which he had passed, the bishop of Hippo was intensely interested in what may be called the anthropological aspect of the great Christian idea of redemption. He had himself been brought out of darkness into "marvellous light," only by entering into the depths of his own soul, and finding, after many struggles, that there was no power but divine grace, as revealed in the life and death of the Son of God, which could bring rest to human weariness, or pardon and peace for human guilt. He had found human nature in his own case too weak and sinful to find any good for itself. In God alone he had found good. This deep sense of human sinfulness coloured all his theology, and gave to it at once its depth—its profound and sympathetic adaptation to all who feel the reality of sin—and that tinge of darkness and exaggeration which has as surely repelled others. When the expression "Augustinism" is used, it points especially to those opinions of the great teacher which were evoked in the Pelagian controversy, to which he devoted the most mature and powerful period of his life. His opponents in this controversy were Pelagius, from whom it derives its name, and Coelestius and Julianus, pupils of the former. Nothing is certainly known as to the home of Pelagius. Augustine calls him Brito, and so do Marius Mercator and Orosius. Jerome points to his Scottish descent, in such terms, however, as to leave it uncertain whether he was a native of Scotland or of Ireland. He was a man of blameless character, devoted to the reformation of society, full of that confidence in the natural impulses of humanity which often accompanies philanthropic enthusiasm. About the year 400 he came, no longer a young man, to Rome, where he lived for more than a decade, and soon made himself conspicuous by his activity and by his opinions. His pupil Coelestius, a lawyer of unknown origin, developed the views of his master with a more outspoken logic, and, while travelling with Pelagius in Africa, in the year 411, was at length arraigned before the bishop of Carthage for the following, amongst other heretical opinions:—(1) that Adam's sin was purely personal, and affected none but himself; (2) that each man, consequently, is born with powers as incorrupt as those of Adam, and only falls into sin under the force of temptation and evil example; (3) that children who die in infancy, being untainted by sin, are saved without baptism. Views such as these were obviously in conflict with the whole course of Augustine's experience, as well as with his interpretation of the catholic doctrine of the Church. And when his attention was drawn to them by the trial and excommunication of Coelestius, he undertook their refutation, first of all in three books on the punishment and forgiveness of sins and the baptism of infants (*De peccatorum meritis et remissione et de baptismo parvulorum*), addressed to his friend Marcellinus, in which he vindicated the necessity of baptism of infants because of original sin and the grace of God by which we are justified (*Retract*. ii. 23). This was in 412. In the same year he addressed a further treatise to the same Marcellinus on *The Spirit and the Letter* (*De spiritu et littera*). Three years later he composed the treatises on *Nature and Grace* (*De natura et gratia*) and the relation of the human to the divine righteousness (*De perfectione iustitiae hominis*). The controversy was continued during many years in no fewer than fifteen treatises. Upon no subject did Augustine bestow more of his intellectual strength, and in relation to no other have his views so deeply and permanently affected the course of Christian thought. Even those who most usually agree with his theological standpoint will hardly deny that, while he did much in these writings to vindicate divine truth and to expound the true relations of the divine and human, he also, here as elsewhere, was hurried into extreme expressions as to the absoluteness of divine grace and the extent of human corruption. Like his great disciple in a later age—Luther—Augustine was prone to emphasize the side of truth which he had most realized in his own experience, and, in contradistinction to the Pelagian exaltation of human nature, to depreciate its capabilities beyond measure.

In addition to these controversial writings, which mark the great epochs of Augustine's life and ecclesiastical activity after his settlement as a bishop at Hippo, he was the author of other works, some of them better known and even more important. His great work, the most elaborate, and in some respects the most significant, that came from his pen, is *The City of God* (*De civitate Dei*). It is designed as a great apologetic treatise in vindication of Christianity and the Christian Church,—the latter conceived as rising in the form of a new civic order on the crumbling ruins of the Roman empire,—but it is also, perhaps, the earliest contribution to the philosophy of history, as it is a repertory throughout of his cherished theological opinions. This work and his *Confessions* are, probably, those by which he is best known, the one as the highest expression of his thought, and the other as the best monument of his living piety and Christian experience. *The City of God* was begun in 413, and continued to be issued in its several portions for a period of thirteen years, or till 426. The *Confessions* were written shortly after he became a bishop, about 397, and give a vivid sketch of his early career. To the devout utterances and aspirations of a great soul they add the charm of personal disclosure, and have never ceased to excite admiration in all spirits of kindred piety. Something of this charm also belongs to the *Retractations*, that remarkable work in which Augustine, in 427, towards the end of his life, held as it were a review of his literary activity, in order to improve what was erroneous and to make clear what was doubtful in it. His systematic treatise on *The Trinity* (*De Trinitate*) which extends to fifteen books and occupied him for nearly thirty years, must not be passed over. This important work, unlike most of his dogmatic writings, was not provoked by any special controversial emergency, but grew up silently during this long period in the author's mind. This has given it something more of completeness and organic arrangement than is usual with Augustine, if it has also led him into the prolonged discussion of various analogies, more curious than apt in their bearing on the doctrine which he expounds. Brief and concise is the presentation of the Catholic doctrine in the compendium, which, about 421, he wrote at the request of a Roman layman named Laurentius (*Encheiridion, sive de fide spe et caritate*). In spite of its title, the compendious work on Christian doctrine (*De doctrina Christiana*), begun as early as 393, but only finished in 426, does not belong to the dogmatic writings. It is a sort of Biblical hermeneutic, in which homiletic questions are also dealt with. His catechetical principles Augustine developed in the charming writing *De catechizandis rudibus* (*c.* 400). A large number of tractates are devoted to moral and theological problems (*Contra mendacium*, *c.* 420; *De bono conjugali*, 401, &c.). A widespread influence was exercised by the treatise *De opere monachorum* (*c.* 400), in which, on the ground of Holy Scripture, manual work was demanded of monks. Of less importance than the remaining works are the numerous exegetical writings, among which the commentary on the Gospel of St John deserves a special mention. These have a value owing to Augustine's appreciation of the deeper spiritual meaning of scripture, but hardly for their exegetical qualities. His *Letters* are full of interest owing to the light they throw on many questions in the ecclesiastical history of the time, and owing to his relations with such contemporary theologians as Jerome. They have, however, neither the liveliness nor the varied interest of the letters of Jerome himself. As a preacher Augustine was of great importance. We still possess almost four hundred sermons which may be ascribed to him with certainty. Many others only pass under his celebrated name. 910

The closing years of the great bishop were full of sorrow. The Vandals, who had been gradually enclosing the Roman empire, appeared before the gates of Hippo, and laid siege to it. Augustine was ill with his last illness, and could only pray for his fellow-citizens. He passed away during the siege, on the 28th of August 430, at the age of seventy-five, and thus was spared the indignity of seeing the city in the hands of the enemy.

The character of Augustine, both as a man and as a theologian, has been briefly indicated in the course of our sketch. None can deny the greatness of Augustine's soul—his enthusiasm, his unceasing search after truth, his affectionate disposition, his ardour, his self-devotion. And even those who may doubt the soundness of his dogmatic conclusions, cannot but acknowledge the depth of his spiritual convictions, and the logical force and penetration with which he handled the most difficult questions, thus weaving all the elements of his experience and of his profound scriptural knowledge into a great system of Christian thought. Of the four great Fathers of the Church he was admittedly the greatest—more profound than Ambrose, his spiritual father, more original and systematic than Jerome, his correspondent, and intellectually far more distinguished than Gregory the Great, his pupil on the papal throne. The theological position and influence of Augustine may be said to be unrivalled. No single name has ever exercised such power over the Christian Church, and no one mind ever made so deep an impression upon Christian thought. In him scholastics and mystics, popes and the opponents of the papal supremacy, have seen their champion. He was the fulcrum on which Luther rested the thoughts by which he sought to lift the past of the Church out of the rut; yet the judgment of Catholics still proclaims the ideas of Augustine as the only sound basis of philosophy.

The best complete edition of Augustine's works is that of the Maurines, in 11 vols. fol. published at Paris, 1679-1700, and reprinted in Migne's *Patrologie* (Paris, 1841-1842). Of the new critical edition in the *Corpus Scriptorum Ecclesiasticorum Latinorum*, issued by the Vienna Academy, thirteen volumes had been published in 1908, including the *Confessions*, the *Retractations*, *De civitate Dei*, and a number of exegetical and of dogmatic polemical works, together with a portion of the *Letters*. An English translation of nearly the whole of Augustine's writings will be found in the *Select Library of the Nicene and post-Nicene Fathers of the Christian Church* (series 1, Buffalo, 1886, &c.). Tillemont, in his *Mémoires pour servir à l'histoire ecclésiastique des VI premiers siècles*, has devoted a quarto volume (vol. xiii.) to Augustine's life and writings. The most complete monographs are those on the Catholic side by Kloth (Aix-la-Chapelle, 1839-1840, 3 vols.) and J.J.F. Poujoulat (7th ed., Paris, 1886, 2 vols.), and on the Protestant side by Bindemann (Berlin, Leipzig, Greifswald, 1844-1869, 3 vols,). There are interesting sketches, from quite different points of view, by von Hertling, *Augustinus* (2nd ed., Mainz, 1904), and Joseph McCabe, *St Augustine and His Age* (London, 1902). See also Nourrisson, *La Philosophie de St Augustin* (2nd ed., Paris, 1866, 2 vols.); H.A. Naville, *St Augustin, étude sur la développement de sa pensée jusqu'à l'époque de son ordination* (Geneva, 1872); Dorner, *Augustinus* (Berlin, 1873); Reuter, *Augustinische Studien* (Gotha, 1886); F. Scheel, *Die Anschauung Augustins über Christi Person und Werk* (Tübingen, 1901); A. Hatzfeld, *Saint Augustin* (6th ed., Paris, 1902); G. von Hertling, *Augustin* (Mainz, 1902); A. Egger, *Der heilige Augustinus* (Kempten, 1904); J.N. Espenberger, *Die Elemente der Erbsunde nach Augustin und der Fruhscholastik* (Mainz, 1905); S. Angus, *The Sources of the First Ten Books of Augustine's De Civitate Dei* (Princeton, 1906); and the more modern text-books of the history of dogma, especially Harnack.

(G. K.)

1 The reference is to the vision described above.

AUGUSTINE, SAINT (d. *c.* 613), first archbishop of Canterbury, occupied a position of authority in the monastery of St Andrew at Rome, when Gregory I. summoned him to lead a mission to England in A.D. 596. The apprehensions of Augustine's followers caused him to return to Rome, but the pope furnished him with letters of commendation and encouraged him to proceed. He landed in Thanet in A.D. 597, and was favourably received by Æthelberht, king of Kent, who granted a dwelling-place for the monks in Canterbury, and allowed them liberty to preach. Augustine first made use of the ancient church of St Martin at Canterbury, which before his arrival had been the oratory of the Queen Berhta and her confessor Liudhard. Æthelberht upon his conversion employed all his influence in support of the mission. In 601 Augustine received the pallium from Gregory and was given authority over the Celtic churches in Britain, as well as all future bishops consecrated in English territory, including York. Authority over the see of York was not, however, to descend to Augustine's successors. In 603 he consecrated Christ Church, Canterbury, and built the monastery of SS. Peter and Paul, afterwards known as St Augustine's. At the conference of Augustine's Oak he endeavoured in vain to bring over the Celtic church to the observance of the Roman Easter. He afterwards consecrated Mellitus and Justus to the sees of London and Rochester respectively. The date of his death is not recorded by Bede, but MS. F of the Saxon Chronicle puts it in 614, and the *Annales Monasterienses* in 612.

See Bede, *Eccl. Hist.* (ed. by Plummer), i. 23-ii. 3.

AUGUSTINIAN CANONS, a religious order in the Roman Catholic Church, called also Austin Canons, Canons Regular, and in England Black Canons, because their cassock and mantle were black, though they wore a white surplice: elsewhere the colour of the habit varied considerably.

The canons regular (see Canon) grew out of the earlier institute of canonical life, in consequence of the urgent exhortations of the Lateran Synod of 1059. The clergy of some cathedrals (in England, Carlisle), and of a great number of collegiate churches all over western Europe, responded to the appeal; and the need of a rule of life suited to the new regime produced, towards the end of the 11th century, the so-called Rule of St Augustine (see Augustinians). This Rule was widely adopted by the canons regular, who also began to bind themselves by the vows of poverty, obedience and chastity. In the 12th century this discipline became universal among them; and so arose the order of Augustinian canons as a religious order in the strict sense of the word. They resembled the monks in so far as they lived in community and took religious vows; but their state of life remained essentially clerical, and as clerics their duty was to undertake the pastoral care and serve the parish churches in their patronage. They were bound to the choral celebration of the divine office, and in its general tenor their manner of life differed little from that of monks.

Their houses, at first without bonds between them, soon tended to draw together and coalesce into congregations with corporate organization and codes of constitutions supplementary to the Rule. The popes encouraged these centralizing tendencies; and in 1339 Benedict XII. organized the Augustinian canons on the same general lines as those laid down for the Benedictines, by a system of provincial chapters and visitations.

Some thirty congregations of canons regular of St Augustine are numbered. The most important were: (1) the Lateran canons, formed soon after the synod of 1059, by the clergy of the Lateran Basilica; (2) Congregation of St Victor in Paris, c. 1100, remarkable for the theological and mystical school of Hugh, Richard and Adam of St Victor; (3) Gilbertines (see Gilbert of Sempringham, St); (4) Windesheim Congregation, *c.* 1400, in the Netherlands and over north and central Germany (see Groot, Gerhard), to which belonged Thomas à Kempis; (5) Congregation of Ste Geneviève in Paris, a reform *c.* 1630. During the later middle ages the houses of these various congregations of canons regular spread all over Europe and became extraordinarily numerous. They underwent the natural and inevitable vicissitudes of all orders, having their periods of depression and degeneracy, and again of revival and reform. The book of Johann Busch, himself a canon of Windesheim, *De Reformatione monasteriorum*, shows that in the 15th century grave relaxation had crept into many monasteries of Augustinian canons in north Germany, and the efforts at reform were only partially successful. The Reformation, the religious wars and the Revolution have swept away nearly all the canons regular, but some of their houses in Austria still exist in their medieval splendour. In England there were as many as 200 houses of Augustinian canons, and 60 of them were among the "greater monasteries" suppressed in 1538-1540 (for list see Tables in F.A. Gasquet's *English Monastic Life*). The first foundation was Holy Trinity, Aldgate, by Queen Maud, in 1108; Carlisle was an English cathedral of Augustinian canons. In Ireland the order was even more numerous, Christ Church, Dublin, being one of their houses. Three houses of the Lateran canons were established in England towards the close of the 19th century. Most of the congregations of Augustinian canons had convents of nuns, called canonesses; many such exist to this day.

See the works of Amort and Du Molinet, mentioned under Canon. Vol. ii. of Helyot's *Hist. des ordres religieux* (1792) is devoted to canons regular of all kinds. The information is epitomized by Max Heimbucher, *Orden und Kongregationen*, i. (1896), §§ 54-60, where copious references to the literature of the subject are supplied. See also Otto Zöckler, *Askese und Mönchtum*, ii. (1897), p. 422; and Wetzer und Welte, *Kirchenlexicon* (2nd ed.), art. "Canonici Regulares" and "Canonissae." For England see J.W. Clark, *Observances in use at the Augustinian Priory at Barnwell* (1897); and an article in *Journal of Theological Studies* (v.) by Scott Holmes.

(E. C. B.)

AUGUSTINIAN HERMITS, or Friars, a religious order in the Roman Catholic Church, sometimes called (but improperly) Black Friars (see Friars). In the first half of the 13th century there were in central Italy various small congregations of hermits living according to different rules. The need of co-ordinating and organizing these hermits induced the popes towards 1250 to unite into one body a number of these congregations, so as to form a single religious order, living according to the Rule of St Augustine, and called the Order of Augustinian Hermits, or simply the Augustinian Order. Special constitutions were drawn up for its government, on the same lines as the Dominicans and other mendicants—a general elected by chapter, provincials to rule in the different countries, with assistants, definitors and visitors. For this reason, and because almost from the beginning the term "hermits" became a misnomer (for they abandoned the deserts and lived conventually in towns), they ranked among the friars, and became the fourth of the mendicant orders. The observance and manner of life was, relatively to those times, mild, meat being allowed four days in the week. The habit is black. The institute spread rapidly all over western Europe, so that it eventually came to have forty provinces and 2000 friaries with some 30,000 members. In England there were not more than about 30 houses (see Tables in F.A. Gasquet's *English Monastic Life*). The reaction against the inevitable tendencies towards mitigation and relaxation led to a number of reforms that produced upwards of twenty different congregations within the order, each governed by a vicar-general, who was subject to the general of the order. Some of these congregations went in the matter of austerity beyond the original idea of the institute; and so in the 16th century there arose in Spain, Italy and France, Discalced or Barefooted Hermits of St Augustine, who provided in each province one house wherein a strictly eremitical life might be led by such as desired it.

About 1500 a great attempt at a reform of this kind was set on foot among the Augustinian Hermits of northern Germany, and they were formed into a separate congregation independent of the general. It was from this congregation that Luther went forth, and great numbers of the German Augustinian Hermits, among them Wenceslaus Link the provincial, followed him and embraced the Reformation, so that the congregation was dissolved in 1526.

The Reformation and later revolutions have destroyed most of the houses of Augustinian Hermits, so that now only about a hundred exist in various parts of Europe and America; in Ireland they are relatively numerous, having survived the penal times. The Augustinian school of theology (Noris, Berti) was formed among the Hermits. There have been many convents of Augustinian Hermitesses, chiefly in the Barefooted congregations; such convents exist still in Europe and North America, devoted to education and hospital work. There have also been numerous congregations of Augustinian Tertiaries, both men and women, connected with the order and engaged on charitable works of every kind (see Tertiaries).

See Helyot, *Hist. des ordres religieux* (1792), iii.; Max Heimbucher, *Orden und Kongregationen*, i. (1896), § 61-65; Wetzer und Welte, *Kirchenlexicon* (2nd ed.), art. "Augustiner"; Herzog, *Realencyklopädie* (3rd ed.), art. "Augustiner." The chief book on the subject is Th. Kolde, *Die deutschen Augustiner-Kongregationen* (1879).

(E. C. B.)

AUGUSTINIANS, in the Roman Catholic Church, a generic name for religious orders that follow the so-called "Rule of St Augustine." The chief of these orders are:—Augustinian Canons (*q.v.*), Augustinian Hermits (*q.v.*) or Friars, Premonstratensians (*q.v.*), Trinitarians (*q.v.*), Gilbertines (see Gilbert of Sempringham, St). The following orders, though not called Augustinians, also have St Augustine's Rule as the basis of their life: Dominicans, Servites, Our Lady of Ransom, Hieronymites, Assumptionsts and many others; also orders of women: Brigittines, Ursulines, Visitation nuns and a vast number of congregations of women, spread over the Old and New Worlds, devoted to education and charitable works of all kinds.

See Helyot, *Ordres religieux* (1792), vols. ii., iii., iv.; Max Heimbucher, *Orden und Kongregationen*, i. (1896), § 66-85; Wetzer und Welte, *Kirchenlexicon*, i., 1665-1667.

St Augustine never wrote a Rule, properly so called; but *Ep.* 211 (*al.* 109) is a long letter of practical advice to a community of nuns, on their daily life; and *Serm.* 355, 356 describe the common life he led along with his clerics in Hippo. When in the second half of the 11th century the clergy of a great number of collegiate churches were undertaking to live a substantially monastic form of life (see Canon), it was natural that they should look back to this classical model for clerics living in community. And so attention was directed to St Augustine's writings on community life; and out of them, and spurious writings attributed to him, were compiled towards the close of the 11th century three Rules, the "First" and "Second" being mere fragments, but the "Third" a substantive rule of life in 45

sections, often grouped in twelve chapters. This Third Rule is the one known as “the Rule of St Augustine.” Being confined to fundamental principles without entering into details, it has proved itself admirably suited to form the foundation of the religious life of the most varied orders and congregations, and since the 12th century it has proved more prolific than the Benedictine Rule. In an uncritical age it was attributed to St Augustine himself, and Augustinians, especially the canons, put forward fantastic claims to antiquity, asserting unbroken continuity, not merely from St Augustine, but from Christ and the Apostles.

The three Rules are printed in Dugdale, *Monasticon* (ed. 1846), vi. 42; and in Holsten-Brockie, *Codex Regularum*, ii. 121. For the literature see Otto Zöckler, *Askese und Mönchtum* (1897), pp. 347, 354.

(E. C. B.)

AUGUSTOWO, a city of Russian Poland, in the government of Suwalki, 20 m. S. of the town of that name, on a canal (65 m.) connecting the Vistula with the Niemen. It was founded in 1557 by Sigismund II. (Augustus), and is laid out in a very regular manner, with a spacious market-place. It carries on a large trade in cattle and horses, and manufactures linen and huckaback. Pop. (1897) 12,746.

AUGUSTUS (a name[1] derived from Lat. *augeo*, increase, *i.e.* venerable, majestic, Gr. Σεβαστός), the title given by the Roman senate, on the 17th of January 27 B.C., to Gaius Julius Caesar Octavianus (63 B.C.-A.D. 14), or as he was originally designated, Gaius Octavius, in recognition of his eminent services to the state (*Mon. Anc.* 34), and borne by him as the first of the Roman emperors. The title was adopted by all the succeeding Caesars or emperors of Rome long after they had ceased to be connected by blood with the first Augustus.

Gaius Octavius was born in Rome on the 23rd of September 63 B.C., the year of Cicero’s consulship and of Catiline’s conspiracy. He came of a family of good standing, long settled at Velitrae (Velletri), but his father was the first of the family to obtain a curule magistracy at Rome and senatorial dignity. His mother, however, was Atia, daughter of Julia, the wife of M. Atius Balbus, and sister of Julius Caesar, and it was this connexion with the great dictator which determined his career. In his fifth year (58 B.C.) his father died; about a year later his mother remarried, and the young Octavius passed under her care to that of his stepfather, L. Marcius Philippus. 912
At the age of twelve (51 B.C.) he delivered the customary funeral panegyric on his grandmother Julia, his first public appearance. On the 18th of October 48 (or ? 47) B.C. he assumed the “toga virilis” and was elected into the pontifical college, an exceptional honour which he no doubt owed to his great-uncle, now dictator and master of Rome. In 46 B.C. he shared in the glory of Caesar’s African triumph, and in 45 he was made a patrician by the senate, and designated as one of Caesar’s “masters of the horse” for the next year. In the autumn of 45, Caesar, who was planning his Parthian campaign, sent his nephew to study quietly at the Greek colony of Apollonia, in Illyria. Here the news of Caesar’s murder reached him and he crossed to Italy. On landing he learnt that Caesar had made him his heir and adopted him into the Julian gens, whereby he acquired the designation of Gaius Julius Caesar Octavianus. The inheritance was a perilous one; his mother and others would have dissuaded him from accepting it, but he, confident in his abilities, declared at once that he would undertake its obligations, and discharge the sums bequeathed by the dictator to the Roman people. Mark Antony had possessed himself of Caesar’s papers and effects, and made light of his young nephew’s pretensions. Brutus and Cassius paid him little regard, and dispersed to their respective provinces. Cicero, much charmed at the attitude of Antonius, hoped to make use of him, and flattered him to the utmost, with the expectation, however, of getting rid of him as soon as he had served his purpose. Octavianus conducted himself with consummate adroitness, making use of all competitors for power, but assisting none. Considerable forces attached themselves to him. The senate, when it armed the consuls against Antonius, called upon him for assistance; and he took part in the campaign in which Antonius was defeated at Mutina (43 B.C.). The soldiers of Octavianus demanded the consulship for him, and the senate, though now much alarmed, could not prevent his election. He now effected a coalition with Antonius and Lepidus, and on the 27th of November 43 B.C. the three were formally appointed a triumvirate for the reconstitution of the commonwealth for five years. They divided the western provinces among them, the east being held for the republic by Brutus and Cassius. They drew up a list of proscribed citizens, and caused the assassination of three hundred senators and two thousand knights. They further confiscated the territories of many cities throughout Italy, and divided them among their soldiers. Cicero was murdered at the demand of Antonius. The remnant of the republican party took refuge either with Brutus and Cassius in the East, or with Sextus Pompeius, who had made himself master of the seas.

Octavianus and Antonius crossed the Adriatic in 42 B.C. to reduce the last defenders of the republic. Brutus and Cassius were defeated, and fell at the battle of Philippi. War soon broke out between the victors, the chief incident of which was the siege and capture by famine of Perusia, and the alleged sacrifice of three hundred of its defenders by the young Caesar at the altar of his uncle. But peace was again made between them (40 B.C.). Antonius married Octavia, his rival’s sister, and took for himself the eastern half of the empire, leaving the west to Caesar. Lepidus was reduced to the single province of Africa. Meanwhile Sextus Pompeius made himself formidable by cutting off the supplies of grain from Rome. The triumvirs were obliged to concede to him the islands in the western Mediterranean. But Octavianus could not allow the capital to be kept in alarm for its daily sustenance. He picked a quarrel with Sextus, and when his colleagues failed to support him, undertook to attack him alone. Antonius, indeed, came at last to his aid, in return for military assistance in the campaign he meditated in the East. But Octavianus was well served by the commander of his fleet, M. Vipsanius Agrippa. Sextus was completely routed, and driven into Asia, where he perished soon afterwards (36 B.C.). Lepidus was an object of contempt to all parties, and Octavianus and Antonius remained to fight for supreme power.

The five years (36-31 B.C.) which preceded the decisive encounter between the two rivals were wasted by Antony in fruitless campaigns, and in a dalliance with Cleopatra which shocked Roman sentiment. By Octavian they were employed in strengthening his hold on the West, and his claim to be regarded as the one possible saviour of Rome and Roman civilization. His marriage with Livia (38 B.C.) placed by his side a sagacious counsellor and a loyal ally, whose services were probably as great as even those of his trusted friend Marcus Agrippa. With their help he set himself to win the confidence of a public still inclined to distrust the author of the proscriptions of 43 B.C. Brigandage was suppressed in Italy, and the safety of the Italian frontiers secured against the raids of Alpine tribes on the north-west and of Illyrians on the east, while Rome was purified and beautified, largely with the help of Agrippa (aedile in 33 B.C.). Meanwhile, indignation at Antony’s un-Roman excesses, and alarm at Cleopatra’s rumoured schemes of founding a Greco-Oriental empire, were rapidly increasing. In 32 B.C. Antony’s repudiation of his wife Octavia, sister of Octavian, and the discovery of his will, with its clear proofs of Cleopatra’s dangerous ascendancy, brought matters to a climax, and war was declared, not indeed against Antony, but against Cleopatra.

The decisive battle was fought on the 2nd of September 31 B.C. at Actium on the Epirot coast, and resulted in the almost total destruction of Antony’s fleet and the surrender of his land forces. Not quite a year later (Aug. 1, 30 B.C.) followed the capture of Alexandria and the deaths by their own hands of Antony and Cleopatra. On the 11th of January 29 B.C. the restoration of peace was marked by the closing of the temple of Janus for the first time for 200 years. In the summer Octavian returned to Italy, and in August celebrated a three days’ triumph. He was welcomed, not as a successful combatant in a civil war, but as the man who had vindicated the sovereignty of Rome against its assailants, as the saviour of the republic and of his fellow-citizens, above all as the restorer of peace.

He was now, to quote his own words, “master of all things,” and the Roman world looked to him for some permanent settlement of the distracted empire. His first task was the re-establishment of a regular and constitutional government, such as had not existed since Julius Caesar crossed the Rubicon twenty years before. To this task he devoted the next eighteen months (Aug. 29-Jan. 27 B.C.). In the article on Rome: *History* (*q.v.*), his achievements are described in detail, and only a brief summary need be given here. The “principate,” to give the new form of government its most appropriate name, was a compromise thoroughly characteristic of the combination of tenacity of purpose with cautious respect for forms and conventions which distinguished its author. The republic was restored; senate,

magistrates and assembly resumed their ancient functions; and the public life of Rome began to run once more in the familiar grooves. The triumvirate with its irregularities and excesses was at an end. The controlling authority, which Octavian himself wielded, could not indeed be safely dispensed with. But henceforward he was to exercise it under constitutional forms and limitations, and with the express sanction of the senate and people. Octavian was legally invested for a period of ten years with the government of the important frontier provinces, with the sole command of the military and naval forces of the state, and the exclusive control of its foreign relations. At home it was understood that he would year by year be elected consul, and enjoy the powers and pre-eminence attached to the chief magistracy of the Roman state. Thus the republic was restored under the presidency and patronage of its "first citizen" (*princeps civitatis*).

In acknowledgment of this happy settlement and of his other services further honours were conferred upon Octavian. On the 13th of January 27 B.C., the birthday of the restored republic, he was awarded the civic crown to be placed over the door of his house, in token that he had saved his fellow-citizens and restored the Republic. Four days later (Jan. 17) the senate conferred upon him the cognomen of Augustus.

But it was not only the machinery of government in Rome that needed repair. Twenty years of civil war and confusion had disorganized the empire, and the strong hand of Augustus, as he must now be called, could alone restore confidence and order. 913
Towards the end of 27 B.C. he left Rome for Gaul, and from that date until October 19 B.C. he was mainly occupied with the reorganization of the provinces and of the provincial administration, first of all in the West and then in the East. It was during his stay in Asia (20 B.C.) that the Parthian king Phraates voluntarily restored the Roman prisoners and standards taken at Carrhae (53 B.C.), a welcome tribute to the respect inspired by Augustus, and a happy augury for the future. In October 19 B.C. he returned to Rome, and the senate ordered that the day of his return (Oct. 12) should thenceforward be observed as a public holiday. The period of ten years for which his *imperium* had been granted him was nearly ended, and though much remained to be done, very much had been accomplished. The pacification of northern Spain by the subjugation of the Astures and Cantabri, the settlement of the wide territories added to the empire by Julius Caesar in Gaul—the "New Gaul," or the "long-haired Gaul" (Gallia Comata) as it was called by way of distinction from the old province of Gallia Narbonensis (see GAUL)—and the re-establishment of Roman authority over the kings and princes of the Near East, were achievements which fully justified the acclamations of senate and people.

In 18 B.C. Augustus's *imperium* was renewed for five years, and his tried friend Marcus Agrippa, now his son-in-law, was associated with him as a colleague. From October of 19 B.C. till the middle of 16 B.C. Augustus's main attention was given to Rome and to domestic reform, and to this period belong such measures as the Julian law "as to the marriage of the orders." In June of 17 B.C. the opening of the new and better age, which he had worked to bring about, was marked by the celebration in Rome of the Secular games. The chief actors in the ceremony were Augustus himself and his colleague Agrippa,—while, as the extant record tells us, the processional hymn, chanted by youths and maidens first before the new temple of Apollo on the Palatine and then before the temple of Jupiter on the Capitol, was composed by Horace. The hymn, the well-known *Carmen Saeculare*, gives fervent expression to the prevalent emotions of joy and gratitude.

In the next year (16 B.C.), however, Augustus was suddenly called away from Rome to deal with a problem which engrossed much of his attention for the next twenty-five years. The defeat of Marcus Lollius, the legate commanding on the Rhine, by a horde of German invaders, seems to have determined Augustus to take in hand the whole question of the frontiers of the empire towards the north, and the effective protection of Gaul and Italy. The work was entrusted to Augustus's step-sons Tiberius and Drusus. The first step was the annexation of Noricum and Raetia (16-15 B.C.), which brought under Roman control the mountainous district through which the direct routes lay from North Italy to the upper waters of the Rhine and the Danube. East of Noricum Tiberius reduced to order for the time the restless tribes of Pannonia, and probably established a military post at Carnuntum on the Danube. To Drusus fell the more ambitious task of advancing the Roman frontier line from the Rhine to the Elbe, a work which occupied him until his death in Germany in 9 B.C. In 13 B.C. Augustus had returned to Rome; his return, and the conclusion of his second period of rule, were commemorated by the erection of one of the most beautiful monuments of the Augustan age, the Ara Pacis Augustae (see ROMAN ART, Pl. II, III). His *imperium* was renewed, again for five years, and in 12 B.C., on the death of his former fellow-triumvir Lepidus, he was elected Pontifex Maximus. But this third period of his imperium brought with it losses which Augustus must have keenly felt. Only a few months after his reappointment as Augustus's colleague, Marcus Agrippa, his trusted friend since boyhood, died. As was fully his due, his funeral oration was pronounced by Augustus, and he was buried in the mausoleum near the Tiber built by Augustus for himself and his family. Three years later his brilliant step-son Drusus died on his way back from a campaign in Germany, in which he had reached the Elbe. Finally in 8 B.C. he lost the comrade who next to Agrippa had been the most intimate friend and counsellor of his early manhood, Gaius Cilnius Maecenas, the patron of Virgil and Horace.

For the moment Augustus turned, almost of necessity, to his surviving step-son. Tiberius was associated with him as Agrippa had been in the tribunician power, was married against his will to Julia, and sent to complete his brother Drusus's work in Germany (7-6 B.C.). But Tiberius was only his step-son, and, with all his great qualities, was never a very lovable man. On the other hand, the two sons of Agrippa and Julia, Gaius and Lucius, were of his own blood and evidently dear to him. Both had been adopted by Augustus (178. c.). In 6 B.C. Tiberius, who had just received the tribunician power, was transferred from Germany to the East, where the situation in Armenia demanded attention. His sudden withdrawal to Rhodes has been variously explained, but, in part at least, it was probably due to the plain indications which Augustus now gave of his wish that the young Caesars should be regarded as his heirs. The elder, Gaius, now fifteen years old (5 B.C.), was formally introduced to the people as consul-designate by Augustus himself, who for this purpose resumed the consulship (12th) which he had dropped since 23 B.C., and was authorized to take part in the deliberations of the senate. Three years later (2 B.C.) Augustus, now consul for the 13th and last time, paid a similar compliment to the younger brother Lucius. In 1 B.C. Gaius was given proconsular imperium, and sent to re-establish order in Armenia, and a few years afterwards (A.D. 2) Lucius was sent to Spain, apparently to take command of the legions there. But the fates were unkind; Lucius fell sick and died at Marseilles on his way out, and in the next year (A.D. 3) Gaius, wounded by an obscure hand in Armenia, started reluctantly for home, only to die in Lycia. Tiberius alone was left, and Augustus, at once accepting facts, formally and finally declared him to be his colleague and destined successor (A.D. 4) and adopted him as his son.

The interest of the last ten years of Augustus's life centres in the events occurring on the northern frontier. The difficult task of bringing the German tribes between the Rhine and the Elbe under Roman rule, commenced by Drusus in 13 B.C., had on his death been continued by Tiberius (9-6 B.C.). During Tiberius's retirement in Rhodes no decisive progress was made, but in A.D. 4 operations on a large scale were resumed. From Velleius Paterculus, who himself served in the war, we learn that in the first campaign Roman authority was restored over the tribes between the Rhine and the Weser, and that the Roman forces, instead of returning as usual to their headquarters on the Rhine, went into winter-quarters near the source of the Lippe. In the next year (A.D. 5) the Elbe was reached by the troops, while the fleet, after a hazardous voyage, arrived at the mouth of the same river and sailed some way up it. Both feats are deservedly commemorated by Augustus himself in the Ancyran monument. To complete the conquest of Germany and to connect the frontier with the line of the Danube, it seemed that only one thing remained to be done, to break the power of the Marcomanni and their king Maroboduus. In the spring of A.D. 6 preparations were made for this final achievement; the territory of the Marcomanni (now Bohemia) was to be invaded simultaneously by two columns. One, starting apparently from the headquarters of the army of Upper Germany at Mainz, was to advance by way of the Black Forest and attack Maroboduus on the west; the other, led by Tiberius himself, was to start from the new military base at Carnuntum on the Danube and operate from the south-east.

But the attack was never delivered, for at this moment, in the rear of Tiberius, the whole of Pannonia and Dalmatia burst into a blaze of insurrection. The crisis is pronounced by Suetonius to have been more serious than any which had confronted Rome since the Hannibalic war, for it was not merely the loss of a province but the invasion of Italy that was threatened, and Augustus openly declared in the senate that the insurgents might be before Rome in ten days. He himself moved to Ariminum to be nearer the seat of war, recruiting was vigorously carried on in Rome and Italy, and legions were summoned from Moesia and even from Asia. In the end, and 914
not including the Thracian cavalry of King Rhoemetalces, a force of 15 legions with an equal number of auxiliaries was employed. Even so the task of putting down the insurrection was difficult enough, and it was not until late in the summer of A.D. 9, after three years of fighting, that Germanicus, who had been sent to assist Tiberius, ended the war by the capture of Andetrium in Dalmatia.

Five days later the news reached Rome of the disaster to Varus and his legions, in the heart of what was to have been the new province of Germany beyond the Rhine. The disaster was avowedly due entirely to Varus's incapacity and vanity, and might no doubt have been repaired by leaders of the calibre of Tiberius and Germanicus. Augustus, however, was now seventy-two, the Dalmatian outbreak had severely tried his nerve, and now for the second time in three years the fates seemed to pronounce clearly against a further prosecution of his long-cherished scheme of a Roman Germany reaching to the Elbe.

All that was immediately necessary was done. Recruiting was pressed forward in Rome, and first Tiberius and then Germanicus were despatched to the Rhine. But the German leaders were too prudent to risk defeat, and the Roman generals devoted their attention mainly to strengthening the line of the Rhine.

The defeat of Varus, and the tacit abandonment of the plans of expansion begun twenty-five years before, are almost the last events of importance in the long principate of Augustus. The last five years of his life (A.D. 10-14) were untroubled by war or disaster. Augustus was ageing fast, and was more and more disinclined to appear personally in the senate or in public. Yet in A.D. 13 he consented, reluctantly we are told, to yet one more renewal of his *imperium* for ten years, stipulating, however, that his step-son Tiberius, himself now over fifty, should be associated with himself on equal terms in the administration of the empire. Early in the same year (January 16, A.D. 13) the last triumph of his principate was celebrated. Tiberius was now in Rome, the command on the Rhine having been given to Germanicus, who went out to it immediately after his consulship (A.D. 12), and the time had come to celebrate the Dalmatian and Pannonian triumph, which the defeat of Varus had postponed. Augustus witnessed the triumphal procession, and Tiberius, as it turned from the Forum to ascend the Capitol, halted, descended from his triumphal car, and did reverence to his adopted father.

One last public appearance Augustus made in Rome. During A.D. 13 he and Tiberius conducted a census of Roman citizens, the third taken by his orders; the first having been in 28 B.C. at the very outset of his rule. The business of the census lasted over into the next year, but on the 11th of May, A.D. 14, before a great crowd in the Campus Martius, Augustus took part in the solemn concluding ceremony of burying away out of sight the old age and inaugurating the new. The ceremony had been full of significance in 28 B.C., and now more than forty years later it was given a pathetic interest by Augustus himself. When the tablets containing the vows to be offered for the welfare of the state during the next lustrum were handed to him, he left the duty of reciting them to Tiberius, saying that he would not take vows which he was never destined to perform.

It was apparently at the end of June or early in July that Augustus left Rome on his last journey. Travelling by road to Astura (Torre Astura) at the southern point of the little bay of Antium, he sailed thence to Capri and to Naples. On his way at Puteoli, the passengers and crew of a ship just come from Alexandria cheered the old man by their spontaneous homage, declaring, as they poured libations, that to him they owed life, safe passage on the seas, freedom and fortune.

At Naples, in spite of increasing disease, he bravely sat out a gymnastic contest held in his honour, and then accompanied Tiberius as far as Beneventum on his way to Brundusium and Illyricum. On his return he was forced by illness to stop at Nola, his father's old home. Tiberius was hastily recalled and had a last confidential talk on affairs of state. Thenceforward, says Suetonius, he gave no more thought to such great affairs. He bade farewell to his friends, inquired after the health of Drusus's daughter who was ill, and then quietly expired in the arms of the wife who for more than fifty years had been his most intimate and trusted guide and counsellor, and to whom his last words were an exhortation to "live mindful of our wedded life." He died on the 19th of August, A.D. 14, in the same room in which his father had died before him, and on the anniversary of his entrance upon his first consulship fifty-seven years before (43 B.C.). The corpse was carried to Rome in slow procession along the Appian Way. On the day of the funeral it was borne to the Campus Martius on the shoulders of senators and there burnt. The ashes were reverently collected by Livia, and placed in the mausoleum by the Tiber which her husband had built for himself and his family. The last act was the formal decree of the senate by which Augustus, like his father Julius before him, was added to the number of the gods recognized by the Roman state.

If we except writers like Voltaire who could see in Augustus only the man who had destroyed the old republic and extinguished political liberty, the verdict of posterity on Augustus has varied just in proportion as his critics have fixed their attention, mainly, on the means by which he rose to power, or the use which he made of the power when acquired. The lines of argument followed respectively by friendly and hostile contemporaries immediately after his death (Tac. *Ann.* i. 9, 10) have been followed by later writers with little change. But of late years, our increasing mistrust of the current gossip about him, and our increased knowledge of the magnitude of what he actually accomplished, have conspicuously influenced the judgments passed upon him. We allow the faults and crimes of his early manhood, his cruelties and deceptions, his readiness to sacrifice everything that came between him and the end he had in view. On the other hand, a careful study of what he achieved between the years 38 B.C., when he married Livia, and his death in A.D. 14, is now held to give him a claim to rank, not merely as an astute and successful intriguer, or an accomplished political actor, but as one of the world's great men, a statesman who conceived and carried through a scheme of political reconstruction which kept the empire together, secured peace and tranquillity, and preserved civilization for more than two centuries.

BIBLIOGRAPHY.—The most comprehensive work on Augustus and his age is that of V. Gardthausen, *Augustus und seine Zeit* (2 vols., Leipzig, 1891-1904), which deals with all aspects of Augustus's life, vol. ii. consisting of elaborate critical and bibliographical notes. See also histories of Rome generally, and among special works:—E.S. Shuckburgh, *Augustus* (London, 1903; reviewed by F.T. Richards in *Class. Rev.* vol. xviii.), containing the text of the *Monumentum Ancyranum* (see also Gardthausen, book xiii.); J.B. Firth, *Augustus Caesar* (London, 1903), in "Heroes of the Nations" series; O. Seeck, "Kaiser Augustus" (*Monographien zur Weltgeschichte*, xvii., 1902), nine essays on special problems, *e.g.* the campaigns of Mutina, Perusia and against Sextus Pompeius, "das Augustische Zeitalter"; A. Duméril, "Auguste et la fondation de l'empire romain," in the *Annales de la Fac. des lett. de Bordeaux* (1890); a suggestive monograph on the reforms of Augustus in relation to the decrease of population is Jules Ferlet's *L'Abaissement de la natalité à Rome* (Paris, 1902).

(H. F. P.)

1 On the name see Neumann, in Pauly-Wissowa's *Realencyclopädie f. cl. alterth.*, s.v. 2374.

AUGUSTUS I. (1526-1586), elector of Saxony, was the younger son of Henry, duke of Saxony, and consequently belonged to the Albertine branch of the Wettin family. Born at Freiberg on the 31st of July 1526, and brought up as a Lutheran, he received a good education and studied at the university of Leipzig. When Duke Henry died in 1541 he decreed that his lands should be divided equally between his two sons, but as his bequest was contrary to law, it was not carried out, and the dukedom passed almost intact to his elder son, Maurice. Augustus, however, remained on friendly terms with his brother, and to further his policy spent some time at the court of the German king, Ferdinand I., in Vienna. In 1544 Maurice secured the appointment of his brother as administrator of the bishopric of Merseburg; but Augustus was very extravagant and was soon compelled to return to the Saxon court at Dresden. Augustus supported his brother during the war of the league of Schmalkalden, and in the policy which culminated in the transfer of the Saxon electorate from John Frederick I., the head of the Ernestine branch of the Wettin family, to Maurice. On the 7th of October 1548 Augustus was married at Torgau to Anna, daughter of Christian III., king of Denmark, and took up his residence at Weissenfels. But he soon desired a more imposing establishment. The result was that Maurice made more generous provision for his brother, who acted as regent of Saxony in 1552 during the absence of the elector. Augustus was on a visit to Denmark when by Maurice's death in July 1553 he became elector of Saxony.

The first care of the new elector was to come to terms with John Frederick, and to strengthen his own hold upon the electoral position. This object was secured by a treaty made at Naumburg in February 1554, when, in return for the grant of Altenburg and other lands, John Frederick recognized Augustus as elector of Saxony. The elector, however, was continually haunted by the fear that the Ernestines would attempt to deprive him of the coveted dignity, and his policy both in Saxony and in Germany was coloured by this fear. In imperial politics Augustus acted upon two main principles: to cultivate the friendship of the Habsburgs, and to maintain peace between the contending religious parties. To this policy may be traced his share in bringing about the religious peace of Augsburg in 1555, his tortuous conduct at the diet of Augsburg eleven years later, and his reluctance to break entirely with the Calvinists. On one occasion only did he waver in his allegiance to the Habsburgs. In 1568 a marriage was arranged between John Casimir, son of the elector palatine, Frederick III., and Elizabeth, a daughter of Augustus, and for a time it seemed possible that the Saxon elector would support his son-in-law in his attempts to aid the revolting inhabitants of the Netherlands. Augustus also entered into communication with the Huguenots; but his aversion to foreign complications prevailed, and the incipient friendship with the elector palatine soon gave way to serious dislike. Although a sturdy Lutheran the elector hoped at one time to unite the Protestants, on whom he continually urged the necessity of giving no cause of offence to their opponents, and he favoured the movement to get rid of the clause in the peace of Augsburg concerning ecclesiastical reservation, which was offensive to many Protestants. His moderation, however, prevented him from joining those who were prepared to take strong measures to attain this end, and he refused to jeopardize the concessions already won.

The hostility between the Albertines and the Ernestines gave serious trouble to Augustus. A preacher named Matthias Flacius held an influential position in ducal Saxony, and taught a form of Lutheranism different from that taught in electoral Saxony. This breach was widened when Flacius began to make personal attacks on Augustus, to prophesy his speedy downfall, and to incite Duke John Frederick to make an effort to recover his rightful position. Associated with Flacius was a knight, William of Grumbach, who, not satisfied with words only, made inroads into electoral Saxony and sought the aid of foreign powers in his plan to depose Augustus. After some delay Grumbach and his protector, John Frederick, were placed under the imperial ban, and Augustus was entrusted with its execution. His campaign in 1567 was short and successful. John Frederick surrendered, and passed his time in prison until his death in 1595; Grumbach was taken and executed; and the position of the elector was made quite secure.

The form of Lutheranism taught in electoral Saxony was that of Melanchthon, and many of its teachers and adherents, who were afterwards called Crypto-Calvinists, were favoured by the elector. When Augustus, freed from the fear of an attack by the Ernestines, became gradually estranged from the elector palatine and the Calvinists, he seemed to have looked with suspicion upon the Crypto-Calvinists, who did not preach the pure doctrines of Luther. Spurred on by his wife the matter reached a climax in 1574, when letters were discovered, which, while revealing a hope to bring over Augustus to Calvinism, cast some aspersions upon the elector and his wife. Augustus ordered the leaders of the Crypto-Calvinists to be seized, and they were tortured and imprisoned. A strict form of Lutheranism was declared binding upon all the inhabitants of Saxony, and many persons were banished from the country. In 1576 he made a serious but unsuccessful attempt to unite the Protestants upon the basis of some articles drawn up at Tolgau, which inculcated a strict form of Lutheranism. The change in Saxony, however, made no difference to the attitude of Augustus on imperial questions. In 1576 he opposed the proposal of the Protestant princes to make a grant for the Turkish War conditional upon the abolition of the clause concerning ecclesiastical reservation, and he continued to support the Habsburgs.

Much of the elector's time was devoted to extending his territories. In 1573 he became guardian to the two sons of John William, duke of Saxe-Weimar, and in this capacity was able to add part of the county of Henneberg to electoral Saxony. His command of money enabled him to take advantage of the poverty of his neighbours, and in this way he secured Vogtland and the county of Mansfeld. In 1555 he had appointed one of his nominees to the bishopric of Meissen, in 1561 he had secured the election of his son Alexander as bishop of Merseburg, and three years later as bishop of Naumburg; and when this prince died in 1565 these bishoprics came under the direct rule of Augustus.

As a ruler of Saxony Augustus was economical and enlightened. He favoured trade by encouraging Flemish emigrants to settle in the country, by improving the roads, regulating the coinage and establishing the first posts. He was specially interested in benefiting agriculture, and added several fine buildings to the city of Dresden. His laws were numerous and comprehensive. The constitution of 1572 was his work, and by these laws the church, the universities and the police were regulated, the administration of justice was improved, and the raising of taxes placed upon a better footing (see Saxony).

In October 1585 the electress Anna died, and a few weeks later Augustus married Agnes Hedwig, a daughter of Joachim Ernest, prince of Anhalt. His own death took place at Dresden on the 21st of January 1586, and he was buried at Freiberg. By his first wife he had fifteen children, but only four of these survived him, among whom was his successor, the elector Christian I. (1560-1591). Augustus was a covetous, cruel and superstitious man, but these qualities were redeemed by his political caution and his wise methods of government. He wrote a small work on agriculture entitled *Künstlich Obstund Gartenbüchlein*.

See C.W. Böttiger and T. Flathe, *Geschichte Sachsens*, Band ii. (Gotha, 1870); M. Ritter, *Deutsche Geschichte im Zeitalter der Gegenreformation*, Band i. (Stuttgart, 1890); R. Calinich, *Kampf und Untergang des Melanchthonismus in Kursachsen* (Leipzig, 1866); J. Falke, *Geschichte des Kurfürsten August in volkswirtschaftlicher Beziehung* (Leipzig, 1868); J. Janssen, *Geschichte des Deutschen Volks seit dem Ausgang des Mittelalters* (Freiburg, 1885-1894); W. Wenck, *Kurfürst Moritz und Herzog August* (Leipzig, 1874).

AUGUSTUS II., king of Poland, and, as Frederick Augustus I., elector of Saxony (1670-1733), second son of John George III., elector of Saxony, was born at Dresden on the 12th of May 1670. He was well educated, spent some years in travel and in fighting against France, and on account of his immense strength was known as "the Strong." On the death of his brother, John George IV., in 1694, he became elector of Saxony, and in 1695 and 1696 led the imperial troops against the Turks, but without very much success. When John Sobieski died in 1696, Augustus was a candidate for the Polish throne, and in order to further his chances became a Roman Catholic, a step which was strongly resented in Saxony. By a lavish expenditure of money, and by his promptness in entering the country, he secured his election and coronation in September 1697, and his principal rival F.L. de Bourbon, prince of Conti, abandoned the contest and returned to France. Augustus continued the war against the Turks for a time, and being anxious to extend his influence and to find a pretext for retaining the Saxon troops in Poland, made an alliance in 1699 with Russia and Denmark against Charles XII. of Sweden. The Poles would not assist, and at the head of the Saxons Augustus invaded Livonia, but for various causes the campaign was not a success, and in July 1702 he was defeated by Charles at Klissow. Augustus was then deposed in Poland, and after holding Warsaw for a short time he fled to Saxony. The alliance with Russia was renewed and in reply Charles invaded Saxony in 1706, and compelled the elector to sign the treaty of Altranstädt in September of that year, to recognize Stanislaus Leszczynski as his successor in Poland, and to abandon the Russian alliance. During the War of the Spanish Succession, Augustus fought with the imperialists in the Netherlands, but after the defeat of Charles XII. at Poltawa in July 1709, he turned his attention to the recovery of Poland. Declaring the treaty of Altranstädt void and renewing his alliance with Russia and Denmark, he quickly recovered the Polish crown. He then attacked Swedish Pomerania. He was handicapped by the mutual jealousy of the Saxons and the Poles, and a struggle broke out in Poland which was only ended when the king promised to limit the number of his army in that country to 18,000 men. Peace was made with Sweden in December 1719 at Stockholm after the death of Charles XII., and Augustus was recognized as king of Poland. His remaining years were spent in futile plans to make Poland a hereditary monarchy, to weaken the power of the Saxon nobles, and to gain territory for his sons in various parts of Europe. He was a man of extravagant and luxurious tastes, and, although he greatly improved the city of Dresden, he cannot be called a good ruler. He sought to govern Saxony in an absolute fashion, and, in spite of his declaration that his conversion to Roman Catholicism was personal only, assisted the spread of the teachings of Rome. His wife was Christine Eberhardine, a member of the Hohenzollern family, who left him when he became a Roman Catholic, and died in 1727. Augustus died at Warsaw on the 1st of February 1733, leaving a son Frederick Augustus, who succeeded him in Poland and Saxony, and many illegitimate children, among whom was the famous general, Maurice of Saxony, known as Marshal Saxe (*q.v.*).

See Otwikowski, *History of Poland under Augustus II.* (Cracow, 1849); F. Förster, *Die Hofe und Kabinette Europas im achtzehnten Jahrhtmdert* (Potsdam, 1839); Jarochowski, *History of Augustus II.* (Posen, 1856-1874); C.W. Böttiger and T. Flathe, *Geschichte des Kurstaates und Königreichs Sachsen* (Gotha, 1867-1873).

AUGUSTUS III., king of Poland, and, as Frederick Augustus II., elector of Saxony (1696-1763), the only legitimate son of Augustus II. ("the Strong"), was born at Dresden on the 17th of October 1696. Educated as a Protestant, he followed his father's example by joining the Roman Catholic Church in 1712, although his conversion was not made public until 1717. In August 1719 he married Maria Josepha, daughter of the emperor Joseph I., and seems to have taken very little part in public affairs until he became elector of Saxony on his father's death in February 1733. He was then a candidate for the Polish crown; and having purchased the support of the emperor Charles VI. by assenting to the Pragmatic Sanction, and that of the czarina Anne by recognizing the claim of Russia to Courland, he was elected king of Poland in October 1733. Aided by the Russians, his troops drove Stanislaus Leszczynski from Poland; Augustus was crowned at Cracow in January 1734, and was generally recognized as king at Warsaw in June 1736. On the death of Charles VI. in October 1740, Augustus was among the enemies of his daughter Maria Theresa, and, as a son-in-law of the emperor Joseph I., claimed a portion of the Habsburg territories. In 1742, however, he was induced to transfer his support to Maria Theresa, and his troops took part in the struggle against Frederick the Great during the Silesian wars, and again when the Seven Years' War

began in 1756. Saxony was in that year attacked by the Prussians, and with so much success that not only was the Saxon army forced to capitulate at Pirna in October, but the elector, who fled to Warsaw, made no attempt to recover Saxony, which remained under the dominion of Frederick. When the treaty of Hubertsburg was concluded in February 1763, he returned to Saxony, where he died on the 5th of October 1763. He left five sons, the eldest of whom was his successor in Saxony, Frederick Christian; and five daughters, one of whom was the wife of Louis, the dauphin of France, and mother of Louis XVI. Another daughter was the wife of Charles III., king of Spain, but she predeceased her father. Augustus, who showed neither talent nor inclination for government, was content to leave Poland under the influence of Russia, and Saxony to the rule of his ministers. He took great interest in music and painting, and added to the collection of art treasures at Dresden.

See C.W. Böttiger and T. Flathe, *Geschichte des Kurstaates und Königreichs Sachsen* (Gotha, 1867-1873); R. Röpell, *Polen um die Mitte des 18. Jahrhunderts* (Gotha, 1876).

AUGUSTUSBAD, a watering-place of Germany, in the kingdom of Saxony, 10 m. E. from Dresden, close to Radeberg, in a pleasant valley. Pop. 900. It has five saline chalybeate springs, used both for drinking and bathing, and specific in feminine disorders, rheumatism, paralysis and neuralgia. The spa is largely frequented in summer and has agreeable public rooms and gardens.

AUK, a name commonly given to several species of sea-fowl. A special interest attaches to the great auk (*Alca impennis*), owing to its recent extinction and the value of its eggs to collectors. (See Garefowl; also Guillemot, Puffin, Razorbill.)

AULARD, FRANÇOIS VICTOR ALPHONSE (1849-), French historian, was born at Montbron in Charente in 1849. Having obtained the degree of doctor of letters in 1877 with a Latin thesis upon C. Asinius Pollion and a French one upon Giacomo Leopardi (whose works he subsequently translated into French), he made a study of parliamentary oratory during the French Revolution, and published two volumes upon *Les Orateurs de la constituante* (1882) and upon *Les Orateurs de la legislative et de la convention* (1885). With these works, which were reprinted in 1905, he entered a fresh field, where he soon became an acknowledged master. Applying to the study of the French Revolution the rules of historical criticism which had produced such rich results in the study of ancient and medieval history, he devoted himself to profound research in the archives, and to the publication of numerous most important contributions to the political, administrative and moral history of that marvellous period. Appointed professor of the history of the French Revolution at the Sorbonne, he formed the minds of students who in their turn have done valuable work. To him we owe the *Recueil des actes du comité de salut public* (vol. i., 1889; vol. xvi., 1904); *La Société des Jacobins; recueil de documents pour l'histoire du club des Jacobins de Paris* (6 vols., 1889-1897); and *Paris pendant la reaction thermidorienne et sous le directoire, recueil de documents pour l'histoire de l'esprit public à Paris* (5 vols., 1898-1902), which was followed by an analogous collection for Paris sous le consulat (2 vols., 1903-1904). For the Société de l'Histoire de la Révolution Française, which brought out under his supervision an important periodical publication called *La Révolution française*, he produced the *Registre des déliberations du consulat provisoire* (1894), and *L'État de la France en l'an VIII et en l'an IX*, with the reports of the prefects (1897), besides editing various works or memoirs written by men of the Revolution, such as J.C. Bailleul, Chaumette, Fournier (called the American), Hérault de Séchelles, and Louvet de Couvrai. But these large collections of documents are not his entire output. Besides a little pamphlet upon Danton, he has written a *Histoire politique de la Révolution française* (1901), and a number of articles which have been collected in volumes under the title *Études et leçons sur la Révolution française* (5 vols., 1893-1908). In a volume entitled *Taine, historien de la Révolution française* (1908), Aulard has submitted the method of the eminent philosopher to a criticism, severe, perhaps even unjust, but certainly well-informed. This is, as it were, the "manifesto" of the new school of criticism applied to the political and social history of the Revolution (see *Les Annales Révolutionnaires*, June 1908).

See A. Mathiez, "M. Aulard, historien et professeur," in the *Revue de la Révolution française* (July 1908).

(C. B.*)

AULIC COUNCIL (*Reichshofrat*), an organ of the Holy Roman Empire, originally intended for executive work, but acting chiefly as a judicature, which worked from 1497 to 1806. In the early middle ages the emperor had already his *consiliarii*; but his council was a fluctuating body of personal advisers. In the 14th century there first arose an official council, with permanent and paid members, many of whom were legists. Its business was largely executive, and it formed something of a ministry; but it had also to deal with petitions addressed to the king, and accordingly it acted as a supreme court of judicature. It was thus parallel to the king's council, or *concilium continuum*, of medieval England; while by its side, during the 15th century, stood the *Kammergericht*, composed of the legal members of the council, in much the same way as the Star Chamber stood beside the English council. But the real history of the Aulic Council, as that term was understood in the later days of the Empire, begins with Maximilian I. in 1497-1498. In these years Maximilian created three organs (apparently following the precedent set by his Burgundian ancestors in the Netherlands)—a *Hofrat*, a *Hofkammer* for finance, and a *Hofkanzlei*. Primarily intended for the hereditary dominions of Maximilian, these bodies were also intended for the whole Empire; and the *Hofrat* was to deal with "all and every business which may flow in from the Empire, Christendom at large, or the king's hereditary principalities." It was thus to be the supreme executive and judicial organ, discharging all business except that of finance and the drafting of documents; and it was intended to serve Maximilian as a *point d'appui* for the monarchy against the system of oligarchical committees, instituted by Berthold, archbishop of Mainz. But it was difficult to work such a body both for the Empire and for the hereditary principalities; and under Ferdinand I. it became an organ for the Empire alone (*circ.* 1558), the hereditary principalities being removed from its cognizance. As such an imperial organ, its composition and powers were fixed by the treaty of Westphalia of 1648. (1) It consisted of about 20 members—a president, a vice-president, the vice-chancellor of the Empire, and some 18 other members. These came partly from the Empire at large, partly (and in greater numbers) from the hereditary lands of the emperor. There were two benches, one of the nobles, one of doctors of civil law; six of the members must be Protestants. The council followed the person of the emperor, and was therefore stationed at Vienna; it was paid by the emperor, and he nominated its members, whose office terminated with his life—an arrangement which made the council more dependent than it should have been on the emperor's will. (2) Its powers were nominally both executive and judicial. (*a*) Its executive powers were small: it gradually lost everything except the formal business of investiture with imperial fiefs and the confirmation of charters, its other powers being taken over by the *Geheimräte*. These *Geheimräte*, a narrow body of secret counsellors, had already become a determinate *concilium* by 1527; and though at first only concerned with foreign affairs, they acquired, from the middle of the 16th century onwards, the power of dealing with imperial affairs in lieu of the Aulic Council. (*b*) In its judicial aspect, the Aulic Council, exercising the emperor's judicial powers on his behalf, and thus succeeding, as it were, to the old *Kammergericht*, had exclusive cognizance of matters relating to imperial fiefs, criminal charges against immediate vassals of the Empire, imperial charters, Italian affairs, and cases "reserved" for the emperor. In all other matters, the Aulic Council was a competitor for judicial work with the Imperial Chamber[1] (*Reichskammergericht*, a tribunal dating from the great diet of Worms of 1495: see under Imperial Chamber). It was determined in 1648 that the one of these

two judicial authorities which first dealt with a case should alone have competence to pursue it. An appeal lay from the decision of the council to the emperor, and judgment on appeal was given by those members of the council who had not joined in the original decision, though in important cases they might be afforced by members of the diet. Neither the council nor the chamber could deal with cases of outlawry, except to prepare such cases for the decision of the diet. To-day the archives of the Aulic Council are in Vienna, though parts of its records have been given to the German states which they concern.

AUTHORITIES.—R. Schröder, *Lehrbuch der deutschen Rechtsgeschichte* (Leipzig, 1904), gives the main facts; S. Adler, *Die Organisation der Centralverwaltung unter Maximilian I.* (Leipzig, 1886), deals with Maximilian's reorganization of the Council; and J. St. Pütter, *Historische Entwickelung der heutigen Staatsverfassung des Teutschen Reichs* (Göttingen, 1798-1799), may be consulted for its development and later form.

(E. BR.)

1 The Aulic Council is the private court of the emperor, with its members nominated by him; the Imperial Chamber is the public court of the Empire, with its members nominated by the estates of the Empire.

AULIE-ATA, a town and fort of Russian Turkestan, province of Syr-darya, 152 m. N.E. of Tashkent, on the Talas river, at the western end of the Alexander range, its altitude being 5700 ft. The inhabitants are mostly Sarts and Tajiks, trading in cattle, horses and hides. Pop. (1897) 12,006.

AULIS, an ancient Boeotian town on the Euripus, situated on a rocky peninsula between two bays, near the modern village of Vathy, about 3 m. S. of Chalcis. Its fame was due to the tradition that it was the starting-place of the Greek fleet before the Trojan War, the scene of the sacrifice of Iphigenia. The temple of Artemis was still to be seen in the time of Pausanias.

AULNOY (or AUNOY), **MARIE CATHERINE LE JUMEL DE BARNEVILLE DE LA MOTTE,** BARONNE D' (*c.* 1650-1705), French author, was born about 1650 at Barneville near Bourg-Achard (Eure). She was the niece of Marie Bruneau des Loges, the friend of Malherbe and of J.G. de Balzac, who was called the "tenth Muse." She married on the 8th of March 1666 François de la Motte, a gentleman in the service of César, duc de Vendôme, who became Baron d'Aulnoy in 1654. With her mother, who by a second marriage had become marquise de Gudaigne, she instigated a prosecution for high treason against her husband. The conspiracy was exposed, and the two women saved themselves by a hasty flight to England. Thence they went (February 1679) to Spain, but were eventually allowed to return to France in reward for secret services rendered to the government. Mme. d'Aulnoy died in Paris on the 14th of January 1705. She wrote fairy tales, *Contes nouvelles ou les Fées a la mode* (3 vols., 1698), in the manner of Charles Perrault. This collection (24 tales) included *L'Oiseau bleu, Finette Cendron, La Chatte blanche* and others. The originals of most of her admirable tales are to be found in the *Pentamerone* (1637) of Giovanni Battista Basile. Other works are: *L'Histoire d'Hippolyte, comte de Duglas* (1690), a romance in the style of Madame de la Fayette, though much inferior to its model; *Mémoires de la cour d'Espagne* (1679-1681); and a *Relation du voyage d'Espagne* (1690 or 1691) in the form of letters, edited in 1874-1876 as *La Cour et la ville de Madrid* by Mme. B. Carey; *Histoire de Jean de Bourbon* (1692); *Mémoires sur la cour de France* (1692); *Mémoires de la cour d'Angleterre* (1695). Her historical writings are partly borrowed from existing records, to which she adds much that must be regarded as fiction, and some vivid descriptions of contemporary manners.

The *Diverting Works of the Countess d'Anois*, including some extremely untrustworthy "Memoirs of her own life," were printed in London in 1707. *The Fairy Tales of Madame d'Aulnoy*, with an introduction by Lady Thackeray Ritchie, appeared in 1892. For biographical particulars see M. de Lescure's introduction to the *Contes des Fées* (1881).

AULOS (Gr. αὐλός; Lat. *tibia*; Egyptian hieroglyphic, *Ma-it*; medieval equivalents, *shalm, chalumeau, schalmei, hautbois*), in Greek antiquities, a class of wood-wind instruments with single or with double reed mouthpiece and either cylindrical or conical bore, thus corresponding to both oboe and clarinet. In its widest acceptation the *aulos* was a generic term for instruments consisting of a tube in which the air column was set in vibration either directly by the lips of the performer, or through the medium of a mouthpiece containing a single or a double reed. Even the pipes of the pan-pipes (*syrinx polycalamus*,[1] σῦριγξ πολυκάλαμος) were sometimes called auloi (αὐλοί). The aulos is also the earliest prototype of the organ, which, by gradual assimilation of the principles of syrinx and bag-pipe, reached the stage at which it became known as the *Tyrrhenian aulos* (Pollux iv. 70) or the *hydraulos*, according to the method of 918
compressing the wind supply (see ORGAN: *Early History*; and SYRINX). The aulos in its earliest form, the reed pipe, during the best classical period had a cylindrical bore (κοιλία) like that of the modern clarinet, and therefore had the acoustic properties of the stopped pipe, whether the air column was set in vibration by means of a single or of a double reed, for the mouthpiece does not affect the harmonic series.[2] To the acoustic properties of open or stopped pipes are due those essential differences which underlie the classification of modern wind instruments. A stopped pipe produces its fundamental tone one octave lower than the tone of an open pipe of corresponding length, and overblows the harmonics of the twelfth, and of the third above the second octave of the fundamental tone, *i.e.* the odd numbers of the series; whereas the open pipe gives the whole series of harmonics, the octave, the twelfth, the double octave, and the third above it, &c.

To produce the diatonic scale throughout the octaves of its compass, the stopped pipe requires eleven lateral holes in the side of the pipe, at appropriate distances from each other, and from the end of the pipe, whereas the open pipe requires but six. The acoustic properties of the open pipe can only be secured in combination with a reed mouthpiece by making the bore conical. The late Romans (and therefore we may perhaps assume the Greeks also, since the Romans acknowledge their indebtedness to the Greeks in matters relating to musical instruments, and more especially to the cithara and aulos) understood the acoustic principle utilized to-day in making wind instruments, that a hole of small diameter nearer the mouthpiece may be substituted for one of greater diameter in the theoretically correct position. This is demonstrated by the 4th-century grammarian Macrobius, who says (*Comm. in Somn. Scip.* ii. 4, 5): "Nec secus probamus in tibiis, de quarum foraminibus vicinis inflantis ori sonus acutus emittitur, de longinquis autem et termino proximis gravior; item acutior per patentiora foramina, gravior per angusta" (see BASSOON). Aristotle gives directions for boring holes in the aulos, which would apply only to a pipe of cylindrical bore (*Probl.* xix. 23). At first the aulos had but three or four holes; to Diodorus of Thebes is due the credit of having increased this number (Pollux iv. 80). Pronomus, the musician, and teacher of Alcibiades (5th century B.C.), further improved the aulos by making it possible to play on one pair of instruments the three musical scales in use at his time, the Dorian, the Phrygian, and the Lydian, whereas previously a separate pair of pipes had been used for each scale (Pausanias ix. 12. 5; Athenaeus xiv. 31). These three modes would require a compass of a tenth in order to produce the fundamental octave in each.

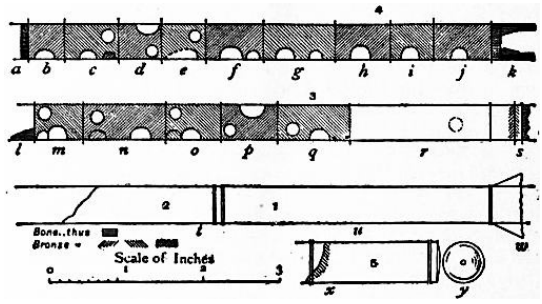
There are two ways in which this increased compass might have been obtained: (1) by increasing the number of holes and covering up those not required, (2) by means of contrivances for lowering the pitch of individual notes as required. We have evidence that both

means were known to the Greeks and Romans. The simplest device for closing holes not in use was a band of metal left free to slide round the pipe, and having a hole bored through it corresponding in diameter with the hole in the pipe. Each hole was provided with a band, which was in some cases prevented from slipping down the pipe by narrow fixed rings of metal. The line on fig. 1 between *r* and *s* is thought to have been one of these rings.

Some pipes had two holes pierced through the bands and the bone, in such a manner that only one could be exposed at a time. This is clearly shown in the diagram (fig. 1) of fragments of an aulos from the museum at Candia, for which the writer is greatly indebted to Professor John L. Myres, by whom measured drawings were made from the instrument in 1893. These highly interesting remains, judging from the closed end (5), seem to belong to a side-blown reed-pipe similar to the Maenad pipes in the Castellani collection at the British Museum, illustrated below; they are constructed like modern flutes, but played by means of a reed inserted into the lateral embouchure.

In the Candia pipe, it seems likely that Nos. 1 and 2 represented the bell end, slightly expanded, No. 3 joining the broken end of No. 2 at *l*; there being a possible fit at the other end at s with a in No. 4 (the drawings must in this case be imagined as reversed for parts 3 and 4), and No. 5 joining on to No. 4 at *k*.

According to Professor Myres there are fragments of a pair of pipes in the Cyprus Museum of precisely the same construction as the one in Candia. In the drawing, the shape and relative position of the holes *on the circumference* is approximate only, but their position lengthways is measured.



(From a drawing by Prof. John L. Myres.)

FIG. 1.—Diagram of the Fragments of an *Aulos* (Candia Mus.).

a, Triple wrapping of bronze as well as slide.
b, Slide with hole.
c, Slides with two holes not uncovered together.
d, Slides with two holes not uncovered together, one hole at back.
e, Slide.
f, Slide missing.
g, Slide missing, scars of slide holes.
h, Slide.
i and *j*, Slide.
k, Socket.
l, Male half of joint.
m, *n*, *o*, Slides, the top hole being in the slide only.
p and *q*, Slides, with two holes; the small hole shown is in the pipe, there being a corresponding hole in the slide at the back.
r, Bronze covering (and slide?).
s, Male joint.
t, The wavy line shows the extreme length of fragment.
u, 13 mm. inside diameter, 14 mm. outside diameter.
w, Engraved lines and conical form of bronze covering.
x, Wavy line shows extreme length of fragment.
y, Stopped end of pipe with engraved lines.

The line between *r* and *s* is either a turned ring or part of bronze cover. The double lines to the right of t are engraved lines.

Bands of silver were found on the ivory pipes from Pompeii[3] (fig. 2), as well as on two pipes belonging to the Castellani collection (fig. 4) and on one from Halicarnassus, in the British Museum. In order to enable the performer to use these bands conveniently, a contrivance such as a little ring, a horn or a hook termed keras (κέρας) was attached to the band.[4]

Thirteen of the bands on the Pompeian pipes still have sockets which probably originally contained *kerata*. Pollux (iv. 80) mentions that Diodorus of Thebes, in order to increase the range of the aulos, made lateral channels for the air (πλάγιαι ὁδοί). These consisted of tubes inserted into the holes in the bands for the purpose of lengthening the column of air, and lowering individual notes at will, the sound being then produced at the extremity of the tube, instead of at the surface of the pipe. It is possible that some of the double holes in the slides of the Candia pipe were intended for the reception of these tubes. These lateral tubes form the archetype of the modern crook or piston.[5] The mouthpiece of the aulos was called *zeugos* (ζεῦγος),[6] the reed tongue *glossa*[7] or *glotta* (γλῶσσα or γλῶττα), and the socket into which the reed was fixed *glottis*[8] (γλωττίς).

The double reed was probably used at first, being the simplest form of mouthpiece; the word *zeugos*, moreover, signifies a pair of like things. There is, however, no difficulty in accepting the probability that a single beating reed or clarinet mouthpiece was used by the Greeks, since the ancient Egyptians used it with the as-it or arghoul (*q.v.*).

The beak-shaped mouthpiece of a pipe found at Pompeii (fig. 3) has all the appearance of the beak of the clarinet, having, on the side not shown, the lay on which to fix a single or beating reed.[9] It may, however, have been the cap of a covered reed, or even a whistle mouthpiece in which the lip does not show in the photograph. It is difficult to form a conclusion without seeing the real instrument. On a mosaic of Monnus in Trèves[10] is represented an aulos which also appears to have a beak-shaped mouthpiece.

The upper part of the aulos, as in the Pompeian pipes, frequently had the form of a flaring cup supported on a pear-shaped bulb, respectively identified as the *holmos* (ὅλμος) and the *hypholmion* (ὑφόλμιον), the support of the *holmos*. An explanation of the original nature and construction of the bulb and flaring cup, so familiar in the various representations of the aulos, and in the real instruments found in Pompeii, is provided by an ancient Egyptian flute belonging to the collection of G. Maspero, illustrated and described by Victor Loret.[11] Loret calls the double bulb the beak mouthpiece of the instrument, and describes its construction; it consists of a piece of reed of larger diameter than that of the flute, and eight centimetres long; this reed has been forcibly compressed a little more than half way down by means of a ligature of twine, thus reducing the diameter from 6 mm. to 4 mm. The end of the pipe, covered by rows of waxed thread, fits into the end of the smaller bulb, to which it was also bound by waxed thread exactly as in the Elgin pipe at the British Museum, described below. There is no indication of the manner in which the pipe was sounded, and Loret assumes that there was once a whistle or flageolet mouthpiece. To the present writer, however, it seems probable that the constricted diameter between the two bulbs formed a socket into which the double reed or straw was inserted, and that, in this case at least, the reed was not taken into the mouth, but vibrated in the upper bulb or air-chamber. This simple contrivance was probably also employed in the earliest Greek pipes, and was later copied and elaborated in wood, bone or metal, the upper bulb being made shorter and developing into the flaring cup, in order that the reeds might be taken directly into the mouth. During the best period of Greek music the reeds

were taken directly into the mouth[12] and not enclosed in an air-chamber. The two pipes were kept in position while the fingers stopped the holes and turned the bands by means of the φορβείᾳ (Lat. *capistrum*), a bandage encircling mouth and cheeks, and having holes through which the reed-mouthpiece passed into the mouth of the performer; the *phorbeia* also relieved the pressure of the breath on the cheeks and lips,[13] which is felt more especially by performers on oboe and bassoon at the present day.

(Drawn from a photo by Brogi.)

Fig. 2.—Roman Ivory Aulos found at Pompeii (Naples Mus.), showing slides and rings.

(From a photo by Brogi.)

Fig. 3.—Beak mouthpiece. Found at Pompeii (Naples Mus.).

In the pair of wooden pipes belonging to the Elgin collection at the British Museum, one of the bulbs, partly broken, but preserved in the same case as the pipes, was fastened to the pipes by means of waxed thread, the indented lines being still visible on the rim of the bulb. The aulos was kept in a case called *sybene*[14] (συβήνη) or *aulotheke*[15] (αὐλοθήκη), and the little bag or case in which the delicate reeds were carried was known by the name of *glottokomeion*[15] (γλωττοκομεῖον).[16] Two Egyptian flute cases are extant, one in the Louvre,[17] and the other in the museum at Leiden. The latter case is of sycamore wood, cylindrical in shape, with a stopper of the same wood; there is no legend or design upon it. The case contained seven pipes, five pieces of reed without bore or holes, and three pieces of straw suitable for making double-reed mouthpieces.[18]

Aristoxenus gives the full compass of a single pipe or pair of pipes as over three octaves:—"For doubtless we should find an interval greater than the above mentioned three octaves between the highest note of the soprano clarinet (aulos) and the lowest note of the bass-clarinet (aulos); and again between the highest note of a clarinet player performing with the speaker open, and the lowest note of a clarinet player performing with the speaker closed."[19]

This, according to the tables of Alypius, would correspond to the full range of the Greek scales, a little over three octaves from  to  . It is evident that the ancient Greeks obtained this full compass on the aulos by means of the harmonics. Proclus (*Comm. in Alcibiad.* chap. 68) states that from each hole of the pipe at least three tones could be produced. Moreover, classic writers maintain that if the performer press the *zeugos* or the *glottai* of the pipes, a sharper tone is produced.[20] This is exactly how a performer on a modern clarinet or oboe produces the higher harmonics of the instrument.[21] The small bore of the aulos in comparison to its length facilitated the production of the harmonics (cf. Zamminer p. 218), as does also the use of a small hole near the mouthpiece, called in Greek *syrinx* (σῦριγξ) and in the modern clarinet the "speaker," which when open enables the performer to overblow with ease the first harmonic of the lowest fundamental tones. To Mr Albert A. Howard of Harvard University is due the credit of having identified the *syrinx* of the aulos with the speaker of the clarinet.[22] This assumption is doubtless correct, and is supported by classical grammarians,[23] who state that the *syrinx* was one of the holes of the aulos. It renders quite clear certain passages in Aristoxenus, Aristotle and Plutarch, and a scholion to Pindar's 12th *Pythian*, which before were difficult to understand (see Syrinx).

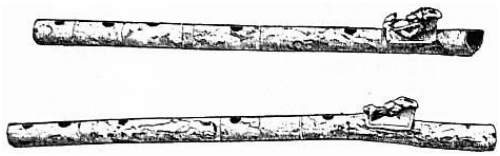


Fig. 4.—The Plagiaulos. Castellani Collection (Maenad Pipes), British Museum.

The aulos or tibia existed in a great number of varieties enumerated by Pollux (*Onomast.* iv. 74 et seq.) and Athenaeus (iv. 76 et seq.). They fall into two distinct classes, the single and the double pipes. There were three principal single pipes, the *monaulos*, the *plagiaulos* and the *syrinx monocalamos*. The double pipes were used by the great musicians of ancient Greece, and notably at the musical contests at Delphi, and what has been said above concerning the construction of the aulos refers mainly to the double pipes. The *monaulos*, a single pipe of Egyptian origin, which, by inference, we assume to have been played from the end by means of a reed, may have been the archetype of the oboe or clarinet. The *plagiaulos photinx* or *tibia obliqua*, invented by the Libyans (Pollux iv. 74), or, according to Pliny (vii. 204), by Midas of Phrygia, was held like the modern flute, but was played by means of a mouthpiece containing a reed. Three of the existing pipes at the British Museum (the two in the Castellani collection, and the pipe from Halicarnassus) belong to this type. The mouthpiece projects from the side of the pipe and communicates with the main bore by means of a slanting passage; the end nearest the mouthpiece is stopped as in the modern flute; in the latter, however, the embouchure is not closed by the lips when playing, and therefore the flute has the acoustic properties of the open pipe, whereas the *plagiaulos* having a reed mouthpiece gave the harmonics of a closed pipe. The double pipes existed in five sizes according to pitch, in the days of Aristoxenus, who, in a treatise on the construction of the auloi (Περὶ αὐλῶν τρήσεως), unfortunately not extant,[24] divides them thus:—

Fig. 5.—Ancient Greek Double Pipes. Elgin Collection, British Museum.

(1) *Parthenioi auloi* (παρθένιοι αὐλοί), the maiden's *auloi*, corresponding to the soprano compass.

(2) *Paidikoi auloi* (παιδικοὶ αὐλοί), the boy's pipes or alto *auloi*, used to accompany boys' songs and also in double pairs at feasts.

(3) *Kitharisterioi auloi* (κιθαριστήριοι αὐλοί), used to accompany the cithara.

(4) *Teleioi auloi*, the perfect aulos, or tenor's pipes; also known as the *pythic auloi* (πυθικοὶ αὐλοί); used for the paeans and for solos at the Pythean games (without chorus). It was the *pythic auloi* and the *kitharisterioi auloi* more especially which were provided with the speaker (syrinx) in order to improve the harmonic notes (see Syrinx).

(5) *Hyperteleioi auloi* (ὑπερτέλειοι αὐλοί) or *andreioi auloi* (ἀνδρεῖοί αὐλοί) (see Athenaeus iv. 79), the bass-auloi.

The Phrygian pipes or *auloi Elymoi*[25] were made of box-wood and were tipped with horn; they were double pipes, but differed from all others in that the two pipes were unequal in length and in the diameter of their bores;[26] sometimes one of the pipes was curved upwards and terminated in a horn bell;[27] they seem to have had a conical bore, if representations on monuments are to be trusted. We may conclude that the archetype of the oboe with conical bore was not unknown to the Greeks; it was frequently used by the Etruscans and Romans, and appears on many has-reliefs, mural paintings and other monuments. For illustrations see Wilhelm Froehner, *Les Musées de France*, pl. iii., "Marsyas playing the double pipes." There the bore is decidedly conical in the ratio of at least 1 : 4 between the mouthpiece and the end of the instrument; the vase is Roman, from the south of France. See also *Bulletino della Commissione Archeologica Comunale di Roma*, Rome, 1879, vol. vii., 2nd series, pl. vii. and p. 119 et seq., "Le Nozze di Elena e Paride," from a bas-relief in the monastery of S. Antonio on the Esquiline; Wilhelm Zahn, *Die schonsten Ornamente und die merkwurdigsten Gemälde aus Pompeji, Herkulaneum und Stabiae* (German and French), vol. iii., pl. 43 and 51 (Berlin, 1828-1859).

For further information on the aulos, consult Albert A. Howard, "The Aulos or Tibia," *Harvard Studies*, iv., 1893; François A. Gevaert, *Histoire de la musique dans l'antiquité*, vol. ii. p. 273 et seq.; Carl von Jan's article "Flote" in August Baumeister's *Denkmaler des klassischen Altertums* (Munich, 1884-1888), vol. i.; Dr Hugo Riemann, *Handbuch der Musikgeschichte*, Bd. I.T. 1, pp. 93-112 (Leipzig, 1904); Caspar Bartholinus, *De Tibiis Veterum* (Amsterdam, 1779).

(K. S.)

1 See Pollux, *Onom.* iv. 69.

2 See Friedrich Zamminer, *Die Musik und musikalischen Instrumente in ihrer Beziehung zu den Gesetzen der Akustik* (Giessen, 1855), p. 305.

3 These pipes were discovered during the excavations in 1867, and are now in the museum at Naples. Excellent reproductions and descriptions of them are given in "The Aulos or Tibia," by Albert A. Howard, *Harvard Studies*, vol. iv. (Boston, 1893), pl. ii. and pp. 48-55.

4 For illustrations of *auloi* provided with these contrivances, see illustration (fig. 2) of an aulos from Pompeii; a relief in Vatican, No. 535; Helbig's *Wandgemälde*, Nos. 56, 69, 730, 765, &c.

5 For illustrations of ὀδοί showing the holes at the ends of the tubes, see *Description des marbres antiques du Musée Campana*, by H. d'Escamps, pl. 25; Wilhelm Froehner's *Catalogue of the Louvre*, No. 378; Glyptothek Museum at Munich, No. 188; Albert A. Howard, "The Aulos or Tibia," *Harvard Studies*, iv. (Boston, 1893), pl. 1, No. 1.

6 For a description of the reed calamus from which pipe and mouthpiece were made see Theophrastus, *Hist. Plant.* iv. 11.

7 Aeschines 86. 29; Aristotle, *H.A.* 6, 10, 9, &c.

8 Lucian, *Harm.* 1.

9 Cf. article Mouthpiece.

10 See *Antike Denkmaler*, Deutsches archäol. Inst., Berlin, 1891, vol. i. pi. 49.

11 See "Les Flûtes égyptiennes antiques," *Journal asiatique*, 8th ser. vol. xiv. (Paris, 1889), pp. 212-215.

12 See Aristotle, *De Audib.* p. 802 b, 18, and p. 804a; Festus, ed. Mueller, p. 116.

13 See Albert A. Howard, op. cit. p. 29, and Dr Hugo Riemann, *Gesch. d. Musik*, Bd. i. T. 1, p. 111 (Leipzig, 1904).

14 Pollux, *Onomasticon*, vii. 153.

15 Hesychius.

16 Pollux ii. 108, vii. 153, x. 153-154; A.A. Howard, op. cit. pp. 26-27. An illustration of the little bag is given in *Denkmaler des klassischen Altertums*, by August Baumeister, vol. i. p. 554, fig. 591.

17 Two Egyptian pipes now in the Louvre were found in a case ornamented with a painting of a female musician playing a double pipe. See E. de Rougé, *Notice sommaire des monuments égyptiens exposés dans les galeries du Louvre*, p. 87.

18 See Victor Loret, "Les Flûtes égyptiennes antiques," in *Journal asiatique*, vol. xiv. (Paris, 1889), pp. 199, 200 and 201 (note), pp. 207, 211 and 217, and Conrad Leemans, *Description raisonnée des monuments égyptiens du Musée d'Antiquités de Leyde*, p. 132, No. 489; contents of case Nos. 474-488.

19 Aristoxenus, *Harm.* bk. i. 20 and 21, H.S. Macran's edition with translation (Oxford, 1902), p. 179.

20 Aristotle, *De audib.* p. 804a; Porphyry, ed. Wallis, p. 249; *ibid.* p. 252.

21 Zamminer, *op. cit.* p. 301.

22 *Op. cit.* p. 32-35.

23 See *Etymologicum magnum* (Augsburg. 1848), s.v. "Syrinx."

24 See Athenaeus xiv. 634, who quotes from Didymus.

25 Pollux iv. 74.

26 Servius *ad Aen.* ix. 615.

27 Tibullus ii. 85; Virg. *Aen.* xi. 735; Ovid, *Met.* iii. 533, *Ex Ponto* i. 1. 39.

AUMALE, HENRI EUGÈNE PHILIPPE LOUIS D'ORLÉANS, Duc d' (1822-1897), French prince and statesman, fifth son of Louis Philippe, duke of Orleans, afterwards king of the French, and of Marie Amélie, princess of the Two Sicilies, was born at Paris on the 16th of January 1822. While still young he inherited a large fortune from the prince de Condé. Brought up by his parents with great simplicity, he was educated at the college of Henri IV., on leaving which at the age of seventeen he entered the army with the rank of a captain of infantry. He distinguished himself during the conquest of Algeria, and was appointed governor of that colony, in which capacity he received the submission of the amir Abd-el-Kader. After the revolution of 1848 he retired to England and busied himself with historical and military studies, replying in 1861 by a *Letter upon the History of France* to Prince Napoleon's violent attacks upon the house of Orleans. On the outbreak of the Franco-Prussian War he volunteered for service in the French army, but his offer was declined. Elected deputy for the Oise department, he returned to France, and succeeded to the *fauteuil* of the comte de Montalembert in the French Academy. In March 1872 he resumed his place in the army as general of division; and in 1873 he presided over the court-martial which condemned Marshal Bazaine to death. About this period, being appointed commandant of the VII. army corps at Besançon, he retired from political life, and in 1879 became inspector-general of the army. By the act of exception passed in 1883 all members of families that had reigned in France serving in the army were deprived of their military positions; consequently the duc d'Aumale was placed on the unemployed supernumerary list. Subsequently, in 1886, another law was promulgated which expelled from French territory the heads of former reigning families, and provided that henceforward all members of those families should be disqualified for any public position or function, and for election to any public body. The duc d'Aumale protested energetically, and was himself expelled. By his will of the 3rd of June 1884, however, he had bequeathed to the Institute of France his Chantilly estate, with all the art-collection he had gathered there. This generosity led the government to withdraw the decree of exile, and the duke returned to France in 1889. He died at Zucco in Sicily on the 7th of May 1897. Of his marriage, contracted in 1844 with his first cousin, Caroline de Bourbon, daughter of the prince of Salerno, were born two sons: the prince de Condé (d. 1866), and the due de Guise (d. 1872). The due d'Aumale's principal literary work was an *Histoire des princes de Condé*, which he left unfinished. 921

See Georges Picot, *M. le duc d'Aumale* (Paris, 1898); Ernest Daudet, *Le duc d'Aumale* (Paris, 1898).

(M. P.*)

AUMALE, a town of northern France, in the department of Seine-Inférieure, on the left bank of the Bresle, 47 m. N.E. of Rouen on the Northern railway. Pop. (1906) 1999. The church is an interesting building of the 16th and 17th centuries, and has a portal attributed to Jean Goujon. The town has glass and steel works.

The territory of Aumale (Albemarle, Aubemale, Aumerle; Lat. *Alba Marla*) in Normandy, a dependency of the archbishopric of Rouen, was granted to Odo of Champagne, brother-in-law of William the Conqueror, who founded the first line of counts of Aumale. Hawise (Hadwide, Havoise or Avoie), countess of Aumale, after the death of her first husband William de Mandeville, earl of Essex (d. 1189), married William des Forts (de Fors, or de Fortz; Lat. de Fortibus), a military adventurer who had been one of the commanders of the fleet under Richard I. during his first crusade. He died in 1195, and his widow married Baldwin de Betun, who became count of Aumale in her right. He died in 1213, and in 1214 William de Fortibus, son of Hawise by her second husband, was confirmed by King John in all his mother's lands. Meanwhile, however, the territory of Aumale shared the fate of the rest of Normandy, and was annexed to the French crown by King Philip Augustus; but the title of earl of Albemarle, derived from it, continued to be borne in England by William de Fortibus, and was passed on to his heirs (see Albemarle). Aumale itself was conferred by Philip Augustus as an appanage on his son Philip. It was subsequently granted by Louis VIII. to Simon, count of Dammartin, whose daughter, Jeanne, countess of Dammartin, transferred it, together with the countship of Ponthieu, to the house of Castile, by her marriage with Ferdinand III., king of Castile,

called the Saint (1238). It then remained in the possession of a branch of her descendants bearing the name of Ponthieu, until it passed to the house of Harcourt on the marriage of Blanche of Ponthieu with John, count of Harcourt (1340). Marie d'Harcourt (d. 1476), heiress of Aumale, married Anthony of Lorraine, count of Vaudémont, and Aumale was created a duchy in the peerage of France for Claude and Francis of Lorraine in 1547. By the marriage of Anne of Lorraine with the duke of Nemours in 1618 the duchy of Aumale passed to the house of Savoy-Nemours. In 1686 Marie Jeanne Baptiste, duchess of Nemours and of Aumale, and wife of Charles Emmanuel II., duke of Savoy, sold Aumale to Louis XIV., who gave it to his natural son, the duke of Maine. After the death of that prince, the dukedom devolved upon his brother, the count of Toulouse, subsequently passing to the latter's son, the duke of Penthièvre, whose daughter married the duke of Orleans. Since the reign of Louis Philippe, king of the French, the title of duke of Aumale has been borne by a son of the duke of Orleans.

AUMONT, the name of a family which played an important part in French history. The origin of the name is uncertain, but it has usually been derived from Aumont, now a small commune in the department of the Somme. The family was of great antiquity, a Jean, sire d'Aumont, having accompanied Louis IX. on crusade. It was already powerful in the 14th century, and during the English wars of that period its members fought in the armies of the kings of France. Towards the end of the century, the family took the part of the dukes of Burgundy, but returned to the side of France on the death of Charles the Bold. Jean d'Aumont, lieutenant-general to the king of France in the government of Burgundy, rendered important services to Louis XII. and Francis I. Another Jean d'Aumont (d. 1595), a marshal of France and knight of the order of the Holy Ghost since its institution in 1578, fought against the Huguenots under the last of the Valois kings; but he was among the first to recognize Henry IV., and was appointed governor of Champagne and of Brittany, where he had to fight against the League. His grandson Antoine (1601-1669) was also a marshal of France (1651), governor of Paris (1662), duke and peer (1665). Louis Marie Augustin, duc d'Aumont (1709-1782), was a celebrated collector of works of art. Louis Marie Celeste d'Aumont, due de Piennes, afterwards duc d'Aumont (1762-1831), emigrated during the Revolution and served in the army of the royalists, as also in the Swedish army. During the Hundred Days he effected a descent upon Normandy in the Bourbon interest, and succeeded in capturing Bayeux and Caen.

AUNCEL (from the Anglo-Fr. *auncelle*, a confused derivation from *l'auncelle*, Ital. *lancella*, a little balance), a balance formerly used in England; now, in dialectical use, a term for the weighing of meat by hand instead of by scales.

AUNDH, a native state of India, in the Deccan division of Bombay, ranking as one of the Satara Jagirs. Its area is 447 sq. m.; its population was 63,921 in 1901, showing a decrease of 2% in the decade. Estimated revenue £9422. The chief, whose title is Pant Pratinidhi, is a Brahman by caste. The state has suffered severely from plague. The town of Aundh is situated 26 m. S.E. of Satara. Pop. about 3500.

AUNGERVYLE, RICHARD (1287-1345), commonly known as Richard de Bury, English bibliophile, writer and bishop, was born near Bury St Edmunds, Suffolk, on the 24th of January 1287. He was the son of Sir Richard Aungervyle, who was descended from one of William the Conqueror's soldiers, settled in Leicestershire, where the family came into possession of the manor of Willoughby. His education was undertaken by his uncle, John de Willoughby, and after leaving the grammar school of his native place he was sent to Oxford, where he is said to have distinguished himself in philosophy and theology. John Pits[1] says, but apparently without authority, that he became a Benedictine monk. He was made tutor to Prince Edward of Windsor (afterwards Edward III.), and, according to Dibdin, inspired him with some of his own love of books. He was mixed up with the sordid intrigues which preceded the deposition of Edward II., and supplied Queen Isabella and Mortimer in Paris with money in 1325 from the revenues of Guienne, of which province he was treasurer. For some time he had to hide in Paris from the officers sent by Edward II. to apprehend him. On the accession of Edward III. his services were rewarded by rapid promotion. He was cofferer to the king, treasurer of the wardrobe and afterwards clerk of the privy seal. The king, moreover, repeatedly recommended him to the pope, and twice sent him, in 1330 and 1333, as ambassador to the papal court, then in exile at Avignon. On the first of these visits he made the acquaintance of a fellow bibliophile in Petrarch, who records his impression (*Epist. Famil.* lib. iii. Ep. 1) of the Englishman as "not ignorant of literature and ... from his youth up curious beyond belief of hidden things." He asked him for information about Thule, but Aungervyle, who promised information when he should once more be at home among his books, never sent any answer, in spite of repeated enquiries. The pope, John XXII., made him his principal chaplain, and presented him with a rochet in earnest of the first vacant bishopric in England.

During his absence from England he was made (1333) dean of Wells. In September of the same year the see of Durham fell vacant, and the king overruled the choice of the monks, who had elected and actually installed their sub-prior, Robert de Graystanes, in favour of Aungervyle. In February 1334 he was made lord treasurer, an appointment he exchanged later in the year for that of lord chancellor. This charge he resigned in the next year, and, after making arrangements for the protection of his northern diocese from an expected inroad of the Scots, he proceeded in July 1336 to France to attempt a settlement of the claims in dispute between Edward and Philip. In the next year he served on three commissions for the defence of the northern counties. In June 1338 he was once more sent abroad to secure peace, but within a month of his appointment Edward himself landed in Flanders to procure allies for his approaching campaign. Aungervyle accompanied him to Coblenz to his meeting with the emperor Louis IV., and in the next year was sent to England to raise money. This seems to have been his last visit to the continent. In 1340 and 1342 he was again engaged in trying to negotiate peace with the Scots, but from this time his life appears to have passed quietly in the care of his diocese and in the accumulation of a library.

He sent far and wide in search of manuscripts, rescuing many treasures from the charge of ignorant and neglectful monks. "No dearness of price," he says, "ought to hinder a man from the buying of books, if he has the money demanded for them, unless it be to withstand the malice of the seller or to await a more favourable opportunity of buying." It is to be supposed that Richard de Bury sometimes brought undue pressure to bear on the owners, for it is recorded that an abbot of St Albans bribed him to secure his influence for the house by four valuable books, and that de Bury, who procured certain coveted privileges for the monastery, bought from him thirty-two other books, for fifty pieces of silver, far less than their normal price. The record of his passion for books, his *Philobiblon*, was completed on his fifty-eighth birthday, the 24th of January 1345, and he died on the 14th of April (May, according to Adam Murimuth) of that year. He gives an account (chapter viii.) of the unwearied efforts made by himself and his agents to collect books. In the eighteenth chapter he records his intention of founding a hall at Oxford, and in connexion with it a library of which his books were to form the nucleus. He even details the rules to be observed for the lending and care of the books, and he had already taken the preliminary steps for the foundation. The bishop died, however, in great poverty, and it seems likely that his collection was dispersed immediately after his death. But the traditional account is that the books were sent to the Durham Benedictines at Oxford, and that on the dissolution of the foundation by Henry VIII. they were divided between Duke Humphrey of Gloucester's library, Balliol College and Dr George Owen. Only two of the volumes are known to be in existence; one is a copy of John of Salisbury's works in the

British Museum, and the other some theological treatises by Anselm and others in the Bodleian.

The chief authority for the bishop's life is William de Chambre (printed in Wharton's *Anglia Sacra*, 1691, and in *Historiae Dunelmensis scriptores tres*, Surtees Soc. 1839), who describes him as an amiable and excellent man, charitable in his diocese, and the liberal patron of many learned men, among these being Thomas Bradwardine, afterwards archbishop of Canterbury, Richard Fitzralph, afterwards archbishop of Armagh, the enemy of the mendicant orders, Walter Burley, who translated Aristotle, John Mauduit the astronomer, Robert Holkot and Richard de Kilvington. John Bale[2] and Pits[3] mention other works of his, *Epistolae Familiares* and *Orationes ad Principes*. The opening words of the *Philobiblon* and the *Epistolae* as given by Bale represent those of the *Philobiblon* and its prologue, so that he apparently made two books out of one treatise. It is possible that the *Orationes* may represent a letter book of Richard de Bury's, entitled *Liber Epistolaris quondam domini Ricardi de Bury, Episcopi Dunelmensis*, now in the possession of Lord Harlech. This MS., the contents of which are fully catalogued in the Fourth Report (1874) of the Historical MSS. Commission (Appendix, pp. 379-397), contains numerous letters from various popes, from the king, a correspondence dealing with the affairs of the university of Oxford, another with the province of Gascony, beside some harangues and letters evidently kept as models to be used on various occasions.

It has often been asserted that the *Philobiblon* itself was not written by Richard de Bury at all, but by Robert Holkot. This assertion is supported by the fact that in seven of the extant MSS. of *Philobiblon* it is ascribed to Holkot in an introductory note, in these or slightly varying terms: *Incipit prologus in philobiblon ricardi dunelmensis episcopi quē librū composuit Robertus holcote de ordine predicalorum sub nomine dicti episcopi*. The Paris MS. has simply *Philobiblon olchoti anglici*, and does not contain the usual concluding note of the date when the book was completed by Richard. As a great part of the charm of the book lies in the unconscious record of the collector's own character, the establishment of Holkot's authorship would materially alter its value. A notice of Richard de Bury by his contemporary Adam Murimuth (*Continuatio Chronicarum*, Rolls Series, 1889, p. 171) gives a less favourable account of him than does William de Chambre, asserting that he was only moderately learned, but desired to be regarded as a great scholar.

The original Latin text was printed at Cologne (1473), Spires (1483), Paris (1500), Oxford (1598 and 1599), &c. It was first translated into English by J.B. Inglis in 1832, and into French by Hippolyte Cocheris in 1856. The best translation is that by Mr E.C. Thomas, accompanying the Latin text, with full biographical and bibliographical introductions (1888). Other editions are in the *King's Classics* (1902) and for the Grolier Club (New York, 1889, ed. A.W. West).

1 *De Ill. Angl. Script.* (1619, p. 467).

2 *Script. Ill. Maj. Brit.* cent. v. No. 69.

3 *De Ill. Angl. Script.* (1619, p. 468).

AUNT SALLY, the English name for a game popular at fairs, race-courses and summer resorts. It consists in throwing hard balls, of wood or leather-covered yarn, at puppets dressed to represent different characters, originally a grotesque female figure called "Aunt Sally," with the object of smashing a clay pipe which is inserted either in the mouth or forehead of the puppet. In France the game is popular under the name *jeu de massacre*. In a variation of the pastime the mark consists of a living person's head thrust through a hole in a sheet of canvas. In case of a hit a second shy is allowed, or a small prize is given.

AURA (from the Gr. for "breath" or "breeze"), a term used in old days to denote a supposed ethereal emanation from a volatile substance; applied later to the "electrical aura," or air-current caused by electrical discharge; in epilepsy (*q.v.*) to one of its premonitory symptoms; and in spiritualism to a mysterious light associated with the presence of spirit-forms. See also Aureola.

AURANGABAD, or Aurungabad, a city of India, in the dominions of the nizam of Hyderabad, north-west division, situated 138 m. from Poona, 207 from Bombay via Poona, and 270 from Hyderabad on the river Kaum. It gives its name to a district. It was founded in 1610, under the name of Fatchnagar, by Malik Ambar, an Abyssinian, who had risen from the condition of a slave to great influence. Subsequently it became the capital of the Mogul conquests in the south of India. Aurangzeb, who erected here a mausoleum to his wife which has been compared to the Taj at Agra, made the city the seat of his government during his viceroyalty of the Deccan, and gave it the name of Aurangabad. It thus grew into the principal city of an extensive province of the same name, stretching westward to the sea, and comprehending nearly the whole of the territory now comprised within the northern division of the presidency of Bombay. Aurangabad long continued to be the capital of the succession of potentates bearing the modern title of nizam, after those chiefs became independent of Delhi. They abandoned it subsequently, and transferred their capital to Hyderabad, when the town at once began to decline. Aurangabad is a railway station on the Hyderabad-Godavari line, 435 m. from Bombay. In 1901 the population, with military cantonments, was 36,837, showing an increase of 8% in the decade. It has a cotton mill.

The district of Aurangabad has an area of 6172 sq. m. The population in 1901 was 721,407. It contains the famous caves of Ajanta, and also the battlefield of Assaye.

AURANGZEB (1618-1707), one of the greatest of the Mogul emperors of Hindustan, was the third son of Shah Jahan, and was born in November 1618. His original name, Mahommed, was changed by his father, with whom he was a favourite, into Aurangzeb, meaning ornament of the throne, and at a later time he assumed the additional titles of Mohi-eddin, reviver of religion, and Alam-gir, conqueror of the world. At a very early age, and throughout his whole life, he manifested profound religious feeling perhaps instilled into him in the course of his education under some of the strictest Mahommedan doctors. He was employed, while very young, in some of his father's expeditions into the country beyond the Indus, gave promise of considerable military talents, and was appointed to the command of an army directed against the Uzbegs. In this campaign he was not completely successful, and soon after was transferred to the army engaged in the Deccan. Here he gained several victories, and in conjunction with the famous general, Mir Jumla, who had deserted from the king of Golconda, he seized and plundered the town of Hyderabad, which belonged to that monarch. His father's express orders prevented Aurangzeb from following up this success, and, not long after, the sudden and alarming illness of Shah Jahan turned his thoughts in another direction. Of Shah Jahan's four sons, the eldest, Dara, a brave and honourable prince, but disliked by the Mussulmans on account of his liberality of thought, had a natural right to the throne. Accordingly, on the illness of his father, he at once seized the reins of government and established himself at Delhi. The second son, Shuja, governor of Bengal, a dissolute and sensual prince, was dissatisfied, and raised an army to dispute the throne with Dara. The keen eye of Aurangzeb saw in this conjuncture of events a favourable opportunity for realising his own ambitious schemes. His religious exercises and temperate habits gave him, in popular estimation, a great superiority over his brothers, but he was too politic to put forward his claims openly. He made overtures to his younger brother Murad, governor of Gujarat, representing that neither of their elder brothers was worthy of the

kingdom, that he himself had no temporal ambition, and desired only to place a fit monarch on the throne, and then to devote himself to religious exercises and make the pilgrimage to Mecca. He therefore proposed to unite his forces to those of Murad, who would thus have no difficulty in making himself master of the empire while the two elder brothers were divided by their own strife. Murad was completely deceived by these crafty representations, and at once accepted the offer. Their united armies then moved northward. Meanwhile Shah Jahan had recovered, and though Dara resigned the crown he had seized, the other brothers professed not to believe in their father's recovery, and still pressed on. Shuja was defeated by Dara's son, but the imperial forces under Jaswant Singh were completely routed by the united armies of Aurangzeb and Murad. Dara in person took the field against his brothers, but was defeated and compelled to fly. Aurangzeb then, by a clever stroke of policy, seized the person of his father, and threw him into confinement, in which he was kept for the remaining eight years of his life. Murad was soon removed by assassination, and the way being thus cleared, Aurangzeb, with affected reluctance, ascended the throne in August 1658. He quickly freed himself from all other competitors for the imperial power. Dara, who again invaded Gujarat, was defeated and closely pursued, and was given up by the native chief with whom he had taken refuge. He was brought up to Delhi, exhibited to the people, and assassinated. Shuja, who had been a second time defeated near Allahabad, was attacked by the imperial forces under Mir Jumla and Mahommed, Aurangzeb's eldest son, who, however, deserted and joined his uncle. Shuja was defeated and fled to Arakan, where he perished; Mahommed was captured, thrown into the fortress of Gwalior, and died after seven years' confinement. No similar contest disturbed Aurangzeb's long reign of forty-six years, which has been celebrated, though with doubtful justice, as the most brilliant period of the history of Hindustan. The empire certainly was wealthy and of enormous extent, for there were successively added to it the rich kingdoms of Bijapur and Golconda, but it was internally decaying and ready to crumble away before the first vigorous assault. Two causes principally had tended to weaken the Mogul power. The one was the intense bigotry and intolerant policy of Aurangzeb, which had alienated the Hindus and roused the fierce animosity of the haughty Rajputs. The other was the rise and rapid growth of the Mahratta power. Under their able leader, Sivaji, these daring freebooters plundered in every direction, nor could all Aurangzeb's efforts avail to subdue them. For the last twenty-six years of his life Aurangzeb was engaged in wars in the Deccan, and never set foot in his own capital. At the close of the long contest the Mogul power was weaker, the Mahratta stronger than at first. Still the personal ability and influence of the emperor were sufficient to keep his realms intact during his own life. His last years were embittered by remorse, by gloomy forebodings, and by constant suspicion, for he had always been in the habit of employing a system of espionage, and only then experienced its evil effects. He died on the 3rd of March 1707 at Ahmadnagar, while engaged on an extensive but unfortunate expedition against the Mahrattas.

See Lane-Poole, *Aurangzib*, "Rulers of India" series (1893).

AURAY, a town of France near the mouth of the Auray river, in the department of Morbihan, 12 m. W. of Vannes on the railway between that town and Lorient. Pop. (1906) 5241. Its port, which is formed by the channel of the river and divides the town into two parts, is frequented by coasting and fishing vessels. The principal buildings are the church of St Esprit (13th century) now secularized; the Renaissance church of St Gildas; the town-hall (18th century); and, at a short distance from the town, the Carthusian monastery, now a deaf and dumb institute, on the site of the battle of 1364, at which Charles of Blois was defeated by John of Montfort (see BRITTANY: *History*). Adjoining the Chartreuse is a small chapel in which are preserved the bones of the Royalists captured by the Republicans in a battle fought near the spot in 1795. In the neighbourhood is the church of Sainte Anne d'Auray, one of the principal places of pilgrimage in Brittany. Auray is one of the chief centres in France for oyster-breeding, and carries on boat-building and sardine-fishing.

AURELIA, VIA, an ancient highroad of Italy, the date of the construction of which is unknown. It ran from Rome to Alsium, where it reached the sea, and thence along the south-west coast of Italy, perhaps originally only as far as Cosa, and was later extended to Vada Volaterrana, and in 109 B.C. to Genua and Dertona by means of the Via Aemilia, though a coast road as far as Genua at least must have existed long before. The name is applied in the Antonine Itinerary to these extensions, and even to the prolongation to Aries. Its line is in the main closely followed by the modern coast highroad; cf., however, for the section between Cosa and Populonia, O. Cuntz in *Jahreshefte des Öslerr. arch. Instituts*, vii. (1904), 54.

(T. As.)

AURELIAN [LUCIUS DOMITIUS AURELIANUS], one of the greatest of the Roman soldier emperors, was born at Sirmium in Pannonia between A.D. 212-214. He was of humble origin, but nothing definite is known of his family. He had always shown great enthusiasm for a military career, and so distinguished himself in the campaigns in which he took part that on one occasion he received a public vote of thanks. At the same time he was proclaimed consul elect, and adopted by Ulpius Crinitus, military governor of Illyria and Thrace. On the death of the emperor Claudius II. Gothicus (270), Aurelian was proclaimed his successor with the universal approval of the soldiers. His first task was to continue the war which had been begun by Claudius against the Goths. He drove them out of Moesia across the Danube, where he left them in possession of Dacia, which he did not think himself able to retain; the name was transferred to Moesia, which was then called Dacia Aureliani. The chronology, however, of Aurelian's reign is very confused, and the abandonment of Dacia is placed by some authorities towards its close. He next entered upon campaigns against the Juthungi, Alamanni, and other Germanic tribes, over whom, after a severe defeat which was said to have imperilled the very existence of the empire, he at length obtained a complete victory. Having thus secured the Rhine and Danube frontiers, he turned his energies towards the east, and in 271 set out on his expedition against Zenobia, queen of Palmyra (*q.v.*). At the same time he crushed two pretenders to the throne—Firmus and Tetricus. Firmus, a wealthy merchant of Seleucia, had proclaimed himself emperor of Egypt. Aurelian, who was at the time in Mesopotamia, hastened thither, and ordered him to be seized and put to death. Tetricus, who had been proclaimed emperor in the west after the death of Gallienus, and left undisturbed by Claudius II., still ruled over Gaul, Spain and Britain. A decisive battle was fought near the modern Châlons, in which Tetricus was defeated. The restoration of the unity of the empire was thus complete. In 274 a brilliant triumph, adorned by the persons of Zenobia and Tetricus, was celebrated at Rome.

Aurelian now turned his attention to the internal affairs of the empire. He introduced sumptuary laws; relieved the poor by distributions of bread and meat, proceeded with great severity against informers and embezzlers; began the construction of various public works and buildings; and proclaimed a general amnesty for political crimes. The restoration and enlargement of the walls of Rome, commenced by him, was not completed till the reign of Probus. An attempt to restore the standard of the coinage is said to have caused a revolt of the workmen and officials connected with the mint, which was only put down with the loss of 7000 soldiers. It has been suggested that this was really an attempt at revolution incited by the senate and praetorian guards, the opportunity being found in disturbances resulting from opposition to the attempted reform, which by themselves could hardly have assumed such serious proportions. Aurelian's restless spirit was not long able to endure a life of inaction in the city. Towards the end of 274, he started on an expedition against the Persians, halting in Thrace by the way. While on the march between Heracleia and Byzantium, at the beginning of the following year, he was assassinated through the treachery of his secretary Eros, who, in order to escape the discovery of his own irregularities, incited certain officers against the emperor by showing them a forged list, on which their names appeared as marked out for death.

Aurelian well deserved the title of restorer of the empire, and it must be remembered that he lived in an age when severity was absolutely necessary. He was a great soldier and a rigid but just disciplinarian. In more favourable circumstances he would have been a great administrator. He displayed a fondness for pomp and show on public occasions; he was the first Roman emperor to wear the

diadem, and assumed the title of Lord and God on medals.

The chief authority for the events of Aurelian's reign is his life by Vopiscus, one of the writers of the "Augustan History"; it is founded on Greek memoirs and certain journals deposited in the Ulpian library at Rome. See L. Homo, *Le Règne de l'empereur Aurélien* (1904), and Groag's art. in Pauly-Wissowa, *Realencyclopädie*, v. 1347 foll.

AURELIANUS, CAELIUS, a physician of Sicca in Numidia, who probably flourished in the 5th century A.D., although some place him two or even three centuries earlier. In favour of the later date is the nature of his Latin, which shows a strong tendency to the Romance, and the similarity of his language to that of Cassius Felix, also an African medical writer, who about 450 wrote a short treatise, chiefly based on Galen. We possess a translation by Aurelianus of two works of Soranus of Ephesus (2nd century), the chief of the "methodist" school of medicine, on chronic and acute maladies—*Tardae* or *Chronicae Passiones*, in five, and *Celeres* or *Acutae Passiones* in three books. The translation, which is especially valuable since the original has been lost, shows that Soranus possessed considerable practical skill in the diagnosis of ordinary and even of exceptional diseases. It is also important as containing numerous references to the methods of earlier medical authorities. We also possess considerable fragments of his *Medicinales Responsiones*, also adapted from Soranus, a general treatise on medicine in the form of question and answer; it deals with rules of health (*salutaria praecepta*) and the pathology of internal diseases (ed. Rose, *Anecdota Graeca et Latina*, ii., 1870). Where it is possible to compare Aurelianus's translation with the original—as in a fragment of his Gynaecia with Soranus's Περὶ γυναικείων—it is found that it is literal, but abridged. There is apparently no MS. of the treatises in existence. (Editions: Amman, 1709; Haller, 1774.)

AURELLE DE PALADINES, LOUIS JEAN BAPTISTE D' (1804-1877), French general, was born at Malzieu, Lozère, on the 9th of January 1804. He was educated at St Cyr, and entered the army as sub-lieutenant of foot in 1824. He served with distinction in Algeria between 1841 and 1848, becoming lieut.-colonel and an officer of the Legion of Honour; took part in the Roman campaigns of 1848 and 1849, and was made colonel. He served as general of brigade throughout the Crimean War of 1854-56, being promoted general of division and commander of the Legion of Honour. During the campaign in Lombardy in 1859 he commanded at Marseilles, and superintended the despatch of men and stores to the seat of war, and for his services he was made a grand officer of the Legion of Honour. Placed on the reserve list in 1869, he was recalled to the Marseilles command on the outbreak of the Franco-German War of 1870-71. After the first capture of Orleans by the Germans, he was appointed by the Government of National Defence, in November 1870, to the command of the Army of the Loire. He was at first very successful against von der Tann-Rathsamhausen, winning the battle of Coulmiers and compelling the Germans to evacuate Orleans, but the capitulation of Metz had set free additional German troops to oppose him, and, after his defeat at Beaune la Rolande and subsequent unsuccessful fighting near Orleans, resulting in its recapture by the Germans in December, Aurelle retreated into the Sologne and was superseded. After the armistice he was elected to the National Assembly by the departments both of Allier and Gironde. He sat for Allier and was one of the fifteen officers chosen to assist in the peace negotiations. He was decorated with the grand cross of the Legion of Honour, and was given the command at Bordeaux, but retired in 1872. Elected a life senator in 1875, he supported the monarchical majority of 1876. He died at Versailles on the 17th of December 1877. He was the author of *La Première Armée de la Loire*, published in 1872.

AUREOLA, Aureole (diminutive of Lat. *aura*, air), the radiance of luminous cloud which, in paintings of sacred personages, is represented as surrounding the whole figure. In the earliest periods of Christian art this splendour was confined to the figures of the persons of the Godhead, but it was afterwards extended to the Virgin Mary and to several of the saints. The aureola, when enveloping the whole body, is generally oval or elliptical in form, but is occasionally circular or quatrefoil. When it is merely a luminous disk round the head, it is called specifically a *nimbus*, while the combination of nimbus and aureole is called a *glory*. The strict distinction between nimbus and aureole is not commonly maintained, and the latter term is most frequently used to denote the radiance round the heads of saints, angels or persons of the Godhead. The *nimbus* in Christian art appeared first in the 5th century, but practically the same device was known still earlier, though its history is obscure, in non-Christian art. Thus (though earlier Indian and Bactrian coins do not show it) it is found with the gods on some of the coins of the Indian kings Kanishka, Huvishka and Vasudeva, 58 B.C. to A.D. 41 (Gardner's *Cat. of Coins of Greek and Scythic Kings of Bactria and India*, Brit. Mus. 1886, plates 26-29). And its use has been traced through the Egyptians to the Greeks and Romans, representations of Trajan (arch of Constantine) and Antoninus Pius (reverse of a medal) being found with it. In the circular form it constitutes a natural and even primitive use of the idea of a crown, modified by an equally simple idea of the emanation of light from the head of a superior being, or by the meteorological phenomenon of a halo. The probability is that all later associations with the symbol refer back to an early astrological origin (cf. Mithras), the person so glorified being identified with the sun and represented in the sun's image; so the aureole is the *Hvareno* of Mazdaism. From this early astrological use the form of "glory" or "nimbus" has been adapted or inherited under new beliefs.

AURICH, a town of Germany, in the Prussian province of Hanover, chief town of the district of East Friesland, on the Ems-Jade canal, 18 m. N.W. from Emden by rail. Pop. (1900) 6013. It is built in the Dutch style, and lies in a sandy but fertile plain, surrounded by pleasant promenades which have taken the place of the old fortifications. It has a palace, formerly the residence of the counts of East Friesland and now used as government offices, a Roman Catholic and two Protestant churches, a gymnasium, and four libraries. There are breweries and small manufactories of paper and tobacco. Close by is the *Upstallsboom*, the hill of oath and liberty, where every year at Whitsuntide representatives of the seven Frisian coast lands assembled to deliberate.

See Wiarda, *Bruchstücke zur Geschichte der Stadt Aurich* (Emden, 1835).

AURICLE (from Lat. diminutive of *auris*, ear), the external ear in animals, or an analogous part in plants, &c. From a supposed resemblance to the ear of a dog, the term was applied to the upper cavities of the heart. The adjective "auricular" is more specially used in the phrase "auricular confession" (see Confession), *i.e.* private.

AURICULA (*Primula auricula*), an Alpine plant, which has been an inmate of British gardens for about three hundred years, and is still prized by florists as a favourite spring flower. It loves a cool soil and shady situation. The florists' varieties are grown in rich composts, for the preparation of which numberless receipts have been given; but many of the old nostrums are now exploded, and a more rational treatment has taken their place. Thus Mr Douglas writes (*Hardy Florists' Flowers*):—

> "There is no mystery, as some suppose, about the potting, any more than there is about the potting material. The compost should consist of turfy loam four parts, leaf-mould one part, sharp river or silver sand one part, and a few bits of broken charcoal mixed with it. The pots to be used should be from 3 to 4½ in. in diameter, inside measure; about 1 in. of potsherds should be placed in the bottom of each pot, and over this some fibrous turf, from which the fine particles of earth have been removed. The old soil should be shaken from the roots of the plants to be potted; and before potting cut off, if necessary, a portion of the main root. In potting press the soil rather firmly around the roots."

Auriculas are best grown in a cold frame mounted on legs about 2 ft. from the ground, and provided with hinged sashes. A graduated stage formed of wood battens 6 in. broad, with a rise of 2 in., should be fixed so as to take each one row of pots, with the plants standing at about 15 in. from the glass; the spaces between the shelves should be closed, while the top board of the back and the front should be hinged so as to be let down when desired for ventilation, the sashes, too, being movable for the same purpose, and also to afford facilities for examining and attending to the plants. This frame should face the north from May to October, and south in winter. No protection will be needed except in very severe frosts, when two or three thicknesses of garden mats may be thrown over the glass, and allowed to remain on until the soil is thawed, should it become frozen.

Auriculas may be propagated from seed, which is to be sown as soon as ripe, in July or August, in boxes, kept under cover, and exposed only to the rays of the morning sun. When seed has been saved from the finer sorts, the operation is one of considerable nicety, as it not unfrequently happens that the best seedlings are at first exceedingly weak. They generally flower in the second or third year, a few good sorts being all that can be expected from a large sowing. The established varieties are increased by taking off the offshoots, an operation performed at the time of potting in July or the beginning of August. But some varieties are very shy in producing offsets.

The original of the auricula is a hardy perennial herb, of dwarf habit, bearing dull yellowish blossoms. This and the commoner forms raised from seed, as well as one or two double forms, are interesting hardy border flowers. The choice florists' varieties are divided into five classes:—the *green-edged*, with the margins of the flowers green; the *grey-edged*, with the green margins powdered with meal so as to appear to be coloured grey; the *white-edged*, with the mealy powder so dense as to cover the green; the *selfs*, which have none of the green variegation of margin seen in the foregoing, but are of some distinct colour, as purple, maroon, &c., but have, like the preceding, a white paste surrounding the eye; and the *alpines*, which resemble the selfs in not having any green marginal variegation, but differ in having a yellow centre more or less dense. The individual flowers of the first three groups of florists' auriculas show four distinct circles:—first the eye or tube, which should have the stamens lying in it, but sometimes has the pin-headed stigma instead, which is a defect; second, the paste or circle of pure white surrounding the eye; third, the body colour, a circle of some dark tint, as maroon or violet, which feathers out more or less towards the edge, but is the more perfect the less it is so feathered, and is quite faulty if it breaks through to the outer circle; fourth, the margin, which is green or grey or white. These circles should be about equal in width and clearly defined, and the nearer they are to this standard the more perfect is the flower. In the group of selfs the conditions are the same, except that there is no margin, and consequently the body colour, which should be uniform in tone, extends to the edge. In the alpines there should be no paste or white surrounding the eye, but this space should be either golden-yellow or creamy-yellow, which makes two subdivisions in this group; and the body colour is more or less distinctly shaded, the edges being of a paler hue. There is besides a group of laced alpines, in which a distinct and regular border of colour surrounds each of the marginal lobes.

The following is a selection of the best varieties cultivated in 1909:—

Green-edged.—Abbé Liszt, Abraham Barker, Shirley Hibberd, Prince Charming, Mrs Henwood.

Grey-edged.—Amy Robsart, George Lightbody, Marmion, Olympus, George Rudd, Richard Headly.

White-edged.—Acme, Conservative, Heather Bell, Mrs Dodson, Rachel, Smiling Beauty.

Selfs.—Andrew Miller, Gerald, Mikado, Mrs Phillips, Mrs Potts, Harrison Weir.

Alpines.—Argus, Dean Hole, Duke of York, Firefly, Flora Mclvor, Mrs Douglas, Mrs Markham, Perfection, Phyllis, Rosy Morn, The Bride, Teviotdale.

AURIFABER (the latinized form of Goldschmidt), a surname borne by three prominent men of the Reformation period in Germany.

1. Andreas (1514-1559) was a physician of some repute, but through his influence with Albert of Brandenburg, last grand-master of the Teutonic order, and first Protestant duke of Prussia, became an outstanding figure in the controversy associated with Andreas Osiander (*q.v.*) whose daughter he had married.

2. Joannes (Vratislaviensis; 1517-1568), the younger brother of Andreas, was born at Breslau on the 30th of January 1517, and educated at Wittenberg, where he formed a close and lasting friendship with Melanchthon. After graduating in 1538 he spent twelve years as *docent* at the university, and having then received his doctorate of divinity, was appointed professor of divinity and pastor of the church of St Nicholas at Rostock. He distinguished himself by his conciliatory disposition, earned the special confidence of Duke John Albert of Mecklenburg, and took a leading part in 1552 in drawing up the constitution of the Mecklenburg church. He also settled some religious disputes in the town of Lübeck. In 1553 Duke Albert of Prussia, anxious to heal the differences in the Prussian church caused by the discussion of Osiander's doctrines, invited him to Königsberg, and in the following year appointed him professor of divinity and president of the Samland diocese. Joannes, however, found it impossible to conciliate all parties, and in 1565 returned to Breslau, where, in 1567, he became pastor in the church of St Elizabeth and inspector of the Lutheran churches and schools. He died on the 19th of October 1568.

3. Joannes (Vinariensis; 1519-1575), was born in the county of Mansfeldt in 1519. He studied at Wittenberg where he heard the lectures of Luther, and afterwards became tutor to Count Mansfeldt. In the war of 1544-45 he accompanied the army as field-preacher, and then lived with Luther as his *famulus* or private secretary, being present at his death in 1546. In the following year he spent six months in prison with John Frederick, elector of Saxony, who had been captured by the emperor, Charles V. He held for some years the office of court-preacher at Weimar, but owing to theological disputes was compelled to resign this office in 1561. In 1566 he was appointed to the Lutheran church at Erfurt, and there remained till his death in November 1575. Besides taking a share in the first collected or Jena edition of Luther's works (1556), Aurifaber sought out and published at Eisleben in 1564-1565 several writings not included in that edition. He also published Luther's *Letters* (1556, 1565), and *Table Talk* (1566). This popular work, which has given him most of his fame, is unfortunately but a second or third hand compilation.

See G. Kawerau's art. in Herzog-Hauck's *Realencyk. für prot. Theologie*, and the literature there cited.

AURIGA (the "charioteer" or "waggoner"), in astronomy, a constellation of the northern hemisphere, found in the catalogues of Eudoxus (4th century B.C.) and Aratus (3rd century B.C.). It was symbolized by the Greeks as an old man in a more or less sitting posture, with a goat and her kids in his left hand, and a bridle in his right. The ancient Greeks associated this constellation with many myths. Some assume it to be Erichthonius, son of Athena and Hephaestus, who was translated to the skies by Zeus on account of his invention of chariots or coaches. Others assume it to be Myrtilus, a son of Hermes and Clytic, and charioteer to Oenomaus, who was

placed in the heavens by Hermes. Another myth has it to be Olenus, a son of Hephaestus, and father of Aega and Helice, two nymphs who nursed Zeus. Ptolemy catalogued fourteen stars, Tycho Brahe twenty-seven, and Hevelius forty in this constellation. Interesting stars are: α *Aurigae* or *Capella* (the goat), one of the brightest stars in the heavens, determined by Newall and Campbell to be a spectroscopic binary; β *Aurigae*, a star of the second magnitude also a spectroscopic binary; ε *Aurigae*, an irregularly variable star; and *Nova Aurigae*, a "new" star discovered by Anderson in 1892, and afterwards found on a photographic plate exposed at Harvard in December 1891. Several fine star clusters also appear in this constellation.

AURILLAC, a town of central France, capital of the department of Cantal, 140 m. N.N.E. of Toulouse, on the Orléans railway between Figeac and Murat. Pop. (1906) 14,097. Aurillac stands on the right bank of the Jordanne, and is dominated from the north-west by the Roc Castanet, crowned by the castle of St Etienne, the keep of which dates from the 11th century. Its streets are narrow and uninteresting, with the exception of one which contains, among other old houses, that known as the Maison des Consuls, a Gothic building of the 16th century, decorated with sculptured stone-work. Aurillac owes its origin to an abbey founded in the 9th century by St Géraud, and the abbey-church, rebuilt in the 17th century in the Gothic style, is the chief building in the town. The former college, which dates from the 17th century, is now occupied by a museum and a library. There is a statue of Pope Silvester II., born near Aurillac in 930 and educated in the abbey, which soon afterwards became one of the most famous schools of France. Aurillac is the seat of a prefect, and its public institutions include tribunals of first instance and of commerce, a chamber of commerce, a lycée, training-colleges and a branch of the Bank of France. The chief manufactures are wooden shoes and umbrellas, and there is trade in cheese and in the cattle and horses reared in the neighbourhood.

AURISPA, GIOVANNI (*c.* 1370-1459), one of the learned Italians of the 15th century, who did so much to promote the revival of the study of Greek in Italy, was born at Noto in Sicily. In 1418 he visited Constantinople, where he remained for some years, perfecting his knowledge of Greek and searching for ancient MSS. His efforts were rewarded by the acquisition of some 250 MSS., with which he returned to Venice. Here he is said to have been obliged to pawn his treasures for 50 gold florins to provide for his immediate wants. Cosimo de' Medici, hearing of his embarrassment, redeemed the MSS. and summoned the owner to Florence. In 1438, at the council of Basel, Aurispa attracted the attention of Pope Eugenius IV., who made him his secretary; he held a similar position under Nicholas V., who presented him to two lucrative abbacies. He died at Ferrara. Considering his long life and reputation Aurispa produced little: Latin translations of the commentary of Hierocles on the golden verses of Pythagoras (1474) and of *Philisci Consolatoria ad Ciceronem* from Dio Cassius (not published till 1510); and, according to Gesner, a translation of the works of Archimedes. Aurispa's reputation rests upon the extensive collection of MSS. copied and distributed by him, and his persistent efforts to revive and promote the study of ancient literature.

AUROCHS (from Lat. *urus*, the wild ox, and "ox") or Urus, the name of the extinct wild ox of Europe (*Bos taurus primigenius*), which after the disappearance of that animal became transferred to the bison. According to the German Freiherr von Herberstein (1486-1566), in his *Moscovia*, of which an Italian translation was published at Venice in 1550, the aurochs survived in Poland (and probably also in Hungary) during the latter middle ages. In this work appear woodcuts—rude but characteristic and unmistakable—of two distinct types of European wild cattle; one the aurochs, or ur, and the other the bison. As Herberstein had travelled in Poland, it is probable that he had seen both species alive, and the drawings were most likely executed under his own direction. It has indeed been suggested that the figure of the aurochs was taken from a domesticated ox, but this is a mistaken idea. Not the least important feature of the work of Herberstein is the application of the name aurochs to the wild ox, as distinct from the bison. The locality where aurochs survived in Herberstein's time was the forest of Jaktozowka, situated about 55 kilometres west-south-west of Warsaw, in the provinces of Bolemow and Sochaczew. From other evidence it appears that the last aurochs was killed in this forest in the year 1627. Herberstein describes the colour of the aurochs as black, and this is confirmed by another old picture of the animal. Gesner's figure of the aurochs, or as he calls it "thur," given in the *Icones* to his *History of Animals*, was probably adapted from Herberstein's. It may be added that an ancient gold goblet depicts the hunting and taming of the wild aurochs.

As a wild animal, then, the aurochs appears to have ceased to exist in the early part of the 17th century; but as a species it survives, for the majority of the domesticated breeds of European cattle are its descendants, all diminished in point of size, and some departing more widely from the original type than others. Aurochs' calves were in all probability captured by the early inhabitants of Britain and the continent and tamed; and from these, with perhaps an occasional blending of wild blood, are descended most European breeds of cattle.

Much misconception, however, has prevailed as to which breeds are the nearest to the ancestral wild stock. At one time this position was supposed to be occupied by the white half-wild cattle of Chillingham and other British parks. These white breeds are, however, partial albinos; and such semi-albinos are always the result of domestication and could not have arisen in the wild state. Moreover, park-cattle display evidence of their descent from dark-coloured breeds by the retention of red or black ears and brown or black muzzles. In the Chillingham cattle the ears are generally red, although sometimes black, and the muzzle is brown; while in the breed at Cadzow Chase Lanarkshire, both ears and muzzle are black, and there are usually flecks of black on the head and forequarters. It is further significant that, in the Chillingham herd, dark-coloured calves, which are weeded out, make their appearance from time to time.

A very ancient British breed is the black Pembroke; and when this breed tends to albinism, the ears and muzzle, and more rarely the fetlocks, remain completely black, or very dark grey, although the colour elsewhere is whitish, more or less flecked and blotched with pale grey. In the shape and curvature of the horns, which at first incline outwards and forwards, and then bend somewhat upwards and inwards, this breed of cattle resembles the aurochs and the (by comparison) dwarfed park-breeds. Moreover, in both the Pembroke and the park-breeds the horns are light-coloured with black tips.

Evidence as to the affinity between these breeds is afforded by the fact that a breed of cattle very similar to that at Chillingham was found in Wales in the 10th century; these cattle being white with red ears. Individuals of this race survived till at least 1850 in Pembroke, where they were at one time kept perfectly pure as a part of the regular farm-stock. Until a period comparatively recent, they were relatively numerous, and were driven in droves to the pasturages of the Severn and the neighbouring markets. Their whole essential characters are the same as those of the cattle at Chillingham. Their horns are white, tipped with black, and extended and turned upwards in the manner distinctive of the park-breed. The inside of the ears and the muzzle are black, and the feet are black to the fetlock joint. The skin is unctuous and of a deep-toned yellow colour. Individuals of the race were sometimes born entirely black, and then were not to be distinguished from the common Pembroke cattle of the mountains.

It is thus evident that park-cattle are an albino offshoot from the ancient Pembroke black breed, which, from their soft and well-oiled skins, are evidently natives of a humid climate, such as that of the forests in which dwelt the wild aurochs. This disposes of a theory that they are descendants of a white sacrificial breed introduced into Britain by the ancient Romans.

The Pembroke and park-cattle are, however, by no means the sole descendants of the aurochs, the black Spanish fighting-bulls claiming a similar descent. This breed shows a light-coloured line along the spine, which was characteristic of the aurochs. It has also been suggested that the Swiss Siemental cattle are nearly related to the aurochs. The latter was a gigantic animal, especially during the Pleistocene period; the skulls and limb-bones discovered in the brick-earths and gravels of the Thames valley and many other parts

of England having belonged to animals that probably stood six feet at the shoulder.

(R. L.*)

AURORA (perhaps through a form *ausosa* from Sansk. *ush*, to burn; the common idea of "brightness" suggests a connexion with *aurum*, gold), the Roman goddess of the dawn, corresponding to the Greek goddess Eos. According to Hesiod (*Theog*. 271) she was the daughter of the Titan Hyperion and Thea (or Euryphassa), and sister of Helios and Selene. By the Titan Astraeus, she was the mother of the winds Zephyrus, Notus and Boreas, of Hesperus and the stars. Homer represents her as rising every morning from the couch of Tithonus (by whom she was the mother of Emathion and Memnon), and drawn out of the east in a chariot by the horses Lampus and Phaëthon to carry light to gods and men (*Odyssey*, xxiii. 253); in Homer, she abandons her course when the sun is fully risen (or at the latest at mid-day, *Iliad*, ix. 66), but in later literature she accompanies the sun all day and thus becomes the goddess of the daylight. From the roseate shafts of light which herald the dawn, she bears in Homer the epithet "rosy-fingered." The conception of a dawn-goddess is common in primitive religions, especially in the Vedic mythology, where the deity Usás is closely parallel to the Greco-Roman; see Paul Regnaud, *Le Rig-Véda* in *Annales du musée Guimet*, vol. i. c. 6 (Paris, 1892). She is also represented as the lover of the hunter Orion (*Odyssey*, v. 121), the representative of the constellation that disappears at the flush of dawn, and the youthful hunter Cephalus, by whom she was the mother of Phaëthon (Apollodorus iii. 14. 3). In works of art, Eos is represented as a young woman, fully clothed, walking fast with a youth in her arms; or rising from the sea in a chariot drawn by winged horses; sometimes, as the goddess who dispenses the dews of the morning, she has a pitcher in each hand. In the fresco-painting by Guido Reni in the Rospigliosi palace at Rome, Aurora is represented strewing flowers before the chariot of the sun. Metaphorically the word Aurora was used (*e.g.* Virg. *Aen*. viii. 686, vii. 606) for the East generally.

AURORA, a city of Kane county, Illinois, U.S.A., in the N.E. part of the state, on the Fox river, about 37 m. W. of Chicago. Pop. (1890) 19,688; (1900) 24,147, of whom 5075 were foreign-born; (1910) 29,807. Aurora is served by the Chicago, Burlington & Quincy, the Chicago & North-Western, the Elgin, Joliet & Eastern, and the Illinois, Iowa and Minnesota railways, and is connected with Chicago by an electric line. The city has a soldiers' memorial hall, erected by popular subscription, and a Carnegie library. Aurora is an important manufacturing centre; among its manufactures are railway cars—the shops of the Chicago, Burlington & Quincy railway being here—flour and cotton, carriages, hardware specialties, corsets, suspenders, stoves and silver-plate. In 1905 the city's factory products were valued at $7,329,028, an increase of 30% in 5 years. The municipality owns and operates the water-works and electric-lighting plants. The first settlement in the vicinity of Aurora was made in 1834. In 1845 the village of East Aurora was incorporated, and West Aurora was incorporated nine years later. In 1853 the two villages were united under a city charter, which was superseded by a revised charter in 1887.

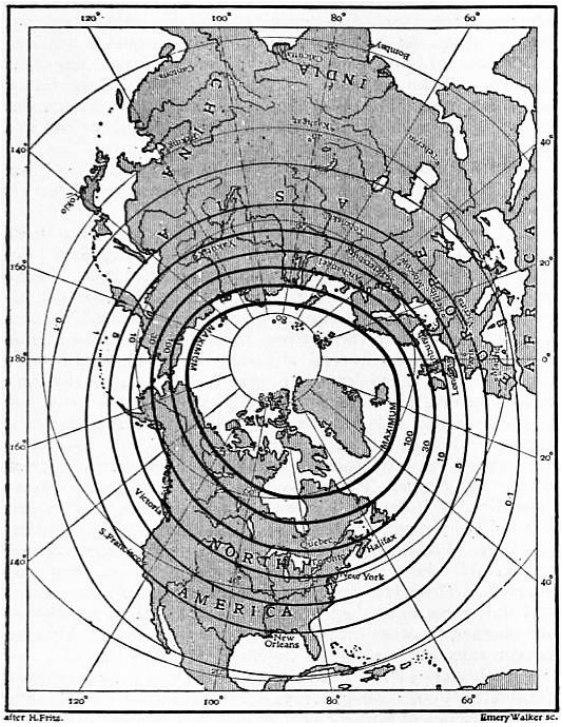
AURORA, a city of Lawrence county, Missouri, U.S.A., 275 m. S.W. of St Louis, on the St Louis & San Francisco, and the St Louis, Iron Mountain & Southern railways. Pop.(1890) 3482; (1900) 6191; (1910) 4148. It is situated near a lead and zinc mining region, where surface lead was discovered in 1873 and systematic mining began in 1887; among the cities of the state it is second to Joplin in mineral importance, and has large iron-works and flour-mills; mining machinery also is manufactured. Farming and fruit-growing are carried on in the surrounding country, and Aurora is the place from which the products are shipped. Aurora was platted in 1870 and was chartered as a city in 1886.

AURORA, a village of Cayuga county, New York, U.S.A., on Cayuga Lake, 16 m. S.W. of Auburn. Pop. (1905) 623; (1910) 493. It is served by the Lehigh Valley railway. Aurora is a beautiful place and a popular summer resort, but it is best known as the seat of Wells College, a non-sectarian college for women, founded in 1868 by Henry Wells (1805-1878), of the Wells Fargo Express Company, and liberally endowed by Edwin B. Morgan (1806-1881), also connected with the same company, and by others. At Aurora are also the Somes school (a preparatory school for boys), founded in 1798 and until 1904 known as the Cayuga Lake Academy, and the Wells school (a preparatory school for girls). The village has a public library. Aurora was settled in 1789 chiefly by residents of New England, and was incorporated in 1905.

AURORA POLARIS (*Aurora Borealis* and *Australis*, Polar Light, Northern Lights), a natural phenomenon which occurs in many forms, some of great beauty.

1. *Forms.*—Various schemes of classification have been proposed, but none has met with universal acceptance; the following are at least the principal types. (1) *Arcs.* These most commonly resemble segments of circles, but are not infrequently elliptical or irregular in outline. The ends of arcs frequently extend to the horizon, but often one or both ends stop short of this. Several arcs may be visible at the same time. Usually the under or concave edge of the arc is the more clearly defined, and adjacent to it the sky often seems darker than elsewhere. It is rather a disputed point whether this dark segment—through which starlight has been seen to pass—represents a real atmospheric condition or is merely a contrast effect. (2) *Bands.* These may be nearly straight and regular in outline, as if broken portions of arcs; frequently they are ribbon-like serpentine forms showing numerous sinuosities. (3) *Rays*. Frequently an arc or band is visibly composed of innumerable short rays separated by distinctly less luminous intervals. These rays are more or less perpendicular to the arc or band; sometimes they are very approximately parallel to one another, on other occasions they converge towards a point. Longer rays often show an independent existence. Not infrequently rays extend from the upper edge of an arc towards the zenith. Combinations of rays sometimes resemble a luminous fan, or a series of fans, or part of a hollow luminous cylinder. Rays often alter suddenly in length, seeming to stretch down towards the horizon or mount towards the zenith. This accounts for the description of aurora as "Merry Dancers." (4) *Curtains or Draperies*. This form is rare except in Arctic regions, where it is sometimes fairly frequent. It is one of the most imposing forms. As a rule the higher portion is visibly made up of rays, the light tending to become more continuous towards the lower edge; the combination suggests a connected whole, like a curtain whose alternate portions are in light and shade. The curtain often shows several conspicuous folds, and the lower edge often resembles frilled drapery. At several stations in Greenland auroral curtains have been observed when passing right overhead to narrow to a thin luminous streak, exactly as a vertical sheet of light would seem to do to one passing underneath it. (5) *Corona*. A fully developed corona is perhaps the finest form of aurora. As the name implies, there is a sort of crown of light surrounding a comparatively or wholly dark centre. Farther from the centre the ray structure is usually prominent. The rays may lie very close together, or may be widely separated from one another. (6) *Patches*. During some displays, auroral light appears in irregular areas or patches, which sometimes bear a very close resemblance to

illuminated detached clouds. (7) *Diffused Aurora*. Sometimes a large part of the sky shows a diffuse illumination, which, though brighter in some parts than others, possesses no definite outlines. How far the different forms indicate real difference in the nature of the phenomenon, and how far they are determined by the position of the observer, it is difficult to say. Not infrequently several different forms are visible at the same time.



2. *Isochasms*.—Aurora is seldom observed in low latitudes. In the southern hemisphere there is comparatively little inhabited land in high latitudes and observational data are few; thus little is known as to how the frequency varies with latitude and longitude. Even in the northern hemisphere there are large areas in the Arctic about which little is known. H. Fritz (**2**) has, however, drawn a series of curves which are believed to give a good general idea of the relative frequency of aurora throughout the northern hemisphere. Fritz' curves, shown in the illustration, are termed isochasms, from the Greek word employed by Aristotle to denote aurora. Points on the same curve are supposed to have the same average number of auroras in the year, and this average number is shown adjacent to the curve. Starting from the equator and travelling northwards we find in the extreme south of Spain an average of only one aurora in ten years. In the north of France the average rises to five a year; in the north of Ireland to thirty a year; a little to the north of the Shetlands to one hundred a year. Between the Shetlands and Iceland we cross the curve of maximum frequency, and farther north the frequency diminishes. The curve of maximum frequency forms a slightly irregular oval, whose centre, the auroral pole, is according to Fritz at about 81° N. lat., 70° W. long. Isochasms reach a good deal farther south in America than in Europe. In other words, auroras are much more numerous in the southern parts of Canada and in the United States than in the same latitudes of Europe.

3. *Annual Variation*.—Table I. shows the annual variation observed in the frequency of aurora. It has been compiled from several authorities, especially Joseph Lovering (**4**) and Sophus Tromholt (**5**). The monthly figures denote the percentages of the total number seen in the year. The stations are arranged in order of latitude. Individual places are first considered, then a few large areas.

The Godthaab data in Table I. are essentially those given by Prof. A. Paulsen (**6**) as observed by Kleinschmidt in the winters of 1865 to 1882, supplemented by Lovering's data for summer. Starting at the extreme north, we have a simple period with a well-marked maximum at midwinter, and no auroras during several months at midsummer. This applies to Hammerfest, Jakobshavn, Godthaab and the most northern division of Scandinavia. The next division of Scandinavia shows a transition stage. To the south of this in Europe the single maximum at mid-winter is replaced by two maxima, somewhere about the equinoxes.

4. In considering what is the real significance of the great difference apparent in Table I. between higher and middle latitudes, a primary consideration is that aurora is seldom seen until the sun is some degrees below the horizon. There is no reason to suppose that the physical causes whose effects we see as aurora are in existence only when aurora is visible. Until means are devised for detecting aurora during bright sunshine, our knowledge as to the hour at which these causes are most frequently or most powerfully in operation must remain incomplete. But it can hardly be doubted that the differences apparent in Table I. are largely due to the influence of sunlight. In high latitudes for several months in summer it is never dark, and consequently a total absence of visible aurora is practically inevitable. Some idea of this influence can be derived from figures obtained by the Swedish International Expedition of 1882-1883 at Cape Thorsden, Spitsbergen, lat. 78° 28′ N. (**7**). The original gives the relative frequency of aurora for each degree of depression of the sun below the horizon, assuming the effect of twilight to be nil (*i.e.* the relative frequency to be 100) when the depression is 18.5° or more. The following are a selection of the figures:—

Angle of depression	4.5°	7.5°	10.5°	12.5°	15.5°.
Relative frequency	0.3	9.3	44.9	74.5	95.9.

These figures are not wholly free from uncertainties, arising from true diurnal and annual variations in the frequency, but they give a good general idea of the influence of twilight.

If sunlight and twilight were the sole cause of the apparent annual variation, the frequency would have a simple period, with a maximum at midwinter and a minimum at midsummer. This is what is actually shown by the most northern stations and districts in Table I. When we come, however, below 65° lat. in Europe the frequency near the equinoxes rises above that at midwinter, and we have a distinct double period, with a principal minimum at midsummer and a secondary minimum at midwinter. In southern Europe—where, however, auroras are too few to give smooth results in a limited number of years—in southern Canada, and in the United States, the difference between the winter and summer months is much reduced. Whether there is any real difference between high and mean latitudes in the annual frequency of the causes rendered visible by aurora, it is difficult to say. The Scandinavian data, from the wealth of observations, are probably the most representative, and even in the most northern district of Scandinavia the smallness of the excess of the frequencies in December and January over those in March and October suggests that some influence tending to create maxima at the equinoxes has largely counterbalanced the influence of sunlight and twilight in reducing the frequency at these seasons.

5. *Fourier Analysis*.—With a view to more minute examination, the annual frequency can be expressed in Fourier series, whose terms represent waves, whose periods are 12, 6, 4, 3, &c. months. This has been done by Lovering (4) for thirty-five stations. The nature of the results will best be explained by reference to the formula given by Lovering as a mean from all the stations considered, viz.:—

$$8.33 + 3.03 \sin(30t + 100°52') + 2.53 \sin(60t + 309° 5') + 0.16 \sin(90t + 213°31') + 0.56 \sin(120t + 162°45') + 0.27 \sin(150t + 32°38').$$

The total number of auroras in the year is taken as 100, and t denotes the time, in months, that has elapsed since the middle of January.

Putting t = 0, 1, &c., in succession, we get the percentages of the total number of auroras which occur in January, February, and so on. The first periodic term has a period of twelve, the second of six months, and similarly for the others. The first periodic term is largest when t × 30° + 100° 52′ = 450°. This makes t = 11.6 months after the middle of January, otherwise the 3rd of January, approximately. The 6-month term has the earliest of its two equal maxima about the 26th of March. These two are much the most important of the periodic terms. The angles 100° 52′, 309° 5′, &c., are known as the phase angles of the respective periodic terms, while 3.03, 2.53, &c., are the corresponding amplitudes. Table II. gives a selection of Lovering's results. The stations are arranged according to latitude.

PLATE I.

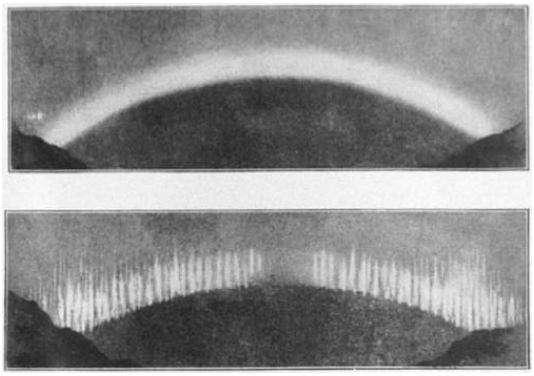


FIG. 1—TWO TYPES OF AURORAL ARCS.

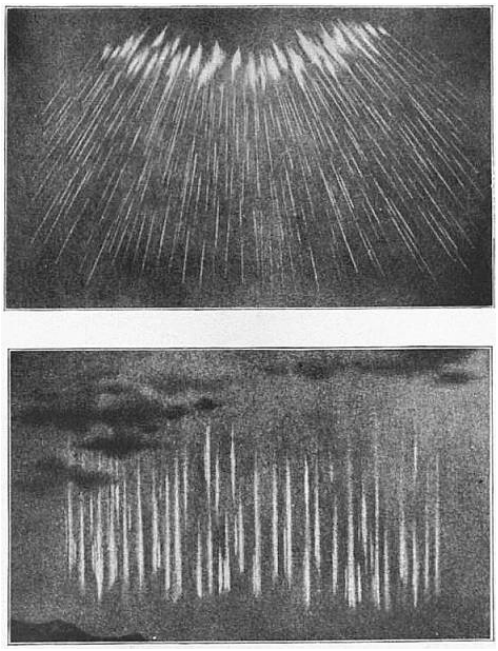


FIG. 2—TWO TYPES OF AURORAL RAYS.

(From the *Internationale Polarforschung*, 1882-1883, by permission of the *Kaiserlichen Akademie der Wissenschaften*, Vienna.)

PLATE II.

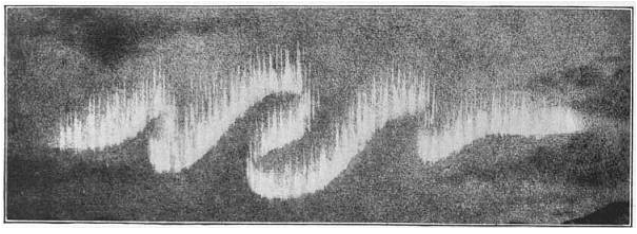


FIG. 3—AURORAL BANDS.

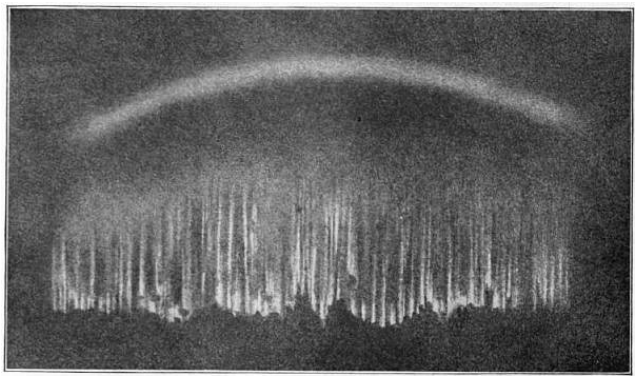


FIG. 4—AURORAL CURTAIN BELOW AN ARC.

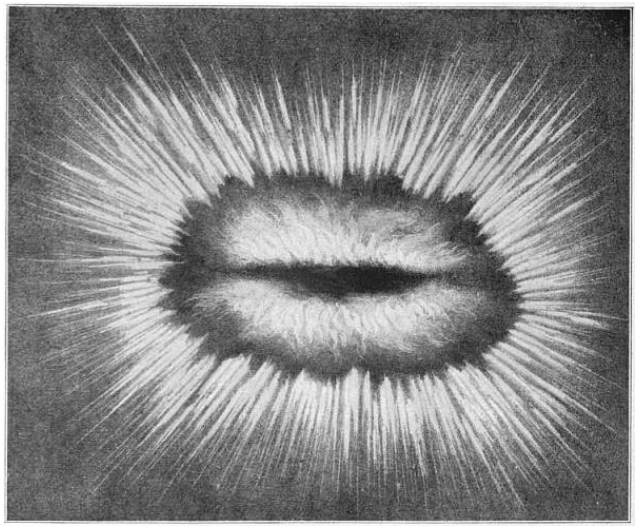


FIG. 5.—AURORAL CORONA.

TABLE I.—*Annual Frequency* (*Relative*).

Place.	Latitude.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sep.	Oct.	Nov.	Dec.
	°												
Hammerfest	70½	20.9	17.6	8.8	0	0	0	0	0	4.4	9.9	17.6	20.9
Jakobshavn	69	14.6	3.0	9.2	.5	0	0	0	0	9.2	15.1	18.4	20.0
Godthaab	64	15.5	12.4	9.7	4.9	0	0	0	1.2	8.7	13.3	17.0	17.4
St Petersburg	60	6.5	9.1	16.8	13.8	3.5	1.2	1.4	5.9	13.8	13.1	7.6	7.3
Christiania	60	8.6	11.4	14.0	11.2	0.6	0	0.2	6.5	14.6	12.2	10.3	10.3
Upsala	60	8.4	12.9	14.9	7.4	0.7	0.2	0.4	7.1	12.4	14.3	10.7	10.7
Stockholm	59	7.6	10.0	14.7	16.4	3.8	0.0	0.0	5.6	12.9	11.4	10.0	7.3
Edinburgh	56	9.6	12.6	14.0	9.5	3.4	0.0	1.7	6.0	12.6	13.5	11.8	5.2
Berlin	52½	7.6	10.8	16.4	15.5	11.4	0.6	2.9	2.9	6.5	13.2	8.5	4.1
London	51½	8.6	10.5	10.2	10.7	4.0	1.1	1.9	5.6	14.5	16.9	9.6	6.4
Quebec	47	3.6	14.8	8.3	14.2	4.1	5.9	7.7	5.9	11.2	12.4	7.7	4.1
Toronto	43½	5.4	9.5	8.7	11.8	9.0	6.2	8.0	6.4	8.5	11.1	8.7	6.7
Cambridge, Mass.	42½	5.1	8.2	11.8	10.2	6.4	5.1	10.3	8.5	13.3	9.2	6.8	5.1
New Haven, Conn.	41½	7.7	7.3	8.9	8.2	7.6	5.7	8.9	8.1	11.9	7.6	10.6	7.5
Scandinavia	N. of 68½	16.4	13.8	14.8	1.6	0.0	0.0	0.0	0.4	7.8	15.1	14.4	15.7
”	68½ to 65	15.3	14.6	13.7	2.9	0.0	0.0	0.0	1.1	9.7	14.6	14.0	14.1
”	65 to 61½	13.2	12.3	14.5	5.4	0.2	0.0	0.0	2.8	13.1	14.2	12.8	11.5
”	61½ to 58	9.5	11.2	13.5	10.9	1.3	0.1	0.4	5.7	13.6	13.8	10.4	9.6
”	S. of 58	8.2	11.9	12.6	13.3	1.5	0.1	0.6	4.9	14.9	13.5	10.3	8.2
New York State	45 to 40½	6.3	7.4	9.1	11.0	7.4	6.6	8.8	10.4	11.7	9.7	6.2	5.4

TABLE II.

Station.	Annual Term.		6-Month Term.		4-Month Term.	
	Amp.	Phase.	Amp.	Phase.	Amp.	Phase.
		°		°		°
Jakobshavn	10.40	123	1.13	206	1.41	333
Godthaab	8.21	111	1.54	316	0.64	335
St Petersburg	2.81	96	5.99	309	0.57	208
Christiania	4.83	116	4.99	317	0.76	189
Upsala	5.41	119	4.57	322	0.86	296
Stockholm	3.68	91	5.80	303	1.31	180
Makerstown (Scotland)	5.79	102	4.47	310	2.00	342
Great Britain	3.87	126	4.24	287	0.40	73
Toronto	0.18	12	2.13	260	0.52	305
Cambridge, Mass.	1.02	262	2.84	339	1.28	253
New Haven, Conn.	0.99	183	1.02	313	0.57	197
New York State	1.34	264	2.29	325	0.54	157

Speaking generally, the annual term diminishes in importance as we travel south. North of 55° in Europe its phase angle seems fairly constant, not differing very much from the value 110° in Lovering's general formula. The 6-month term is small, in the two most northern stations, but south of 60° N. lat. it is on the whole the most important term. Excluding Jakobshavn, the phase angles in the 6-month term vary wonderfully little, and approach the value 309° in Lovering's general formula. North of lat. 50° the 4-month term is, as a rule, comparatively unimportant, but in the American stations its relative importance is increased. The phase angle, however, varies so much as to suggest that the term mainly represents local causes or observational uncertainties. Lovering's general formula suggests that the 4-month term is really less important than the 3-month term, but he gives no data for the latter at individual stations.

6. Sunlight is not the only disturbing cause in estimates of auroral frequency. An idea of the disturbing influence of cloud may be derived from some interesting results from the Cape Thorsden (**7**) observations. These show how the frequency of visible auroras diminished as cloud increased from 0 (sky quite clear) to 10 (sky wholly overcast).

Grouping the results, we have:

Amount of cloud	0	1 to 3	4 to 6	7 to 9	10
Relative frequency	100	82	57	46	8

Out of a total of 1714 hours during which the sky was wholly overcast the Swedish expedition saw auroras on 17, occurring on 14 separate days, whereas 226 hours of aurora would have occurred out of an equal number of hours with the sky quite clear. The figures being based on only one season's observations are somewhat irregular. Smoothing them, Carlheim-Gyllensköld gives $f = 100' - 7.3c$ as the most probable linear relation between c, the amount of cloud, and f, the frequency, assuming the latter to be 100 when there is no cloud.

7. *Diurnal Variation.*—The apparent daily period at most stations is largely determined by the influence of daylight on the visibility. It

is only during winter and in high latitudes that we can hope to ascertain anything directly as to the real diurnal variation of the causes whose influence is visible at night as aurora. Table III. gives particulars of the number of occasions when aurora was seen at each hour of the twenty-four during three expeditions in high latitudes when a special outlook was kept.

The data under A refer to Cape Thorsden (78° 28′ N. lat., 15° 42′ E. long.), those under B to Jan Mayen (**8**) (71° 0′ N. lat., 8° 28′ W. long.), both for the winter of 1882-1883. The data under C are given by H. Arctowski (**9**) for the "Belgica" Expedition in 1898. They may be regarded as applying approximately to the mean position of the "Belgica," or 70½° S. lat., 86½° W. long. The method of counting frequencies was fairly alike, at least in the case of A and B, but in comparing the different stations the data should be regarded as relative rather than absolute. The Jan Mayen data refer really to Göttingen mean time, but this was only twenty-three minutes late on local time. In calculating the percentages of forenoon and afternoon occurrences half the entries under noon and midnight were assigned to each half of the day. Even at Cape Thorsden, the sun at midwinter is only 11° below the horizon at noon, and its effect on the visibility is thus not wholly negligible. The influence of daylight is presumably the principal cause of the difference between the phenomena during November, December and January at Cape Thorsden and Jan Mayen, for in the equinoctial months the results from these two stations are closely similar. Whilst daylight is the principal cause of the diurnal inequality, it is not the only cause, otherwise there would be as many auroras in the morning (forenoon) as in the evening (afternoon). The number seen in the evening is, however, according to Table III., considerably in excess at all seasons. Taking the whole winter, the percentage seen in the evening was the same for the "Belgica" as for Jan Mayen, *i.e.* for practically the same latitudes South and North. At Cape Thorsden from November to January there seems a distinct double period, with minima near noon and midnight. The other months at Cape Thorsden show a single maximum and minimum, the former before midnight. The same phenomenon appears at Jan Mayen especially in November, December and January, and it is the normal state of matters in temperate latitudes, where the frequency is usually greatest between 8 and 10 P.M. An excess of evening over morning occurrences is also the rule, and it is not infrequently more pronounced than in Table III. Thus at Tasiusak (65° 37′ N. lat., 37° 33′ W. long.) the Danish Arctic Expedition (**10**) of 1904 found seventy-five out of every hundred occurrences to take place before midnight.

TABLE III.—*Diurnal Variation.*

Hour.	Dec.		Nov. and Jan.		Feb., March, Sept. and Oct.		Sept. to March (N. Lat.). March to Sept. (S. Lat.).		
	A	B	A	B	A	B	A	B	C
1	14	7	14	8	27	23	55	38	24
2	10	6	15	6	20	25	45	37	23
3	9	4	15	5	15	21	39	30	10
4	10	5	21	7	14	18	45	30	4
5	13	5	20	3	10	10	43	18	2
6	11	3	15	4	2	3	28	10	1
7	9	2	13	3	1	2	23	7	0
8	5	1	6	1	0	0	11	2	0
9	7	2	9	0	0	0	16	2	0
10	10	0	5	0	0	0	15	0	0
11	9	0	6	0	0	0	15	0	0
Noon	10	0	4	0	0	0	14	0	0
1	10	0	6	0	0	0	16	0	0
2	14	0	10	0	0	0	24	0	0
3	18	1	20	3	0	0	38	4	0
4	16	7	19	7	1	1	36	15	0
5	12	11	22	10	5	2	39	23	3
6	14	10	21	16	8	5	43	31	3
7	16	13	23	16	20	9	59	38	14
8	15	12	22	18	24	24	61	54	25
9	14	15	18	17	27	28	59	60	31
10	12	15	19	15	31	25	62	55	29
11	10	12	18	17	33	26	61	55	26
Midnight	9	9	13	11	28	22	50	42	26
Totals	277	140	354	167	266	244	897	551	221
Percentages—									
Forenoon	42	28	42	25	39	46	41	35	35
Afternoon	58	72	58	75	61	54	59	65	65

8. The preceding remarks relate to auroras as a whole; the different forms differ considerably in their diurnal variation. Arcs, bands and, generally speaking, the more regular and persistent forms, show their greatest frequencies earlier in the night than rays or patches. Table IV. shows the percentages of e. (evening) and m. (morning) occurrences of the principal forms as recorded by the Arctic observers at Cape Thorsden, Jan Mayen and Tasiusak.

TABLE IV.

	Arcs.		Bands.		Rays.		Patches.	
	e.	m.	e.	m.	e.	m.	e.	m.
Cape Thorsden	76	24	66	34	52	48	51	49
Jan Mayen	78	22	68	32	60	40	60	40
Tasiusak	85	15	85	15	65	35	62	38

At Cape Thorsden diffused auroral light had percentages e. 65, m. 35, practically identical with those for bands. At Tasiusak, 8 P.M. was the hour of most frequent occurrence for arcs and bands, whereas patches had their maximum frequency at 11 P.M. and rays at midnight.

9. *Lunar and other Periods.*—The action of moonlight necessarily gives rise to a true lunar period in the visibility of aurora. The extent to which it renders aurora invisible depends, however, so much on the natural brightness of the aurora—which depends on the time and the place—and on the sharpness of the outlook kept, that it is difficult to gauge it. Ekholm and Arrhenius (**11**) claim to have established the existence of a true tropical lunar period of 27-32 days, and also of a 26-day period, or, as they make it, a 25.929-day period. A 26-day period has also been derived by J. Liznar (**12**), after an elaborate allowance for the disturbing effects of moonlight from the observations in 1882-1883 at Bossekop, Fort Rae and Jan Mayen. Neither of these periods is universally conceded. The connexion between aurora and earth magnetic disturbances renders it practically certain that if a 26-day or similar period exists in the one phenomenon it exists also in the other, and of the two terrestrial magnetism (*q.v.*) is probably the element least affected by external complications, such as the action of moonlight.

10. *Sun-spot Connexion.*—The frequency of auroral displays is much greater in some years than others. At most places the variation in the frequency has shown a general similarity to that of sun-spots. Table V. gives contemporaneous data for the frequency of sun-spots and of auroras seen in Scandinavia. The sun-spot data prior to 1902 are from A. Wolfer's table in the *Met. Zeitschrift* for 1902, p. 195; the more recent data are from his quarterly lists. All are observed frequencies, derived after Wolf's method; maxima and minima are in heavy type.

The auroral data are from Table E of Tromholt's catalogue (**5**), with certain modifications. In Tromholt's yearly data the year commences with July. This being inconvenient for comparison with sun-spots, use was made of his monthly values to obtain corresponding data for years commencing with January. The Tromholt-Schroeter data for Scandinavia as a whole commenced with

1761; the figures for earlier years were obtained by multiplying the data for Sweden by 1.356, the factor being derived by comparing the figures for Sweden alone and for the whole of Scandinavia from July 1761 to June 1783.

In a general way Table V. warrants the conclusion that years of many sun-spots are years of many auroras, and years of few sun-spots years of few auroras; but it does not disclose any very definite relationship between the two frequencies. The maxima and minima in the two phenomena in a good many cases are not found in the same years. On the other hand, there is absolute coincidence in a number of cases, some of them very striking, as for instance the remarkably low minima of 1810 and 1823.

11. During the period 1764 to 1872 there have been ten years of maximum, and ten of minimum, in sun-spot frequency. Taking the three years of greatest frequency at each maximum, and the three years of least frequency at each minimum, we get thirty years of many and thirty of few sun-spots. Also we can split the period into an earlier half, 1764 to 1817, and a later half, 1818 to 1872, containing respectively the earlier five and the later five of the above groups of sun-spot maximum and minimum years. The annual means derived from the whole group, and the two sub-groups, of years of many and few sun-spots are as follows:—

Years of	1764-1872.		1764-1817.		1818-1872.	
	Spots.	Auroras.	Spots.	Auroras.	Spots.	Auroras.
Many sun-spots	93.4	99.9	86.7	70.7	100.1	129.1
Few sun-spots	13.4	61.5	13.6	51.6	13.1	71.3

In each case the excess of auroras in the group of years of many sun-spots is decided, but the results from the two sub-periods do not harmonize closely. The mean sun-spot frequency for the group of years of few sun-spots is almost exactly the same for the two sub-periods, but the auroral frequency for the later group is nearly 40% in excess of that for the earlier, and even exceeds the auroral 931
frequency in the years of many sun-spots in the earlier sub-period. This inconsistency, though startling at first sight, is probably more apparent than real. It is almost certainly due in large measure to a progressive change in one or both of the units of frequency. In the case of sun-spots, A. Schuster (**13**) has compared J.R. Wolf and A. Wolfer's frequencies with data obtained by other observers for areas of sun-spots, and his figures show unquestionably that the unit in one or other set of data must have varied appreciably from time to time. Wolf and Wolfer have, however, aimed persistently at securing a definite standard, and there are several reasons for believing that the change of unit has been in the auroral rather than the sun-spot frequency. R. Rubenson (**14**), from whom Tromholt derives his data for Sweden, seems to accept this view, assigning the apparent increase in auroral frequency since 1860 to the institution by the state of meteorological stations in 1859, and to the increased interest taken in the subject since 1865 by the university of Upsala. The figures themselves in Table V. certainly point to this conclusion, unless we are prepared to believe that auroras have increased enormously in number. If, for instance, we compare the first and the last three 11-year cycles for which Table V. gives complete data, we obtain as yearly means:—

1749-1781	Sun-spots	56.4	Auroras	77.5
1844-1876	”	55.8	”	112.2

The mean sun-spot frequencies in the two periods differ by only 1%, but the auroral frequency in the later period is 45% in excess of that in the earlier.

The above figures would be almost conclusive if it were not for the conspicuous differences that exist between the mean sun-spot frequencies for different 11-year periods. Schuster, who has considered the matter very fully, has found evidence of the existence of other periods—notably 8.4 and 4.8 years—in addition to the recognized period of 11.125 years, and he regards the difference between the maxima in successive 11-year periods as due at least partly to an overlapping of maxima from the several periodic terms. This cannot, however, account for all the fluctuations observed in sun-spot frequencies, unless other considerably longer periods exist. There has been at least one 33-year period during which the mean value of sun-spot frequency has been exceptionally low, and, as we shall see, there was a corresponding remarkable scarcity of auroras. The period in question may be regarded as extending from 1794 to 1826 inclusive. Comparing it with the two adjacent periods of thirty-three years, we obtain the following for the mean annual frequencies:—

33-Year Period.	Sun-spots.	Auroras.
1761-1793	65.6	76.1
1794-1826	20.3	39.5
1827-1859	56.1	84.4

12. The association of high auroral and sun-spot frequencies shown in Table V. is not peculiar to Scandinavia. It is shown, for instance, in Loomis's auroral data, which are based on observations at a variety of European and American stations (*Ency. Brit.* 9th ed. art. Meteorology, Table XXVIII.). It does not seem, however, to apply universally. Thus at Godthaab we have, according to Adam Paulsen (**15**), comparing 3-year periods of few and many sun-spots:—

3-Year Period.	Total Sun-spot Frequency.	Total Nights of Aurora.
1865-1868	48	274
1869-1872	339	138
1876-1879	23	273

The years start in the autumn, and 1865-1868 includes the three winters of 1865 to '66, '66 to '67, and '67 to '68. Paulsen also gives data from two other stations in Greenland, viz. Ivigtut (1869 to 1879) and Jakobshavn (1873 to 1879), which show the same phenomenon as at Godthaab in a prominent fashion. Greenland lies to the north of Fritz's curve of maximum auroral frequency, and the suggestion has been made that the zone of maximum frequency expands to the south as sun-spots increase, and contracts again as they diminish, the number of auroras at a given station increasing or diminishing as the zone of maximum frequency approaches to or recedes from it. This theory, however, does not seem to fit all the facts and stands in want of confirmation.

Table V.

Year.	Frequency.		Year.	Frequency.		Year.	Frequency.		Year.	Frequency.	
	Sun-spot.	Auroral.		Sun-spot.	Auroral.		Sun-spot.	Auroral.		Sun-spot.	Auroral.
1749	80.9	103	1789	118.1	89	1829	67.0	93	1869	73.9	160
1750	83.4	134	1790	89.9	90	1830	71.0	132	1870	139.1	195
1751	47.7	53	1791	66.6	54	1831	47.8	89	1871	111.2	185
1752	47.8	111	1792	60.0	64	1832	27.5	54	1872	101.7	200
1753	30.7	96	1793	46.9	29	1833	8.5	79	1873	66.3	189
1754	12.2	65	1794	41.0	37	1834	13.2	81	1874	44.7	158
1755	9.6	34	1795	21.3	34	1835	56.9	58	1875	17.1	133
1756	10.2	60	1796	16.0	37	1836	121.5	98	1876	11.3	137
1757	32.4	83	1797	6.4	61	1837	138.3	137	1877	12.3	126
1758	47.6	80	1798	4.1	35	1838	103.2	159	1878	3.4	..
1759	54.0	113	1799	6.8	28	1839	85.8	165	1879	6.0	..
1760	62.9	86	1800	14.5	30	1840	63.2	82	1880	32.3	..
1761	85.9	124	1801	34.0	34	1841	36.8	75	1881	54.3	..
1762	61.2	114	1802	45.0	65	1842	24.2	91	1882	59.7	..
1763	45.1	89	1803	43.1	73	1843	10.7	66	1883	63.7	..
1764	36.4	107	1804	47.5	101	1844	15.0	81	1884	63.5	..
1765	20.9	76	1805	42.2	85	1845	40.1	26	1885	52.2	..

1766	11.4	51	1806	28.1	62	1846	61.5	50	1886	25.4	..
1767	37.8	68	1807	10.1	42	1847	98.5	63	1887	13.1	..
1768	69.8	80	1808	8.1	20	1848	124.3	107	1888	6.8	..
1769	106.1	89	1809	2.5	20	1849	95.9	131	1889	6.3	..
1770	100.8	83	1810	0.0	4	1850	66.5	95	1890	7.1	..
1771	81.6	62	1811	1.4	13	1851	64.5	60	1891	35.6	..
1772	66.5	38	1812	5.0	11	1852	54.2	92	1892	73.0	..
1773	34.8	58	1813	12.2	18	1853	39.0	65	1893	84.9	..
1774	30.6	98	1814	13.9	17	1854	20.6	64	1894	78.0	..
1775	7.0	33	1815	35.4	10	1855	6.7	49	1895	64.0	..
1776	19.8	17	1816	45.8	33	1856	4.3	46	1896	41.8	..
1777	92.5	64	1817	41.1	60	1857	22.8	38	1897	26.2	..
1778	154.4	59	1818	30.4	74	1858	54.8	88	1898	26.7	..
1779	125.9	60	1819	23.9	43	1859	93.8	131	1899	12.1	..
1780	84.8	67	1820	15.7	62	1860	95.7	119	1900	9.5	..
1781	68.1	103	1821	6.6	37	1861	77.2	127	1901	2.7	..
1782	38.5	67	1822	4.0	33	1862	59.1	135	1902	5.0	..
1783	22.8	70	1823	1.8	13	1863	44.0	135	1903	24.4	..
1784	10.2	78	1824	8.5	14	1864	47.0	124	1904	42.0	..
1785	24.1	83	1825	16.6	40	1865	30.5	119	1905	62.8	..
1786	82.9	136	1826	36.3	58	1866	16.3	130	1906	53.8	..
1787	132.0	115	1827	49.7	79	1867	7.3	127	1907	62.0	..
1788	130.9	97	1828	62.5	60	1868	37.3	144	1908	48.5	..

13. *Auroral Meridian.*—It is a common belief that the summit of an auroral arc is to be looked for in the observer's magnetic meridian. On any theory it would be rather extraordinary if this were invariably true. In temperate latitudes auroral arcs are seldom near the zenith, and there is reason to believe them at very great heights. In high latitudes the average height is probably less, but the direction in which the magnetic needle points changes rapidly with change of latitude and longitude, and has a large diurnal variation. 932
Thus there must in general be a difference between the observer's magnetic meridian—answering to the mean position of the magnetic needle at his station—and the direction the needle would have at a given hour, if undisturbed by the aurora, at any spot where the phenomena which the observer sees as aurora exist.

Very elaborate observations have been made during several Arctic expeditions of the azimuths of the summits of auroral arcs. At Cape Thorsden (**7**) in 1882-1883 the mean azimuth derived from 371 arcs was 24° 12′ W., or 11° 27′ to the W. of the magnetic meridian. As to the azimuths in individual cases, 130 differed from the mean by less than 10°, 118 by from 10° to 20°, 82 by from 20° to 30°, 21 by from 30° to 40°, 14 by from 40° to 50°; in six cases the departure exceeded 50°, and in one case it exceeded 70°. Also, whilst the mean azimuths deduced from the observations between 6 A.M. and noon, between noon and 6 P.M., and between 6 P.M. and midnight, were closely alike, their united mean being 22.4° W. of N. (or E. of S.), the mean derived from the 113 arcs observed between midnight and 6 A.M. was 47.8° W. At Jan Mayen (**8**) in 1882-1883 the mean azimuth of the summit of the arcs was 28.8° W. of N., thus approaching much more closely to the magnetic meridian 29.9° W. As to individual azimuths, 113 lay within 10° of the mean, 37 differed by from 10° to 20°, 18 by from 20° to 30°, 6 by from 30° to 40°, whilst 6 differed by over 40°. Azimuths were also measured at Jan Mayen for 338 auroral bands, the mean being 22.0° W., or 7.9° to the east of the magnetic meridian. Combining the results from arcs and bands, Carlheim-Gyllensköld gives the "anomaly" of the auroral meridian at Jan Mayen as 5.7° E. At the British Polar station of 1882, Fort Rae (62° 23′ N. lat., 115° 44′ W. long.), he makes it 15.7° W. At Godthaab in 1882-1883 the auroral anomaly was, according to Paulsen, 15.5° E., the magnetic meridian lying 57.6° W. of the astronomical.

14. *Auroral Zenith.*—Another auroral direction having apparently a close relation to terrestrial magnetism is the imaginary line drawn to the eye of an observer from the centre of the corona—*i.e.* the point to which the auroral rays converge. This seems in general to be nearly coincident with the direction of the dipping needle.

Thus at Cape Thorsden (**7**) in 1882-1883 the mean of a considerable number of observations made the angle between the two directions only 1° 7′, the magnetic inclination being 80° 35′, whilst the coronal centre had an altitude of 79° 55′ and lay somewhat to the west of the magnetic meridian. Even smaller mean values have been found for the angle between the auroral and magnetic "zeniths"—as the two directions have been called—*e.g.* 0° 50′ at Bossekop (**16**) in 1838-1839, and 0° 7′ at Treurenberg (**17**) (79° 55′ N. lat., 16° 51′ E. long.) in 1899-1900.

15. *Relations to Magnetic Storms.*—That there is an intimate connexion between aurora when visible in temperate latitudes and terrestrial magnetism is hardly open to doubt. A bright aurora visible over a large part of Europe seems always accompanied by a magnetic storm and earth currents, and the largest magnetic storms and the most conspicuous auroral displays have occurred simultaneously. Noteworthy examples are afforded by the auroras and magnetic storms of August 28-29 and September 1-2, 1859; February 4, 1872; February 13-14 and August 12, 1892; September 9, 1898; and October 31, 1903. On some of these occasions aurora was brilliant in both the northern and southern hemispheres, whilst magnetic disturbances were experienced the whole world over. In high latitudes, however, where both auroras and magnetic storms are most numerous, the connexion between them is much less uniform. Arctic observers, both Danish and British, have repeatedly reported displays of aurora unaccompanied by any special magnetic disturbance. This has been more especially the case when the auroral light has been of a diffused character, showing only minor variability. When there has been much apparent movement, and brilliant changes of colour in the aurora, magnetic disturbance has nearly always accompanied it. In the Arctic, auroral displays seem sometimes to be very local, and this may be the explanation. On the other hand, Arctic observers have reported an apparent connexion of a particularly definite character. According to Paulsen (**18**), during the Ryder expedition in 1891-1892, the following phenomenon was seen at least twenty times by Lieut. Vedel at Scoresby Sound (70° 27′ N. lat., 26° 10′ W. long.). An auroral curtain travelling with considerable velocity would approach from the south, pass right overhead and retire to the north. As the curtain approached, the compass needle always deviated to the west, oscillated as the curtain passed the zenith, and then deviated to the east. The behaviour of the needle, as Paulsen points out, is exactly what it should be if the space occupied by the auroral curtain were traversed by electric currents directed upwards from the ground. The Danish observers at Tasiusak (**10**) in 1898-1899 observed this phenomenon occasionally in a slightly altered form. At Tasiusak the auroral curtain after reaching the zenith usually retired in the direction from which it had come. The direction in which the compass needle deviated was west or east, according as the curtain approached from the south or the north; as the curtain retired the deviation eventually diminished.

Kr. Birkeland (**19**). who has made a special study of magnetic disturbances in the Arctic, proceeding on the hypothesis that they arise from electric currents in the atmosphere, and who has thence attempted to deduce the position and intensity of these currents, asserts that whilst in the case of many storms the data were insufficient, when it was possible to fix the position of the mean line of flow of the hypothetical current relatively to an auroral arc, he invariably found the directions coincident or nearly so.

16. In the northern hemisphere to the south of the zone of greatest frequency, the part of the sky in which aurora most generally appears is the magnetic north. In higher latitudes auroras are most often seen in the south. The relative frequency in the two positions seems to vary with the hour, the type of aurora, probably with the season of the year, and possibly with the position of the year in the sun-spot cycle.

At Jan Mayen (**8**) in 1882-1883, out of 177 arcs whose position was accurately determined, 44 were seen in the north, their summits averaging 38.5° above the northern horizon; 88 were seen in the south, their average altitude above the southern horizon being 33.5°; while 45 were in the zenith. At Tasiusak (**10**) in 1898-1899 the magnetic directions of the principal types were noted separately. The results are given in Table VI.

TABLE VI.

Direction.	Absolute Number for each Type.					Percentage from all Types.
	Arcs.	Bands.	Curtains.	Rays.	Patches.	

N.	9	16	5	15	4	10
N.E.	9	13	2	20	4	9
E.	3	11	2	26	3	9
S.E.	5	6	1	10	7	6
S.	45	43	1	16	15	24
S.W.	9	9	2	12	13	9
W.	3	11	2	22	6	9
N.W.	2	8	2	8	5	5

Table VI. accounts for only 81% of the total displays; of the remainder 15% appeared in the zenith, while 4% covered the whole sky. Auroral displays generally cover a considerable area, and are constantly changing, so the figures are necessarily somewhat rough. But clearly, whilst the arcs and bands, and to a lesser extent the patches, showed a marked preference for the magnetic meridian, the rays showed no such preference.

At Cape Thorsden (**7**) in 1882-1883 auroras as a whole were divided into those seen in the north and those seen in the south. The variation throughout the twenty-four hours in the percentage seen in the south was as follows:—

Hour.	0-3.	3-6.	6-9.	9-12.
A.M.	69	55	44	35
P.M.	55	70	65	65

The mean from the whole twenty-four hours is sixty-three. Between 3 A.M. and 3 P.M. the percentage of auroras seen in the south thus appears decidedly below the mean.

17. The following data for the apparent angular width of arcs were obtained at Cape Thorsden, the arcs being grouped according to the height of the lower edge above the horizon. Group I. contained thirty arcs whose altitudes did not exceed 11° 45′; Group II. thirty arcs whose altitudes lay between 12° and 35°; and Group III, thirty arcs whose altitudes lay between 36° and 80°.

Group.	I.	II.	III.
Greatest width.	11.5°	12.0°	21.0°
Least width.	1.0°	0.75°	2.0°
Mean width.	3.45°	4.6°	6.9°

There is here a distinct tendency for the width to increase with the altitude. At the same time, arcs near the horizon often appeared wider than others near the zenith. Furthermore, Gyllensköld says that when arcs mounted, as they not infrequently did, from the horizon, their apparent width might go on increasing right up to the zenith, or it might increase until an altitude of about 45° was reached and then diminish, appearing much reduced when the zenith was reached. Of course the phenomenon might be due to actual change in the arc, but it is at least consistent with the view that arcs are of two kinds, one form constituting a layer of no great vertical depth but considerable real horizontal width, the other form having little horizontal width but considerable vertical depth, and resembling to some extent an auroral curtain.

18. According to numerous observations made at Cape Thorsden, the apparent angular velocity of arcs increases on the average with their altitude. Dividing the whole number of arcs, 156, whose angular velocities were measured into three numerically equal groups, according to their altitude, the following were the results in minutes of arc per second of time (or degrees per minute of time):—

Group.	I.	II.	III.	All.
Mean altitude	10.5°	34.6°	72.3°	..
Greatest velocity	4.81	15.12	109.09	..
Mean velocity	0.48	2.42	8.67	3.86

Each group contained auroras which appeared stationary. The intervals to which the velocities referred were usually from five to ten minutes, but varied widely. The velocity 109.09 was much the largest observed, the next being 52.38; both were from observations lasting under half a minute.

19. In 1882-1883 the direction of motion of arcs was from north to south in 62% of the cases at Jan Mayen, and in 58% of the cases at Cape Thorsden. This seems the more common direction in the northern hemisphere, at least for stations to the south of the zone of maximum frequency, but a considerable preponderance of movements towards the north was observed in Franz Joseph Land by the Austrian Expedition of 1872-1874. The apparent motion of arcs is sometimes of a complicated character. One end only, for example, may appear to move, as if rotating round the other; or the two ends may move in opposite directions, as if the arc were rotating about a vertical axis through its summit.

20. *Height.*—If an auroral arc represented a definite self-luminous portion of space of small transverse dimensions at a uniform height above the ground, its height could be accurately determined by observations made with theodolites at the two ends of a measured base, provided the base were not too short compared to the height. If a very long base is taken, it becomes increasingly open to doubt whether the portions of space emitting auroral light to the observers at the two ends are the same. There is also difficulty in ensuring that the observations shall be simultaneous, an important matter especially when the apparent velocity is considerable. If the base is short, definite results can hardly be hoped for unless the height is very moderate. Amongst the best-known theodolite determinations of height are those made at Bossekop in Norway by the French Expedition of 1838-1839 (**16**) and the Norwegian Expedition of 1882-1883, and those made in the latter year by the Swedes at Cape Thorsden and the Danes at Godthaab. At Bossekop and Cape Thorsden there were a considerable proportion of negative or impossible parallaxes. Much the most consistent results were those obtained at Godthaab by Paulsen (**15**). The base was 5.8 km. (about 3½ miles) long, the ends being in the same magnetic meridian, on opposite sides of a fiord, and observations were confined to this meridian, strict simultaneity being secured by signals. Heights were calculated only when the observed parallax exceeded 1°, but this happened in three-fourths of the cases. The calculated heights—all referring to the lowest border of the aurora—varied from 0.6 to 67.8 km. (about 0.4 to 42 m.), the average being about 20 km. (12 m.). Regular arcs were selected in most cases, but the lowest height obtained was for a collection of rays forming a curtain which was actually situated between the two stations.

In 1885 Messrs Garde and Eherlin made similar observations at Nanortalik near Cape Farewell in Greenland, but using a base of only 1250 metres (about ¾ m.). Their results were very similar to Paulsen's. On one occasion twelve observations, extending over half an hour, were made on a single arc, the calculated heights varying in a fairly regular fashion from 1.6 to 12.9 km. (about 1 to 8 m.). The calculated horizontal distances of this arc varied between 5 and 24 km. (about 3 and 15 m.), the motion being sometimes towards, sometimes away from the observers, but not apparently exceeding 3 km. (nearly 2 m.) per minute. Heights of arcs have often been calculated from the apparent altitudes at stations widely apart in Europe or America. The heights calculated in this way for the under surface of the arc, have usually exceeded 100 m.; some have been much in excess of this figure. None of the results so obtained can be accepted without reserve, but there are several reasons for believing that the average height in Greenland is much below that in lower latitudes. Heights have been calculated in various less direct ways, by observing for instance the angular altitude of the summit of an arc and the angular interval between its extremities, and then making some assumption such as that the portion visible to an observer may be treated as a circle whose centre lies over the so-called auroral pole. The mean height calculated at Arctic stations, where careful observations have been made, in this or analogous ways, has varied from 58 km. (about 36 m.) at Cape Thorsden (Gyllensköld) to 227 km. (about 141 m.) at Bossekop (Bravais). The height has also been calculated on the hypothesis that auroral light has its source where the atmospheric pressure is similar to that at which most brilliancy is observed when electric discharges pass in vacuum tubes. Estimates on this basis have suggested heights of the order of 50 km. (about 31 m.). There are, of course, many uncertainties, as the conditions of discharge in the free atmosphere may differ widely from those in glass vessels. If the Godthaab observations can be trusted, auroral discharges must often occur within a few miles of the earth's surface in Arctic regions. In confirmation of this view reference may be made to a number of instances where observers—*e.g.* General Sabine, Sir John Franklin, Prof. Selim Lemström, Dr David Walker (at Fort Kennedy in 1858-1859), Captain Parry (Fort Bowen, 1825) and others—have seen aurora below the clouds or between themselves and mountains. One or two instances of this kind have even been described in Scotland. Prof. Cleveland Abbe (**20**)

has given a full historical account of the subject to which reference may be made for further details.

21. *Brightness.*—In auroral displays the brightness often varies greatly over the illuminated area and changes rapidly. Estimates of the intensity of the light have been based on various arbitrary scales, such for instance as the size of type which the observer can read at a given distance. The estimate depends in the case of reading type on the general illumination. In other cases scales have been employed which make the result mainly depend on the brightest part of the display. At Jan Mayen (**8**) in 1882-1883 a scale was employed running from 1, taken as corresponding to the brightness of the milky way, to 4, corresponding to full moonlight. The following is an analysis of the results obtained, showing the number of times the different grades were reached:—

Scale of Intensity.	1.	2.	3.	4.	Mean Intensity.
Arcs	27	53	13	1	1.87
Bands	46	83	49	22	2.24
Rays	30	116	138	28	2.21
Corona	3	14	12	12	2.81

On one or two occasions at Jan Mayen auroral light is described as making the full moon look like an ordinary gas jet in presence of electric light, whilst rays could be seen crossing and brighter than the moon's disk. Such extremely bright auroras seem very rare, however, even in the Arctic. There is a general tendency for both bands and rays to appear brightest at their lowest parts; arcs seldom appear as bright at their summits as nearer the horizon. It is not unusual for arcs and bands to look as if pulses or waves of light were travelling along them; also the direction in which these pulses travel does not seem to be wholly arbitrary. Movements to the east were twice as numerous at Jan Mayen and thrice as numerous at Traurenberg as movements to the west. In some cases changes of intensity take place round the auroral zenith, simulating the effect that would be produced by a cyclonic rotation of luminous matter. In the case of isolated patches the intensity often waxes and wanes as if a search-light were being thrown on and turned off.

22. *Colour.*—The ordinary colour of aurora is white, usually with a distinct yellow tint in the brighter forms, but silvery white when the light is faint. When the light is intense and changing rapidly, red is not infrequently present, especially towards the lower edge. Under these circumstances, green is also sometimes visible, especially towards the zenith. Thus a bright auroral ray may seem red towards the foot and green at its summit, with yellow intervening. In some cases the green may be only a contrast effect. Other colours, *e.g.* violet, have occasionally been noticed but are unusual.

23. *Spectrum.*—The spectrum of aurora consists of a number of lines. Numerous measurements have been made of the wave-lengths of the brightest. One line, in the yellow green, is so dominant optically as often to be described as the auroral line. Its wave-length is probably very near 5571 tenth-metres, and it is very close to, if not absolutely coincident with, a prominent line in the spectrum of krypton. This line is so characteristic that its presence or absence is the usual criterion for deciding whether an atmospheric light is 934
aurora. The Swedish Expedition (**17**) of 1899-1902, engaged in measuring an arc of the meridian in Spitsbergen, were unusually well provided spectrographically, and succeeded in taking photographs of aurora in conjunction with artificial lines—chiefly of hydrogen—which led to results claiming exceptional accuracy. In the spectrograms three auroral rays—including the principal one mentioned above—were pre-eminent. For the two shorter wave-lengths, for whose measurement he claims the highest precision, the observer, J. Westman, gives the values 4276.4 and 3913.5. In addition, he assigns wave-lengths for 156 other auroral lines between wave-lengths 5205 and 3513. The following table gives the wave-lengths of the photographically brightest of these, retaining four significant figures in place of Westman's five.

Table VII.

4830	4489	4329	3997	3861
4709	4420	4242	3986	3804
4699	4371	4230	3947	3793
4661	4356	4225	3937	3704
4560	4344	4078	3880	3607
4550	4337	4067	3876	3589

There are a number of optically bright lines of longer wave-length. For the principal of these Angot (1) gives the following wave-lengths (unit 1 μμ or 1×10^{-9} metre):—630, 578, 566, 535, 523, 500.

Out of a total of 146 auroral lines, with wave-lengths longer than 3684 tenth-metres, Westman identifies 82 with oxygen or nitrogen lines at the negative pole in vacuum discharges. Amongst the lines thus identified are the two principal auroral lines having wave-lengths 4276.4 and 3913.5. The interval considered by Westman contains at least 300 oxygen and nitrogen lines, so that approximate coincidence with a number of auroral lines was almost inevitable, and an appreciable number of the coincidences may be accidental. E.C.C. Baly (**21**), making use of the observations of the Russian expedition in Spitsbergen in 1899, accepts as the wave-lengths of the three principal auroral lines 5570, 4276 and 3912; and he identifies all three and ten other auroral lines ranging between 5570 and 3707 with krypton lines measured by himself. In addition to these, he mentions other auroral lines as very probably krypton lines, but in their case the wave-lengths which he quotes from Paulsen (**22**) are given to only three significant figures, so that the identification is more uncertain. The majority of the krypton lines which Baly identifies with auroral lines require for their production a Leyden jar and spark gap.

If, as is now generally believed, aurora represents some form of electrical discharge, it is only reasonable to suppose that the auroral lines arise from atmospheric gases. The conditions, however, as regards pressure and temperature under which the hypothetical discharges take place must vary greatly in different auroras, or even sometimes in different parts of the same aurora. Further, auroras are often possessed of rapid motion, so that conceivably spectral lines may receive small displacements in accordance with Doppler's principle. Thus the differences in the wave-lengths of presumably the same lines as measured by different Arctic observers may be only partly due to unfavourable observational conditions. Many of the auroral lines seen in any single aurora are exceedingly faint, so that even their relative positions are difficult to settle with high precision.

24. Whether or not auroral displays are ever accompanied by a characteristic sound is a disputed question. If sound waves originate at the seat of auroral displays they seem hardly likely to be audible on the earth, unless the aurora comes very low and great stillness prevails. It is thus to the Arctic one looks for evidence. According to Captain H.P. Dawson (**26**), in charge of the British Polar Station at Fort Rae in 1882-1883, "The Indians and *voyageurs* of the Hudson Bay Company, who often pass their nights in the open, say that it [sound] is not uncommon ... there can be no doubt that distinct sound does occasionally accompany certain displays of aurora." On the one occasion when Captain Dawson says he heard it himself, "the sound was like the swishing of a whip or the noise produced by a sharp squall of wind in the upper rigging of a ship, and as the aurora brightened and faded so did the sound which accompanied it." If under these conditions the sound was really due to the aurora, the latter, as Captain Dawson himself remarks, must have been pretty close.

25. Usually the electric potential near the ground is positive compared to the earth and increases with the height (see Atmospheric Electricity). Several Arctic observers, however, especially Paulsen (**18**) have observed a diminution of positive potential, or even a change to negative, for which they could suggest no explanation except the presence of a bright aurora. Other Arctic observers have failed to find any trace of this phenomenon. If it exists, it is presumably confined to cases when the auroral discharge comes unusually low.

26. *Artificial Phenomena resembling Aurora.*—At Sodankylä, the station occupied by the Finnish Arctic Expedition of 1882-1883, Selim Lemström and Biese (**23**) described and gave drawings of optical phenomena which they believed to be artificially produced aurora. A number of metallic points, supported on insulators, were connected by wires enclosing several hundred square metres on the top of a hill. Sometimes a Holtz machine was employed, but even without it illumination resembling aurora was seen on several occasions, extending apparently to a considerable height. In the laboratory, Kr. Birkeland (**19**) has produced phenomena bearing a striking resemblance to several forms of aurora. His apparatus consists of a vacuum vessel containing a magnetic sphere—intended to represent the earth—and the phenomena are produced by sending electric discharges through the vessel.

27. *Theories.*—A great variety of theories have been advanced to account for aurora. All or nearly all the most recent regard it as some form of electrical discharge. Birkeland (**19**) supposes the ultimate cause to be cathode rays emanating from the sun; C. Nordmann (**24**) replaces the cathode rays by Hertzian waves; while Svante Arrhenius (**25**) believes that negatively charged particles are driven through the sun's atmosphere by the Maxwell-Bartoli repulsion of light and reach the earth's atmosphere. For the size and density of particles which he considers most likely, Arrhenius calculates the time required to travel from the sun as forty-six hours. By modifying the hypothesis as to the size and density, times appreciably longer or shorter than the above would be obtained. Cathode rays usually have a velocity about a tenth that of light, but in exceptional cases it may approach a third of that of light. Hertzian waves have the velocity of light itself. On either Birkeland's or Nordmann's theory, the electric impulse from the sun acts indirectly by creating secondary cathode rays in the earth's atmosphere, or ionizing it so that discharges due to natural differences of potential are immensely facilitated. The ionized condition must be supposed to last to a greater or less extent for a good many hours to account for aurora being seen throughout the whole night. The fact that at most places the morning shows a marked decay of auroral frequency and intensity as compared to the evening, the maximum preceding midnight by several hours, is certainly favourable to theories which postulate ionization of the atmosphere by some cause or other emanating from the sun.

AUTHORITIES.—The following works are numbered according to the references in the text:—(**1**) A. Angot, *Les Aurores polaires* (Paris, 1895); (**2**) H. Fritz, *Das Polarlicht* (Leipzig, 1881); (**3**) Svante August Arrhenius, *Lehrbuch der kosmischen Physik*; (**4**) Joseph Lovering, "On the Periodicity of the Aurora Borealis," *Mem. American Acad.* vol. x. (1868); (**5**) Sophus Tromholt, *Catalog der in Norwegen bis Juni 1878 beobachteten Nordlichter*; (**6**) *Observations internationales polaires* (1882-1883), *Expédition Danoise*, tome i. "Aurores boréales"; (**7**) Carlheim-Gyllensköld, "Aurores boréales" in *Observations faites au Cap Thorsden Spitzberg par l'expédition suédoise*, tome ii. 1; (**8**) "Die Österreichische Polar Station Jan Mayen" in *Die Internationale Polarforschung*, 1882-1883, Bd. ii. Abth. 1; (**9**) Henryk Arctowski, "Aurores australes" in *Expédition antarctique belge ... Voyage du S. Y. "Belgica"*; (**10**) G.C. Amdrup, *Observations ... faites par l'expédition danoise*; H. Ravn, *Observations de l'aurore boréale de Tasiusak*; (**11**) *K. Sven. Vet.-Akad. Hand.* Bd. 31, Nos. 2, 3, &c.; (**12**) *Sitz. d. k. Akad. d. Wiss.* (Vienna), Math. Naturw. Classe, Bd. xcvii. Abth. iia, 1888; (**13**) *Proc. Roy. Soc.*, 1906, lxxvii. A, 141; (**14**) *Kongl. Sven. Vet.-Akad. Hand.* Bd. 15, No. 5, Bd. 18, No. 1; (**15**) *Bull. Acad. Roy. Danoise*, 1889, p. 67; (**16**) *Voyages ... pendant les années 1838, 1839 et 1840 sur ... la Recherche*, "Aurores boréales," by MM. Lottin, Bravais, &c.; (**17**) *Missions scientifiques ... au Spitzberg ... en 1899-1902, Mission suédoise*, tome ii. VIII^{e} Section, C. "Aurores boréales"; (**18**) *Bull. Acad. R. des Sciences de Danemark*, 1894, p. 148; (**19**) Kr. Birkeland, *Expédition norvégienne 1899-1900 pour l'étude des aurores boréales* (Christiania, 1901); (**20**) *Terrestrial Magnetism*, vol. iii. (1898), pp. 5, 53, 149; (**21**) *Astrophysical Journal*, 1904, xix. p. 187; (**22**) *Rapports présentés au Congrès International de Physique réuni à Paris*, 1900, iii. 438; (**23**) *Expédition polaire finlandaise* (1882-1884), tome iii.; (**24**) Charles Nordmann, *Thèses présentées à la Faculté des Sciences de Paris* (1903); (**25**) *Terrestrial Magnetism*, vol. 10, 1905, p. 1; (**26**) *Observations of the International Polar Expeditions 1882-1883 Fort Rae* ... by Capt. H.P. Dawson, R.A.

(C. CH.)

AURUNCI, the name given by the Romans to a tribe which in historical times occupied only a strip of coast on either side of the Mons Massicus between the Volturnus and the Liris, although it must at an earlier period have extended over a considerably wider area. Their own name for themselves in the 4th century B.C. was *Ausŏnes*, and in Greek writers we find the name *Ausŏnia* applied to 935
Latium and Campania (see Strabo v. p. 247; Aristotle, *Pol.* iv. (vii.) 10; Dion. Hal. i. 72), while in the Augustan poets (*e.g.* Virgil, *Aen.* vii. 795) it is used as one of many synonyms for Italy. In history the tribe appears only for a brief space, from 340 to 295 B.C. (Mommsen, *C.I.L.* x. pp. 451, 463, 465), and their struggle with the Romans ended in complete extermination; their territory was parcelled out between the Latin colonies of Cales (Livy viii. 16) and Suessa Aurunca (*id.* ix. 28) which took the place of an older town called *Ausona* (*id.* ix. 25; viii. 15), and the maritime colonies Sinuessa (the older *Vescia*) and Minturnae (both in 295 B.C., Livy x. 21). The coin formerly attributed to Suessa Aurunca on the strength of its supposed legend *Aurunkud* has now been certainly referred to Naples (see R.S. Conway, *Italic Dialects*, 145, and *Verner's law in Italy*, p. 78, where the change of *s* to *r* is explained as probably due to the Latin conquest). Seeing that the tribe was blotted out at the beginning of the 3rd century B.C., we can scarcely wonder that no record of its speech survives; but its geographical situation and the frequency of the *co*-suffix in that strip of coast (besides *Aurunci* itself we have the names *Vescia*, *Mons Massicus*, *Marica*, *Glanica* and *Caedicii*; see *Italic Dialects*, pp. 283 f.) rank them beyond doubt with their neighbours the Volsci (*q.v.*).

(R. S. C.)

AUSCULTATION (from Lat. *auscultare*, to listen), a term in medicine, applied to the method employed by physicians for determining, by the sense of hearing, the condition of certain internal organs. The ancient physicians appear to have practised a kind of auscultation, by which they were able to detect the presence of air or fluids in the cavities of the chest and abdomen. Still no general application of this method of investigation was resorted to, or was indeed possible, till the advance of the study of anatomy led to correct ideas regarding the locality, structure and uses of the various organs of the body, and the alterations produced in them by disease. In 1761 Leopold Auenbrugger (1722-1809), a Viennese physician, published his *Inventum Novum*, describing the art of percussion in reference more especially to diseases of the chest. This consisted in tapping with the fingers the surface of the body, so as to elicit sounds by which the comparative resonance of the subjacent parts or organs might be estimated. Auenbrugger's method attracted but little attention till the French physician J.N. Corvisart (1755-1828) in 1808 demonstrated its great practical importance, and then its employment in the diagnosis of affections of the chest soon became general. Percussion was originally practised in the manner above mentioned (*immediate percussion*), but subsequently the method of *mediate percussion* was introduced by P.A. Piorry (1794-1879). It is accomplished by placing upon the spot to be examined some solid substance, upon which the percussion strokes are made with the fingers. For this purpose a thin oval piece of ivory (called a *pleximeter*, or stroke-measurer) may be used, with a small hammer; but one or more fingers of the left hand applied flat upon the part answer equally well, and this is the method which most physicians adopt. Percussion must be regarded as a necessary part of auscultation, particularly in relation to the examination of the chest; for the physician who has made himself acquainted with the normal condition of that part of the body in reference to percussion is thus able to recognize by the ear alterations of resonance produced by disease. But percussion alone, however important in diagnosis, could manifestly convey only limited and imperfect information, for it could never indicate the nature or extent of functional disturbance.

In 1819 the distinguished French physician R.T.H. Laënnec (1781-1826) published his *Traité de L'auscultation médiate*, embodying the present methods of auscultatory examination, and venturing definite conclusions based on years of his own study. He also invented the stethoscope (στῆθος, the breast, and σκοπεῖν, to examine). Since then many men have widened the scope of auscultation, notably Skoda, Wintrich, A. Geigel, Th. Weber and Gerhardt. According to Laënnec the essential of a good stethoscope was its capability of intensifying the tone vibrations. But since his time the opinion of experts on this matter has somewhat changed, and there are now two definite schools. The first and older condemns the resonating stethoscope, maintaining that the tones are bound to be altered; the second and younger school warmly advocates its use. In America, more than elsewhere, there is a type of phonendoscope much used by the younger men, which has the advantage that it can be used when the older type of instrument fails, viz. when the patient is recumbent and too ill to be moved. By slipping it beneath the patient's back a fairly accurate idea of the breathing over the bases of the lungs behind can often be obtained.

Stethoscopes have been made of many forms and materials. They usually consist of a hollow stem of wood, hard rubber or metal, with an enlarged tip slightly funnel-shaped at one end, and an ear-plate with a hole in the middle, fastened perpendicularly to the other end. To enable the instrument to be more conveniently carried, the ear-plate can be unscrewed from the tube. The length of the stem of the instrument is of minor importance, but its bore should be as nearly as possible that of the entrance of the external ear. A flexible stethoscope in general use both in England and America transmits the sound from a funnel through tubes to the ears of the observer. This is the common form of a binaural resonating stethoscope. It is convenient and gives a loud tone, but is condemned by the older school, who say that the resonance is confusing, and that the slightest movement in handling gives rise to perplexing murmurs.

Nevertheless, it is this form of instrument which has by far the greatest vogue. It is probable, however, that the most skilled physicians of all find a special use in each form, the monaural non-resonating type being more sensitive to high-pitched sounds, and of greater assistance in differentiating the sounds and murmurs of the heart, the ordinary binaural form being more useful in examining the lungs and other organs. In using the stethoscope, it must be applied very carefully, so that the edge of the funnel makes an air-tight connexion with the skin, and in the monaural form the ear must be but lightly applied to the ear-plate, not pressing heavily on the patient.

The numerous diseases affecting the lungs can now be recognized and discriminated from each other with a precision which, but for auscultation and the stethoscope, would have been altogether unattainable. The same holds good in the case of the heart, whose varied and often complex forms of disease can, by auscultation, be identified with striking accuracy. But in addition to these its main uses, auscultation is found to render great assistance in the investigation of many obscure internal affections, such as aneurysms and certain diseases of the oesophagus and stomach. To the accoucheur the stethoscope yields valuable aid in the detection of some forms of uterine tumours, and especially in the diagnosis of pregnancy—the only evidence now accepted as absolutely diagnostic of that condition being the hearing of the foetal heart sounds.

AUSONIUS, DECIMUS MAGNUS (*c*. 310-395), Roman poet and rhetorician, was born at Burdigala [*Bordeaux*]. He received an excellent education, especially in grammar and rhetoric, but confesses that his progress in Greek was unsatisfactory. Having completed his studies, he practised for some time as an advocate, but his inclination lay in the direction of teaching. He set up (in 334) a school of rhetoric in his native place, which was largely attended, his most famous pupil being Paulinus, afterwards bishop of Nola. After thirty years of this work, he was summoned by Valentinian to the imperial court, to undertake the education of Gratian, the heir-apparent. The prince always entertained the greatest regard for his tutor, and after his accession bestowed upon him the highest titles and honours, culminating in the consulship (379). After the murder of Gratian (383), Ausonius retired to his estates near Burdigala. He appears to have been a (not very enthusiastic) convert to Christianity. He died about 395.

His most important extant works are: in prose, *Gratiarum Actio*, an address of thanks to Gratian for his elevation to the consulship; *Periochae*, summaries of the books of the *Iliad* and *Odyssey*; and one or two *epistolae*; in verse, *Epigrammata*, including several free translations from the Greek Anthology; *Ephemeris*, the occupations of a day; *Parentalia* and *Commemoratio Professorum Burdigalensium*, on deceased relatives and literary friends; *Epitaphia*, chiefly on the Trojan heroes; *Caesares*, memorial verses on the Roman emperors from Julius Caesar to Elagabalus; *Ordo Nobilium Urbium*, short poems on famous cities; *Ludus Septem Sapientum*, speeches delivered by the Seven Sages of Greece; *Idyllia*, of which the best-known are the *Mosella*, a descriptive poem on the Moselle, and the infamous *Cento Nuptialis*. We may also mention *Cupido Cruciatus*, Cupid on the cross; *Technopaegion*, a literary trifle consisting of a collection of verses ending in monosyllables; *Eclogarum Liber*, on astronomical and astrological subjects; *Epistolae*, including letters to Paulinus and Symmachus; lastly, *Praefatiunculae*, three poetical epistles, one to the emperor Theodosius. Ausonius was rather a man of letters than a poet; his wide reading supplied him with material for a great variety of subjects, but his works exhibit no traces of a true poetic spirit; even his versification, though ingenious, is frequently defective.

There are no MSS. containing the whole of Ausonius's works. Editio princeps, 1472; editions by Scaliger 1575, Souchay 1730, Schenkl 1883, Peiper 1886; cf. *Mosella*, Böcking 1845, de la Ville de Mirmont (critical edition with translation) 1889, and *De Ausonii Mosella*, 1892, Hosius 1894. See Deydou, *Un Poète bordelais* (1868); Everat, *De Ausonii Operibus* (1885); Jullian, *Ausone et Bordeaux* (1893); C. Verrier and R. de Courmont, *Les Épigrammes d'Ausone* (translation with bibliography, 1905); R. Pichon, *Les Derviers Écrivains profanes* (1907).

AUSSIG (Czech *Oustí nad Labem*), a town of Bohemia, Austria, 68 m. N. of Prague by rail. Pop. (1900) 37,255, mostly German. It is situated in a mountainous district, at the confluence of the Biela and the Elbe, and, besides being an active river port, is an important junction of the northern Bohemian railways. Aussig has important industries in chemicals, textiles, glass and boat-building, and carries on an active trade in coal from the neighbouring mines, stone and stoneware, corn, fruit and wood. It was the birthplace of the painter, Raphael Mengs (1728-1779). Aussig is mentioned as a trading centre as early as 993. It was made a city by Ottokar II. in the latter part of the 13th century. In 1423 it was pledged by King Sigismund to the elector Frederick of Meissen, who occupied it with a Saxon garrison. In 1426 it was besieged by the Hussites, who on the 16th of June, though only 25,000 strong, defeated a German army of 70,000, which had been sent to its relief, with great slaughter. The town was stormed and sacked next day. After lying waste for three years, it was rebuilt in 1429. It suffered much during the Thirty Years' and Seven Years' Wars, and in 1830 it had only 1400 inhabitants. Not far from Aussig is the village of Kulm, where, on the 29th and 30th of August 1813, a battle took place between the French under Vandamme and an allied army of Austrians, Prussians and Russians. The French were defeated, and Vandamme surrendered with his army of 10,000 men.

AUSTEN, JANE (1775-1817), English novelist, was born on the 16th of December 1775 at the parsonage of Steventon, in Hampshire, a village of which her father, the Rev. George Austen, was rector. She was the youngest of seven children. Her mother was Cassandra Leigh, niece of Theophilus Leigh, a dry humorist, and for fifty years master of Balliol, Oxford. The life of no woman of genius could have been more uneventful than Miss Austen's. She did not marry, and she never left home except on short visits, chiefly to Bath. Her first sixteen years were spent in the rectory at Steventon, where she began early to trifle with her pen, always jestingly, for family entertainment. In 1801 the Austens moved to Bath, where Mr Austen died in 1805, leaving only Mrs Austen, Jane and her sister Cassandra, to whom she was always deeply attached, to keep up the home; his sons were out in the world, the two in the navy, Francis William and Charles, subsequently rising to admiral's rank. In 1805 the Austen ladies moved to Southampton, and in 1809 to Chawton, near Alton, in Hampshire, and there Jane Austen remained till 1817, the year of her death, which occurred at Winchester, on July 18th, as a memorial window in the cathedral testifies.

During her placid life Miss Austen never allowed her literary work to interfere with her domestic duties: sewing much and admirably, keeping house, writing many letters and reading aloud. Though, however, her days were quiet and her area circumscribed, she saw enough of middle-class provincial society to find a basis on which her dramatic and humorous faculties might build, and such was her power of searching observation and her sympathetic imagination that there are not in English fiction more faithful representations of the life she knew than we possess in her novels. She had no predecessors in this genre. Miss Austen's "little bit (two inches wide) of ivory" on which she worked "with so fine a brush"—her own phrases—was her own invention.

Her best-known, if not her best work, *Pride and Prejudice*, was also her first. It was written between October 1796 and August 1797, although, such was the blindness of publishers, not issued until 1813, two years after *Sense and Sensibility*, which was written, on an old scenario called "Eleanor and Marianne," in 1797 and 1798. Miss Austen's inability to find a publisher for these stories, and for *Northanger Abbey*, written in 1798 (although it is true that she sold that MS. in 1803 for £10 to a Bath bookseller, only, however, to see it locked away in a safe for some years, to be gladly resold to her later), seems to have damped her ardour; for there is no evidence that between 1798 and 1809 she wrote anything but the fragment called "The Watsons," after which year she began to revise her early work for the press. Her other three books belong to a later date—*Mansfield Park*, *Emma* and *Persuasion* being written between 1811 and 1816. The years of publication were *Sense and Sensibility*, 1811; *Pride and Prejudice*, 1813; *Mansfield Park*, 1814; and *Emma*, 1816—all in their author's lifetime. *Persuasion* and *Northanger Abbey* were published posthumously in 1818. All were anonymous,

agreeably to their author's retiring disposition.

Although *Pride and Prejudice* is the novel which in the mind of the public is most intimately associated with Miss Austen's name, both *Mansfield Park* and *Emma* are finer achievements—at once riper and richer and more elaborate. But the fact that *Pride and Prejudice* is more single-minded, that the love story of Elizabeth Bennet and D'Arcy is not only *of* the book but *is* the book (whereas the love story of Emma and Mr Knightley and Fanny Price and Edmund Bertram have parallel streams), has given *Pride and Prejudice* its popularity above the others among readers who are more interested by the course of romance than by the exposition of character. Entirely satisfactory as is *Pride and Prejudice* so far as it goes, it is, however, thin beside the niceness of analysis of motives in *Emma* and the wonderful management of two housefuls of young lovers that is exhibited in *Mansfield Park*.

It has been generally agreed by the best critics that Miss Austen has never been approached in her own domain. No one indeed has attempted any close rivalry. No other novelist has so concerned herself or himself with the trivial daily comedy of small provincial family life, disdaining equally the assistance offered by passion, crime and religion. Whatever Miss Austen may have thought privately of these favourite ingredients of fiction, she disregarded all alike when she took her pen in hand. Her interest was in life's little perplexities of emotion and conduct; her gaze was steadily ironical. The most untoward event in any of her books is Louisa's fall from the Cobb at Lyme Regis, in *Persuasion*; the most abandoned, Maria's elopement with Crawford, in *Mansfield Park*. In pure ironical humour Miss Austen's only peer among novelists is George Meredith, and indeed *Emma* may be said to be her *Egoist*, or the *Egoist* his *Emma*. But irony and fidelity to the fact alone would not have carried her down the ages. To these gifts she allied a perfect sense of dramatic progression and an admirably lucid and flowing prose style which makes her stories the easiest reading.

Recognition came to Miss Austen slowly. It was not until quite recent times that to read her became a necessity of culture. But she is now firmly established as an English classic, standing far above Miss Burney (Madame d'Arblay) and Miss Edgeworth, who in her day were the popular women novelists of real life, while Mrs Radcliffe and "Monk" Lewis, whose supernatural fancies' *Northanger Abbey* was written in part to ridicule, are no longer anything but names. Although, however, she has become only lately a household word, Miss Austen had always her panegyrists among the best intellects—such as Coleridge, Tennyson, Macaulay, Scott, Sydney Smith, Disraeli and Archbishop Whately, the last of whom may be said to have been her discoverer. Macaulay, whose adoration of Miss Austen's genius was almost idolatrous, considered *Mansfield Park* her greatest feat; but many critics give the palm to *Emma*. Disraeli read *Pride and Prejudice* seventeen times. Scott's testimony is often quoted: "That young lady had a talent for describing the involvements, feelings and characters of ordinary life which is to me the most wonderful I have ever met with. The big bow-wow I can do myself like any one going; but the exquisite touch which renders commonplace things and characters interesting from the truth of the description and the sentiment is denied to me."

Many monographs on Miss Austen have been written, in addition to the authorized *Life* by her nephew J.E. Austen Leigh in 1870, and the collection of her *Letters* edited by Lord Brabourne in 1884. The chief books on her and around her are *Jane Austen*, by S.F. Malden (1889); *Jane Austen*, by Goldwin Smith (1890); *Jane Austen: Her Contemporaries and Herself*, by W.H. Pollock; *Jane Austen: Her Homes and Her Friends*, by Constance Hill (1902); *Jane Austen and Her Times*, by G.E. Mitton (1905); *Jane Austen's Sailor Brothers*, by J H. and E.C. Hubback (1906); and the essay on her in Lady Richmond (Thackeray) Ritchie's *Book of Sibyls* (1883).

(E. V. L.)

AUSTERLITZ (Czech *Slavkov*), a town of Austria, in Moravia, 15 m. E.S.E. of Brünn by rail. Pop. (1900) 3145, mostly Czech. It contains a magnificent palace belonging to the prince of Kaunitz-Rietberg, and a beautiful church.

The great battle in which the French under Napoleon I. defeated the Austrians and Russians on the 2nd of December 1805, was fought in the country to the west of Austerlitz, the position of Napoleon's left wing being almost equi-distant from Brünn and from Austerlitz. The wooded hills to the northward throw out to the south and south-west long spurs, between which are the low valleys of several rivers and brooks. The scene of the most important fighting was the Pratzen plateau. The famous "lakes" in the southern part of the field were artificial ponds, which have long since been drained. On the west or Brünn side of the Goldbach is another and lower ridge, which formed in the battle the first position of the French right and centre. On the other wing is the mass of hills from which the spurs and streams descend: here the Olmütz-Brünn road passes. The road from Brunn to Vienna, Napoleon's presumed line of retreat, runs in a southerly direction, and near the village of Raigern (3 m. west of Monitz) is very close to the extreme right of the French position, a fact which had a great influence on the course of the battle. (The course of events which led to the action is described under Napoleonic Campaigns.) Napoleon, falling back before the advance of the allied Austrians and Russians from Olmütz, bivouacked west of the Goldbach, whilst the allies, holding, near Austerlitz, the junction of the roads from Olmutz and from Hungary, formed up in the valleys east of the Pratzen heights. The cavalry of both sides remained inactive, Napoleon's by express order, the enemy's seemingly from mere negligence, since they had 177 squadrons at their disposal. Napoleon, having determined to fight, as usual called up every available battalion; the splendid III. corps of Davout only arrived upon the field after a heavy march, late on the night of December 1st. The plan of the allies was to attack Napoleon's right, and to cut him off from Vienna, and their advanced guard began, before dark on the 1st of December, to skirmish towards Telnitz. At that moment Napoleon was in the midst of his troops, thousands of whom had made their bivouac-straw into torches in his honour. The glare of these seemed to the allies to betoken the familiar device of lighting fires previous to a retreat, and thus confirmed them in the impression which Napoleon's calculated timidity had given. Thus encouraged, those who desired an immediate battle soon gained the upper hand in the councils of the tsar and the emperor Francis. The attack orders for the 2nd of December (drawn up by the Austrian general Weyrother, and explained by him to a council of superior officers, of whom some were hostile, the greater part indifferent, and the chief Russian member, General Kutusov, asleep) gave the five columns and the reserve, into which the Austro-Russian army was organized, the following tasks: the first and second (Russians) to

move south-westward behind the Pratzen ridge towards Telnitz and Sokolnitz; the third (Russian) to cross the southern end of the plateau, and come into line on the right of the first two; the fourth (Austrians and Russians under Kolowrat) on the right of the third to advance towards Kobelnitz. An Austrian advanced guard preceded the 1st and 2nd columns. Farther still on the right the 5th column (cavalry under Prince John of Liechtenstein) was to hold the northern part of the plateau, south of the Brunn-Olmutz road; across the road itself was the corps of Prince Bagration, and in rear of Liechtenstein's corps was the reserve (Russians under the grand-duke Constantine). Thus, the farther the four main columns penetrated into the French right wing, the wider would the gap become between Bagration and Kolowrat, and Liechtenstein's squadrons could not form a serious obstacle to a heavy attack of Napoleon's centre. The whole plan was based upon defective information and preconceived ideas; it has gone down to history as a classical example of bad generalship, and its author Weyrother, who was perhaps nothing worse than a pedant, as a charlatan.

Napoleon, on the other hand, with the exact knowledge of the powers of his men, which was the secret of his generalship, entrusted nearly half of his line of battle to a division (Legrand's) of Soult's corps, which was to be supported by Davout, some of whose brigades had marched, from Vienna, 90 m. in forty-eight hours. But the ground which this thin line was to hold against three columns of the enemy was marshy and densely intersected by obstacles, and the III. corps was the best in the *Grande Armée*, while its leader was perhaps the ablest of all Napoleon's marshals. The rest of the army formed in the centre and left. "Whilst they march to turn my right," said Napoleon in the inspiriting proclamation which he issued on the eve of the battle, "they present me their flank," and the great counterstroke was to be delivered against the Pratzen heights by the French centre. This was composed of Soult's corps, with Bernadotte's in second line. On the left, around the hill called by the French the Santon (which was fortified) was Lannes' corps, supported by the cavalry reserve under Murat. The general reserve consisted of the Guard and Oudinot's grenadiers.

The attack of the allies was begun by the first three columns, which moved down from their bivouacs behind the Pratzen plateau before dawn on the 2nd, towards Telnitz and Sokolnitz. The Austrian advanced guard engaged at daybreak, and the French in Telnitz made a vigorous defence; both parties were reinforced, and Legrand drew upon himself, in fulfilling his mission, the whole weight of the allied attack. The contest was long and doubtful, but the Russians gradually drove back Legrand and a part of Davout's corps; numerous attacks both of infantry and cavalry were made, and by the successive arrival of reinforcements each side in turn received fresh impetus. Finally, at about 10 A.M., the allies were in possession of the villages on the Goldbach from Sokolnitz southwards, and Davout's line of battle had reformed more than a mile to rearward, still, however, maintaining touch with the French centre on the Goldbach at Kobelnitz. Between the two lines the fighting continued almost to the close of the battle. With 12,500 men of all arms the Marshal held in front of him over 40,000 of the enemy.

In the centre, the defective arrangements of the allied staff had delayed the 4th column (Kolowrat), the line of march of which was crossed by Liechtenstein's cavalry moving in the opposite direction. The objective of this column was Kobelnitz, and the two emperors and Kutusov accompanied it. The delay had, however, opened a gap between Kolowrat and the 3rd column on his left; and towards this gap, and the denuded Pratzen plateau, Napoleon sent forward St Hilaire's division of Soult's corps for the decisive attack. Kutusov was pursuing this march to the south-west when he was surprised by the swift advance of Soult's men on the plateau itself. Napoleon had here double the force of the allies; Kutusov, however, displayed great energy, changed front to his right and called up his reserves. The French did not win the plateau without a severe struggle. St Hilaire's (the right centre) division was fiercely engaged by Kolowrat's column, General Miloradovich opposed the left centre attack under Vandamme, but the French leaders were two of the best fighting generals in their army. The rearmost troops of the Russian 2nd column, not yet committed to the fight on the Goldbach, made a bold counter stroke against St Hilaire's right flank, but were repulsed, and Soult now turned to relieve the pressure on Davout by attacking Sokolnitz. The Russians in Sokolnitz surrendered, an opportune cavalry charge further discomfited the allied left, and the Pratzen plateau was now in full possession of the French. Even the Russian Guard failed to shake Vandamme's hold. In the meanwhile Lannes and Murat had been engaged in the defence of the Santon. Here the allied leaders displayed the greatest vigour, but they were unable to drive back the French. The cavalry charges in this quarter are celebrated in the history of the mounted arm; and Kellermann, the hero of Marengo, won fresh laurels against the cavalry of Liechtenstein's command. The French not only held their ground, but steadily advanced and eventually forced back the allies on Austerlitz, thereby barring their retreat on Olmütz. The last serious attempt of the allies in the centre led to some of the hardest fighting of the day; the Russian Imperial Guard under the grand-duke Constantine pressed closely upon St Hilaire and Vandamme on the plateau, and only gave way when the French Guard and the Grenadiers came into action. After the "Chevalier Guards" had been routed by Marshal Bessières and the Guard cavalry, the allies had no more hope of victory; orders had already been sent to Buxhöwden, who commanded the three columns engaged against Davout, to retreat on Austerlitz. No further attempt was made on the plateau, which was held by the French from Pratzen to the Olmütz road. The allied army was cut in two, and the last confused struggle of the three Russian columns on the Goldbach was one for liberty only. The fighting in Telnitz was perhaps the hardest of the whole battle, but the inevitable retreat, every part of which was now under the fire of the French on the plateau, was terribly costly. Soult now barred the way to Austerlitz, and the allies turned southward towards Satschan. As they retreated, the ice of the Satschan pond was broken up by the French artillery, and many of the fugitives were drowned. In the twelve hours from 7 A.M. to nightfall, the 65,000 French troops had lost 6800 men, or about 10%; the allies (82,500 engaged) had 12,200 killed and wounded, and left in the enemy's hands 15,000 prisoners (many wounded) and 133 guns.

AUSTIN, ALFRED (1835-), English poet-laureate, was born at Headingley, near Leeds, on the 30th of May 1835. His father, Joseph Austin, was a merchant of the city of Leeds; his mother, a sister of Joseph Locke, M.P. for Honiton. Mr Austin was educated at Stonyhurst, Oscott, and London University, where he graduated in 1853. He was called to the bar four years later, and practised as a barrister for a short time; but in 1861, after two comparatively false starts in poetry and fiction, he made his first noteworthy appearance as a writer with a satire called *The Season*, which contained incisive lines, and was marked by some promise both in wit and observation. In 1870 he published a volume of criticism, *The Poetry of the Period*, which was again conceived in a spirit of satirical invective, and attacked Tennyson, Browning, Matthew Arnold and Swinburne in no half-hearted fashion. The book aroused some discussion at the time, but its judgments were extremely uncritical. In 1881 Mr Austin returned to verse with a tragedy, *Savonarola*, to which he added *Soliloquies* in 1882, *Prince Lucifer* in 1887, *England's Darling* in 1896, *The Conversion of Winckelmann* in 1897, &c. A keen Conservative in politics, for several years he edited *The National Review*, and wrote leading articles for *The Standard*. On Tennyson's death in 1892 it was felt that none of the then living poets, except Swinburne or William Morris, who were outside consideration on other grounds, was of sufficient distinction to succeed to the laurel crown, and for several years no new poet-laureate was nominated. In the interval the claims of one writer and another were much canvassed, but eventually, in 1896, Mr Austin was appointed. As poet-laureate, his occasional verses did not escape adverse criticism; his hasty poem in praise of the Jameson Raid in 1896 being a notable instance. The most effective characteristic of Mr Austin's poetry, as of the best of his prose, is a genuine and intimate love of nature. His prose idylls, *The Garden that I love* and *In Veronica's Garden*, are full of a pleasant, open-air flavour, which is also the outstanding feature of his *English Lyrics*. His lyrical poems are wanting in spontaneity and individuality, but many of them possess a simple, orderly charm, as of an English country lane. He has, indeed, a true love of England, sometimes not without a suspicion of insularity, but always fresh and ingenuous. A drama by him, *Flodden Field*, was acted at His Majesty's theatre in 1903.

AUSTIN, JOHN (1790-1859), English jurist, was born on the 3rd of March 1790. His father was the owner of flour mills at Ipswich and in the neighbourhood, and was in good circumstances. John was the eldest of five brothers. One of his brothers, Charles (1799-1874), obtained great distinction at the bar. John Austin entered the army at a very early age; he is said to have been only sixteen. He served with his regiment under Lord William Bentinck in Malta and Sicily. He seems to have liked his profession, and to have joined in the amusements and even in the follies of his brother officers. Yet it appears from a journal kept by him at the time that he occupied himself with studies of a far more serious kind than is common amongst young officers in the army. He notes having read in the course of one year Dugald Stewart's *Philosophical Essays*, Drummond's *Academical Questions*, Enfield's *History of Philosophy*, and Mitford's

History of Greece, and upon all of these he makes observations which disclose much thought and a capacity for criticism which must have come from extensive reading elsewhere. The prevailing note of this journal is one of bitter self-depreciation. He says in it that the retrospect of the past year (1811) "has hardly given rise to one single feeling of satisfaction," and farther on he says that "indolence, always the prominent vice of my character," has "assumed over me an empire I almost despair of shaking off." It is difficult to believe that a man only just of age, whose serious reading consisted of such books, and who (as appears from the same journal) was in the habit of turning to the classics as an alternative, could have deserved the reproach of indolence.

In 1812, he resigned his commission in the army, and returned home. He then began to read law in the chambers of a barrister. He 939
was called to the bar in the year 1818, and joined the Norfolk circuit, but he never obtained any large practice, and he finally retired from the bar in 1825. In 1819 he married Sarah Taylor (see Austin, Sarah).

Although Austin had failed to attain success at the bar it was not long before he had an opportunity of exercising his abilities and in a manner peculiarly suited to his particular turn of mind. In 1826 a number of eminent men were engaged in the foundation of University College, and it was determined to establish in it a chair of jurisprudence. This chair was offered to Austin and he agreed to accept it. As he was not called upon to begin his lectures immediately, he resolved to proceed to Germany in order to prepare himself for his duties by studying the method of legal teaching pursued at German universities. He resided first at Heidelberg, and afterwards at Bonn, where he lived on terms of intimacy with such distinguished lawyers as Savigny and K.J.A. Mittermaier; and such eminent men of letters as Niebuhr, Brandis, Schlegel and A.W. Heffter. He began lecturing in 1828, and at first was not without encouragement. His class was a peculiarly brilliant one. It included a number of men who afterwards became eminent in law, politics and philosophy—Sir George Cornewall Lewis, Charles Buller, Charles Villiers, Sir Samuel Romilly and his brother Lord Romilly, Edward Strutt afterwards Lord Belper, Sir William Erie and John Stuart Mill were all members of his class. All of these have left on record expressions of the profound admiration which the lectures excited in the minds of those who heard them. But the members of his class, though exceptional in quality, were few in number, and as there was no fixed salary attached to the professorship, Austin could not afford to remain in London, and in 1832 he resigned. In that year he published his *Province of Jurisprudence determined*, being the first ten of his delivered lectures compressed into six.

There is ample testimony that Austin's lectures were very highly appreciated by those who heard them. Their one fault was that they were over-elaborated. In his desire to avoid ambiguity, he repeats his explanations and qualifications to an extent which must have tired his hearers. Nevertheless the lectures excited an admiration which almost amounted to enthusiasm. Nor was Austin's influence confined to his lectures. Sir William Erle says in a letter written to him in 1844, "The interchange of mind with you in the days of Lincoln's Inn I regard as a deeply important event in my life, and I ever remember your friendship with thankfulness and affection." John Stuart Mill, whose views on political subjects were entirely opposed to those of Austin, spoke of him after his death as the man "to whom he (Mill) had been intellectually and morally most indebted," and he expressed the opinion "that few men had contributed more by their individual influence, and their conversation, to the formation and growth of the most active minds of the generation."

In 1833 a royal commission was issued to draw up a digest of criminal law and procedure. Of this commission Austin was a member. The first report was signed by all the commissioners, and was presented in June 1834. Nevertheless it appears from some notes made at the time that Austin, though he thought it his duty to sign the report, strongly objected to some passages which it contained. It is pretty obvious from the nature of these objections that nothing would have satisfied him short of a complete recasting of the criminal law, whereas what the commissioners were ordered to produce was not a code but a digest. Probably Austin felt, as Mr Justice Wills felt some years later, that the anomalies which a code would remove would "choke a digest."

In 1834 the benchers of the Inner Temple appointed Austin to give lectures on the "General Principles of Jurisprudence and International Law." He delivered a few lectures in the spring of that year, but in June the course was by order of the benchers suspended on account of the smallness of the attendance, and it was never resumed. He then went to live with his wife and only child Lucie (afterwards Lady Duff-Gordon) at Boulogne. Here he remained for about a year and a half. He then accepted an appointment offered him by Sir James Stephen to go as royal commissioner to Malta in conjunction with Mr (afterward Sir George) Cornewall Lewis, to inquire into the nature and extent of the grievances of which the natives of that island complained.

The Austins remained in Malta until July 1838. After their return they lived a good deal abroad, and in 1844 they settled in Paris, where they remained until driven out of France by the revolution of 1848. They then took a house at Weybridge, and there Austin remained until his death in December 1859. He was urged by his friends to publish a second edition of the *Province of Jurisprudence*, which was then out of print, and he went so far as to allow a prospectus to be issued by Mr Murray of an extended work on "The Principles and Relations of Jurisprudence and Ethics." But nothing came of it.

In 1842 Austin published in the *Edinburgh Review* an attack upon Friedrich List's system of trade protection (*Das nationale System der politischen Okonomie*). And in 1859 he published a pamphlet entitled "A Plea for the Constitution." This was occasioned by the publication of Lord Grey's essay on "Parliamentary Government." Its main object was to show that the consequences to be anticipated from Parliamentary Reform were all of them either impossible of realization or mischievous. He thought any attempt on the part of the poorer classes to improve their position was barred by the inexorable laws of political economy; and that if they obtained power they would only use it to plunder the rich; whilst, on the other hand, he seems not to have had any suspicion that the "proprietary class" were likely to disregard the interests of the poor. He thinks that political power is safest in the hands of those possessed of hereditary or acquired property; and that without property even intelligence and knowledge afford no presumption of political capacity. Undoubtedly Austin was a utilitarian in the Benthamite sense, and remained so to the end of his life. It must be remembered that Bentham's sole and immutable test of human action was the greatest happiness of the greatest number. This is a principle which an aristocrat may adopt if he chooses, no less than a democrat; an individualist no less than a socialist; and there is nothing in the "Plea for the Constitution" which contravenes this. But Austin thought, and in this no doubt he differed from Bentham, that the mass of the people did not know their own interests so well as "an aristocracy of independent gentlemen" who might be trusted to provide for the wants of all classes alike.

Austin's position as a jurist is much more difficult to estimate. Twice his influence appeared likely to produce some impression upon English law, but upon both occasions it lasted only a short time, and never extended very far. The men whom he influenced were very eminent, but in numbers they were few. As a rule, students for the bar never at any time paid any attention to his teaching. The first published lectures were almost forgotten when Mr (afterwards Sir Henry) Maine was appointed to lecture on jurisprudence at the Inner Temple. Both in his private and public lectures Maine constantly urged upon his hearers the importance of Austin's analytical inquiries into the meaning of legal terms. He used to say that it was Austin's inquiries which had made a philosophy of law possible. Undoubtedly Maine's influence revived for a short time the interest in Austin's teaching. Maine was lecturing about the time of Austin's death, and in 1861 Mrs Austin published a second edition of the *Province of Jurisprudence*, and this was followed soon after by two volumes which contained in addition in a fragmentary form the remaining lectures delivered at University College and other notes (*Lectures on Jurisprudence; or The Philosophy of Positive Law*).

It cannot be said that Austin's views of jurisprudence have had, as yet, any visible influence whatever on the study of English law. But if we consider what it was that Austin endeavoured to teach, it can hardly be said that the subject is one which a lawyer can with impunity neglect. He proposes to distinguish law from morals; to explain the notions which have been entertained of duty, right, 940
liberty, injury, punishment and redress; and their connexion with, and relations to, sovereignty; to examine the distinction between rights *in rem* and rights *in personam*, and between rights *ex contractu* and rights *ex delicto*; and further to determine the meaning of such terms as right, obligation, injury, sanction, person, thing, act and forbearance. These are some of the terms, notions and distinctions which Austin endeavoured to explain. They are daily in the mouth of every practising lawyer. The only portion of Austin's work which has attracted much attention of recent years is his conception of sovereignty, and his dictum that all laws properly so called must be considered as sanctioned expressly or tacitly by the sovereign. This has been indignantly denied. It has been considered enough to justify this denial to point out that there are in existence states where the seat of sovereignty, and the ultimate source of law, cannot be accurately indicated. But this criticism is entirely misplaced; for as pointed out by Maine (*Early History of Institutions*, Lecture xii.), in an elaborate discussion of Austin's views, which in the main he accepts, what Austin was engaged upon was not an inquiry into the nature of sovereignty as it is found to exist, but an inquiry into what was the connexion between the various forms of political superiority. And this inquiry was undertaken in order to enable him to distinguish the province of jurisprudence properly so called from the province of morality; an inquiry which was hopeless unless the connexion just stated was clearly conceived. Austin's views of sovereignty, therefore, was an abstraction, useless it is true for some purposes, but by no means useless for others. "There is," as Maine says, "not the smallest necessity for accepting all the conclusions of these great writers (*i.e.* Bentham and Austin) with

implicit deference, but there is the strongest necessity for knowing what these conclusions are. They are indispensable, if for no other object, for the purpose of clearing the head." These last words exactly express the work which Austin set himself to do. It was to clear his own head, and the heads of his hearers, that he laboured so hard. As Austin once said of himself, his special vocation was that of untying intellectual knots. The disentangling of classifications and distinctions, the separation of real from accidental distinctions, the analysis of ideas confusedly apprehended, these (as has been truly said) were the characteristics of Austin's work which specially distinguished him. Austin thought that this somewhat irksome task was a necessary preliminary both to the study of law as a science, and to the production of a code. It is a curious reflection that whilst the lectures in which these inquiries were begun (though not completed) excited the admiration of his contemporaries, hardly any one now thinks such inquiries worth pursuing.

The *Lectures on Jurisprudence* were reviewed by J.S. Mill in the *Edinburgh Review* of October 1863, and this review is republished in Mill's *Dissertations and Discussions*, vol. 3, p. 206. Professor Jethro Brown has published (1906) an edition of Austin's earlier lectures, in which they are stated in an abbreviated form. There is a sketch of his life by his widow in the preface to the *Lectures on Jurisprudence*, which she published after his death.

(W. Ma.)

AUSTIN, SARAH (1793-1867), English author, was born in 1793, the daughter of John Taylor (d. 1826), a wool-stapler and a member of the well-known Taylor family of Norwich. Her great grandfather, Dr John Taylor (1694-1761), had been pastor of the Presbyterian church there, and wrote a once famous polemical work on *The Scripture Doctrine of Original Sin* (1738), which called forth celebrated treatises by Jonathan Edwards on *Original Sin*. Her mother, Susannah Cook, was an exceedingly clever woman who transmitted both her beauty and her talent to her daughter. Their friends included Dr Alderson and his daughter Mrs Opie, Henry Crabbe Robinson, the Gurneys and Sir James Mackintosh. Sarah Taylor married in 1820 John Austin (*q.v.*). They lived in Queen Square, Westminster, where Mrs. Austin, whose tastes, unlike her husband's, were extremely sociable, gathered round her a large circle, Jeremy Bentham, James Mill and the Grotes being especially intimate. She received many Italian exiles, who found a real friend in her. In 1821 was born her only child, Lucie, afterwards Lady Duff-Gordon. Mrs. Austin never attempted any considerable original work, contenting herself chiefly with translations, of which the most important are the *History of the Reformation in Germany* and the *History of the Popes* (1840), from the German of Leopold von Ranke, *Report on the State of Public Instruction in Prussia* (1834) from the French of V. Cousin, and F.W. Carove's *The Story without an End* (1864). After her husband's death in 1859 she edited his *Lectures on Jurisprudence*. She also edited the *Memoirs of Sydney Smith* (1855) and Lady Duff-Gordon's *Letters from Egypt* (1865). She died at Weybridge on the 8th of August 1867.

See *Three Generations of Englishwomen* (1888), by her grand-daughter, Mrs Janet Ross.

AUSTIN, STEPHEN FULLER (1793-1836), American pioneer, was born in Austinville, Wythe county, Virginia, on the 3rd of November 1793. He was the son of Moses Austin (1767-1821), a native of Durham, Connecticut, who in 1820 obtained from Mexico a grant of land for an American colony in Texas, but died before he could carry out his project. The son was educated in New London, Connecticut, and at Transylvania University, Lexington, Kentucky, and settled in Missouri, where he was a member of the territorial legislature from 1813 to 1819. In 1819 he removed to Arkansas Territory, where he was appointed a circuit judge. After his father's death he obtained a confirmation of the Texas grants from the newly established Mexican government, and in 1821-1823 he established a colony of several hundred American families on the Brazos river, the principal town being named, in his honour, San Felipe de Austin. He was a firm defender of the rights of the Americans in Texas, and in 1833 he was sent to the city of Mexico to present a petition from a convention in Texas praying for the erection of a separate state government. While there, despairing of success for his petition, he wrote home recommending the organization of a state without waiting for the consent of the Mexican congress. This letter falling into the hands of the Mexican government, Austin, while returning home, was arrested at Saltillo, carried as a prisoner back to Mexico, and imprisoned for a year without trial. Returning to Texas in 1835, he found the Texans in armed revolt against Mexican rule, and was chosen commander-in-chief of the revolutionary forces, but after failing to take San Antonio he resigned the command, for which he had never considered himself fitted, and in November 1835 went to the United States as a commissioner to secure loans and supplies, and to learn the position the United States authorities would be likely to take in the event of a declaration of Texan independence. He succeeded in raising large sums, and received assurances that satisfied him that Americans would look with great favour on an independent Texas. Returning to Texas in the summer of 1836, he became a candidate, rather reluctantly, for the presidency of the newly established republic of Texas, but was defeated by Samuel Houston, under whom he was secretary of state until his sudden death on the 7th of December 1836.

See *A Comprehensive History of Texas*, edited by D.G. Wooten (2 vols., Dallas, 1898).

AUSTIN, a city and the county-seat of Mower county, Minnesota, U.S.A., on the Red Cedar river and Turtle creek, (by rail) 105 m. S. of Minneapolis and 100 m. from St Paul. Pop. (1900) 5474; (1905, state census) 6489 (913 foreign-born); (1910, U.S. census) 6960. It is served by the Chicago Great Western and the Chicago, Milwaukee & St Paul railways. Austin is the seat of the Southern Minnesota Normal College and Austin School of Commerce (1896), and has a Carnegie library, court house and city hall. It is a market for livestock, and for dairy and farm products, and has slaughtering and packing establishments, flour mills, creameries and cheese factories, canning and preserving factories, carriage works, a flax fibre mill and grain elevators. Brick, tile, sewer-pipe, and hydraulic cement are manufactured, and there are railway repair shops. A valuable water-power is utilized for manufacturing purposes. Fresh-water pearls of considerable value and beauty are found in the Red Cedar river. The city owns and operates its own water-supply system and electric-lighting plant. Austin was settled in 1855, was incorporated as a village in 1868, and was chartered as a city in 1873.

AUSTIN, the capital of Texas, U.S.A., and the county-seat of Travis county, on the N. bank of the Colorado river, near the centre of the state and about 145 m. W.N.W. of Houston. Pop. (1890) 14,575; (1900) 22,258, of whom 5822 were negroes; (1910 census) 29,860. Austin is served by the Houston & Texas Central, the International & Great Northern, and the Missouri, Kansas & Texas railways. The city is built on high bluffs 40-120 ft. above the river, which is spanned here by a bridge, built in 1874. The Texas State Capitol, a handsome building of red Texas granite, with a dome 318 ft. high, cost more than $3,500,000, and stands in a square in the centre of the city. It was built (1881-1888) by Chicago capitalists in exchange for a land grant of 3,000,000 acres. It is in the form of a Greek cross, with an extreme length of 556.5 ft. and an extreme width of 288.8 ft. Next to the National Capitol at Washington, it is the largest capitol building in the United States, and it is said to be one of the ten largest buildings in the world. Austin is the seat of the University of Texas (opened in 1883; co-educational); the medical department of the state university is at Galveston, and the departments in Austin are the college of arts, department of education, department of engineering, department of law, school of pharmacy, and school of nursing. The government of the university is vested in a board of eight regents nominated by the governor and

appointed with the advice and consent of the state senate. At Austin are also state institutions and asylums for the insane, the blind, the coloured deaf and blind; the state school for the deaf and dumb; the state Confederate home; the Confederate woman's home (1907; for wives and widows of Confederate soldiers and sailors), maintained by the Daughters of the Confederacy; St Mary's Academy (Roman Catholic, under the supervision of the Sisters of the Holy Cross, founded 1875, chartered 1886); St Edward's College (Roman Catholic, chartered 1885); the Austin Presbyterian Theological Seminary (Presbyterian Church, South), opened in 1902 by the Synod of Texas, and after 1905 partly controlled by the Synod of Arkansas; Tillotson College (a negro school under Congregational control, founded by the American Missionary Association, chartered in 1877, and opened in 1881), and Samuel Huston College (for negroes; Methodist Episcopal; opened in 1900 and named in honour of an Iowan benefactor). The principal newspapers of Austin are the *Statesman* (Democratic, established in 1871), a morning paper, and the *Tribune* (Democratic, established in 1891), an evening paper. The *Quarterly of the Texas State Historical Society* is published here. Austin is the principal trade and jobbing centre for central and western Texas, is an important market for livestock, cotton, grain and wool, and has extensive manufactories of flour, cotton-seed oil, leather goods, lumber and wooden ware; the value of the factory product in 1905 was $1,569,353, being 105.2% more than in 1900. The city owns and operates its water-supply system. In 1890-1893 one of the largest dams in the world, an immense structure of granite masonry, 1200 ft. long. 60-70 ft. high, and 18 to 66 ft. thick, was constructed across the Colorado river 2 m. above the city for the purpose of supplying water and power, creating a reservoir (Lake M'Donald) about 30 m. long. Freshets in the spring of 1900, however, undermined the wall, and on the 7th of April the dam broke with a resulting loss of several lives and about $1,000,000 worth of property. The rebuilding of the dam was projected in 1907. Austin was first settled in 1838 and was named Waterloo, but in 1839, when it was chosen as the site of the capital of the Republic of Texas, it was renamed in honour of Stephen F. Austin, one of its founders. Under the influence of General Sam Houston the capital was for a time in 1842-1845 removed from Austin to Houston, but in 1845 an ordinance was passed making Austin the capital, and it remained the state capital after Texas entered the Union, although Huntsville and Tehuacana Springs in 1850 and Houston in 1872 attempted in popular elections to be chosen in its place. The first Anglo-American settlement in Texas, established on the Brazos river in 1823 by members of the Austin colony, was San Felipe de Austin now San Felipe. In 1909 Austin adopted a commission form of government.

AUSTRALASIA, a term used by English geographers in a sense nearly synonymous with the Oceania of continental writers. It thus comprises all the insular groups which extend almost continuously from the south-eastern extremity of Asia to more than half-way across the Pacific. Its chief divisions are Malaysia with the Philippines; Australia with Tasmania and New Zealand; Melanesia, that is, New Guinea, New Britain, New Ireland, Admiralty, the Solomons, New Hebrides, Santa Cruz, Fiji, Loyalties and New Caledonia; Micronesia, that is, the Ladrones, Pelew and Carolines, with the Marshall and Gilbert groups; lastly, Polynesia, that is, Samoa, Tonga, Cook, Tahiti, the Marquesas, Ellice, Hawaii and all intervening clusters. The term is so far justified in that it harmonizes better than Oceania did with the names of the other continents, and also embodies the two essential facts that it is a south-eastern extension of Asia, and that its central and most important division is the great island-continent of Australia. In a more restricted sense the term Australasia corresponds to the large division including Australia, Tasmania and New Zealand.

See *Australasia*, 2 vols. Stanford Compendium Series, new issue (London, 1907-1908).

AUSTRALIA, the only continent entirely in the southern hemisphere. It lies between 10° 39′ and 39° 11½′ S., and between 113° 5′ and 153° 16′ E. Its greatest length is 2400 m. from east to west, and the greatest breadth 1971 m. from north to south. The area is, approximately, 2,946,691 sq. m., with a coast line measuring about 8850 m. This is equal to 1 m. to each 333 sq. m. of land, the smallest proportion of coast shown by any of the continents.

Physical Geography

General character.

Physiography.—The salient features of the Australian continent are its compact outline, the absence of navigable rivers communicating with the interior, the absence of active volcanoes or snow-capped mountains, its isolation from other lands, and its antiquity. Some of the most profound changes that have taken place on this globe occurred in Mesozoic times, and a great portion of Australia was already dry land when vast tracts of Europe and Asia were submerged; in this sense, therefore, Australia has been rightly referred to as one of the oldest existing land surfaces. It has been described as at once the largest island and the smallest continent on the globe. The general contours exemplify the law of geographers in regard to continents, viz. as to their having a high border around a depressed interior, and the highest mountains on the side of the greatest ocean. On the N. Australia is bounded by the Timor Sea, the Arafura Sea and Torres Strait; on the E. by the Pacific Ocean; on the S. by Bass Strait and the Southern Ocean; and on the W. by the Indian Ocean. It stands up from the ocean depths in three fairly well-marked terraces. The basal plain of these terraces is the bed of the ocean, which on the Pacific side has an average depth of 15,000 ft. From this profound foundation rise Australia, New Guinea and Melanesia, in varying slopes. The first ledge rising from the ocean floor has a depth averaging 8000 ft. below sea-level. The outer edge of this ledge is roughly parallel to the coast of Western Australia, and more than 150 m. from the land. Round the Australian Bight it continues parallel to the coast, until south of Spencer Gulf (the basal ledge still averaging 8000 ft. in depth) it sweeps southwards to lat. 55°, and forms a submarine promontory 1000 m. long. The edge of the abysmal area comes close to the eastern coasts of Tasmania and New South Wales, approaching to within 60 m. of Cape Howe. The terrace closest to the land, known as the continental shelf, has an average depth of 600 ft., and connects Australia, New Guinea, and Tasmania in one unbroken sweep. Compared with other continents, the Australian continental shelf is extremely narrow, and there are points on the eastern coast where the land plunges down to oceanic depths with an abruptness rarely paralleled. Off the Queensland coast the shelf broadens, its outer edge being lined by the seaward face of the Great Barrier Reef. From Torres Strait to Dampier Land the shelf spreads out, and connects Australia with New Guinea and the Malay Archipelago. An elongation of the shelf to the south joins Tasmania with the mainland. The vertical relief of the land above the ocean is a very important factor in determining the climate as well as the distribution of the fauna and flora of a continent.

The land mass of Australia rises to a mean height much less than that of any other continent; and the chief mountain systems are parallel to, and not far from, the coast-line. Thus, taking the continent as a whole, it may be described as a plateau, fringed by a low-lying well-watered coast, with a depressed, and for the most part arid, interior. A great plain, covering quite 500,000 sq. m., occupies a position a little to the east of a meridional line bisecting the continent, and south of the 22nd degree, but portions of it stretch upwards to the low-lying country south of the Gulf of Carpentaria. The contour of the continent in latitude 30° 5′ is as follows:—a short strip of coastal plain; then a sharp incline rising to a mountain range 4000 ft. above sea-level, at a distance of 40 m. from the coast. From this a gently-sloping plateau extends to almost due north of Spencer Gulf, at which point its height has fallen almost to sea-level. Then there is a gentle rise to the low steppes, 500 to 1000 ft. above sea-level. A further gentle rise in the high steppes leads to the mountains of the West Australian coast, and another strip of low-lying coastal land to the sea.

With a circumference of 8000 m. Australia presents a contour wonderfully devoid of inlets from the sea except on its northern shores, where the coast-line is largely indented. The Gulf of Carpentaria, situated in the north, is enclosed on the east by the projection of Cape York, and on the west by Arnheim Land, and forms the principal bay on the whole coast, measuring about 6° of long. by 6° of lat. Farther to the west, Van Diemen's Gulf, though much smaller, forms a better-protected bay, having Melville Island between it and the ocean; while beyond this, Queen's Channel and Cambridge Gulf form inlets about 14° 50′ S. On the north-west of the continent the coast-line is much broken, the chief indentations being Admiralty Gulf, Collier Bay and King Sound, on the shores of Tasman Land. Western Australia, again, is not favoured with many inlets, Exmouth Gulf and Shark's Bay being the only bays of any size. The same remark may be made of the rest of the sea-board; for, with the exception of Spencer Gulf, the Gulf of St Vincent and Port Phillip on the south, and Moreton Bay, Hervey Bay and Broad Sound on the east, the coast-line is singularly uniform. There are, however, numerous spacious harbours, especially on the eastern coast, which are referred to in the detailed articles dealing with the different states. The

Great Barrier Reef forms the prominent feature off the north-east coast of Australia; its extent from north to south is 1200 m., and it is therefore the greatest of all coral reefs. The channel between the reef and the coast is in places 70 m. wide and 400 ft. deep. There are a few clear openings in the outer rampart which the reef presents to the ocean. These are opposite to the large estuaries of the Queensland rivers, and might be thought to have been caused by fresh water from the land. The breaks are, however, some 30 to 90 m. away from land and more probably were caused by subsidence; the old river-channels known to exist below sea-level, as well as the former land connexion with New Guinea, seem to point to the conditions assumed in Darwin's well-known subsidence theory, and any facts that appear to be inconsistent with the theory of a steady and prolonged subsidence are explainable by the assumption of a slight upheaval.

With the exception of Tasmania there are no important islands belonging geographically to Australia, for New Guinea, Timor and other islands of the East Indian archipelago, though not removed any great distance from the continent, do not belong to its system. On the east coast there are a few small and unimportant islands. In Bass Strait are Flinders Island, about 800 sq. m. in area, Clarke Island, and a few other small islands. Kangaroo Island, at the entrance of St Vincent Gulf, is one of the largest islands on the Australian coast, measuring 80 m. from east to west with an average width of 20 m. Numerous small islands lie off the western coast, but none has any commercial importance. On the north coast are Melville and Bathurst Islands; the former, which is 75 m. long and 38 m. broad, is fertile and well watered. These islands are opposite Port Darwin, and to the westward of the large inlet known as Van Diemen's Gulf. In the Gulf of Carpentaria are numerous islands, the largest bearing the Dutch name of Groote Eylandt.

Mountains.

Along the full length of the eastern coast extends a succession of mountain chains. The vast Cordillera of the Great Dividing Range originates in the south-eastern corner of the continent, and runs parallel with and close to the eastern shore, through the states of Victoria and New South Wales, right up to the far-distant York Peninsula in Queensland. In Victoria the greatest elevation is reached in the peaks of Mount Bogong (6508 ft.) and Mount Feathertop (6303 ft.), both of which lie north of the Dividing Range; in the main range Mount Hotham (6100 ft.) and Mount Cobberas (6025 ft.) are the highest summits. In New South Wales, but close to the Victorian border, are found the loftiest peaks of Australia, Mount Kosciusco and Mount Townsend, rising to heights of 7328 and 7260 ft. respectively. The range is here called the Muniong, but farther north it receives the name of Monaro Range; the latter has a much reduced altitude, its average being only about 2000 ft. As the tableland runs northward it decreases both in height and width, until it narrows to a few miles only, with an elevation of scarcely 1500 ft.; under the name of the Blue Mountains the plateau widens again and increases in altitude, the chief peaks being Mount Clarence (4000 ft.), Mount Victoria (3525 ft.), and Mount Hay (3270 ft.). The Dividing Range decreases north of the Blue Mountains, until as a mere ridge it divides the waters of the coastal rivers from those flowing to the Darling. The mass widens out once more in the Liverpool Range, where the highest peak, Mount Oxley, reaches 4500 ft., and farther north, in the New England Range, Ben Lomond reaches an elevation of 5000 ft. Near the Queensland border, Mount Lindsay, in the Macpherson Range, rises to a height of 5500 ft. In the latitude of Brisbane the chain swerves inland; no other peak north of this reaches higher than Mount Bartle Frere in the Bellenden Ker Range (5438 ft.). The Southern Ocean system of the Victorian Dividing Range hardly attains to the dignity of high mountains. An eastern system in South Australia touches at a few points a height of 3000 ft.; and the Stirling Range, belonging to the south-western system of South Australia, reaches to 2340 ft. There are no mountains behind the Great Australian Bight. On the west the Darling Range faces the Indian Ocean, and extends from Point D'Entrecasteaux to the Murchison river. North of the Murchison, Mount Augustus and Mount Bruce, with their connecting highlands, cut off the coastal drainage from the interior; but no point on the north-west coast reaches a greater altitude than 4000 ft. Several minor ranges, the topography of which is little known, extend from Cambridge Gulf, behind a very much broken coast-line, to Limmen Bight on the Gulf of Carpentaria. Nothing is more remarkable than the contrast between the aspect of the coastal ranges on the north-east and on the south-east of the continent. The higher Australian peaks in the south-east look just what they are, the worn and denuded stumps of mountains, standing for untold ages above the sea. Their shoulders are lifted high above the tree-line. Their summits stand out gaunt and lonely in an unbroken solitude. Having left the tree-line far behind him, nothing is visible to the traveller for miles around but barren peaks and torn crags in indescribable confusion. A verdure of herbage clothes the valleys that have been scooped from the summits downwards. But there are no perpetual snow-fields, no glaciers creep down these valleys, and no alpine hamlets ever appear to break the monotony. The mountains of the north-east, on the contrary, are clothed to their summits with a rich and varied flora. Naked crags, when they do appear, lift themselves from a sea of green, and a tropical vegetation, quite Malaysian in character, covers everything.

The absence of active volcanoes in Australia is a state of things, in a geological sense, quite new to the continent. Some of the volcanoes of the western districts of Victoria have been in eruption probably subsequent to the advent of the black-fellow. In some instances the cones are quite intact, and the beds of ash and scoriae are as yet almost unaffected by denuding agencies. Late in the Tertiary period vast sheets of lava poured from many points of the Great Dividing Range of eastern Australia. But it is notable that all recent volcanic action was confined to a wide belt parallel to the coast. No evidences of recent lava flows can be found in the interior over the great alluvial plain, the Lower, or the Higher Steppes. Nor has the continent, as a whole, in recent times been subjected to any violent earth tremors; though in 1873, to the north of Lake Amadeus, in central Australia, Ernest Giles records the occurrence of earthquake shocks violent enough to dislodge considerable rock masses.

Australia possesses one mountain which, though not a volcano, is a "burning mountain." This is Mount Wingen, situated in a spur of the Liverpool Range and close to the town of Scone. Its fires are not volcanic, but result from the combustion of coal some distance underground, giving off much smoke and steam; geologists estimate that the burning has been going on for at least 800 years.

Rivers.

The coastal belt of Australia is everywhere well watered, with the exception of the country around the Great Australian Bight and Spencer Gulf. Flowing into the Pacific Ocean on the east coast there are some fine rivers, but the majority have short and rapid courses. In Queensland a succession of rivers falls into the Pacific from Cape York to the southern boundary of the state. The Burdekin is the finest of these, draining an area of 53,500 sq. m., and emptying into Upstart Bay; it receives numerous tributaries in its course, and carries a large body of fresh water even in the driest seasons. The Fitzroy river is the second in point of size; it drains an area of 55,600 sq. m., and receives several tributary streams during its course to Keppel Bay. The Brisbane river, falling into Moreton Bay, is important chiefly from the fact that the city of Brisbane is situated on its banks. In New South Wales there are several important rivers, the largest of which is the Hunter, draining 11,000 sq. m., and having a course of 200 m. Taking them from north to south, the principal rivers are the Richmond, Clarence, Macleay, Hastings, Manning, Hunter, Hawkesbury and Shoalhaven. The Snowy river has the greater part of its course in New South Wales, but its mouth and the last 120 m. are in Victoria. The other rivers worth mentioning are the Yarra, entering the sea at Port Phillip, Hopkins and Glenelg. The Murray (*q.v.*), the greatest river of Australia, debouches into Lake Alexandrina, and thence into the sea at Encounter Bay in South Australia. There are no other rivers of importance in South Australia, but the Torrens and the Gawler may be mentioned. Westward of South Australia, on the shores of the Australian Bight, there is a stretch of country 300 m. in length unpierced by any streams, large or small, but west of the bight, towards Cape Leeuwin, some small rivers enter the sea. The south-west coast is watered by a few streams, but none of any size; amongst these is the Swan, upon which Perth, the capital of Western Australia, is built. Between the Swan and North-West Cape the principal rivers are the Greenough, Murchison and Gascoyne; on the north-west coast, the Ashburton, Fortescue and De Grey; and in the Kimberley district, the Fitzroy, Panton, Prince Regent and the Ord. In the Northern Territory are several fine rivers. The Victoria river is navigable for large vessels for a distance of about 43 m. from the sea, and small vessels may ascend for another 80 m. The Fitzmaurice, discharging into the estuary of the Victoria, is also a large stream. The Daly, which in its upper course is called the Katherine, is navigable for a considerable distance, and small vessels are able to ascend over 100 m. The Adelaide, discharging into Adam Bay, has been navigated by large vessels for about 38 m., and small vessels ascend still farther. The South Alligator river, flowing into Van Diemen's Gulf, is also a fine stream, navigable for over 30 m. by large vessels; the East Alligator river, falling into the same gulf, has been navigated for 40 m. Besides those mentioned, there are a number of smaller rivers discharging on the north coast, and on the west shore of the Gulf of Carpentaria the Roper river discharges itself into Limmen Bight. The Roper is a magnificent stream, navigable for about 75 or 80 m. by vessels of the largest tonnage, and light draught vessels can ascend 20 m. farther. Along the portion of the south shore of the Gulf of Carpentaria which belongs to Queensland and the east coast, many large rivers discharge their waters, amongst them the Norman, Flinders, Leichhardt, Albert and Gregory on the southern shore, and the Batavia, Archer, Coleman, Mitchell, Staaten and Gilbert on the eastern shore. The rivers flowing into the Gulf of Carpentaria, as well as those in the Northern Territory, drain country which is subject to regular monsoonal rains, and have the general characteristics of sub-tropical rivers.

The network of streams forming the tributaries of the Darling and Murray system give an idea of a well-watered country. The so-called rivers have a strong flow only after heavy rains, and some of them do not ever reach the main drainage line. Flood waters disappear often within a distance of a few miles, being absorbed by porous soil, stretches of sand, and sometimes by the underlying bed-rocks. In many cases the rivers as they approach the main stream break up into numerous branches, or spread their waters over vast flats. This is especially the case with the tributaries of the Darling on its left bank, where in seasons of great rains these rivers overspread their banks and flood the flat country for miles around and thus reach the main stream. Lieutenant John Oxley went down the Lachlan (1817) during one of these periods of flood, and the great plains appeared to him to be the fringe of a vast inland sea. As a matter of fact, they are an alluvial deposit spread out by the same flood waters. The great rivers of Australia, draining inland, carve out valleys, dissolve limestone, and spread out their deposit over the plains when the waters become too sluggish to bear their burden

farther. From a geological standpoint, the Great Australian Plain and the fertile valley of the Nile have had a similar origin. Taking the Lachlan as one type of Australian river, we find it takes its rise amongst the precipitous and almost unexplored valleys of the Great Dividing Range. With the help of its tributaries it acts as a denuding agent for 14,000 sq. m. of country, and carries its burden of sediment westwards. A point is reached about 200 m. from the Dividing Range, where the river ceases to act as a denuding agent, and the area of deposition begins, at a level of 250 ft. above the sea, but before the waters can reach the ocean they have still to travel about 1000 m.

The Darling is reckoned amongst the longest rivers in the world, for it is navigable, part of the year, from Walgett to its confluence with the Murray, 1758 m., and then to the sea, a further distance of 587 m.—making in all 2345 m. of navigable water. But this gives no correct idea of the true character of the Darling, for it can hardly be said to drain its own watershed. From the sources of its various tributaries to the town of Bourke, the river may be described as draining a watershed. But from Bourke to the sea, 550 m. in a direct line, the river gives rather than receives water from the country it flows through.

The annual rainfall and the area of the catchment afford no measure whatever as to the size of a river in the interior of Australia. The discharge of the Darling river at Bourke does not amount to more than 10% of the rainfall over the country which it drains. It was this remarkable fact which first led to the idea that, as the rainfall could not be accounted for either by evaporation or by the river discharge, much of the 90% unaccounted for must sink into the ground, and in part be absorbed by some underlying bed-rock. All Australian rivers, except the Murray and the Murrumbidgee, depend entirely and directly on the rainfall. They are flooded after rain, and in seasons of drought many of them, especially the tributaries of the Darling, become chains of ponds. Springs which would equalize the discharge of rivers by continuing to pour water into their beds after the rainy season has passed seem entirely absent in the interior. Nor are there any snowfields to feed rivers, as in the other continents. More remarkable still, over large tracts of country the water seems disposed to flow away from, rather than to, the river-beds. As the low-lying plains are altogether an alluvial deposit, the coarser sediments accumulate in the regions where the river first overflows its banks to spread out over the plains. The country nearest the river receiving the heaviest deposit becomes in this way the highest ground, and so continues until a “break-away” occurs, when a new river-bed is formed, and the same process of deposition and accumulation is repeated. As the general level of the country is raised by successive alluvial deposits, the more ancient river-beds become buried, but being still connected with the newer rivers at some point or other, they continue to absorb water. This underground network of old river-beds underlying the great alluvial plains must be filled to repletion before flood waters will flow over the surface. It is not surprising, therefore, that comparatively little of the rainfall over the vast extent of the great central plain ever reaches the sea by way of the river systems; indeed these systems as usually shown on the maps leave a false impression as to the actual condition of things.

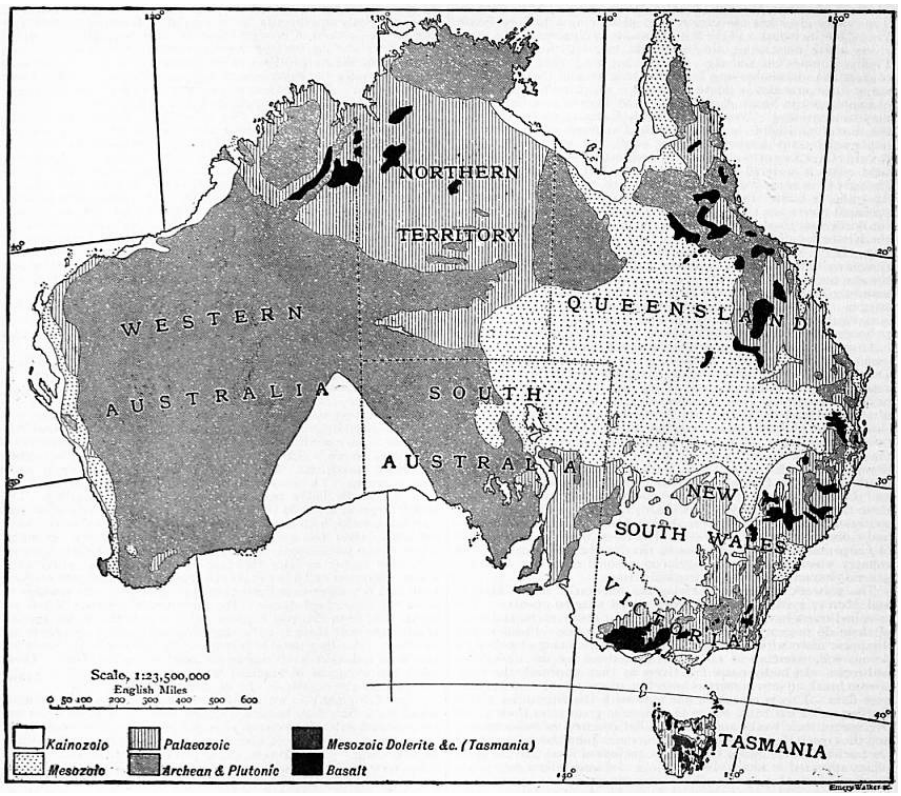
Steppes.

The great alluvial plain is one of Australia’s most notable inland features; its extent is upwards of 500,000 sq. m., lying east of 135° W. and extending right across the continent from the Gulf of Carpentaria to the Murray river. The interior of the continent west of 135° and north of the Musgrave ranges is usually termed by geographers the Australian Steppes. It is entirely different in all essential features from the great alluvial plains. Its prevailing aspect is characterized by flat and terraced hills, capped by desert sandstone, with stone-covered flats stretching over long distances. The country round Lake Eyre, where some of the land is actually below sea-level, comes under this heading. The higher steppes, as far as they are known, consist of Ordovician and Cambrian rocks, with an average elevation of 1500 to 3000 ft. above sea-level. Over this country water-courses are shown on maps. These run in wet seasons, but in every instance for a short distance only, and sooner or later they are lost in sand-hills, where their waters disappear and a line of stunted gum-trees (*Eucalyptus rostrata*) is all that is present to indicate that there may be even a soakage to mark the abandoned course. The steppes cover a surface of 400,000 sq. m., and from this vast expanse not a drop of the scanty rainfall reaches the sea; there is no leading drainage system and there are no rivers. Another notable feature of the interior is the so-called lake area, a district stretching to the north of Spencer Gulf. These lakes are expanses of brackish waters that spread or contract as the season is one of drought or rain. In seasons of drought they are hardly more than swamps and mud flats, which for a time may become a grassy plain, or desolate coast encrusted with salt. The country around is the dreariest imaginable, the surface is a dead level, there is no heavy timber and practically no settlement. Lake Torrens, the largest of these depressions, sometimes forms a sheet of water 100 m. in length. To the north again stretches Lake Eyre, and to the west Lake Gairdner. Some of these lake-beds are at or slightly below sea-level, so that a very slight depression of the land to the south of them would connect much of the interior with the Southern Ocean.

Lakes.

(T. A. C.)

Geology.—The states of Australia are divided by natural boundaries, which separate geographical areas having different characters, owing, mainly, to their different geological structures. Hence the general stratigraphical geology can be most conveniently summarized for each state separately, dealing here with the geological history of Australia as a whole. Australia is essentially the fragment of a great plateau land of Archean rocks. It consists in the main of an Archean block or “coign,” which still occupies nearly the whole of the western half of the continent, outcrops in north-eastern Queensland, forms the foundation of southern New South Wales and eastern Victoria, and is exposed in western Victoria, in Tasmania, and in the western flank of the Southern Alps of New Zealand. These areas of Archean rocks were doubtless once continuous. But they have been separated by the foundering of the Coral Sea and the Tasman Sea, which divided the continent of Australia from the islands of the Australasian festoon; and the foundering of the band across Australia, from the Gulf of Carpentaria, through western Queensland and western New South Wales, to the lower basin of the Murray, has separated the Archean areas of eastern and western Australia. The breaking up of the old Archean foundation block began in Cambrian and Ordovician times. A narrow Cambrian sea must have extended across central Australia from the Kimberley Goldfield in the north-west, through Tempe Downs and the Macdonnell chain in central Australia, to the South Australian highlands, central Victoria at Mansfield, and northern Tasmania. Cambrian rocks occur in each of these districts, and they are best developed in the South Australian highlands, where they include a long belt of contemporary glacial deposits. Marine Ordovician rocks were deposited along the same general course. They are best developed in the Macdonnell chain in central Australia and in Victoria, where the fullest sequence is known; while they also extended north-eastward from Victoria into New South Wales, where, as yet, no Cambrian rocks have been found. The Silurian system was marked by the retreat of the sea from central Australia; but the sea still covered a band across Victoria, from the coast to the Murray basin, passing to the east of Melbourne. This Silurian sea was less extensive than the Ordovician in Victoria; but it appears to have been wider in New South Wales and in Queensland. The best Silurian sequence is in New South Wales. Silurian rocks are well developed in western Tasmania, and the Silurian sea must have washed the south-western corner of the continent, if the rocks of the Stirling Range be rightly identified as of this age.



The Devonian system includes a complex series of deposits, which are of most interest in eastern Australia. This period was marked by intense earth movements, which affected the whole of the east Australian highlands. The Lower Devonian beds are in the main terrestrial, or coarse littoral deposits, and volcanic rocks. The Middle Devonian was marked by the same great transgression as in Europe and America; it produced inland seas, extending into Victoria, New South Wales and Queensland, in which were deposited limestones with a rich coral fauna. The Upper Devonian was a period of marine retreat; the crustal disturbances of the Lower Devonian were renewed and great quartz-pebble beaches were formed on the rising shore lines, producing the West Coast Range conglomerates of Tasmania, and the similar rocks to the south-east of Mansfield in Victoria. Intrusions of granitic *massifs* in the Devonian period formed the primitive mountain axis of Victoria, which extends east and west across the state and forms the nucleus of the Victorian highlands. Similar granitic intrusions occurred in New South Wales and Queensland, and built up a mountain chain, which ran north and south across the continent; its worn-down stumps now form the east Australian highlands.

The Carboniferous period began with a marine transgression, enabling limestones to form in Tasmania and New South Wales; and at the same time the sea first got in along the western edge of the western plateau, depositing the Carboniferous rocks of the Gascoyne basin and the coastal plain of north-western Australia. The Upper Carboniferous period was in the main terrestrial, and during it were laid down the coal-seams of New South Wales; they are best developed in the basin of the Hunter river, and they extend southward, covered by Mesozoic deposits, beyond Sydney. The Coal Measures become narrower in the south, until, owing to the eastward projection of the highlands, the Lower Palaeozoic rocks reach the coast. The coal-seams must have been formed in well-watered, lowland forests, at the foot of a high mountain range, built up by the Devonian earth movements. The mountains both in Victoria and New South Wales were snow-capped, and glaciers flowed down their flanks and laid down Carboniferous glacial deposits, which are still preserved in basins that flank the mountain ranges, such as the famous conglomerates of Bacchus Marsh, Heathcote and the Loddon valley in Victoria, and of Branxton and other localities in New South Wales. The age of the glacial deposits is later than the *Glossopteris* flora and occurs early in the time of the *Gangamopteris* flora. Kitson's work in Tasmania shows that there also the glacial beds may be correlated with the lower or Greta Coal Measures of New South Wales.

The Permian deposits are best developed in New South Wales and Tasmania, where their characters show the continuation of the Carboniferous conditions. The Mesozoic begins with a Triassic land period in the mainland of Australia; while the islands of the Australasian festoon contain the Triassic marine limestones, which fringe the whole of the Pacific. The Triassic beds are best known in New South Wales, where round Sydney they include a series of sandstones and shales. They also occur in northern Tasmania.

The Jurassic system is represented by two types. In Victoria, Tasmania, northern New South Wales and Queensland, there are Jurassic terrestrial deposits, containing the coal seams of Victoria, of the Clarence basin of north-eastern New South Wales, and of the Ipswich series in Queensland; the same beds range far inland on the western slopes of the east Australian highlands in New South Wales and Queensland and they occur, with coal-seams, at Leigh's Creek, at the northern foot of the South Australian highlands. They are also preserved in basins on the western plateau, as shown by brown coal deposits passed through in the Lake Phillipson bore. The second and marine type of the Jurassics occurs in Western Australia, on the coastal plain skirting the western foot of the western plateau.

The Cretaceous period was initiated by the subsidence of a large area to the south of the Gulf of Carpentaria, whereby a Lower Cretaceous sea spread southward, across western Queensland, western New South Wales and the north-eastern districts of South Australia. In this sea were laid down the shales of the Rolling Downs formation. The sea does not appear to have extended completely across Australia, breaking it into halves, for a projection from the Archean plateau of Western Australia extended as far east as the South Australian highlands, and thence probably continued eastward, till it joined the Victorian highlands. The Cretaceous sea gradually receded and the plains of the Rolling Downs formation formed on its floor were covered by the sub-aerial and lacustrine deposits of the Desert Sandstone.

The Kainozoic period opened with fresh earth movements, the most striking evidence of which are the volcanic outbreaks all round the Australian coasts. These movements in the south-east formed the Great Valley of Victoria, which traverses nearly the whole of the state between the Victorian highlands to the north, and the Jurassic sandstones of the Otway Ranges and the hills of south Gippsland. In this valley were laid down, either in Eocene or Oligocene times, a great series of lake beds and thick accumulations of brown coal. Similar deposits, of approximately the same age, occur in Tasmania and New Zealand; and at about the same time there began the Kainozoic volcanic period of Australasia. The first eruptions piled up huge domes of lavas rich in soda, including the geburite-dacites and sölvsbergites of Mount Macedon in Victoria, and the kenyte and tephrite domes of Dunedin, in New Zealand. These rocks were followed by the outpouring of the extensive older basalts in the Great Valley of Victoria and on the highlands of eastern Victoria, and also in New South Wales and Queensland. Then followed a marine transgression along most of the southern coast of Australia. The sea encroached far on the land from the Great Australian Bight and there formed the limestones of the Nullarbor Plains. The sea extended up the Murray basin into the western plains of New South Wales. Farther east the sea was interrupted by the still existing land-connexion between Tasmania and Victoria; but beyond it, the marine deposits are found again, fringing the coasts of eastern Gippsland and Croajingolong. These marine deposits are not found anywhere along the eastern coast of Australia; but they occur, and reach about the same height above sea-level, in New Guinea, and are widely developed in New Zealand. No doubt eastern Australia then extended far out into the Tasman Sea. The great monoclinal fold which formed the eastern face of the east Australian highlands, west of Sydney, is of later age. After this marine period was brought to a close the sea retreated. Tasmania and Victoria were separated by the foundering of Bass Strait, and at the same time the formation of the rift valley of Spencer Gulf, and Lake Torrens, isolated the South

Australian highlands from the Eyre Peninsula and the Westralian plateau. Earth movements are still taking place both along Bass Strait and the Great Valley of South Australia, and apparently along the whole length of the southern coast of Australia.

The Flowing Wells of Central Australia.—The clays of the Rolling Downs formation overlie a series of sands and drifts, saturated with water under high pressure, which discharges at the surface as a flowing well, when a borehole pierces the impermeable cover. The first of these wells was opened at Kallara in the west of New South Wales in 1880. In 1882, Dr W.L. Jack concluded that western Queensland might be a deep artesian basin. The Blackhall bore, put down at his advice from 1885 to 1888, reached a water-bearing layer at the depth of 1645 ft. and discharged 291,000 gallons a day. It was the first of the deep artesian wells of the continent. As the plains on the Rolling Downs formation are mostly waterless, the discovery of this deep reservoir of water has been of great aid in the development of central Australia. In Queensland to the 30th of June 1904, 973 wells had been sunk, of which 596 were flowing wells, and the total flow was 62,635,722 cub. ft. a day. The deepest well is that at Whitewood, 5046 ft. deep. In New South Wales by the 30th of June 1903, the government had put down 101 bores producing 66 flowing wells and 22 sub-artesian wells, with a total discharge of 54,000,000 gallons a day; and there were also 144 successful private wells. In South Australia there are 38 deep bores, from 20 of which there is a flow of 6,250,000 gallons a day.

The wells were first called artesian in the belief that the ascent of the water in them was due to the hydrostatic pressure of water at a higher level in the Queensland hills. The well-water was supposed to have percolated underground, through the Blythesdale Braystone, which outcrops in patches on the eastern edge of the Rolling Downs formation. But the Blythesdale Braystone is a small local formation, unable to supply all the wells that have been sunk; and many of the wells derive their water from the Jurassic shales and mudstones. The difference in level between the outcrop of the assumed eastern intake and of the wells is often so small, in comparison with their distance apart, that the friction would completely sop up the whole of the available hydrostatic head. Many of the well-waters contain gases; thus the town of Roma is lighted by natural gas which escapes from its well. The chemical characters of the well-waters, the irregular distribution of the water-pressure, the distribution of the underground thermal gradients, and the occurrence in some of the wells of a tidal rise and fall of a varying period, are facts which are not explained on the simple hydrostatic theory. J.W. Gregory has maintained (*Dead Heart of Australia*, 1906, pp. 273-341) that the ascent of water in these wells is due to the tension of the included gases and the pressure of overlying sheets of rocks, and that some of the water is of plutonic origin.[1]

(J. W. G.)

Climate.—The Australian continent, extending over 28° of latitude, might be expected to show a considerable diversity of climate. In reality, however, it experiences fewer climatic variations than the other great continents, owing to its distance (28°) from the Antarctic circle and (11°) from the equator. There is, besides, a powerful determining cause in the uniform character and undivided extent of its dry interior. The plains and steppes already described lie either within or close to the tropics. They present to the fierce play of the sun almost a level surface, so that during the day that surface becomes intensely heated and at night gives off its heat by radiation. Ordinarily the alternate expansion and contraction of the atmosphere which takes place under such circumstances would draw in a supply of moisture from the ocean, but the heated interior, covering some 900,000 sq. m., is so immense, that the moist air from the ocean does not come in sufficient supply, nor are there mountain chains to intercept the clouds which from time to time are formed; so that two-fifths of Australia, comprising a region stretching from the Australian Bight to 20° S. and from 117° to 142° E., receives less than an average of 10 in. of rain throughout the year, and a considerable portion of this region has less than 5 in. No part of Victoria and very little of Queensland and New South Wales lie within this area. The rest of the continent may be considered as well watered. The north-west coast, particularly the portions north of Cambridge Gulf and the shores of the Gulf of Carpentaria, are favoured with an annual visitation of the monsoon from December to March, penetrating as far as 500 m. into the continent, and sweeping sometimes across western and southern Queensland to the northern interior of New South Wales. It is this tropical downpour that fills and floods the rivers flowing into Lake Eyre and those falling into the Darling on its right bank. The whole of the east coast of the continent is well watered. From Cape York almost to the tropic of Capricorn the rainfall exceeds 50 in. and ranges to over 70 in. At Brisbane the fall is 50 in., and portions of the New South Wales coast receive a like quantity, but speaking generally the fall is from 30 in. to 40 in. The southern shores of the continent receive much less rain. From Cape Howe to Melbourne the fall may be taken at from 30 in. to 40 in., Melbourne itself having an average of 25.6 in. West of Port Phillip the fall is less, averaging 20 in. to 30 in., diminishing greatly away from the coast. Along the shores of Encounter Bay and St Vincent and Spencer Gulfs, the precipitation ranges from 10 to 20 in., the yearly rainfall at Adelaide is a little less than 21 in., while the head of Spencer Gulf is within the 5 to 10 in. district. The rest of the southern coast west as far as 124° E., with the exception of the southern projection of Eyre Peninsula, which receives from 10 to 20 in., belongs to the district with from 5 to 10 in. annual rainfall. The south-western angle of the continent, bounded by a line drawn diagonally from Jurien river to Cape Riche, has an average of from 30 to 40 in. annual rainfall, diminishing to about 20 to 30 in. in the country along the diagonal line. The remainder of the south and west coast from 124° E. to York Sound in the Kimberley district for a distance of some 150 m. inland has a fall ranging from 10 to 20 in. The 10 to 20 in. rainfall band circles across the continent through the middle of the Northern Territory, embraces the entire centre and south-west of Queensland, with the exception of the extreme south-western angle of the state, and includes the whole of the interior of New South Wales to a line about 200 m. from the coast, as well as the western and northern portions of Victoria and South Australia south of the Murray.

The area of Australia subject to a rainfall of from 10 to 20 in. is 843,000 sq. m. On the seaward side of this area in the north and east is the 20 to 30 in. annual rainfall area, and still nearer the sea are the exceptionally well-watered districts. The following table shows the area of the rainfall zones in square miles:—

Rainfall.	Rainfall Area in sq. m.
Under 10 inches	1,219,600
10 to 20 ”	843,100
20 to 30 ”	399,900
30 to 40 ”	225,700
40 to 50 ”	140,300
50 to 60 ”	47,900
60 to 70 ”	56,100
Over 70 ”	14,100
Total	2,946,700

The tropic of Capricorn divides Australia into two parts. Of these the northern or intertropical portion contains 1,145,000 sq. m., comprising half of Queensland, the Northern Territory, and the north-western divisions of Western Australia. The whole of New South Wales, Victoria and South Australia proper, half of Queensland, and more than half of Western Australia, comprising 1,801,700 sq. m., are without the tropics. In a region so extensive very great varieties of climate are naturally to be expected, but it may be stated as a general law that the climate of Australia is milder than that of corresponding lands in the northern hemisphere. During July, which is the coldest month in southern latitudes, one-half of Australia has a mean temperature ranging from 45° to 61°, and the other half from 62° to 80°. The following are the areas subject to the various average temperatures during the month referred to:—

Temperature Fahr.	Area in sq. m.
45°-50°	18,800
50°-55°	506,300
55°-60°	681,800
60°-65°	834,400
65°-70°	515,000
70°-75°	275,900
75°-80°	24,500

The temperature in December ranges from 60° to above 95° Fahr., half of Australia having a mean temperature below 84°. Dividing the land into zones of average summer temperature, the following are the areas which would fall to each:—

Temperature Fahr.	Area in sq. m.
60°-65°	67,800
65°-70°	63,700
70°-75°	352,300
75°-80°	439,200

80°-85°	733,600
85°-90°	570,600
90°-95°	584,100
95° and over	135,400

Judging from the figures just given, it must be conceded that a considerable area of the continent is not adapted for colonization by European races. The region with a mean summer temperature in excess of 95° Fahr. is the interior of the Northern Territory north of the 20th parallel; and the whole of the country, excepting the seaboard, lying between the meridians of 120° and 140°, and north of the 25th parallel, has a mean temperature in excess of 90° Fahr.

Queensland.

The area of Australia is so large that the characteristics of its climate will not be understood without reference to the individual states. About one-half of the colony of Queensland lies in the tropics, the remaining area lying between the tropic and 29° S. The temperature, however, has a daily range less than that of other countries under the same isothermal lines. This circumstance is due to the sea-breezes, which blow with great regularity, and temper what would otherwise be an excessive heat. The hot winds which prevail during the summer in some of the other colonies are unknown in Queensland. Of course, in a territory of such large extent there are many varieties of climate, and the heat is greater along the coast than on the elevated lands of the interior. In the northern parts of the colony the high temperature is very trying to persons of European descent. The mean temperature at Brisbane, during December, January and February, is about 76°, while during the months of June, July and August it averages about 60°. Brisbane, however, is situated near the extreme southern end of the colony, and its average temperature is considerably less than that of many of the towns farther north. Thus the winter in Rockhampton averages nearly 65°, while the summer heat rises almost to 85°; and at Townsville and Normanton the average temperature is still higher. The average rainfall along the coast is high, especially in the north, where it ranges from 60 to 70 in. per annum, and along a strip of country south from Cape Melville to Rockingham Bay the average rainfall exceeds 70 in. At Brisbane the rainfall is about 50 in., taking an average of forty years. A large area of the interior is watered to the extent of 20 to 30 in. per annum, but in the west and south, more remote than from 250 to 300 m., there is a rainfall of less than 20 in.

New South Wales.

Climatically, New South Wales is divided into three marked divisions. The coastal region has an average summer temperature ranging from 78° in the north to 67° in the south, with a winter temperature of from 59° to 52°. Taking the district generally, the difference between the mean summer and mean winter temperatures may be set down as averaging not more than 20°, a range smaller than is found in most other parts of the world. Sydney, situated in latitude 33° 51′ S., has a mean temperature of 62.9° Fahr., which corresponds with that of Barcelona in Spain and of Toulon in France, the former of these being in latitude 41° 22′ N. and the latter in 43° 7′ N. At Sydney the mean summer temperature is 70.8° Fahr., and that of winter 53.9°. The range is thus 16.9° Fahr. At Naples, where the mean temperature for the year is about the same as at Sydney, the summer temperature reaches a mean of 74.4°, and the mean of winter is 47.6°, with a range 26.8°. The mean temperature of Sydney for a long series of years was spring 62°, summer 71°, autumn 64°, winter 54°.

Passing from the coast to the tableland, a distinct climatic region is entered. Cooma, with a mean summer temperature of 65.4°, and a mean winter temperature of 41.4°, may be taken as illustrative of the climate of the southern tableland, and Armidale of the northern. The yearly average temperature of the latter is scarcely 65.5°, while the summer only reaches 67.7°, and the winter falls to 44.4°.

The climatic conditions of the western districts of the state are entirely different from those of the other two regions. The summer is hot, but on the whole the climate is very healthy. The town of Bourke, lying on the upper Darling, may be taken as an example of many of the interior districts, and illustrates peculiarly well the defects as well as the excellencies of the climate of the whole region. Bourke has exactly the same latitude as Cairo, yet its mean summer temperature is 1.3° less, and its mean annual temperature 4° less than that of the Egyptian city. New Orleans, also on the same parallel, is 4° hotter in summer. As regards winter temperature Bourke leaves little to be desired. The mean winter reading of the thermometer is 54.7, and accompanied as this is by clear skies and an absence of snow, the season is both pleasant and invigorating. The rainfall of New South Wales ranges from an annual average of 64 in. at various points on the northern coast, and at Kiandra in the Monaro district, to 9 in. at Milparinka in the trans-Darling district. The coastal districts average about 42 in. per annum, the tablelands 32 in., and the western interior has an average as low as 20 in. At Sydney, the average rainfall, since observations were commenced, has been 50 in.

Victoria.

The climate of Victoria does not differ greatly from that of New South Wales. The heat, however, is generally less intense in summer, and the cold greater in winter. Melbourne, which stands in latitude 37° 50′ S., has a mean temperature of 57.3°, and therefore corresponds with Washington in the United States, Madrid, Lisbon and Messina. The difference between summer and winter is, however, less at Melbourne than at any of the places mentioned, the result of a long series of observations being spring 57°, summer 65.3°, autumn 58.7°, and winter 49.2°. The highest recorded temperature in the shade at Melbourne is 110.7°, and the lowest 27°, but it is rare for the summer heat to exceed 85°, or for the winter temperature in the daytime to fall below 40°. Ballarat, the second city of Victoria, lies above 100 m. west from Melbourne at a height of 1400 ft. above sea-level. It has a minimum temperature of 29°, and a maximum of 104.5°, the average yearly mean being 54.1°. The rainfall of Melbourne averages 25.58 in., the mean number of rainy days being 131.

South Australia.

South Australia proper extends over 26 degrees of latitude, and naturally presents considerable variations of climate. The coldest months are June, July and August, during which the temperature is very agreeable, averaging 53.6°, 51.7°, and 54° in those months respectively. On the plains slight frosts occur occasionally, and ice is sometimes seen on the highlands. In summer the sun has great power, and the temperature reaches 100° in the shade, with hot winds blowing from the interior. The weather on the whole is remarkably dry. At Adelaide there are on an average 120 rainy days per annum, with a mean rainfall of 20-88 in. The country is naturally very healthful, as evidence of which may be mentioned that no great epidemic has ever visited the state.

Western Australia.

Western Australia has practically only two seasons, the winter or wet season, which commences in April and ends in October, and the summer or dry season, which comprises the remainder of the Year. During the wet season frequent and heavy rains fall, and thunderstorms, with sharp showers, occur in the summer, especially on the north-west coast, which is sometimes visited by hurricanes of great violence. In the southern and early-settled parts of the state the mean temperature is about 64°, but in the more northern portions the heat is excessive, though the dryness of the atmosphere makes it preferable to moist tropical climates. The average rainfall at Perth is 33 in. per annum.

The climate of the Northern Territory is extremely not, except on the elevated tablelands; altogether, the temperature of this part of the continent is very similar to that of northern Queensland, and the climate is not favourable to Europeans. The rainfall in the extreme north, especially in January and February, is very heavy, and the annual average along the coast is about 63 in. The whole of the peninsula north of 15° S. has a rainfall considerably exceeding 40 in. This region is backed by a belt of about 100 m. wide, in which the rainfall is from 30 to 40 in., from which inwards the rainfall gradually declines until between Central Mount Stuart and Macdonnell ranges it falls to between 5 and 10 in.

Fauna and Flora.—The origin of the fauna and flora of Australia has attracted considerable attention. Much accumulated evidence, biological and geological, has pointed to a southern extension of India, an eastern extension of South Africa, and a western extension of Australia into the Indian Ocean. The comparative richness of proteaceous plants in Western Australia and South Africa first suggested a common source for these primitive types. Dr H.O. Forbes drew attention to a certain community amongst birds and other vertebrates, invertebrates, and amongst plants, on all the lands stretching towards the south pole. A theory was therefore propounded that these known types were all derived from a continent which has been named Antarctica. The supposed continent extended across the south pole, practically joining Australia and South America. Just as we have evidence of a former mild climate in the arctic regions, so a similar mild climate has been postulated for Antarctica. Modern naturalists consider that many of the problems of Australia’s remarkable fauna and flora can be best explained by the following hypothesis:—The region now covered by the antarctic ice-cap was in early Tertiary times favoured by a mild climate; here lay an antarctic continent or archipelago. From an area corresponding to what is now South America there entered a fauna and flora, which, after undergoing modification, passed by way of Tasmania to Australia. These immigrants then developed, with some exceptions, into the present Australian flora and fauna. This theory has advanced from the position of a disparaged heresy to acceptance by leading thinkers. The discovery as fossil, in South America, of primitive or ancestral forms of marsupials has given it much support. One of these, *Prothylacinus*, is regarded as the forerunner of the marsupial wolf of Tasmania. An interesting link between divergent marsupial families, still living in Ecuador, the *Coenolestes*, is another discovery of recent years. On the Australian side the fact that Tasmania is richest in marsupial types indicates the gate by which they entered. It is not to be supposed that this antarctic element, to which Professor Tate has applied the name *Euronotian*, entered a desert barren of all life. Previous to its arrival Australia doubtless possessed considerable vegetation and a scanty fauna, chiefly invertebrate. At a comparatively recent date Australia received its third and newest constituent. The islands of Torres Strait have been shown to be

the denuded remnant of a former extension of Cape York peninsula in North Queensland. Previous to the existence of the strait, and across its site, there poured into Australia a wealth of Papuan forms. Along the Pacific slope of the Queensland Cordillera these found in soil and climate a congenial home. Among the plants the wild banana, pepper, orange and mangosteen, rhododendron, epiphytic orchids and the palm; among mammals the bats and rats; among birds the cassowary and rifle birds; and among reptiles the crocodile and tree snakes, characterize this element. The numerous facts, geological, geographical and biological, which when linked together lend great support to this theory, have been well worked out in Australia by Mr Charles Hedley of the Australian Museum, Sydney.

Fauna.

The zoology of Australia and Tasmania presents a very conspicuous point of difference from that of other regions of the globe, in the prevalence of non-placental mammalia. The vast majority of the mammalia are provided with an organ in the uterus, by which, before the birth of their young, a vascular connexion is maintained between the embryo and the parent animal. There are two orders, the Marsupialia and the Monotremata, which do not possess this organ; both these are found in Australia, to which region indeed they are not absolutely confined.

The geographical limits of the marsupials are very interesting. The opossums of America are marsupials, though not showing anomalies as great as kangaroos and bandicoots (in their feet), and *Myrmecobius* (in the number of teeth). Except the opossums, no single living marsupial is known outside the Australian zoological region. The forms of life characteristic of India and the Malay peninsula come down to the island of Bali. Bali is separated from Lombok by a strait not more than 15 m. wide. Yet this narrow belt of water is the boundary line between the Australasian and the Indian regions. The zoological boundary passing through the Bali Strait is called “Wallace’s line,” after the eminent naturalist who was its discoverer. He showed that not only as regards beasts, but also as regards birds, these regions are thus sharply limited. Australia, he pointed out, has no woodpeckers and no pheasants, which are widely-spread Indian birds. Instead of these it has mound-making turkeys, honey-suckers, cockatoos and brush-tongued lories, all of which are found nowhere else in the world.

The marsupials constitute two-thirds of all the Australian species of mammals. It is the well-known peculiarity of this order that the female has a pouch or fold of skin upon her abdomen, in which she can place the young for suckling within reach of her teats. The opossum of America is the only species out of Australasia which is thus provided. Australia is inhabited by at least 110 different species of marsupials, which is about two-thirds of the known species; these have been arranged in five tribes, according to the food they eat, viz., the grass-eaters (kangaroos), the root-eaters (wombats), the insect-eaters (bandicoots), the flesh-eaters (native cats and rats), and the fruit-eaters (phalangers).

The kangaroo (*Macropus*) lives in droves in the open grassy plains. Several smaller forms of the same general appearance are known as wallabies, and are common everywhere. The kangaroo and most of its congeners show an extraordinary disproportion of the hind limbs to the fore part of the body. The rock wallabies again have short tarsi of the hind legs, with a long pliable tail for climbing, like that of the tree kangaroo of New Guinea, or that of the jerboa. Of the larger kangaroos, which attain a weight of 200 lb and more, eight species are named, only one of which is found in Western Australia. Fossil bones of extinct kangaroo species are met with; these kangaroos must have been of enormous size, twice or thrice that of any species now living.

There are some twenty smaller species in Australia and Tasmania, besides the rock wallabies and the hare kangaroos; these last are wonderfully swift, making clear jumps 8 or 10 ft. high. Other terrestrial marsupials are the wombat (*Phascolomys*), a large, clumsy, burrowing animal, not unlike a pig, which attains a weight of from 60 to 100 lb; the bandicoot (*Perameles*), a rat-like creature whose depredations annoy the agriculturist; the native cat (*Dasyurus*), noted robber of the poultry yard; the Tasmanian wolf (*Thylacinus*), which preys on large game; and the recently discovered *Notoryctes*, a small animal which burrows like a mole in the desert of the interior. Arboreal species include the well-known opossums (*Phalanger*); the extraordinary tree-kangaroo of the Queensland tropics; the flying squirrel, which expands a membrane between the legs and arms, and by its aid makes long sailing jumps from tree to tree; and the native bear (*Phascolarctos*), an animal with no affinities to the bear, and having a long soft fur and no tail.

The *Myrmecobius* of Western Australia is a bushy-tailed ant-eater about the size of a squirrel, and from its lineage and structure of more than passing interest. It is, Mivart remarks, a survival of a very ancient state of things. It had ancestors in a flourishing condition during the Secondary epoch. Its congeners even then lived in England, as is proved by the fact that their relics have been found in the Stonesfield oolitic rocks, the deposition of which is separated from that which gave rise to the Paris Tertiary strata by an abyss of past time which we cannot venture to express even in thousands of years.

We pass on to the other curious order of non-placental mammals, that of the Monotremata, so called from the structure of their organs of evacuation with a single orifice, as in birds. Their abdominal bones are like those of the marsupials; and they are furnished with pouches for their young, but have no teats, the milk being distilled into their pouches from the mammary glands. Australia and Tasmania possess two animals of this order—the echidna, or spiny ant-eater (hairy in Tasmania), and the *Platypus anatinus*, the duckbilled water mole, otherwise named the *Ornithorhynchus paradoxus*. This odd animal is provided with a bill or beak, which is not, like that of a bird, affixed to the skeleton, but is merely attached to the skin and muscles.

Australia has no apes, monkeys or baboons, and no ruminant beasts. The comparatively few indigenous placental mammals, besides the dingo or wild dog—which, however, may have come from the islands north of this continent—are of the bat tribe and of the rodent or rat tribe. There are four species of large fruit-eating bats, called flying foxes, twenty of insect-eating bats, above twenty of land-rats, and five of water-rats. The sea produces three different seals, which often ascend rivers from the coast, and can live in lagoons of fresh water; many cetaceans, besides the “right whale” and sperm whale; and the dugong, found on the northern shores, which yields a valuable medicinal oil.

The birds of Australia in their number and variety of species may be deemed some compensation for its poverty of mammals; yet it will not stand comparison in this respect with regions of Africa and South America in the same latitudes. The black swan was thought remarkable when discovered, as belying an old Latin proverb. There is also a white eagle. The vulture is wanting. Sixty species of parrots, some of them very handsome, are found in Australia. The emu corresponds with the African and Arabian ostrich, the rhea of South America, and the cassowary of the Moluccas and New Guinea. In New Zealand this group is represented by the apteryx, as it formerly was by the gigantic moa, the remains of which have been found likewise in Queensland. The graceful *Menura superba*, or lyre-bird, with its tail feathers spread in the shape of a lyre, is a very characteristic form. The mound-raising megapodes, the bower-building satin-birds, and several others, display peculiar habits. The honey-eaters present a great diversity of plumage. There are also many kinds of game birds, pigeons, ducks, geese, plovers and quails. The ornithology of New South Wales and Queensland is more varied and interesting than that of the other provinces.

As for reptiles, Australia has a few tortoises, all of one family, and not of great size. The “leathery turtle,” which is herbivorous, and yields abundance of oil, has been caught at sea off the Illawarra coast so large as 9 ft. in length. The saurians or lizards are numerous, chiefly on dry sandy or rocky ground in the tropical region. The great crocodile of Queensland has been known to attain a length of 30 ft.; there is a smaller one about 6 ft. in length to be met with in the shallow lagoons of the interior of the Northern Territory. Lizards occur in great profusion and variety. The monitor, or fork-tongued lizard, which burrows in the earth, climbs and swims, is said to grow to a length of 8 to 9 ft. This species and many others do not extend to Tasmania. The monitor is popularly known as the goanna, a name derived from the iguana, an entirely different animal. There are about twenty kinds of night-lizards, and many which hibernate. One species can utter a cry when pained or alarmed, and the tall-standing frilled lizard can lift its forelegs, and squat or hop like a kangaroo. There is also the *Moloch horridus* of South and Western Australia, covered with tubercles bearing large spines, which give it a very strange aspect. This and some other lizards have power to change their colour, not only from light to dark, but over some portions of their bodies, from yellow to grey or red. Frogs of many kinds are plentiful, the brilliant green frogs being especially conspicuous and noisy. Australia is rich in snakes, and has more than a hundred different kinds. Most of these are venomous, but all are not equally dreaded. Five rather common species are certainly deadly—the death adder, the brown, the black, the superb and the tiger snakes. During the colder months these reptiles remain in a torpid state. No certain cure has been or is likely to be discovered for their poison, but in less serious cases strychnine has been used with advantage. In tropical waters a sea snake is found, which, though very poisonous, rarely bites. Among the inoffensive species are counted the graceful green “tree snake,” which pursues frogs, birds and lizards to the topmost branches of the forest; also several species of pythons, the commonest of which is known as the carpet snake. These great reptiles may attain a length of 10 ft.; they feed on small animals which they crush to death in their folds.

The Australian seas are inhabited by many fishes of the same genera as exist in the southern parts of Asia and Africa. Of those peculiar to Australian waters may be mentioned the arripis, represented by what is called among the colonists a salmon trout. A very fine freshwater fish is the Murray cod, which sometimes weighs 100 lb; and the golden perch, found in the same river, has rare beauty of colour. Among the sea fish, the schnapper is of great value as an article of food, and its weight comes up to 50 lb This is the *Pagrus unicolor*, of the family of *Sparidae*, which includes also the bream. Its colours are beautiful, pink and red with a silvery gloss; but the male as it grows old takes on a singular deformity of the head, with a swelling in the shape of a monstrous human-like nose. These fish frequent rocky shoals off the eastern coast and are caught in numbers outside Port Jackson for the Sydney market. Two species of mackerel, differing somewhat from the European species, are also caught on the coasts. The so-called red garnet, a pretty fish, with

hues of carmine and blue stripes on its head, is much esteemed for the table. The *Trigla polyommata*, or flying garnet, is a greater beauty, with its body of crimson and silver, and its large pectoral fins, spread like wings, of a rich green, bordered with purple, and relieved by a black and white spot. Whiting, mullet, gar-fish, rock cod and many others known by local names, are in the lists of edible fishes belonging to New South Wales and Victoria. Oysters abound on the eastern coast, and on the shelving banks of a vast extent of the northern coast the pearl oyster is the source of a considerable industry.

Two existing fishes may be mentioned as ranking in interest with the *Myrmecobius* (ant-eater) in the eyes of the naturalist. These are the *Ceratodus Forsteri* and the Port Jackson shark. The "mud-fish" of Queensland (*Ceratodus Forsteri*) belongs to an ancient order of fishes—the Dipnoi, only a few species of which have survived from past geological periods. The Dipnoi show a distinct transition between fishes and amphibia. So far the mud-fish has been found only in the Mary and the Burnett rivers. Hardly of less scientific interest is the Port Jackson shark (*Heterodontus*). It is a harmless helmeted ground-shark, living on molluscs, and almost the sole survivor of a genus abundant in the Secondary rocks of Europe.

Flora.

The eastern parts of Australia are very much richer both in their botany and in their zoology than any of the other parts. This is due in part to the different physical conditions there prevailing and in part to the invasion of the north-eastern portion of the continent by a number of plants characteristically Melanesian. This element was introduced via Torres Strait, and spread down the Queensland coast to portions of the New South Wales littoral, and also round the Gulf of Carpentaria, but has never been able to obtain a hold in the more arid interior. It has so completely obliterated the original flora, that a Queensland coast jungle is almost an exact replication of what may be seen on the opposite shores of the straits, in New Guinea. This wealth of plant life is confined to the littoral and the coastal valleys, but the central valleys and the plateaux have, if not a varied flora, a considerable wealth of timber trees in every way superior to the flora inland in the same latitudes. In the interior there is little change in the general aspect of the vegetation, from the Australian Bight to the region of Carpentaria, where the exotic element begins. Behind the luxuriant jungles of the sub-tropical coast, once over the main range, we find the purely Australian flora with its apparent sameness and sombre dulness. Physical surroundings rather than latitude determine the character of the flora. The contour lines showing the heights above sea-level are the directions along which species spread to form zones. Putting aside the exotic vegetation of the north and east coast-line, the Australian bush gains its peculiar character from the prevalence of the so-called gum-trees (*Eucalyptus*) and the acacias, of which last there are 300 species, but the eucalypts above all are everywhere. Dwarfed eucalypts fringe the tree-limit on Mount Kosciusco, and the soakages in the parched interior are indicated by a line of the same trees, stunted and straggling. Over the vast continent from Wilson's Promontory to Cape York, north, south, east and west—where anything can grow—there will be found a gum-tree. The eucalypts are remarkable for the oil secreted in their leaves, and the large quantity of astringent resin of their bark. This resinous exudation (Kino) somewhat resembles gum, hence the name "gum" tree. It will not dissolve in water as gums do, but it is soluble in alcohol, as resin usually is. Many of the gum-trees throw off their bark, so that it hangs in long dry strips from the trunk and branches, a feature familiar in "bush" pictures. The bark, resin and "oils" of the eucalyptus are well known as commercial products. As early as 1866, tannic acid, gallic acid, wood spirit, acetic acid, essential oil and eucalyptol were produced from various species of eucalyptus, and researches made by Australian chemists, notably by Messrs. Baker and Smith of the Sydney Technical College, have brought to light many other valuable products likely to prove of commercial value. The genus *Eucalyptus* numbers more than 150 species, and provides some of the most durable timbers known. The iron-bark of the eastern coast uplands is well known (*Eucalyptus sideroxylon*), and is so called from the hardness of the wood, the bark not being remarkable except for its rugged and blackened aspect. Samples of this timber have been studied after forty-three years' immersion in sea-water. Portions most liable to destruction, those parts between the tide marks, were found perfectly sound, and showed no signs of the ravages of marine organisms. Other valuable timber trees of the eastern portion of the continent are the blackbutt, tallow-wood, spotted gum, red gum, mahogany, and blue gum, eucalyptus; and the turpentine (*Syncarpia laurifolia*), which has proved to be more resistant to the attacks of teredo than any other timber and is largely used in wharf construction in infested waters. There are also several extremely valuable soft timbers, the principal being red cedar (*Cedrela Toona*), silky oak (*Grevillea robusta*), beech and a variety of teak, with several important species of pine. The red gum forests of the Murray valley and the pine forests bordering the Great Plains are important and valuable. In Western Australia there are extensive forests of hardwood, principally jarrah (*Eucalyptus marginata*), a very durable timber; 14,000 sq. m. of country are covered with this species. Jarrah timber is nearly impervious to the attacks of the teredo, and there is good evidence to show that, exposed to wear and weather, or placed under the soil, or used as submarine piles, the wood remained intact after nearly fifty years' trial. The following figures show the high density of Australian timber:— 949

Australian timber.	Specific gravity.
Jarrah	1.12
Grey iron-bark	1.18
Red iron-bark	1.22
Forest oak	1.21
Tallow wood	1.23
Mahogany	1.20
Grey gum	917
Red gum	995

European timber.	Specific gravity.
Ash	.753
Beech	.690
Chestnut	.535
British oak	.99

The resistance to breaking or rupture of Australian timber is very high; grey iron-bark with a specific gravity of 1.18 has a modulus of rupture of 17,900 lb per sq. in. compared with 11,800 lb for British oak with a specific gravity of .69 to .99. No Australian timber in the foregoing list has a less modulus than 13,100 lb per sq. in.

Various "scrubs" characterize the interior, differing very widely from the coastal scrubs. "Mallee" scrub occupies large tracts of South Australia and Victoria, covering probably an extent of 16,000 sq. m. The mallee is a species of eucalyptus growing 12 to 14 ft. high. The tree breaks into thin stems close to the ground, and these branch again and again, the leaves being developed umbrella-fashion on the outer branches. The mallee scrub appears like a forest of dried osier, growing so close that it is not always easy to ride through it. Hardly a leaf is visible to the height of one's head; but above, a crown of thick leather-like leaves shuts out the sunlight. The ground below is perfectly bare, and there is no water. Nothing could add to the sterility and the monotony of these mallee scrubs. "Mulga" scrub is a somewhat similar thicket, covering large areas. The tree in this instance is one of the acacias, a genus distributed through all parts of the continent. Some species have rather elegant blossoms, known to the settlers as "wattle." They serve admirably to break the sombre and monotonous aspect of the Australian vegetation. Two species of acacia are remarkable for the delicate and violet-like perfume of their wood—myall and yarran. The majority of the species of *Acacia* are edible and serve as reserve fodder for sheep and cattle. In the alluvial portions of the interior salsolaceous plants—saltbush, bluebush, cottonbush—are invaluable to the pastoralist, and to their presence the pre-eminence of Australia as a wool-producing country is largely due.

Grasses and herbage in great variety constitute the most valuable element of Australian flora from the commercial point of view. The herbage for the most part grows with marvellous rapidity after a spring or autumn shower and forms a natural shelter for the more stable growth of nutritious grasses.

Under the system of grazing practised throughout Australia it is customary to allow sheep, cattle and horses to run at large all the year round within enormous enclosures and to depend entirely upon the natural growth of grass for their subsistence. Proteaceous plants, although not exclusively Australian, are exceedingly characteristic of Australian scenery, and are counted amongst the oldest flowering plants of the world. The order is easily distinguished by the hard, dry, woody texture of the leaves and the dehiscent fruits. They are found in New Zealand and also in New Caledonia, their greatest developments being on the south-west of the Australian continent. Proteaceae are found also in Tierra del Fuego and Chile. They are also abundant in South Africa, where the order forms the most conspicuous feature of vegetation. The range in species is very limited, no one being common to eastern and western Australia. The chief genera are banksia (*honeysuckle*), and hakea (*needle bush*).

The Moreton Bay pine (*Araucaria Cunninghamii*) is reckoned amongst the giants of the forest. The genus is associated with one long extinct in Europe. Moreton Bay pine is chiefly known by the utility of its wood. Another species, *A. Bidwillii*, or the bunya-bunya, afforded food in its nut-like seeds to the aborigines. A most remarkable form of vegetation in the north-west is the gouty-stemmed tree (*Adansonia Gregorii*), one of the Malvaceae. It is related closely to the famous baobab of tropical Africa. The "grass-tree" (*Xanthorrhoea*), of the uplands and coast regions, is peculiarly Australian in its aspect. It is seen as a clump of wire-like leaves, a few

feet in diameter, surrounding a stem, hardly thicker than a walking-stick, rising to a height of 10 or 12 ft. This terminates in a long spike thickly studded with white blossoms. The grass-tree gives as distinct a character to an Australian picture as the agave and cactus do to the Mexican landscape. With these might be associated the gigantic lily of Queensland (*Nymphaea gigantea*), the leaves of which float on water, and are quite 18 in. across. There is also a gigantic lily (*Doryanthes excelsa*) which grows to a height of 15 feet. The "flame tree" is a most conspicuous feature of an Illawarra landscape, the largest racemes of crimson red suggesting the name. The waratah or native tulip, the magnificent flowering head of which, with the kangaroo, is symbolic of the country, is one of the Proteaceae. The natives were accustomed to suck its tubular flowers for the honey they contained. The "nardoo" seed, on which the aborigines sometimes contrived to exist, is a creeping plant, growing plentifully in swamps and shallow pools, and belongs to the natural order of Marsileaceae. The spore-cases remain after the plant is dried up and withered. These are collected by the natives, and are known over most of the continent as nardoo.

No speculation of hypothesis has been propounded to account satisfactorily for the origin of the Australian flora. As a step towards such hypothesis it has been noted that the Antarctic, the South African, and the Australian floras have many types in common. There is also to a limited extent a European element present. One thing is certain, that there is in Australia a flora that is a remnant of a vegetation once widely distributed. Heer has described such Australian genera as Banksia, Eucalyptus, *Grevillea* and *Hakea* from the Miocene of Switzerland. Another point agreed upon is that the Australian flora is one of vast antiquity. There are genera so far removed from every living genus that many connecting links must have become extinct. The region extending round the south-western extremity of the continent has a peculiarly characteristic assemblage of typical Australian forms, notably a great abundance of the Proteaceae. This flora, isolated by arid country from the rest of the continent, has evidently derived its plant life from an outside source, probably from lands no longer existing.

Political and Economic Conditions

Population.[2]—The Australian people are mainly of British origin, only 3¼% of the population of European descent being of non-British race. It is certain that the aborigines (see the section on Aborigines below) are very much less numerous than when the country was first colonized, but their present numbers can be given for only a few of the states. At the census of 1901, 48,248 aborigines were enumerated, of whom 7434 were in New South Wales, 652 in Victoria, 27,123 in South Australia, and 6212 in Western Australia. The assertion by the Queensland authorities that there are 50,000 aborigines in that state is a crude estimate, and may be far wide of the truth. In South Australia and the Northern Territory a large number are outside the bounds of settlement, and it is probable that they are as numerous there as in Queensland. The census of Western Australia included only those aborigines in the employment of the colonists; and as a large part of this, the greatest of the Australian states, is as yet unexplored, it may be presumed that the aborigines enumerated were very far short of the whole number of persons of that race in the state. Taking all things into consideration, the aboriginal population of the continent may be set down at something like 180,000. Chinese, numbering about 30,000, are chiefly found in New South Wales, Queensland, Victoria, and the Northern Territory. Of Japanese there were 3500, of Hindu and Sinhalese 4600, according to recent computation, but the policy of the Commonwealth is adverse to further immigration of other than whites. South Sea Islanders and other coloured races, numbering probably about 15,000, were in 1906 to be found principally in Queensland, but further immigration of Pacific Islanders to Australia is now restricted, and the majority of those in the country in 1906 were deported by the middle of 1907.

At the close of 1906 the population of Australia was approximately 4,120,000, exclusive of aborigines. The increase of population since 1871 was as follows: 1871, 1,668,377; 1881, 2,252,617; 1891, 3,183,237; 1901, 3,773,248. The expansion has been due mainly to the natural increase; that is, by reason of excess of births over deaths. Immigration to Australia has been very slight since 1891, owing originally to the stoppage of progress consequent on the bank crisis of 1893, and, subsequently, to the disinclination of several of the state governments towards immigration and their failure to provide for the welfare of immigrants on their arrival. During 1906 a more rational view of the value of immigration was adopted by the various state governments and by the federal government, and immigration to Australia is now systematically encouraged. Australia's gain of population by immigration,—*i.e.* the excess of the inward over the outward movement of a population—since the discovery of gold in 1851, arranged in ten years periods, was

1852-1861	520,713
1862-1871	188,158
1872-1881	223,326
1882-1891	374,097
1892-1901	2,377

During the five years following the last year of the foregoing table, there was practically no increase in population by immigration.

The birth rate averages 26.28 per thousand of the population and the death rate 12.28, showing a net increase of 14 per thousand by reason of the excess of births over deaths. The marriage rate varies as in other countries from year to year according to the degree of prosperity prevailing. In the five years 1881-1888 the rate was 8.08 marriages (16.1 persons) per thousand of the population, declining to 6.51 in 1891-1895; in recent years there has been a considerable improvement, and the Australian marriage rate may be quoted as ranging between 6.75 and 7.25. The death rate of Australia is much below that of European countries and is steadily declining. During the twenty years preceding the census of 1901 there was a fall in the death rate of 3.4 per thousand, of which, however, 1 per thousand is attributable to the decline in the birth rate, the balance being attributable to improved sanitary conditions.

Territorial Divisions.—Australia is politically divided into five states, which with the island of Tasmania form the Commonwealth of Australia. The area of the various states is as follows:

	Sq. m.
New South Wales	310,700
Victoria	87,884
Queensland	668,497
South Australia	903,690
Western Australia	975,920
	————
	2,946,691
Tasmania	26,215
	=======
Commonwealth	2,972,906

To the area of the Commonwealth shown in the table might be added that of New Guinea, 90,000 sq. m.; this would bring the area of the territory controlled by the Commonwealth to 3,062,906 sq. m. The distribution of population at the close of 1906 (4,118,000) was New South Wales 1,530,000, Victoria 1,223,000, Queensland 534,000, South Australia 381,000, Western Australia 270,000, Tasmania 180,000. The rate of increase since the previous census was 1.5% per annum, varying from 0.31 in Victoria to 2.06 in New South Wales and 6.9 in Western Australia.

Australia contains four cities whose population exceeds 100,000, and fifteen with over 10,000. The principal cities and towns are Sydney (pop. 530,000), Newcastle, Broken Hill, Parramatta, Goulburn, Maitland, Bathurst, Orange, Lithgow, Tamworth, Grafton, Wagga and Albury, in New South Wales; Melbourne (pop. 511,900), Ballarat, Bendigo, Geelong, Eaglehawk, Warrnambool, Castlemaine, and Stawell in Victoria; Brisbane (pop. 128,000), Rockhampton, Maryborough, Townsville, Gympie, Ipswich, and Toowoomba in Queensland; Adelaide (pop. about 175,000), Port Adelaide and Port Pirie in South Australia; Perth (pop. 56,000), Fremantle, and Kalgoorlie in Western Australia; and Hobart (pop. 35,500) and Launceston in Tasmania.

Defence.—Up to the end of the 19th century, little was thought of any locally-raised or locally-provided defensive forces, the mother-country being relied upon. But the Transvaal War of 1899-1902, to which Australia sent 6310 volunteers (principally mounted rifles), and the gradual increase of military sentiment, brought the question more to the front, and more and more attention was given to making Australian defence a matter of local concern. Naval defence in any case remained primarily a question for the Imperial navy, and by agreement (1903, for ten years) between the British government and the governments of the Commonwealth (contributing an annual subsidy of £200,000) and of New Zealand (£40,000), an efficient fleet patrolled the Australasian waters, Sydney, its headquarters, being ranked as a first-class naval station. Under the agreement a royal naval reserve was maintained, three of the Imperial vessels provided being utilized as drill ships for crews recruited from the Australian states. At the end of 1908 the strength of

the naval forces under the Commonwealth defence department was: permanent, 217, naval militia, 1016; the estimated expenditure for 1908-1909 being £63,531. In 1908-1909 a movement began for the establishment by Australia of a local flotilla of torpedo-boat destroyers, to be controlled by the Commonwealth in peace time, but subject to the orders of the British admiralty in war time, though not to be removed from the Australian coast without the sanction of the Commonwealth; and by 1909 three such vessels had been ordered in England preparatory to building others in Australia. The military establishment at the beginning of 1909 was represented by a small permanent force of about 1400, a militia strength of about 17,000, and some 6000 volunteers, besides 50,000 members of rifle clubs and 30,000 cadets; the expenditure being (estimate, 1908-1909) £623,946. But a reorganization of the military forces, on the basis of obligatory national training, was already contemplated, though the first Bill introduced for this purpose by Mr Deakin's government (Sept. 1908) was dropped, and in 1909 the subject was still under discussion.

Religion.—There is no state church in Australia, nor is the teaching of religion in any way subsidized by the state. The Church of England claims as adherents 39% of the population, and the Roman Catholic Church 22%; next in numerical strength are the Wesleyans and other Methodists, numbering 12%, the various branches of the Presbyterians 11%, Congregationalists 2%, and Baptists 2%. These proportions varied very little between 1881 and 1906, and may be taken as accurately representing the present strength of the various Christian denominations. Churches of all denominations are liberally supported throughout the states, and the residents of every settlement, however small, have their places of worship erected and maintained by their own contributions.

Instruction.—Education is very widely distributed, and in every state it is compulsory for children of school ages to attend school. The statutory ages differ in the various states; in New South Wales and Western Australia it is from 6 to 13 years inclusive, in Victoria 6 to 12 years, in Queensland 6 to 11 years, and in South Australia 7 to 12 years inclusive. Religious instruction is not imparted by the state-paid teachers in any state, though in certain states persons duly authorized by the religious organizations are allowed to give religious instruction to children of their own denomination where the parents' consent has been obtained. According to the returns for 1905 there were 7292 state schools, with 15,628 teachers and 648,927 pupils, and the average attendance of scholars was 446,000. Besides state schools there were 2145 private schools, with 7825 teachers and 137,000 scholars, the average number of scholars in attendance being 120,000. The census of 1901 showed that about 83% of the whole population and more than 91% of the population over five years of age could read and write. There was, therefore, a residue of 9% of illiterates, most of whom were not born in Australia. The marriage registers furnish another test of education. In 1905 only ten persons in every thousand married were unable to sign their names, thus proving that the number of illiterate adults of Australian birth is very small.

Instruction at state schools is either free or at merely nominal cost, and high schools, technical colleges and agricultural colleges are maintained by appropriations from the general revenues of the states. There are also numerous grammar schools and other private schools. Universities have been established at Sydney, Melbourne, Adelaide and Hobart, and are well equipped and numerously attended; they are in part supported by grants from the public funds and in part by private endowments and the fees paid by students. The number of students attending lectures is about 2500 and the annual income a little over £100,000. The cost of public instruction in Australia averages about 11s. 4d. per inhabitant, and the cost per scholar in average attendance at state schools is £4 : 13 : 9.

Pastoral and Agricultural Industries.—The continent is essentially a pastoral one, and the products of the flocks and herds constitute the chief element in the wealth of Australia. Practically the whole of the territory between the 145° meridian and the Great Dividing Range, as well as extensive tracts in the south and west, are a natural sheep pasture with climatic conditions and indigenous vegetation pre-eminently adapted for the growth of wool of the highest quality. Numerically the flocks of Australia represent one-sixth of the world's sheep, and in just over half a century (1851-1905) the exports of Australian wool alone reached the value of £650,000,000. During the same period, owing to the efforts of pastoralists to improve their flocks, there was a gradual increase in the weight of wool produced per sheep from 3¼ ℔ to an average of over 7 ℔ The cattle and horse-breeding industries are of minor importance as compared with wool-growing, but nevertheless represent a great source of wealth, with vast possibilities of expansion in the over-sea trade. The perfection of refrigeration in over-sea carriage, which has done so much to extend the markets for Australian beef and mutton, has also furthered the expansion of dairying, there being an annual output of over 160 million ℔ of butter, valued at £6,000,000; of this about 64 million ℔, valued at £2,500,000, is exported annually to British markets.

Next to the pastoral industry, agriculture is the principal source of Australian wealth. At the close of 1905 the area devoted to tillage was 9,365,000 acres, the area utilized for the production of breadstuffs being 6,270,000 acres or over two-thirds of the whole extent of cultivation. At first wheat was cultivated solely in the coastal country, but experience has shown that the staple cereal can be most successfully grown over almost any portion of the arable lands within the 20 to 40 in. rainfall areas. The value of Australian wheat and flour exported in 1905 was £5,500,000.

Other important crops grown are—maize, 324,000 acres; oats, 493,000 acres; other grains, 160,000 acres; hay, 1,367,000 acres; potatoes, 119,000 acres; sugar-cane, 141,000 acres; vines, 65,000 acres; and other crops, 422,000 acres. The chief wheat lands are in Victoria, South Australia and New South Wales; the yield averages about 9 bushels to the acre; this low average is due to the endeavour of settlers on new lands to cultivate larger areas than their resources can effectively deal with; the introduction of scientific farming should almost double the yield. Maize and sugar-cane are grown in New South Wales and Queensland. The vine is cultivated in all the states, but chiefly in South Australia, Victoria and New South Wales. Australia produces abundant quantities and nearly all varieties of fruits; but the kinds exported are chiefly oranges, pineapples, bananas and apples. Tobacco thrives well in New South Wales and Victoria, but kinds suitable for exportation are not largely grown. Compared with the principal countries of the world, Australia does not take a high position in regard to the gross value of the produce of its tillage, the standard of cultivation being for the most part low and without regard to maximum returns, but in value per inhabitant it compares fairly well; indeed, some of the states show averages which surpass those of many of the leading agricultural countries. For 1905 the total value of agricultural produce estimated at the place of production was £18,750,000 sterling, or about £4 : 13 : 4 per inhabitant.

Timber Industry.—Although the timbers of commercial value are confined practically to the eastern and a portion of the western coastal belt and a few inland tracts of Australia, they constitute an important national asset. The early settlement of heavily timbered country was characterized by wanton destruction of vast quantities of magnificent timber; but this waste is a thing of the past, and under the pressure of a demand for sound timber both for local use and for exportation, the various governments are doing much to conserve the state forests. In Western Australia, New South Wales, Tasmania and Queensland there are many hundreds of well-equipped saw-mills affording employment to about 5000 men. The export of timber is in ordinary years valued at a million sterling and the total production at £2,250,000.

Fisheries.—Excellent fish of many varieties abound in the Australian seas and in many of the rivers. In several of the states, fish have been introduced successfully from other countries. Trout may now be taken in many of the mountain streams. At one time whaling was an important industry on the coasts of New South Wales and Tasmania, and afterwards on the Western Australian coasts. The industry gravitated to New Zealand, and finally died out, chiefly through the wasteful practice of killing the calves to secure the capture of the mothers. Of late years whaling has again attracted attention, and a small number of vessels prosecute the industry during the season. The only source of maritime wealth that is now being sufficiently exploited to be regarded as an industry is the gathering of pearl-oysters from the beds off the northern and north-western coasts of the continent. In Queensland waters there are about 300 vessels, and on the Western Australian coast about 450 licensed craft engaged in the industry, the annual value of pearl-shell and pearls raised being nearly half a million sterling. Owing to the depletion of some of the more accessible banks, and to difficulties in connexion with the employment of coloured crews, many of the vessels have now gone farther afield. As the pearl-oyster is remarkably prolific, it is considered by experts that within a few years of their abandonment by fishing fleets the denuded banks will become as abundantly stocked as ever.

Mineral Production.—Australia is one of the great gold producers of the world, and its yield in 1905 was about £16,000,000 sterling, or one-fourth of the gold output of the world; and the total value of its mineral production was approximately £25,000,000. Gold is found throughout Australia, and the present prosperity of the states is largely due to the discoveries of this metal, the development of other industries being, in a country of varied resources, a natural sequence to the acquisition of mineral treasure. From the date of its first discovery, up to the close of 1905, gold to the value of £460,000,000 sterling has been obtained in Australia. Victoria, in a period of fifty-four years, contributed about £273,000,000 to this total, and is still a large producer, its annual yield being about 800,000 oz., 29,000 men being engaged in the search for the precious metal. Queensland's annual output is between 750,000 and 800,000 oz.; the number of men engaged in gold-mining is 10,000. In New South Wales the greatest production was in 1852, soon after the first discovery of the precious metal, when the output was valued at £2,660,946; the production in 1905 was about 270,000 oz., valued at £1,150,000. For many years Western Australia was considered to

Gold.

be destitute of mineral deposits of any value, but it is now known that a rich belt of mineral country extends from north to south. The first important discovery was made in 1882, when gold was found in the Kimberley district; but it was not until a few years later that this rich and extensive area was developed. In 1887 gold was found in Yilgarn, about 200 m. east of Perth. This was the first of the many rich discoveries in the same district which have made Western Australia the chief gold-producer of the Australian group. In 1907 there were eighteen goldfields in the state, and it was estimated that over 30,000 miners were actively engaged in the search for gold. In 1905 the production amounted to 1,983,000 oz., valued at £8,300,000. Tasmania is a gold producer to the extent of about 70,000 or 80,000 oz. a year, valued at £300,000; South Australia produces about 30,000 oz.

Gold is obtained chiefly from quartz reefs, but there are still some important alluvial deposits being worked. The greatest development of quartz reefing is found in Victoria, some of the mines being of great depth. There are eight mines in the Bendigo district over 3000 ft. deep, and fourteen over 2500 ft. deep. In the Victoria mine a depth of 3750 ft. has been reached, and in Lazarus mine 3424 ft. In the Ballarat district a depth of 2520 ft. has been reached in the South Star mine. In Queensland there is one mine 3156 ft. deep, and several others exceed 2000 ft. in depth. A considerable number of men are engaged in the various states on alluvial fields, in hydraulic sluicing, and dredging is now adopted for the winning of gold in river deposits. So far this form of winning is chiefly carried on in New South Wales, where there are about fifty gold-dredging plants in successful operation. Over 70,000 men are employed in the gold-mining industry, more than two-thirds of them being engaged in quartz mining.

Silver.

Silver has been discovered in all the states, either alone or in the form of sulphides, antimonial and arsenical ores, chloride, bromide, iodide and chloro-bromide of silver, and argentiferous lead ores, the largest deposits of the metal being found in the last-mentioned form. The leading silver mines are in New South Wales, the returns from the other states being comparatively insignificant. The fields of New South Wales have proved to be of immense value, the yield of silver and lead during 1905 being £2,500,000, and the total output to the end of the year named over £40,000,000. The Broken Hill field, which was discovered in 1883, extends over 2500 sq. m. of country, and has developed into one of the principal mining centres of the world. It is situated beyond the river Darling, and close to the boundary between New South Wales and South Australia. The lodes occur in Silurian metamorphic micaceous schists, intruded by granite, porphyry and diorite, and traversed by numerous quartz reefs, some of which are gold-bearing. The Broken Hill lode is the largest yet discovered. It varies in width from 10 ft. to 200 ft., and may be traced for several miles. Although indications of silver abound in all the other states, no fields of great importance have yet been discovered. Up to the end of 1904 Australia had produced silver to the value of £45,000,000. At Broken Hill mines about 11,000 miners are employed.

Copper.

Copper is known to exist in all the states, and has been mined extensively in South Australia, New South Wales, Queensland and Tasmania. The low quotations which ruled for a number of years had a depressing effect upon the industry, and many mines once profitably worked were temporarily closed, but in 1906 there was a general revival. The discovery of copper had a marked effect on the fortunes of South Australia at a time when the young colony was surrounded by difficulties. The first important mine, the Kapunda, was opened up in 1842. It is estimated that at one time 2000 tons were produced annually, but the mine was closed in 1879. In 1845 the celebrated Burra Burra mine was discovered. This mine proved to be very rich, and paid £800,000 in dividends to the original owners. For a number of years, however, the mine has been suffered to remain untouched, as the deposits originally worked were found to be depicted. For many years the average output was from 10,000 to 13,000 tons of ore, yielding from 22 to 23% of copper. For the period of thirty years during which the mine was worked the production of ore amounted to 234,648 tons, equal to 51,622 tons of copper, valued at £4,749,924. The Wallaroo and Moonta mines, discovered in 1860 and 1861, proved to be even more valuable than the Burra Burra, the Moonta mines employing at one time upwards of 1600 hands. The dividends paid by these mines amounted to about £1,750,000 sterling. The satisfactory price obtained during recent years has enabled renewed attention to be paid to copper mining in South Australia, and the production of the metal in 1905 was valued at £470,324. The principal deposits of copper in New South Wales are found in the central part of the state between the Macquarie, Darling and Bogan rivers. Deposits have also been found in the New England and southern districts, as well as at Broken Hill, showing that the mineral is widely distributed throughout the state. The more important mines are those of Cobar, where the Great Cobar mine produces annually nearly 4000 tons of refined copper. In northern Queensland copper is found throughout the Cloncurry district, in the upper basin of the Star river, and the Herberton district. The returns from the copper fields in the state are at present a little over half a million sterling per annum, and would be still greater if it were not for the lack of suitable fuel for smelting purposes, which renders the economical treatment of the ore difficult; the development of the mines is also retarded by the want of easy and cheaper communication with the coast. In Western Australia copper deposits have been worked for some years. Very rich lodes of the metal have been found in the Northampton, Murchison and Champion Bay districts, and also in the country to the south of these districts on the Irwin river. Tasmania is now the largest copper-producing state of the Commonwealth; in 1905 the output was over £672,010 and in earlier years even larger. The chief mines belong to the Mount Lyell Mining & Railway Co., and are situated on the west side of the island with an outlet by rail to Strahan on the west coast. The total value of copper produced in Australia up to the end of 1905 was £42,500,000 sterling, £24,500,000 having been obtained in South Australia, £7,500,000 in New South Wales, £6,400,000 in Tasmania and over £3,500,000 in Queensland.

Tin.

Tin was known to exist in Australia from the first years of colonization. The wealth of Queensland and the Northern Territory in this mineral, according to the reports of Dr Jack, late Government geologist of the former state, and the late Rev. J.E. Tenison-Woods, appears to be very great. The most important tin-mines in Queensland are in the Herberton district, south-west of Cairns; at Cooktown, on the Annan and Bloomfield rivers; and at Stanthorpe, on the border of New South Wales. Herberton and Stanthorpe have produced more than three-fourths of the total production of the state. Towards the close of the 19th century the production greatly decreased in consequence of the low price of the metal, but in 1899 a stimulus was given to the industry, and since then the production has increased very considerably, the output for 1905 being valued at £989,627. In New South Wales lode tin occurs principally in the granite and stream tin under the basaltic country in the extreme north of the state, at Tenterfield, Emmaville, Tingha, and in other districts of New England. The metal has also been discovered in the Barrier ranges, and many other places. The value of the output in 1905 was £226,110. The yield of tin in Victoria is very small, and until lately no fields of importance have been discovered; but towards the latter end of 1899 extensive deposits were reported to exist in the Gippsland district —at Omeo and Tarwin. In South Australia tin-mining is unimportant. In Western Australia the production from the tin-fields at Greenbushes and elsewhere was valued at £87,000. Tasmania during the last few years has attained the foremost position in the production of tin, the annual output now being about £363,000. The total value of tin produced in Australia is nearly a million sterling per annum, and the total production to the end of 1905 was £22,500,000, of which Tasmania produced about 40%, New South Wales one-third, Queensland a little more than a fourth.

Iron.

Iron is distributed throughput Australia, but for want of capital for developing the fields this industry has not progressed. In New South Wales there are, together with coal and limestone in unlimited supply, important deposits of rich iron ores suitable for smelting purposes; and for the manufacture of steel of certain descriptions abundance of manganese, chrome and tungsten ores are available. The most extensive fields are in the Mittagong, Wallerawang and Rylstone districts, which are roughly estimated to contain in the aggregate 12,944,000 tons of ore, containing 5,853,000 tons of metallic iron. Extensive deposits, which are being developed successfully, occur in Tasmania, it being estimated that there are, within easy shipping facilities, 17,000,000 tons of ore. Magnetite, or magnetic iron, the richest of all iron ores, is found in abundance near Wallerawang in New South Wales. The proximity of coal-beds now being worked should accelerate the development of the iron deposits, which, on an average, contain 41% of metal. Magnetite occurs in great abundance in Western Australia, together with haematite, which would be of enormous value if cheap labour were available. Goethite, limonite and haematite are found in New South Wales, at the junction of the Hawkesbury sandstone formation and the Wianamatta shale, near Nattai, and are enhanced in their value by their proximity to coal-beds. Near Lithgow extensive deposits of limonite, or clay-band ore, are interbedded with coal. Some samples of ore, coal and limestone, obtained in the Mittagong district, with pig-iron and castings manufactured therefrom, were exhibited at the Mining Exhibition in London and obtained a first award.

Other Minerals.

Antimony is widely diffused throughout Australia, and is sometimes found associated with gold. In New South Wales the principal centre of this industry is Hillgrove, near Armidale, where the Eleanora Mine, one of the richest in the state, is situated. The ore is also worked for gold. In Victoria the production of antimony gave employment in 1890 to 238 miners, but owing to the low price of the metal, production has almost ceased. In Queensland the fields were all showing development in 1891, when the output exhibited a very large increase compared with that of former years; but, as in the case of Victoria, the production of the metal seems to have ceased. Good lodes of stibnite (sulphide of antimony) have been found near Roebourne in Western Australia, but no attempt has yet been made to work them.

Bismuth is known to exist in all the Australian states, but up to the present time it has been mined for only in three states, viz. New South Wales, Queensland, South Australia and Tasmania. It is usually found in association with tin and other minerals. The principal mine in New South Wales is situated at Kingsgate, in the New England district, where the mineral is generally associated with molybdenum and gold.

Manganese probably exists in all the states, deposits having been found in New South Wales, Victoria, Queensland and Western Australia, the richest specimens being found in New South Wales. Little, however, has been done to utilize the deposits, the demands of the colonial markets being extremely limited. The ore generally occurs in the form of oxides, manganite and pyrolusite, and contains a high percentage of sesquioxide of manganese.

Platinum and the allied compound metal iridosmine have been found in New South Wales, but so far in inconsiderable quantities. Iridosmine occurs commonly with gold or tin in alluvial drifts.

The rare element tellurium has been discovered in New South Wales at Bingara and other parts of the northern districts, as well as at Tarana, on the western line, though at present in such minute quantities as would not repay the cost of working. At many of the mines at Kalgoorlie, Western Australia, large quantities of ores of telluride of gold have been found in the lode formations.

Lead is found in all the Australian states, but is worked only when associated with silver. In Western Australia the lead occurs in the form of sulphides and carbonates of great richness, but the quantity of silver mixed with it is very small. The lodes are most frequently of great size, containing huge masses of galena, and so little gangue that the ore can very easily be dressed to 83 or 84%. The association of this metal with silver in the Broken Hill mines of New South Wales adds very greatly to the value of the product.

Mercury is found in New South Wales and Queensland. In New South Wales, in the form of cinnabar, it has been discovered on the Cudgegong river, near Rylstone, and it also occurs at Bingara, Solferino, Yulgilbar and Cooma. In the last-named place the assays of ore yielded 22% of mercury.

Titanium, in the minerals known as octahedrite and brookite, is found in alluvial deposits in New South Wales, in conjunction with diamonds.

Wolfram (tungstate of iron and manganese) occurs in some of the states, notably in New South Wales, Victoria, Tasmania and Queensland. Scheelite, another mineral of tungsten, is also found in Queensland. Molybdenum, in the form of molybdenite (sulphide of molybdenum), is found in Queensland, New South Wales and Victoria, associated in the parent state with tin and bismuth in quartz reefs.

Zinc ores, in the several varieties of carbonates, silicates, oxide, sulphide and sulphate of zinc, have been found in several of the Australian states but have attracted little attention except in New South Wales, where special efforts are being made successfully to produce a high-grade zinc concentrate from the sulphide ores. Several companies are devoting all their energies to zinc extraction, and the output is now equal to about 5% of the world’s production.

Nickel, so abundant in the island of New Caledonia, has up to the present been found in none of the Australian states except Queensland and Tasmania. Few attempts, however, have been made to prospect systematically for this valuable mineral.

Cobalt occurs in New South Wales, Victoria and South Australia, and efforts have been made in the former state to treat the ore, the metal having a high commercial value; but the market is small, and no attempt has been made up to 1907 to produce it on any large scale. The manganese ores of the Bathurst district of New South Wales often contain a small percentage of cobalt—sufficient, indeed, to warrant further attempts to work them. In New South Wales chromium is found in the northern portion of the state, in the Clarence and Tamworth districts and also near Gundagai. It is usually associated with serpentine. In the Gundagai district the industry was rapidly becoming a valuable one, but the low price of chrome has greatly restricted the output. Chromium has been discovered in Tasmania also.

Arsenic, in its well-known and beautiful forms, orpiment and realgar, is found in New South Wales and Victoria. It usually occurs in association with other minerals in veins.

Fuel.

The Australian states have been bountifully supplied with mineral fuel. Five distinct varieties of black coal, of well-characterized types, may be distinguished, and these, with the two extremes of brown coal or lignite and anthracite, form a perfectly continuous series. Brown coal, or lignite, occurs principally in Victoria. Attempts have frequently been made to use the mineral for ordinary fuel purposes, but its inferior quality has prevented its general use. Black coal forms one of the principal resources of New South Wales; and in the other states the deposits of this valuable mineral are being rapidly developed. Coal of a very fair description was discovered in the basin of the Irwin river, in Western Australia, as far back as the year 1846. It has been ascertained from recent explorations that the area of carboniferous formation in that state extends from the Irwin northwards to the Gascoyne river, about 300 m., and probably all the way to the Kimberley district. The most important discovery of coal in the state, so far, is that made in the bed of the Collie river, near Bunbury, to the south of Perth. The coal has been treated and found to be of good quality, and there are grounds for supposing that there are 250,000,000 tons in the field. Dr Jack, late government geologist of Queensland, considers the extent of the coal-fields of that state to be practically unlimited, and is of opinion that the carboniferous formations extend to a considerable distance under the Great Western Plains. It is roughly estimated that the Coal Measures at present practically explored extend over an area of about 24,000 sq. m. Coal-mining is an established industry in Queensland, and is progressing satisfactorily. The mines, however, are situated too far from the coast to permit of serious competition with Newcastle in an export trade, and the output is practically restricted to supplying local requirements. The coal-fields of New South Wales are situated in three distinct regions—the northern, southern and western districts. The first of these comprises chiefly the mines of the Hunter river districts; the second includes the Illawarra district, and, generally, the coastal regions to the south of Sydney, together with Berrima, on the tableland; and the third consists of the mountainous regions on the Great Western railway and extends as far as Dubbo. The total area of the Carboniferous strata of New South Wales is estimated at 23,950 sq. m. The seams vary in thickness. One of the richest has been found at Greta in the Hunter river district; it contains an average thickness of 41 ft. of clean coal, and the quantity underlying each acre of ground has been computed to be 63,700 tons. The coal mines of New South Wales give employment to 14,000 persons, and the annual production is over 6,600,000 tons. Black coal has been discovered in Victoria, and about 250,000 tons are now being raised. The principal collieries in the state are the Outtrim Howitt, the Coal Creek Proprietary and the Jumbunna. In South Australia, at Leigh’s Creek, north of Port Augusta, coal-beds have been discovered. The quantity of coal extracted annually in Australia had in 1906 reached 7,497,000 tons.

Kerosene shale (torbanite) is found in several parts of New South Wales. It is a species of cannel coal, somewhat similar to the Boghead mineral of Scotland, but yielding a much larger percentage of volatile hydro-carbon than the Scottish mineral. The richest quality yields about 100 to 130 gallons of crude oil per ton, or 17,000 to 18,000 cub. ft. of gas, with an illuminating power of 35 to 40 sperm candles, when gas only is extracted from the shale.

Large deposits of alum occur close to the village of Bulladelah, 30 m. from Port Stephens, New South Wales. It is said to yield well, and a quantity of the manufactured alum is sent to Sydney for local consumption. Marble is found in many parts of New South Wales and South Australia. Kaolin, fire-clays and brick-clays are common to all the states. Except in the vicinity of cities and townships, however, little use has been made of the abundant deposits of clay. Kaolin, or porcelain clay, although capable of application to commercial purposes, has not as yet been utilized to any extent, although found in several places in New South Wales and in Western Australia.

Asbestos has been found in New South Wales in the Gundagai Bathurst and Broken Hill districts—in the last-mentioned district in considerable quantities. Several specimens of very fair quality have also been met with in Western Australia.

Gems.

Many descriptions of gems and gem stones have been discovered in various parts of the Australian states, but systematic search has been made principally for the diamond and the noble opal. Diamonds are found in all the states; but only in New South Wales have any attempts been made to work the diamond drifts. The best of the New South Wales diamonds are harder and much whiter than the South African diamonds, and are classified as on a par with the best Brazilian gems, but no large specimens have yet been found. The finest opal known is obtained in the Upper Cretaceous formation at White Cliffs, near Wilcannia, New South Wales, and at these mines about 700 men find constant employment. Other precious stones, including the sapphire, emerald, oriental emerald, ruby, opal, amethyst, garnet, chrysolite, topaz, cairngorm, onyx, zircon, &c., have been found in the gold and tin bearing drifts and river gravels in numerous localities throughout the states. The sapphire is found in all the states, principally in the neighbourhood of Beechworth, Victoria. The oriental topaz has been found in New South Wales. Oriental amethysts also have been found in that state, and the ruby has been found in Queensland, as well as in New South Wales. Turquoises have been found near Wangaratta, in Victoria, and mining operations are being carried on in that state. Chrysoberyls have been found in New South Wales; spinel rubies in New South Wales and Victoria; and white topaz in all the states. Chalcedony, carnelian, onyx and cat’s eyes are found in New South Wales; and it is probable that they are also to be met with in the other states, particularly in Queensland. Zircon, tourmaline, garnet and other precious stones of little commercial value are found throughout Australia.

Commerce.—The number of vessels engaged in the over-sea trade of Australia in 1905 was 2112, viz. 1050 steamers, with a tonnage of 2,629,000, and 1062 sailers, tonnage 1,090,000; the total of both classes was 3,719,000 tons. The nationality of the tonnage was,

British 2,771,000, including Australian 288,000, and foreign 948,000. The destination of the shipping was, to British ports 2,360,000 tons, and to foreign ports 1,350,000 tons. The value of the external trade was £95,188,000, viz. £38,347,000 imports, and £56,841,000 exports. The imports represent £9:11:6 per inhabitant and the exports £14 : 4 : 2, with a total trade of £23 : 15 : 8. The import trade is divided between the United Kingdom and possessions and foreign countries as follows:—United Kingdom £23,074,000, British possessions £5,384,000, and foreign states £9,889,000, while the destination of the exports is, United Kingdom £26,703,000, British possessions £12,519,000, and foreign countries £17,619,000. The United Kingdom in 1905 sent 60% of the imports taken by Australia, compared with 26% from foreign countries, and 14% from British possessions; of Australian imports the United Kingdom takes 47%, foreign countries 31% and British possessions 22%. In normal years (that is to say, when there is no large movement of capital) the exports of Australia exceed the imports by some £15,300,000. This sum represents the interest payable on government loans placed outside Australia, mainly in England, and the income from British and other capital invested in the country; the former may be estimated at £7,300,000 and the latter £8,000,000 per annum. The principal items of export are wool, skins, tallow, frozen mutton, chilled beef, preserved meats, butter and other articles of pastoral produce, timber, wheat, flour and fruits, gold, silver, lead, copper, tin and other metals. In 1905 the value of the wool export regained the £20,000,000 level, and with the rapid recovery of the numerical strength of the flocks, great improvements in the quality and weight of fleeces, this item is likely to show permanent advancement. The exports of breadstuffs—chiefly to the United Kingdom—exceed six millions per annum, butter two and a half millions, and minerals of all kinds, except gold, six millions. Gold is exported in large quantities from Australia. The total gold production of the country is from £14,500,000 to £16,000,000, and as not more than three-quarters of a million are required to strengthen existing local stocks, the balance is usually available for export, and the average export of the precious metal during the ten years, 1896-1905, was £12,500,000 per annum. The chief articles of import are apparel and textiles, machinery and hardware, stimulants, narcotics, explosives, bags and sacks, books and paper, oils and tea.

Lines of steamers connect Australia with London and other British ports, with Germany, Belgium, France, Italy, Japan, China, India, San Francisco, Vancouver, New York and Montevideo, several important lines being subsidized by the countries to which they belong, notably Germany, France and Japan.

Railways.—Almost the whole of the railway lines in Australia are the property of the state governments, and have been constructed and equipped wholly by borrowed capital. There were on the 30th of June 1905, 15,000 m. open for traffic, upon which nearly £135,000,000 had been expended.

The railways are of different gauges, the standard narrow gauge of 4 ft. 8½ in. prevailing only in New South Wales; in Victoria the gauge is 5 ft. 3 in., in South Australia 5 ft. 3 in. and 3 ft. 6 in., and in the other states 3 ft. 6 in. Taking the year 1905, the gross earnings amounted to £11,892,262; the working expenses, exclusive of interest, £7,443,546; and the net earnings £4,448,716; the latter figure represents 3.31% upon the capital expended upon construction and equipment; in the subsequent year still better results were obtained. In several of the states, New South Wales and South Australia proper, the railways yield more than the interest paid by the government on the money borrowed for their construction. The earnings per train-mile vary greatly; but for all the lines the average is 7s. 1d., and the working expenses about 4s. 5d., making the net earnings 2s. 8d. per train-mile. The ratio of receipts from coaching traffic to total receipts is about 41%, which is somewhat less than in the United Kingdom; but the proportion varies greatly amongst the states themselves, the more densely populated states approaching most nearly to the British standard. The tonnage of goods carried amounts to about 16,000,000 tons, or 4 tons per inhabitant, which must be considered fairly large, especially as no great proportion of the tonnage consists of minerals on which there is usually a low freightage. Excluding coal lines and other lines not open to general traffic, the length of railways in private hands is only 382 m. or about 2½% of the total mileage open. Of this length, 277 m. are in Western Australia. The divergence of policy of that state from that pursued by the other states was caused by the inability of the government to construct lines, when the extension of the railway system was urgently needed in the interests of settlement. Private enterprise was, therefore, encouraged by liberal grants of land to undertake the work of construction; but the changed conditions of the state have now altered the state policy, and the government have already acquired one of the two trunk lines constructed by private enterprise, and it is not likely that any further concessions in regard to railway construction will be granted to private persons.

Posts and Telegraphs.—The postal and telegraphic facilities offered by the various states are very considerable. There are some 6686 post-offices throughout the Commonwealth, or about one office to every 600 persons. The letters carried amount to about 80 per head, the newspapers to 32 per head and the packets to 15 per head. The length of telegraph lines in use is 46,300 m., and the length of wire nearly three times that distance. In 1905 there were about 11,000,000 telegraphic messages sent, which gives an average of 2.7 messages per inhabitant. The postal services and the telegraphs are administered by the federal government.

Banking.—Depositors in savings banks represent about twenty-nine in every hundred persons, and in 1906 the sum deposited amounted to £37,205,000 in the names of 1,152,000 persons. In ordinary banks the deposits amounted to £106,625,000, so that the total deposits stood at £143,830,000, equivalent to the very large sum of £34, 18s. per inhabitant. The coin and bullion held by the banks varies between 20 and 24 millions sterling and the note circulation is almost stationary at about 3¼ millions.

Public Finance.—Australian public finance requires to be treated under the separate headings of Commonwealth and states finance. Under the Constitution Act the Commonwealth is given the control of the postal and telegraph departments, public defence and several other services, as well as the power of levying customs and excise duties; its powers of taxation are unrestricted, but so far no taxes have been imposed other than those just mentioned. The Commonwealth is empowered to retain one-fourth of the net revenue from customs and excise, the balance must be handed back to the states. This arrangement was to last until 1910. Including the total receipts derived from the customs, the Commonwealth revenue, during the year 1906, was made up as follows:—

Customs and excise	£8,999,485
Posts, telegraphs, &c.	2,824,182
Other revenue	55,676
	£11,879,343

The return made to the states was £7,385,731, so that the actual revenue disposed of by the Commonwealth was less by that amount, or £4,493,612. The expenditure was distributed as follows:—

Customs collection	£261,864
Posts, telegraphs, &c.	2,774,804
Defence	949,286
Other expenditure	508,887
Total	£4,494,841

The states have the same powers of taxation as the Commonwealth except in regard to customs and excise, over which the Commonwealth has exclusive power, but the states are the owners of the crown lands, and the revenues derived from this source form an important part of their income. The states have a total revenue, from sources apart from the Commonwealth, of £23,820,439, and if to this be added the return of customs duties made by the federal government, the total revenue is £31,206,170. Although the financial operations of the Commonwealth and the states are quite distinct, a statement of the total revenue of the Australian Commonwealth and states is not without interest as showing the weight of taxation and the different sources from which revenue is obtained. For 1906 the respective revenues were:—

Commonwealth	£11,879,343
States	23,820,439
	£35,699,782
Direct taxation	£3,200,000
Indirect taxation; customs and excise	8,999,485
Land revenue	3,500,000
Post-office and telegraphs	2,824,182
Railways, &c.	13,650,000
Other service	3,526,115

The revenue from direct taxation is equal to 15s. 10d. per inhabitant, from indirect taxation £2 : 4 : 6, and the total revenue from all sources £35,699,782, equal to £8 : 16 : 2 per inhabitant. The federal government has no public debt, but each of the six states has

contracted debts which aggregate £237,000,000, equal to about £58, 8s. per inhabitant. The bulk of this indebtedness has been contracted for the purpose of constructing railways, tramways, water-supplies, and other revenue-producing works and services, and it is estimated that only 8% of the total indebtedness can be set down for unproductive services.

Information regarding Australian state finance will be found under the heading of each state.

(T. A. C.)

Aborigines

The origin of the natives of Australia presents a difficult problem. The chief difficulty in deciding their ethnical relations is their remarkable physical difference from the neighbouring peoples. And if one turns from physical criteria to their manners and customs it is only to find fresh evidence of their isolation. While their neighbours, the Malays, Papuans and Polynesians, all cultivate the soil, and build substantial huts and houses, the Australian natives do neither. Pottery, common to Malays and Papuans, the bows and arrows of the latter, and the elaborate canoes of all three races, are unknown to the Australians. They then must be considered as representing an extremely primitive type of mankind, and it is necessary to look far afield for their prehistoric home.

Origin.

Wherever they came from, there is abundant evidence that their first occupation of the Australian continent must have been at a time so remote as to permit of no traditions. No record, no folk tales, as in the case of the Maoris of New Zealand, of their migration, are preserved by the Australians. True, there are legends and tales of tribal migrations and early tribal history, but nothing, as A.W. Howitt points out, which can be twisted into referring even indirectly to their first arrival. It is almost incredible there should be none, if the date of their arrival is to be reckoned as only dating back some centuries. Again, 955
while they differ physically from neighbouring races, while there is practically nothing in common between them and the Malays, the Polynesians, or the Papuan Melanesians, they agree in type so closely among themselves that they must be regarded as forming one race. Yet it is noteworthy that the languages of their several tribes are different. The occurrence of a large number of common roots proves them to be derived from one source, but the great variety of dialects—sometimes unintelligible between tribes separated by only a few miles—cannot be explained except by supposing a vast period to have elapsed since their first settlement. There is evidence in the languages, too, which supports the physical separation from their New Zealand neighbours and, therefore, from the Polynesian family of races. The numerals in use were limited. In some tribes there were only three in use, in most four. For the number “five” a word meaning “many” was employed. This linguistic poverty proves that the Australian tongue has no affinity to the Polynesian group of languages, where denary enumeration prevails: the nearest Polynesians, the Maoris, counting in thousands. Further evidence of the antiquity of Australian man is to be found in the strict observance of tribal boundaries, which would seem to show that the tribes must have been settled a long time in one place.

A further difficulty is created by a consideration of the Tasmanian people, extinct since 1876. For the Tasmanians in many ways closely approximated to the Papuan type. They had coarse, short, woolly hair and Papuan features. They clearly had no racial affinities with the Australians. They did not possess the boomerang or woomerah, and they had no boats. When they were discovered, a mere raft of reeds in which they could scarcely venture a mile from shore was their only means of navigation. Yet while the Tasmanians are so distinctly separated in physique and customs from the Australians, the fauna and flora of Tasmania and Australia prove that at one time the two formed one continent, and it would take an enormous time for the formation of Bass Strait. How did the Tasmanians with their Papuan affinities get so far south on a continent inhabited by a race so differing from Papuans? Did they get to Tasmania before or after its separation from the main continent? If before, why were they only found in the south? It would have been reasonable to expect to find them sporadically all over Australia. If after, how did they get there at all? For it is impossible to accept the theory of one writer that they sailed or rowed round the continent—a journey requiring enormous maritime skill, which, according to the theory, they must have promptly lost.

Four points are clear: (1) the Australians represent a distinct race; (2) they have no kinsfolk among the neighbouring races; (3) they have occupied the continent for a very long period; (4) it would seem that the Tasmanians must represent a still earlier occupation of Australia, perhaps before the Bass Strait existed.

Several theories have been propounded by ethnologists. An attempt has been made to show that the Australians have close affinities with the African negro peoples, and certain resemblances in language and in customs have been relied on. Sorcery, the scars raised on the body, the knocking out of teeth, circumcision and rules as to marriage have been quoted; but many such customs are found among savage peoples far distant from each other and entirely unrelated. The alleged language similarities have broken down on close examination. A.R. Wallace is of the opinion that the Australians “are really of Caucasian type and are more nearly allied to ourselves than to the civilized Japanese or the brave and intelligent Zulus.” He finds near kinsmen for them in the Ainus of Japan, the Khmers and Chams of Cambodia and among some of the Micronesian islanders who, in spite of much crossing, still exhibit marked Caucasic types. He regards the Australians as representing the lowest and most primitive examples of this primitive Caucasic type, and he urges that they must have arrived in Australia at a time when their ancestors had no pottery, knew no agriculture, domesticated no animals, had no houses and used no bows and arrows. This theory has been supported by the investigations of Dr Klaatsch, of the university of Heidelberg, who would, however, date Australian ancestry still farther back, for his studies on the spot have convinced him that the Australians are “a generalized, not a specialized, type of humanity—that is to say, they are a very primitive people, with more of the common undeveloped characteristics of man, and less of the qualities of the specialized races of civilization.” Dr Klaatsch’s view is that they are survivals of a primitive race which inhabited a vast Antarctic continent of which South America, South Africa and Australia once formed a part, as evidenced by the identity of many species of birds and fish. He urges that the similarities of some of the primitive races of India and Africa to the aborigines of Australia are indications that they were peopled from one common stock. This theory, plausible and attractive as it is, and fitting in, as it does, with the acknowledged primitive character of the Australian blackfellow, overlooks, nevertheless, the Tasmanian difficulty. Why should a Papuan type be found in what was certainly once a portion of the Australian continent? The theory which meets this difficulty is that which has in its favour the greatest weight of evidence, viz. that the continent was first inhabited by a Papuan type of man who made his way thither from Flores and Timor, New Guinea and the Coral Sea. That in days so remote as to be undateable, a Dravidian people driven from their primitive home in the hills of the Indian Deccan made their way south via Ceylon (where they may to-day be regarded as represented by the Veddahs) and eventually sailed and drifted in their bark boats to the western and north-western shores of Australia. It is difficult to believe that they at first arrived in such numbers as at once to overwhelm the Papuan population. There were probably several migrations. What seems certain, if this theory is adopted, is that they did at last accumulate to an extent which permitted of their mastering the former occupiers of the soil, who were probably in very scattered and defenceless communities.

In the slow process of time they drove them into the most southerly corner of Australia, just as the Saxons drove the Celts into Cornwall and the Welsh hills. Even if this Dravidian invasion is put subsequent to the Bass Strait forming, even if one allows the probability of much crossing between the two races at first, in time the hostilities would be renewed. With their earliest settlements on the north-north-west coasts, the Dravidians would probably tend to spread out north, north-east and east, and a southerly line of retreat would be the most natural one for the Papuans.[3] When at last they were driven to the Strait they would drift over on rafts or in clumsy shallops; being thereafter left in peace to concentrate their race, then possibly only in an approximately pure state, in the island to which the Dravidians would not take the trouble to follow them, and where they would have centuries in which once more to fix their racial type and emphasize over again those differences, perhaps temporarily marred by crossing, which were found to exist on the arrival of the Whites.

This Indo-Aryan origin for the Australian blackfellows is borne out by their physique. In spite of their savagery they are admitted by those who have studied them to be far removed from the low or Simian type of man. Dr Charles Pickering (1805-1878), who studied the Australians on the spot, writes: “Strange as it may appear, I would refer to an Australian as the finest model of the human proportions I 956
have ever met; in muscular development combining perfect symmetry, activity and strength, while his head might have compared with the antique bust of a philosopher.” Huxley concluded, from descriptions, that “the Deccan tribes are indistinguishable from the Australian races.” Sir W.W. Hunter states that the Dravidian tribes were driven southwards in Hindustan, and that the grammatical relations of their dialects are “expressed by suffixes,” which is true as to the Australian languages. He states that Bishop Caldwell,[4] whom he calls “the great missionary scholar of the Dravidian tongue,” showed that the south and western Australian tribes use almost the same words for “I, thou, he, we, you, as the Dravidian fishermen on the Madras coast.” When in addition to all this it is found that physically the Dravidians resemble the Australians; that the boomerang is known among the wild tribes of the Deccan alone (with the doubtful exception of ancient Egypt) of all parts of the world except Australia, and that the Australian canoes are like those of the

Dravidian coast tribes, it seems reasonable enough to assume that the Australian natives are Dravidians, exiled in remote times from Hindustan, though when their migration took place and how they traversed the Indian Ocean must remain questions to which, by their very nature, there can be no satisfactory answer.

The low stage of culture of the Australians when they reached their new home is thus accounted for, but their stagnation is remarkable, because they must have been frequently in contact with more civilized peoples. In the north of Australia there are traces of Malay and Papuan blood. That a far more advanced race had at one time a settlement on the north-west coast is indicated by the cave-paintings and sculptures discovered by Sir George Grey. In caves of the valley of the Glenelg river, north-west Australia, about 60 m. inland and 20 m. south of Prince Regent's river, are representations of human heads and bodies, apparently of females clothed to the armpits, but all the faces are without any indication of mouths. The heads are surrounded with a kind of head-dress or halo and one wears a necklace. They are drawn in red, blue and yellow. The figures are almost life-size. Rough sculptures, too, were found, and two large square mounds formed of loose stones, and yet perfect parallelograms in outline, placed due east and west. In the same district Sir George Grey noticed among the blackfellows people he describes as "almost white." On the Gascoyne river, too, were seen natives of an olive colour, quite good-looking; and in the neighbourhood of Sydney rock-carvings have been also found. All this points to a temporary occupation by a race at a far higher stage of culture than any known Australians, who were certainly never capable of executing even the crude works of art described.

Physique.

Physically the typical Australian is the equal of the average European in height, but is inferior in muscular development, the legs and arms being of a leanness which is often emphasized by an abnormal corpulence. The bones are delicately formed, and there is the lack of calf usual in black races. The skull is abnormally thick and the cerebral capacity small. The head is long and somewhat narrow, the forehead broad and receding, with overhanging brows, the eyes sunken, large and black, the nose thick and very broad at the nostrils. The mouth is large and the lips thick but not protuberant. The teeth are large, white and strong. In old age they appear much ground down; particularly is this the case with women, who chew the different kinds of fibres, of which they make nets and bags. The lower jaw is heavy; the cheekbones somewhat high, and the chin small and receding. The neck is thicker and shorter than that of most Europeans. The colour of the skin is a deep copper or chocolate, never sooty black. When born, the Australian baby is of a much lighter colour than its parents and remains so for about a week. The hair is long, black or very dark auburn, wavy and sometimes curly, but never woolly, and the men have luxuriant beards and whiskers, often of an auburn tint, while the whole body inclines to hairiness. On the Balonne river, Queensland, Baron Mikluho Maclay found a group of hairless natives. The head hair is usually matted with grease and dirt, but when clean is fine and glossy. The skin gives out an objectionable odour, owing to the habit of anointing the body with fish-oils, but the true fetor of the negro is lacking in the Australian. The voices of the blackfellows are musical. Their mental faculties, though inferior to those of the Polynesian race, are not contemptible. They have much acuteness of perception for the relations of individual objects, but little power of generalization. No word exists in their language for such general terms as tree, bird or fish; yet they have invented a name for every species of vegetable and animal they know. The grammatical structure of some north Australian languages has a considerable degree of refinement. The verb presents a variety of conjugations, expressing nearly all the moods and tenses of the Greek. There is a dual, as well as a plural form in the declension of verbs, nouns, pronouns and adjectives. The distinction of genders is not marked, except in proper names of men and women. All parts of speech, except adverbs, are declined by terminational inflections. There are words for the elementary numbers, one, two, three; but "four" is usually expressed by "two-two." They have no idea of decimals. The number and diversity of separate languages is bewildering.

Character.

In disposition the Australians are a bright, laughter-loving folk, but they are treacherous, untruthful and hold human life cheaply. They have no great physical courage. They are mentally in the condition of children. None of them has an idea of what the West calls morality, except the simple one of right or wrong arising out of property. A wife will be beaten without mercy for unfaithfulness to her husband, but the same wife will have had to submit to the first-night promiscuity, a widespread revel which Roth shows is a regular custom in north-west-central Queensland. A husband claims his wife as his absolute property, but he has no scruple in handing her over for a time to another man. There is, however, no proof that anything like community of women or unlimited promiscuity exists anywhere. It would be wrong, however, to conclude that moral considerations have led up to this state of things. Of sexual morality, in the everyday sense of the word, there is none. In his treatment of women the aboriginal may be ranked lower than even the Fuegians. Yet the Australian is capable of strong affections, and the blind (of whom there have always been a great number) are cared for, and are often the best fed in a tribe.

Manners.

The Australians when first discovered were found to be living in almost a prehistoric simplicity. Their food was the meat they killed in the chase, or seeds and roots, grubs or reptiles. They never, in any situation, cultivated the soil for any kind of food-crop. They never reared any kind of cattle, or kept any domesticated animal except the dog, which probably came over with them in their canoes. They nowhere built permanent dwellings, but contented themselves with mere hovels for temporary shelter. They neither manufactured nor possessed any chattels beyond such articles of clothing, weapons, ornaments and utensils as they might carry on their persons, or in the family store-bag for daily use. In most districts both sexes are entirely nude. Sometimes in the south during the cold season they wear a cloak of skin or matting, fastened with a skewer, but open on the right-hand side.

When going through the bush they sometimes wear an apron of skins, for protection merely. No headgear is worn, except sometimes a net to confine the hair, a bunch of feathers, or the tails of small animals. The breast or back, of both sexes, is usually tattooed, or rather, scored with rows of hideous raised scars, produced by deep gashes made at puberty. Their dwellings for the most part are either bowers, formed of the branches of trees, or hovels of piled logs, loosely covered with grass or bark, which they can erect in an hour, wherever they encamp. But some huts of a more substantial form were seen by Captain Matthew Flinders on the south-east coast in 1799, and by Captain King and Sir T. Mitchell on the north-east, where they no longer appear. The ingenuity of the race is mostly exhibited in the manufacture of their weapons of warfare and the chase. While the use of the bow and arrow does not seem to have occurred to them, the spear and axe are in general use, commonly made of hard-wood; the hatchets of stone, and the javelins pointed with stone or bone. The characteristic weapon of the Australian is the boomerang (*q.v.*). Their nets, made by women, either of the tendons of animals or the fibres of plants, will catch and hold the kangaroo or the emu, or the very large fish of Australian rivers. Canoes of bent bark, for the inland waters, are hastily prepared at need; but the inlets and straits of the north-eastern sea-coast are navigated by larger canoes and rafts of a better construction. As to food, they are omnivorous. In central Queensland and elsewhere, snakes, both venomous and harmless, are eaten, the head being first carefully smashed to pulp with a stone.

Tribal organization.

The tribal organization of the Australians was based on that of the family. There were no hereditary or formally elected chiefs, nor was there any vestige of monarchy. The affairs of a tribe were ruled by a council of men past middle age. Each tribe occupied a recognized territory, averaging perhaps a dozen square miles, and used a common dialect. This district was subdivided between the chief heads of families. Each family, or family group, had a dual organization which has been termed (1) the Social, (2) the Local. The first was matriarchal, inheritance being reckoned through the mother. No territorial association was needed. All belonged to the same totem or totemic class, and might be scattered throughout the tribe, though subject to the same marriage laws. The second was patriarchal and of a strictly territorial nature. A family or group of families had the same hunting-ground, which was seldom changed, and descended through the males. Thus, the sons inherited their fathers' hunting-ground, but bore their mothers' name and therewith the right to certain women for wives. The Social or matriarchal took precedence of the Local or patriarchal organization. In many cases it arranged the assemblies and ceremonial of the tribe; it regulated marriage, descent and relationship; it ordered blood feuds, it prescribed the rites of hospitality and so on. Nevertheless the Local side of tribal life in time tended to overwhelm the Social and to organize the tribe irrespective of matriarchy, and inclined towards hereditary chieftainship.

The most intricate and stringent rules existed as to marriage within and without the totemic inter-marrying classes. There is said to be but one exception to the rule that marriage must be contracted outside the totem name. This exception was discovered by Messrs Spencer and Gillen among the Arunta of central Australia, some allied septs, and their nearest neighbours to the north, the Kaitish. This tribe may legally marry within the totem, but always avoids such unions. Even in casual amours these class laws were invariably observed, and the young man or woman who defied them was punished, he with death, she with spearing or beating. At the death of a man, his widows passed to his brother of the same totem class. Such a system gave to the elder men of a tribe a predominant position, and generally respect was shown to the aged. Laws and penalties in protection of property were enforced by the tribe. Thus, among some tribes of Western Australia the penalty for abducting another's wife was to stand with leg extended while each male of the tribe stuck his spear into it. Laws, however, did not protect the women, who were the mere chattels of their lords. Stringent rules, too,

governed the food of women and the youth of both sexes, and it was only after initiation that boys were allowed to eat of all the game the forest provided. In every case of death from disease or unknown causes sorcery was suspected and an inquest held, at which the corpse was asked by each relative in succession the name of the murderer. This formality having been gone through, the flight of the first bird which passed over the body was watched, the direction being regarded as that in which the sorcerer must be sought. Sometimes the nearest relative sleeps with his head on the corpse, in the belief that he will dream of the murderer. The most sacred duty an Australian had to perform was the avenging of the death of a kinsman, and he was the object of constant taunts and insults till he had done so. Cannibalism was almost universal, either in the case of enemies killed in battle or when animal food was scarce. In the Luritcha tribe it was customary when a child was in weak health to kill a younger and healthy one and feed the weakling on its flesh. Cannibalism seems also to have sometimes been in the nature of a funeral observance, in honour of the deceased, of whom the relatives reverently ate portions.

Religion.

They had no special forms of religious worship, and no idols. The evidence on the question of whether they believed in a Supreme Being is very contradictory. Messrs Spencer and Gillen appear to think that such rudimentary idea of an All-Father as has, it is thought, been detected among the blackfellows is an exotic growth fostered by contact with missionaries. A.W. Howitt and Dr Roth appear to have satisfied themselves of a belief, common to most tribes, in a mythic being (he has different names in different tribes) having some of the attributes of a Supreme Deity. But Mr Howitt finds in this being "no trace of a divine nature, though under favourable conditions the beliefs might have developed into an actual religion." Other authorities suggest that it is going much too far to deny the existence of religion altogether, and instance as proof of the divinity of the supra-normal anthropomorphic beings of the Baiame class, the fact that the Yuin and cognate tribes dance around the image of Daramulun (their equivalent of Baiame) and the medicine men "invocate his name." A good deal perhaps depends on each observer's view of what religion really is. The Australians believed in spirits, generally of an evil nature, and had vague notions of an after-life. The only idea of a god known to be entertained by them seems to be that of the Euahlayi and Kamilaori tribe, Baiame, a gigantic old man lying asleep for ages, with his head resting on his arm, which is deep in the sand. He is expected one day to awake and eat up the world. Researches go to show that Baiame has his counterpart in other tribes, the myth varying greatly in detail. But the Australians are distinguished by possessing elaborate initiatory ceremonies. Circumcision of one or two kinds was usual in the north and south, but not in Western Australia or on the Murray river. In South Australia boys had to undergo three stages of initiation in a place which women were forbidden to approach. At about ten they were covered with blood from head to foot, several elder men bleeding themselves for the purpose. At about twelve or fourteen circumcision took place and (or sometimes as an alternative on the east coast) a front tooth was knocked out, to the accompaniment of the booming of the bullroarer (*q.v.*). At the age of puberty the lad was tattooed or scarred with gashes cut in back, shoulders, arms and chest, and the septum of the nose was pierced. The gashes varied in patterns for the different tribes. Girls, too, were scarred at puberty and had teeth knocked out, &c. The ceremonies—known to the Whites under the native generic term for initiatory rites, *Bora*,—were much the same throughout Australia. Polygamy was rare, due possibly to the scarcity of women.[5] Infanticide was universally recognized. The mode of disposing of the dead varied. Among some tribes a circular grave was dug and the body placed in it with its face towards the east, and a high mound covered with bark or thatch raised over it. In New South Wales the body is often burned and the ashes buried. On the Lower Murray the body is placed on a platform of sticks and left to decay. Young children are often not buried for months, but are carried about by their mothers. At the funeral of men there is much mourning, the female relatives cutting or tearing their hair off and plastering their faces with clay, but for women no public ceremonies took place.

The numbers of the native Australians are steadily diminishing. It was estimated that when first visited by Europeans the native population did not much exceed 200,000. A remnant of the race exists in each of the provinces, while a few tribes still wander over the interior.

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(C. AR.)

HISTORY

1. *The Discovery of Australia.*

It is impossible to say who were the first discoverers of Australia, although there is evidence that the Chinese had some knowledge of the continent so far back as the 13th century. The Malays, also, would seem to have been acquainted with the northern coast; while Marco Polo, who visited the East at the close of the 13th century, makes reference to the reputed existence of a great southern continent. There is in existence a map, dedicated to Henry VIII. of England, on which a large southern land is shown, and the tradition of a Terra Australis appears to have been current for a long period before it enters into authentic history.

In 1503 a French navigator named Binot Paulmyer, sieur de Gonneville, was blown out of his course, and landed on a large island, which was claimed to be the great southern land of tradition, although Flinders and other authorities are inclined to think that it must have been Madagascar. Some French authorities confidently put forward a claim that Guillaume le Testu, of Provence, sighted the continent in 1531. The Portuguese also advance claims to be the first discoverers of Australia, but so far the evidence cannot be said to establish their pretensions. As early as 1597 the Dutch historian, Wytfliet, describes the Australis Terra as the most southern of all lands, and proceeds to give some circumstantial particulars respecting its geographical relation to New Guinea, venturing the opinion that, were it thoroughly explored, it would be regarded as a fifth part of the world.

De Torres.

Early in the 17th century Philip III. of Spain sent out an expedition from Callao, in Peru, for the purpose of searching for a southern continent. The little fleet comprised three vessels, with the Portuguese pilot, De Quiros, as navigator, and De Torres as admiral or military commander. They left Callao on the 21st of December 1605, and in the following year discovered the island now known as Espiritu Santo, one of the New Hebrides group, which De Quiros, under the impression that it was indeed the land of which he was in search, named *La Austrialia del Espiritu Santo*. Sickness and discontent led to a mutiny on De Quiros' vessel, and the crew, overpowering their officers during the night, forced the captain to navigate his ship to Mexico. Thus, abandoned by his consort, De Torres, compelled to bear up for the Philippines to refit, discovered and sailed through the strait that bears his name, and may even have caught a glimpse of the northern coast of the Australian continent. His discovery was not, however, made known until 1792, when Dalrymple rescued his name from oblivion, bestowing it upon the passage which separates New Guinea from Australia. De Quiros returned to Spain to re-engage in the work of petitioning the king to despatch an expedition for the purpose of prosecuting the discovery of the Terra Australis. He was finally successful in his petitions, but died before accomplishing his work, and was buried in an unknown grave in Panama, never being privileged to set his foot upon the continent the discovery of which was the inspiration of his life.

Dutch discoverers.

During the same year in which De Torres sailed through the strait destined to make him famous, a little Dutch vessel called the "Duyfken," or "Dove," set sail from Bantam, in Java, on a voyage of discovery. This ship entered the Gulf of Carpentaria, and sailed south as far as Cape Keerweer, or Turn-again. Here some of the crew landed, but, being attacked by natives, made no attempt to explore the country. In 1616 Dirk Hartog discovered the island bearing his name. In 1622 the "Leeuwin," or "Lioness," made some discoveries on the south-west coast; and during the following year the yachts "Pera" and "Arnheim" explored the shores of the Gulf of Carpentaria. Arnheim Land, a portion of the Northern Territory, still appears on many maps as a memento of this voyage. Among other early Dutch discoverers were Edel; Pool, in 1629, in the Gulf of Carpentaria; Nuyts, in the "Guide Zeepaard," along the southern coast, which he called, after himself, Nuyts Land; De Witt; and Pelsaert, in the "Batavia." Pelsaert was wrecked on Houtman's Abrolhos; his crew mutinied, and he and his party suffered greatly from want of water. The record of his voyage is interesting from the fact that he was the first to carry back to Europe an authentic

account of the western coast of Australia, which he described in any but favourable terms. It is to Dutch navigators in the early portion of the 17th century that we owe the first really authentic accounts of the western coast and adjacent islands, and in many instances the names given by these mariners to prominent physical features are still retained. By 1665 the Dutch possessed rough charts of almost the whole of the western littoral, while to the mainland itself they had given the name of New Holland. Of the Dutch discoverers, Pelsaert was the only one who made any detailed observations of the character of the country inland, and it may here be remarked that his journal contains the first notice and description of the kangaroo that has come down to us.

In 1642 Abel Janszoon Tasman sailed on a voyage of discovery from Batavia, the headquarters of the governor and council of the Dutch East Indies, under whose auspices the expedition was undertaken. He was furnished with a yacht, the "Heemskirk," and a fly-boat, the "Zeehaen" (or "Sea Hen"), under the command of Captain Jerrit Jansen. He left Batavia on what has been designated by Dutch historians the "Happy Voyage," on the 14th of August 1642. After a visit to the Mauritius, then a Dutch possession, Tasman bore away to the south-east, and on the 24th of November sighted the western coast of the land which he named Van Diemen's Land, in honour of the governor under whose directions he was acting. The honour was later transferred to the discoverer himself, and the island is now known as Tasmania. Tasman doubled the southern extremity of Van Diemen's Land and explored the east coast for some distance. The ceremony of hoisting a flag and taking possession of the country in the name of the government of the Netherlands was actually performed, but the description of the wildness of the country, and of the fabulous giants by which Tasman's sailors believed it to be inhabited, deterred the Dutch from occupying the island, and by the international principle of "non-user" it passed from their hands. Resuming his voyage in an easterly direction, Tasman sighted the west coast of the South Island of New Zealand on the 13th of December of the same year, and describes the coast-line as consisting of "high mountainous country."

Dampier.

The first English navigator to sight the Australian continent was William Dampier, who made a visit to these shores in 1688, as supercargo of the "Cygnet," a trader whose crew had turned buccaneers. On his return to England he published an account of his voyage, which resulted in his being sent out in the "Roebuck" in 1699 to prosecute his discoveries further. To him we owe the exploration of the coast for about 900 m.—from Shark's Bay to Dampier's Archipelago, and thence to Roebuck Bay. He appears to have landed in several places in search of water. His account of the country was quite as unfavourable as Pelsaert's. He described it as barren and sterile, and almost devoid of animals, the only one of any importance somewhat resembling a raccoon—a strange creature, which advanced by great bounds or leaps instead of walking, using only its hind legs, and covering 12 or 15 ft. at a time. The reference is, of course, to the kangaroo, which Pelsaert had also remarked and quaintly described some sixty years previously.

During the interval elapsing between Dampier's two voyages, an accident led to the closer examination of the coasts of Western Australia by the Dutch. In 1684 a vessel had sailed from Holland for the Dutch possessions in the East Indies, and after rounding the Cape of Good Hope, she was never again heard of. Some twelve years afterwards the East India Company fitted out an expedition under the leadership of Commander William de Vlamingh, with the object of searching for any traces of the lost vessel on the western shores of New Holland. Towards the close of the year 1696 this expedition reached the island of Rottnest, which was thoroughly explored, and early the following year a landing party discovered and named the Swan river. The vessels then proceeded northward without finding any traces of the object of their search, but, at the same time, making fairly accurate charts of the coast-line.

Cook.

The great voyage of Captain James Cook, in 1769-1770, was primarily undertaken for the purposes of observing the transit of Venus, but he was also expressly commissioned to ascertain "whether the unexplored part of the southern hemisphere be only an immense mass of water, or contain another continent." H.M.S. "Endeavour," the vessel fitted out for the voyage, was a small craft of 370 tons, carrying twenty-two guns, and built originally for a collier, with a view rather to strength than to speed. Chosen by Cook himself, she was renamed the "Endeavour," in allusion to the great work which her commander was setting out to achieve. Mr Charles Green was commissioned to conduct the astronomical observations, and Sir Joseph Banks and Dr Solander were appointed botanists to the expedition. After successfully observing the transit from the island of Tahiti, or Otaheite, as Cook wrote it, the "Endeavour's" head was turned south, and then north-west, beating about the Pacific in search of the eastern coast of the great continent whose western shores had been so long known to the Dutch. On the 6th of October 1769 the coast of New Zealand was sighted, and two days later Cook cast anchor in Poverty Bay, so named from the inhospitality and hostility of the natives.

After voyaging westward for nearly three weeks, Cook, on the 19th of April 1770, sighted the eastern coast of Australia at a point which he named after his lieutenant, who discovered it, Point Hicks, and which modern geographers identify with Cape Everard.

The "Endeavour" then coasted northward, and after passing and naming Mount Dromedary, the Pigeon House, Point Upright, Cape St George and Red Point, Botany Bay was discovered on the 28th of April 1770, and as it appeared to offer a suitable anchorage, the "Endeavour" entered the bay and dropped anchor. The ship brought-to opposite a group of natives, who were cooking over a fire. The great navigator and his crew, unacquainted with the character of the Australian aborigines, were not a little astonished that these natives took no notice of them or their proceedings. Even the splash of the anchor in the water, and the noise of the cable running out through the hawse-hole, in no way disturbed them at their occupation, or caused them to evince the slightest curiosity. But as the captain of the "Endeavour" ordered out the pinnace and prepared to land, the natives threw off their nonchalance; for on the boat approaching the shore, two men, each armed with a bundle of spears, presented themselves on a projecting rock and made threatening signs to the strangers. It is interesting to note that the ingenious *wommera*, or throw-stick, which is peculiar to Australia, was first observed on this occasion. As the men were evidently determined to oppose any attempt at landing, a musket was discharged between them, in the hope that they would be frightened by the noise, but it produced no effect beyond causing one of them to drop his bundle of spears, of which, however, he immediately repossessed himself, and with his comrade resumed the same menacing attitude. At last one cast a stone towards the boat, which earned him a charge of small shot in the leg. Nothing daunted, the two ran back into the bush, and presently returned furnished with shields made of bark, with which to protect themselves from the firearms of the crew. Such intrepidity is certainly worthy of passing notice. Unlike the American Indians, who supposed Columbus and his crew to be supernatural beings, and their ships in some way endowed with life, and were thrown into convulsions of terror by the first discharge of firearms which they witnessed, these Australians were neither excited to wonder by the ship nor overawed by the superior number and unknown weapons of the strangers. Cook examined the bay in the pinnace, and landed several times; but by no endeavour could he induce the natives to hold any friendly communication with him. The well-known circumstance of the great variety of new plants here obtained, from which Botany Bay derives its name, should not be passed over. Before quitting the bay the ceremony was performed of hoisting the Union Jack, first on the south shore, and then near the north head, formal possession of the territory being thus taken for the British crown. During the sojourn in Botany Bay the crew had to perform the painful duty of burying a comrade—a seaman named Forby Sutherland, who was in all probability the first British subject whose body was committed to Australian soil.

After leaving Botany Bay, Cook sailed northward. He saw and named Port Jackson, but forbore to enter the finest natural harbour in Australia. Broken Bay and other inlets, and several headlands, were also seen and named, but the vessel did not come to an anchor till Moreton Bay was reached, although the wind prevented Cook from entering this harbour. Still sailing northward, taking notes as he proceeded for a rough chart of the coast, and landing at Bustard and Keppel Bays and the Bay of Inlets, Cook passed over 1300 m. without the occurrence of any event worthy of being chronicled, till suddenly one night at ten o'clock the water was found to shoal, without any sign of breakers or land. While Cook was speculating on the cause of this phenomenon, and was in the act of ordering out the boats to take soundings, the "Endeavour" struck heavily, and fell over so much that the guns, spare cables, and other heavy gear had at once to be thrown overboard to lighten the ship. As day broke, attempts were made to float the vessel off with the morning tide; but these were unsuccessful. The water was rising so rapidly in the hold that with four pumps constantly going the crew could hardly keep it in check. At length one of the midshipmen suggested the device of "fothering," which he had seen practised in the West Indies. This consists of passing a sail, attached to cords, and charged with oakum, wool, and other materials, under the vessel's keel, in such a manner that the suction of the leak may draw the canvas into the aperture, and thus partially stop the vent. This was performed with great success, and the vessel was floated off with the evening tide. The land was soon after made near the mouth of a small stream, which Cook called, after the ship, the Endeavour river. A headland close by he named Cape Tribulation. The ship was steered into the river, and there careened and thoroughly repaired. Cook having completed the survey of the east coast, to which he gave the name of New South Wales, sighted and named Cape York, the northernmost point of Australia, and took final possession of his discoveries northward from 38° S. to 10½° S., on a spot which he named Possession Island, thence returning to England by way of Torres Straits and the Indian Ocean.

The great navigator's second voyage, undertaken in 1772, with the "Resolution" and the "Adventure," is of less importance. The vessels became separated, and both at different times visited New Zealand. Captain Tobias Furneaux, in the "Adventure," also found his way to Storm Bay in Tasmania. In 1777, while on his way to search for a north-east passage between the Atlantic and Pacific

oceans, Cook again touched at the coast of Tasmania and New Zealand.

On his first voyage, in 1770, Cook had some grounds for the belief that Van Diemen's Land, as Tasmania was then called, was a separate island. The observations of Captain Furneaux, however, did not strengthen this belief, and when making his final voyage, the great navigator appears to have definitely concluded that it was part of the mainland of Australia. This continued to be the opinion of geographers until 1798, when Bass discovered the strait which bears his name. The next recorded expedition is a memorable one in the annals of Australian history—the despatch of a British colony to the shores of Botany Bay. The fleet sailed in May 1787, and arrived off the Australian coast early in the following January.

2. *Inland Exploration.*

For a period of twenty-five years after the first establishment of a British settlement in Australia, the colonists were only acquainted with the country along the coast extending northwards about 70 m. from Sydney and about a like distance to the south and shut in to the west by the Blue Mountain range, forming a narrow strip not more than 50 m. wide at its broadest part.

The Blue Mountains attain a height of between 3000 and 4000 ft. only, but they are intersected with precipitous ravines 1500 ft. deep, which baffled every effort to reach the interior until in 1813, when a summer of severe drought had made it of vital importance to find new pastures, three of the colonists, Messrs Blaxland, Lawson and Wentworth, more fortunate than their predecessors in exploration, after crossing the Nepean river at Emu Plains and ascending the Dividing Range, were able to reach a position enabling them to obtain a view of the grassy valley of the Fish river, which lies on the farther side of the Dividing Range. The western descent of the mountains appeared to the explorers comparatively easy, and they returned to report their discovery. A line of road was constructed across the mountains as far as the Macquarie river by the surveyor, Mr Evans, and the town of Bathurst laid out. This marks the beginning of the occupation of the interior of the continent. Some small expeditions were made from Bathurst, resulting in the discovery of the Lachlan, and in 1816 the first of the great exploration expeditions of Australia was fitted out under

Oxley.

Lieutenant Oxley, R.N. Oxley was accompanied by Mr Evans and Mr Allan Cunningham the botanist, and the object of his expedition was to trace the course of the Lachlan in a westerly direction. Oxley traced the river until it lost itself in the swamps east of 147° E., then crossing the river he traversed the country between the Lachlan and Murrumbidgee as far as 34° S. and 144° 30′ E. On his return journey Oxley again crossed the Lachlan about 160 m., measured along the river, below the point where he left it on his journey south. Continuing in a north-easterly direction Oxley struck the Macquarie river at a place he called Wellington, and from this place in the following year he organized a second expedition in hopes of discovering an inland sea. He was, however, disappointed in this, as after descending the course of the Macquarie below Mount Harris, he found that the river ended in an immense swamp overgrown with reeds. Oxley now turned aside—led by Mr Evans's report of the country eastward—crossed the Arbuthnot range, and traversing the Liverpool Plains, and ascending the Peel and Cockburn rivers to the Blue Mountains, gained sight of the open sea, which he reached at Port Macquarie. A valuable extension of geographical knowledge had been gained by this circuitous journey of more than 800 m. Yet its result was a disappointment to those who had looked for means of inland navigation by the Macquarie river, and by its supposed issue in a mediterranean sea.

During the next two or three years public attention was occupied with Captain King's maritime explorations of the north-west coast in three successive voyages, and by explorations of Western Australia in 1821. These steps were followed by the foundation of a settlement on Melville Island, in the extreme north, which, however, was soon abandoned. In 1823 Lieutenant Oxley proceeded to Moreton Bay and Port Curtis, the first place 500 m., the other 690 m. north of Sydney, to choose the site of a new penal establishment. From a shipwrecked English sailor he met with, who had lived with the savages, he heard of the river Brisbane. About the same time, in the opposite direction, south-west of Sydney, a large extent of the interior was revealed. Messrs Hamilton Hume and Hovell set out from Lake George, crossed the Murrumbidgee, and, after following the river for a short distance, struck south, skirting the foothills of what are now known as the Australian Alps until they reached a fine river, which was called the Hume after the leader's father. Crossing the Murray at Albury, the explorers, bearing to the south-west, skirted the western shore of Port Philip and reached the sea-coast near where the town of Geelong now stands. In 1827 and the two following years, Cunningham prosecuted instructive explorations on both sides of the Liverpool range, between the upper waters of the Hunter and those of the Peel and other tributaries of the Brisbane north of New South Wales. Some of his discoveries, including those of Pandora's Pass and the Darling Downs, were of great practical utility.

By this time much had thus been done to obtain an acquaintance with the eastern parts of the Australian continent, although the problem of what could become of the large rivers flowing north-west and south-west into the interior was still

Darling.

unsolved. With a view to determine this question, Governor Sir Ralph Darling, in the year 1828, sent out the expedition under Captain Charles Sturt, who, proceeding first to the marshes at the end of the Macquarie river, found his progress checked by the dense mass of reeds in that quarter. He therefore turned westward, and struck a large river, with many affluents, to which he gave the name of the Darling. This river, flowing from north-east to south-west, drains the marshes in which the Macquarie and other streams from the south appeared to be lost. The course of the Murrumbidgee, a deep and rapid river, was followed by the same eminent explorer in his second expedition in 1831 with a more satisfactory result. He travelled on this occasion nearly 2000 m., and discovered that both the Murrumbidgee, carrying with it the waters of the Lachlan morass, and likewise the Darling, from a more northerly region, finally joined another and larger river. This stream, the Murray, in the upper part of its course runs in a north-westerly direction, but afterwards turning southwards, almost at a right angle, expands into Lake Alexandrina on the south coast, about 60 m. south-east of the town of Adelaide, and finally enters the sea at Encounter Bay in E. long. 139°.

After gaining a practical solution of the problem of the destination of the westward-flowing rivers, Sir Thomas Mitchell, in 1833, led an expedition northward to the upper branches of the Darling; the party met with a sad disaster in the death of

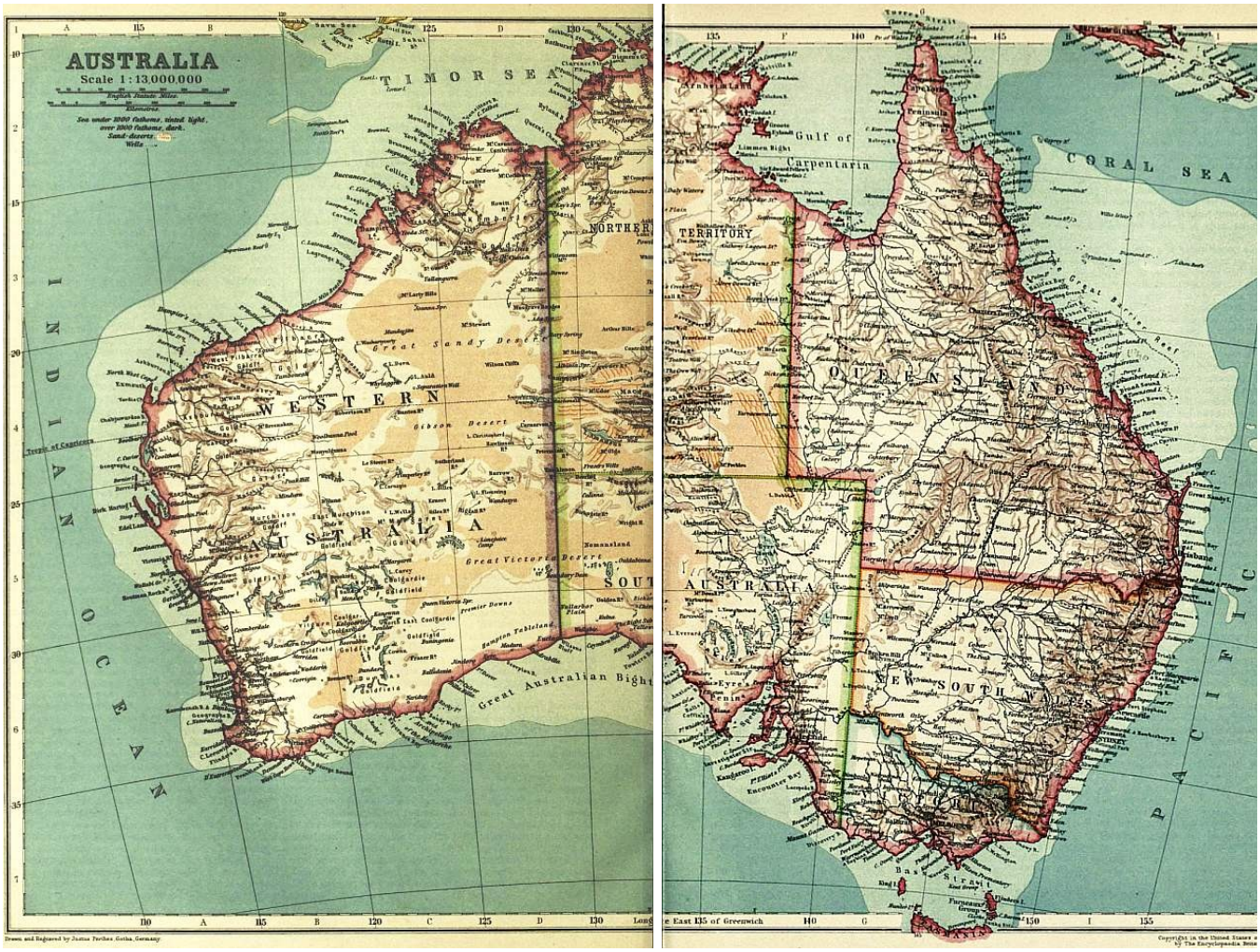
Mitchell.

Richard Cunningham, brother of the eminent botanist, who was murdered by the blacks near the Bogan river. The expedition reached the Darling on the 25th of May 1833, and after establishing a depot at Fort Bourke, Mitchell traced the Darling southwards for 300 m. until he was certain the river was identical with that reported by Sturt as joining the Murray about 142° E.

Meantime, from the new colony of Adelaide, South Australia, on the shores of Gulf St Vincent, a series of adventurous journeys to the north and to the west was begun by Mr Eyre, who explored a country very difficult of access. In 1840 he performed a

Eyre.

feat of extraordinary personal daring, travelling all the way along the barren sea-coast of the Great Australian Bight, from Spencer Gulf to King George Sound. Eyre also explored the interior north of the head of Spencer Gulf, where he was misled, however, by appearances to form an erroneous theory about the water-surfaces named Lake Torrens. It was left to the veteran explorer, Sturt, to achieve the arduous enterprise of penetrating from the Darling northward to the very centre of the continent. This was in 1845, the route lying for the most part over a stony desert, where the heat (reaching 131° Fahr.), with scorching winds, caused much suffering to the party. The most northerly point reached by Sturt on this occasion was about S. lat. 24° 25′.



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Leichhardt.

A military station having been fixed by the British government at Port Victoria, on the coast of Arnheim Land, for the protection of shipwrecked mariners on the north coast, it was thought desirable to find an overland route between this settlement and Moreton Bay, in what then was the northern portion of New South Wales, now called Queensland. This was the object of Dr Leichhardt's expedition in 1844, which proceeded first along the banks of the Dawson and the Mackenzie, tributaries of the Fitzroy river, in Queensland. It thence passed farther north to the Burdekin, ascending to the source of that river, and turned westward across a table-land, from which there was an easy descent to the Gulf of Carpentaria. Skirting the low shores of this gulf, all the way round its upper half to the Roper, Leichhardt crossed Arnheim Land to the Alligator river, which he descended to the western shore of the peninsula, and arrived at Port Victoria, otherwise Port Essington, after a journey of 3000 m., performed within a year and three months. In 1847 Leichhardt undertook a much more formidable task, that of crossing the entire continent from east to west. His starting-point was on the Fitzroy Downs, north of the river Condamine, in Queensland, between the 26th and 27th degrees of S. latitude. But this eminent explorer had not proceeded far into the interior before he met his death, his last despatch dating from the Cogoon, 3rd of April 1848. In the same region, from 1845 to 1847, Sir Thomas Mitchell and Mr E.B. Kennedy explored the northern tributaries of the Darling, and a river in S. lat. 24°, named the Barcoo or Victoria, which flows to the south-west. This river was more thoroughly examined by Mr A.C. Gregory in 1858. Mr Kennedy lost his life in 1848, being killed by the natives while attempting to explore the peninsula of Cape York, from Rockingham Bay to Weymouth Bay.

Among the performances of less renown, but of much practical utility in surveying and opening new paths through the country, we may mention that of Captain Banister, showing the way across the southern part of Western Australia, from Swan river to King George Sound, and that of Messrs Robinson and G.H. Haydon in 1844, making good the route from Port Phillip to Gipps' Land with loaded drays, through a dense tangled scrub, which had been described by Strzelecki as his worst obstacle. Again, in Western Australia there were the explorations of the Arrowsmith, the Murchison, the Gascoyne, and the Ashburton rivers, by Captain Grey, Mr Roe, Governor Fitzgerald, Mr R. Austin, and the brothers Gregory, whose discoveries have great importance from a geographical point of view.

Stuart.

These local researches, and the more comprehensive attempts of Leichhardt and Mitchell to solve the chief problems of Australian geography, must yield in importance to the grand achievement of Mr Stuart in 1862. The first of his tours independently performed, in 1858 and 1859, were around the South Australian lakes, namely, Lake Torrens, Lake Eyre and Lake Gairdner. These waters had been erroneously taken for parts of one vast horse-shoe or sickle shaped lake, only some 20 m. broad, believed to encircle a large portion of the inland country, with drainage at one end by a marsh into Spencer Gulf. The mistake, shown in all the old maps of Australia, had originated in a curious optical illusion. When Mr Eyre viewed the country from Mount Deception in 1840, looking between Lake Torrens and the lake which now bears his own name, the refraction of light from the glittering crust of salt that covers a large space of stony or sandy ground produced an appearance of water. The error was discovered, after eighteen years, by the explorations of Mr Babbage and Major Warburton in 1858, while Mr Stuart, about the same time, gained a more complete knowledge of the same district.

A reward of £10,000 having been offered by the legislature of South Australia to the first man who should traverse the whole continent from south to north, starting from the city of Adelaide, Mr Stuart resolved to make the attempt. He started in March 1860, passing Lake Torrens and Lake Eyre, beyond which he found a pleasant, fertile country till he crossed the Macdonnell range of mountains, just under the line of the tropic of Capricorn. On the 23rd of April he reached a mountain in S. lat. nearly 22°, and E. long. nearly 134°, which is the most central marked point of the Australian continent, and has been named Central Mount Stuart. Mr Stuart did not finish his task on this occasion, on account of indisposition and other causes. But the 18th degree of latitude had been reached, where the watershed divided the rivers of the Gulf of Carpentaria from the Victoria river, flowing towards the north-west coast. He had also proved that the interior of Australia was not a stony desert, like the region visited by Sturt in 1845. On the first day of the next year, 1861, Mr Stuart again started for a second attempt to cross the continent, which occupied him eight months. He failed, however, to advance farther than one geographical degree north of the point reached in 1860, his progress being arrested by dense scrubs and the want of water.

Meanwhile, in the province of Victoria, by means of a fund subscribed among the colonists and a grant by the legislature, the ill-fated expedition of Messrs Burke and Wills was started. It made for the Barcoo (Cooper's Creek), with a view to reach the Gulf of

Burke and Wills. Carpentaria by a northerly course midway between Sturt's track to the west and Leichhardt's to the east. The leading men of the party were Mr Robert O'Hara Burke, an officer of police, and Mr William John Wills, of the Melbourne observatory. Leaving the main body of his party at Menindie on the Darling under a man named Wright, Burke, with seven men, five horses and sixteen camels, pushed on for Cooper's Creek, the understanding being that Wright should follow him in easy stages to the depot proposed to be there established. Wright frittered away his time in the district beyond the Darling and did not attempt to follow the party to Cooper's Creek, and Burke, tired of waiting, determined to push on. Accordingly, dividing his party, leaving at the depot four men and taking with him Wills and two men, King and Gray, with a horse and six camels, he left Cooper's Creek on the 16th of December and crossed the desert traversed by Sturt fifteen years before. They got on in spite of great difficulties, past the McKinlay range of mountains, S. lat. 21° and 22°, and then reached the Flinders river, which flows into the head of the Gulf of Carpentaria. Here, without actually standing on the sea-beach of the northern shore, they met the tidal waters of the sea. On the 23rd of February 1861 they commenced the return journey, having in effect accomplished the feat of crossing the Australian continent. Gray, who had fallen ill, died on the 16th of April. Five days later, Burke, Wills and King had repassed the desert to the place on Cooper's Creek (the Barcoo, S. lat. 27° 40′, E. long. 140° 30′), where they had left the depot, with the rest of the expedition. Here they experienced a cruel disappointment. The depot was abandoned; the men in charge had quitted the place the same day, believing that Burke and those with him were lost. The men who had thus abandoned the depot rejoined the main body of the expedition under Wright, who at length moved to Cooper's Creek, and, incredible to relate, neglected to search for the missing explorers. Burke, Wills and King, when they found themselves so fearfully left alone and unprovided in the wilderness, wandered about in that district till near the end of June. They subsisted miserably on the bounty of some natives, and partly by feeding on the seeds of a plant called nardoo. At last both Wills and Burke died of starvation. King, the sole survivor, was saved by meeting the friendly blacks, and was found alive in September by Mr A.W. Howitt's party, sent on purpose to find and relieve that of Burke.

Four other parties, besides Howitt's, were sent out that year from different Australian provinces. Three of them, respectively commanded by Mr Walker, Mr Landsborough, and Mr Norman, sailed to the north, where the latter two landed on the shores of the Gulf of Carpentaria, while Mr Walker marched inland from Rockhampton. The fourth party, under Mr J. McKinlay, from Adelaide, made for the Barcoo by way of Lake Torrens. By these means, the unknown region of Mid Australia was simultaneously entered from the north, south, east and west, and important additions were made to geographical knowledge Landsborough crossed the entire continent from north to south. between February and June 1862; and McKinlay, from south to north, before the end of August in that year. The interior of New South Wales and Queensland, all that lies east of the 140th degree of longitude, was examined. The Barcoo or Cooper's Creek and its tributary streams were traced from the Queensland mountains, holding a south-westerly course to Lake Eyre in South Australia; the Flinders, the Gilbert, the Gregory, and other northern rivers watering the country towards the Gulf of Carpentaria were also explored. These valuable additions to Australian geography were gained through humane efforts to relieve the lost explorers. The bodies of Burke and Wills were recovered and brought to Melbourne for a solemn public funeral, and a noble monument has been erected to their honour.

Mr Stuart, in 1862, made his third and final attempt to traverse the continent from Adelaide along a central line, which, inclining a little westward, reaches the north coast of Arnheim Land, opposite Melville Island. He started in January, and on the 7th of April reached the farthest northern point, near S. lat. 17°, where he had turned back in May of the preceding year. He then pushed on, through a very thick forest, with scarcely any water, till he came to the streams which supply the Roper, a river flowing into the western part of the Gulf of Carpentaria. Having crossed a table-land of sandstone which divides these streams from those running to the western shores of Arnheim Land, Mr Stuart, in the month of July, passed down what is called the Adelaide river of north Australia. Thus he came at length to stand on the verge of the Indian Ocean; "gazing upon it," a writer has said, "with as much delight as Balboa, when he crossed the Isthmus of Darien from the Atlantic to the Pacific." The line crossing Australia which was thus explored has since been occupied by the electric telegraph connecting Adelaide, Melbourne, Sydney, and other Australian cities with London.

A third part, at least, of the interior of the whole continent, between the central line of Stuart and the known parts of Western Australia, from about 120° to 134° E. long., an extent of half a million square miles, still remained a blank in the map.

Gosse. But the two expeditions of 1873, conducted by William Christie Gosse (1842-1881), afterwards deputy surveyor-general for South Australia, and Colonel (then Major) Egerton Warburton, made a beginning in the exploration of this *terra incognita* west of the central telegraph route. That line of more than 1800 m., having its southern extremity at the head of Spencer Gulf, its northern at Port Darwin, in Arnheim Land, passes Central Mount Stuart, in the middle of the continent, S. lat. 22°, E. long. 134°. Mr Gosse, with men and horses provided by the South Australian government, started on the 21st of April from the telegraph station 50 m. south of Central Mount Stuart, to strike into Western Australia. He passed the Reynolds range and Lake Amadeus in that direction, but was compelled to turn south, where he found a tract of well-watered grassy land. A singular rock of conglomerate, 2 m. long, 1 m. wide, and 1100 ft. high, with a spring of water in its centre, struck his attention. The country was mostly poor and barren, sandy hillocks, with scanty growth of spinifex. Mr Gosse, having travelled above 600 m., and getting to 26° 32′ S. and 127° E., two degrees within the Western Australian boundary, was forced to return. Meantime a more successful attempt to reach the

Warburton. western coast from the centre of Australia was made by Major Warburton, with thirty camels, provided by Mr (afterwards Sir) T. Elder, of South Australia. Leaving the telegraph line at Alice Springs (23° 40′ S., 133° 14′ E.), 1120 m. north of Adelaide city, Warburton succeeded in making his way to the De Grey river, Western Australia. Overland routes had now been found possible, though scarcely convenient for traffic, between all the widely separated Australian provinces. In northern Queensland, also, there were several explorations about this period, with results of some interest. That performed by Mr W. Hann, with Messrs Warner, Tate and Taylor, in 1873, related to the country north of the Kirchner range, watered by the Lynd, the Mitchell, the Walsh and the Palmer rivers, on the east side of the Gulf of Carpentaria. The coasting expedition of Mr G. Elphinstone Dalrymple, with Messrs Hill and Johnstone, finishing in December 1873, effected a valuable survey of the inlets and navigable rivers in the Cape York Peninsula.

Of the several attempts to cross Western Australia, even Major Warburton's expedition, the most successful, had failed in the important particular of determining the nature of the country through which it passed. Major Warburton had virtually raced across from the Macdonnell range in South Australia to the headwaters of the Oakover river on the north-west coast, without allowing himself

Forrest. sufficient time to note the characteristics of the country. The next important expedition was differently conducted. John (afterwards Sir John) Forrest was despatched by the Perth government with general instructions to obtain information regarding the immense tract of country out of which flow the rivers falling into the sea on the northern and western shores of Western Australia. Leaving Yewin, a small settlement about lat. 28° S., long. 116° E., Forrest travelled north-east to the Murchison river, and followed the course of that river to the Robinson ranges; thence his course lay generally eastward along the 26th parallel. Forrest and his party safely crossed the entire extent of Western Australia, and entering South Australia struck the overland telegraph line at Peake station, and, after resting, journeyed south to Adelaide. Forrest traversed seventeen degrees of desert in five months, a very wonderful achievement, more especially as he was able to give a full report of the country through which he passed. His report destroyed all hope that pastoral settlement would extend to the spinifex region; and the main object of subsequent explorers was to determine the extent of the desert in the direction of north and south. Ernest Giles made

Giles. several attempts to cross the Central Australian Desert, but it was not until his third attempt that he was successful. His journey ranks almost with Forrest's in the importance of its results and the success with which the appalling difficulties of the journey were overcome. Through the generosity of Sir Thomas Elder, of Adelaide, Giles's expedition was equipped with camels. It started on the 23rd of May 1875 from Port Augusta. Working westerly along the line of the 30th parallel, Giles reached Perth in about five months. After resting in Perth for a short time, he commenced the return journey, which was made for the most part between the 24th and 25th parallels, and again successfully traversed the desert, reaching the overland telegraph line in about seven months. Giles's journeys added greatly to our knowledge of the characteristics of Western and South Australia, and he was able to bear out the common opinion that the interior of Australia west of 132° E. long, is a sandy and waterless waste, entirely unfit for settlement.

The list of explorers since 1875 is a long one; but after Forrest's and Giles's expeditions the main object ceased to be the discovery of pastoral country: a new zest had been added to the cause of exploration, and most of the smaller expeditions

Recent explorers. concerned themselves with the search for gold. Amongst the more important explorations may be ranked those of Tietkins in 1889, of Lindsay in 1891, of Wells in 1896, of Hübbe in 1896, and of the Hon. David Carnegie in 1896-97. Lindsay's expedition, which was fitted out by Sir Thomas Elder, the generous patron of Australian exploration, entered Western Australia about the 26th parallel south lat., on the line of route taken by Forrest in 1874. From this point the explorer worked in a south-westerly direction to Queen Victoria Springs, where he struck the track of Giles's expedition of 1875. From the Springs the expedition went north-west and made a useful examination of the country lying between 119° and 115° meridians and between 26° and 28° S. lat. Wells's expedition started from a base about 122° 20′ E. and 25° 54′ S., and worked northward to the Joanna Springs,

situated on the tropic of Capricorn and near the 124th meridian. From the springs the journey was continued along the same meridian to the Fitzroy river. The country passed through was mostly of a forbidding character, except where the Kimberley district was entered, and the expedition suffered even more than the usual hardships. The establishment of the gold-fields, with their large 963
population, caused great interest to be taken in the discovery of practicable stock routes, especially from South Australia in the east, and from Kimberley district in the north. Alive to the importance of the trade, the South Australian government despatched Hübbe from Oodnadatta to Coolgardie. He successfully accomplished his journey, but had to report that there was no practicable route for cattle between the two districts.

One of the most successful expeditions which traversed Western Australia was that led and equipped by the Hon. David Carnegie, which started in July 1896, and travelled north-easterly until it reached Alexander Spring; then turning northward, it traversed the country between Wells's track of 1896 and the South Australian border. The expedition encountered very many hardships, but successfully reached Hall Creek in the Kimberley district. After a few months' rest it started on the return journey, following Sturt Creek until its termination in Gregory's Salt Sea, and then keeping parallel with the South Australian border as far as Lake Macdonald. Rounding that lake the expedition moved south-west and reached the settled districts in August 1897. The distance travelled was 5000 m., and the actual time employed was eight months. This expedition put an end to the hope, so long entertained, that it was possible to obtain a direct and practicable route for stock between Kimberley and Coolgardie gold-fields; and it also proved that, with the possible exception of small isolated patches, the desert traversed contained no auriferous country.

It may be said that exploration on a large scale is now at an end; there remain only the spaces, nowhere very extensive, between the tracks of the old explorers yet to be examined, and these are chiefly in the Northern Territory and in Western Australia north of the tropic of Capricorn. The search for gold and the quest for unoccupied pasturage daily diminish the extent of these areas.

3. *Political History*.

Early colonization.

Of the six Australian states, New South Wales is the oldest. It was in 1788, eighteen years after Captain Cook explored the east coast, that Port Jackson was founded as a penal station for criminals from England; and the settlement retained that character, more or less, during the subsequent fifty years, transportation being virtually suspended in 1839. The colony, however, from 1821 had made a fair start in free industrial progress. By this time, too, several of the other provinces had come into existence. Van Diemen's Land, now called Tasmania, had been occupied as early as 1803. It was an auxiliary penal station under New South Wales till in 1825 it became a separate government. From this island, ten years later, parties crossed Bass Strait to Port Phillip, where a new settlement was shortly established, forming till 1851 a part of New South Wales, but now the state of Victoria. In 1827 and 1829, an English company endeavoured to plant a settlement at the Swan river, and this, added to a small military station established in 1825 at King George Sound, constituted Western Australia. On the shores of the Gulf St Vincent, again, from 1835 to 1837, South Australia was created by another joint-stock company, as an experiment in the Wakefield scheme of colonization. Such were the political component parts of British Australia up to 1839. The early history, therefore, of New South Wales is peculiar to itself. Unlike the other mainland provinces, it was at first held and used chiefly for the reception of British convicts. When that system was abolished, the social conditions of New South Wales, Victoria, and South Australia became more equal. Previous to the gold discoveries of 1851 they may be included, from 1839, in a general summary view.

Rise of New South Wales.

The first British governors at Sydney, from 1788, ruled with despotic power. They were naval or military officers in command of the garrison, the convicts and the few free settlers. The duty was performed by such men as Captain Arthur Phillip, Captain Hunter, and others. In the twelve years' rule of General Macquarie, closing with 1821, the colony made a substantial advance. By means of bond labour roads and bridges were constructed, and a route opened into the interior beyond the Blue Mountains. A population of 30,000, three-fourths of them convicts, formed the infant commonwealth, whose attention was soon directed to the profitable trade of rearing fine wool sheep, first commenced by Captain John McArthur in 1803. During the next ten years, 1821-1831, Sir Thomas Brisbane and Sir Ralph Darling, two generals of the army, being successively governors, the colony increased, and eventually succeeded in obtaining the advantages of a representative institution, by means of a legislative council. Then came General Sir Richard Bourke, whose wise and liberal administration proved most beneficial. New South Wales became prosperous and attractive to emigrants with capital. Its enterprising ambition was encouraged by taking fresh country north and south. In the latter direction, explored by Mitchell in 1834 and 1836, lay Australia Felix, now Victoria, including the well-watered, thickly-wooded country of Gipps' Land.

Growth of Victoria.

This district, then called Port Phillip, in the time of Governor Sir George Gipps, 1838-1846, was growing fast into a position claiming independence. Melbourne, which began with a few huts on the banks of the Yarra-Yarra in 1835, was in 1840 a busy town of 6000 inhabitants, the population of the whole district, with the towns of Geelong and Portland, reaching 12,850; while its import trade amounted to £204,000, and its exports to £138,000. Such was the growth of infant Victoria in five years; that of Adelaide or South Australia, in the same period, was nearly equal to it. At Melbourne there was a deputy governor, Mr Latrobe, under Sir George-Gipps at Sydney. Adelaide had its own governors, first Captain Hindmarsh, next Colonel Gawler, and then Captain George Grey. Western Australia progressed but slowly, with less than 4000 inhabitants altogether, under Governors Stirling and Hutt.

Discovery of gold.

The general advancement of Australia, to the era of the gold-mining, had been satisfactory, in spite of a severe commercial crisis, from 1841 to 1843, caused by extravagant land speculations and inflated prices. Victoria produced already more wool than New South Wales, the aggregate produce of Australia in 1852 being 45,000,000 lb; and South Australia, between 1842 and this date, had opened most valuable mines of copper. The population of New South Wales in 1851 was 190,000; that of Victoria, 77,000; and that of South Australia about the same. At Summerhill Creek, 20 m. north of Bathurst, in the Macquarie plains, gold was discovered, in February 1851, by Mr E. Hargraves, a gold-miner from California. The intelligence was made known in April or May; and then began a rush of thousands,—men leaving their former employments in the bush or in the towns to search for the ore so greatly coveted in all ages. In August it was found at Andersen's Creek, near Melbourne; a few weeks later the great Ballarat gold-field, 80 m. west of that city, was opened; and after that, Bendigo to the north. Not only in these lucky provinces, New South Wales and Victoria, where the auriferous deposits were revealed, but in every British colony of Australasia, all ordinary industry was left for the one exciting pursuit. The copper mines of South Australia were for the time deserted, while Tasmania and New Zealand lost many inhabitants, who emigrated to the more promising country. The disturbance of social, industrial and commercial affairs, during the first two or three years of the gold era, was very great. Immigrants from Europe, and to some extent from North America and China, poured into Melbourne, where the arrivals in 1852 averaged 2000 persons in a week. The population of Victoria was doubled in the first twelvemonth of the gold fever, and the value of imports and exports was multiplied tenfold between 1851 and 1853. The colony of Victoria was constituted a separate province in July 1851, Mr Latrobe being appointed governor, followed by Sir Charles Hotham and Sir Henry Barkly in succession.

Responsible government.

The separation of the northern part of eastern Australia, under the name of Queensland, from the original province of New South 964
Wales, took place in 1859. At that time the district contained about 25,000 inhabitants; and in the first six years its population was quadrupled and its trade trebled. At the beginning of 1860, when the excitement of the gold discoveries was wearing off, five of the states had received from the home government the boon of responsible government, and were in a position to work out the problem of their position without external interference; it was not, however, until 1890 that Western Australia was placed in a similar position. After the establishment of responsible government the main questions at issue were the secular as opposed to the religious system of public instruction, protection as opposed to a revenue tariff, vote by ballot, adult suffrage, abolition of transportation and assignment of convicts, and free selection of lands before survey; these, and indeed all the great questions upon which the country was divided, were settled within twenty years of the granting of self-government.[6] With the disposal of these important problems, politics in Australia became a struggle for office between men whose political principles were very much alike, and the tenure of power enjoyed by the various governments did not depend upon the principles of administration so much as upon the personal fitness of the head of the ministry, and the acceptability of his ministry to the members of the more popular branch of the legislature.

General Australian problems.

The two most striking political events in the modern history of Australia, as a whole, apart from the readiness it has shown to remain a part of the British empire (*q.v.*), and to develop along Imperial lines, are the advent of the Labour party and the establishment of federation. As regards the last mentioned it may be said that it was accomplished from within, there being no real external necessity for the union of the states. Leading politicians have in all the states felt the cramping effects of mere domestic legislation, albeit on the proper direction of such legislation depends the well-being of the

people; and to this sense of the limitations of local politics was due, as much as to anything else, the movement towards federation.

Before coming, however, to the history of federation, and the evolution of the Labour party, we must refer briefly to some other questions which have been of general interest in Australia. Taking the states as a whole, agrarian legislation has been the most important subject that has engrossed the attention of their parliaments, and every state has been more or less engaged in tinkering with its land laws. The main object of all such legislation is to secure the residence of the owners on the land. The object of settlers, however, in a great many, perhaps in the majority of instances, is to dispose of their holdings as soon as possible after the requirements of the law have been complied with, and to avoid permanent settlement. This has greatly facilitated the formation of large estates devoted chiefly to grazing purposes, contrary to the policy of the legislature, which has everywhere sought to encourage tillage, or tillage joined to stock-rearing, and to discourage large holdings. The importance of the land question is so great that it is hardly an exaggeration to say that it is usual for every parliament of Australia to have before it a proposal to alter or amend its land laws. Since 1870 there have been five radical changes made in New South Wales. In Victoria the law has been altered five times, and in Queensland and South Australia seven times.

Agrarian legislation.

The prevention or regulation of the immigration of coloured races has also claimed a great share of parliamentary attention. The agitation against the influx of Chinese commenced very soon after the gold discoveries, the European miners objecting strongly to the presence of these aliens upon the diggings. The allegations made concerning the Chinese really amounted to a charge of undue industry. The Chinese were hard-working and had the usual fortune attending those who work hard. They spent little on drink or with the storekeepers, and were, therefore, by no means popular. As early as 1860 there had been disturbances of a serious character, and the Chinese were chased off the goldfields of New South Wales, serious riots occurring at Lambing Flat, on the Burrangong goldfield. The Chinese difficulty, so far as the mining population was concerned, was solved by the exhaustion of the extensive alluvial deposits; the miners' prejudice against the race, however, still exists, though they are no longer serious competitors, and the laws of some of the states forbid any Chinese to engage in mining without the express authority in writing of the minister of mines. The nearness of China to Australia has always appeared to the Australian democracy as a menace to the integrity of the white settlements; and at the many conferences of representatives from the various states, called to discuss matters of general concern, the Chinese question has always held a prominent place, but the absence of any federal authority had made common action difficult. In 1888 the last important conference on the Chinese question was held in Sydney and attended by delegates from all the states. Previously to the meeting of the conference there had been a great deal of discussion in regard to the influx of Chinese, and such influx was on all sides agreed to be a growing danger. The conference, therefore, merely expressed the public sentiment when it resolved that, although it was not advisable to prohibit altogether this class of immigration, it was necessary in the public interests that the number of Chinese privileged to land should be so limited as to prevent the people of that race from ever becoming an important element in the community. In conformity with this determination the various state legislatures enacted new laws or amended the existing laws to cope with the difficulty; these remained until they were in effect superseded by Commonwealth legislation. The objection to admitting immigrants was not only to the Chinese, but extended to all Asiatics; but as a large proportion of the persons whose entrance into the colonies it was desired to stop were British subjects, and the Imperial government refused to sanction any measure directly prohibiting in plain terms the movement of British subjects from one part of the empire to another, resort was made to indirect legislation; this was the more advisable, as the rise of the Japanese power in the East and the alliance of that country with Great Britain rendered it necessary to pay attention to the susceptibilities of a powerful nation whose subjects might be affected by restrictive laws. Eventually the difficulty was overcome by the device of an educational test based on the provisions of an act in operation in Natal. It was provided that a person was to be prohibited from landing in Australia who failed to write in any prescribed language fifty words dictated to him by the commonwealth officer supervising immigration. The efficacy of this legislation is in its administration, the language in which coloured aliens are usually tested being European. The agitation against the Chinese covered a space of over fifty years, a long period in the history of a young country, and was promoted and kept alive almost entirely by the trades unions, and the restriction acts were the first legislative triumph of the Labour party, albeit that party was not at the time directly represented in parliament.

Immigration question.

One of the most notable events in the modern history of Australia occurred shortly after the great strike of 1890. This was what is ordinarily termed the bank crisis of 1893. Although this crisis followed on the great strike, the crisis of two things had no real connexion, the crisis being the natural result of events long anterior to 1890. The effects of the crisis were mainly felt in the three eastern states, Queensland, New South Wales and Victoria, Tasmania and South Australia being affected chiefly by reason of the fact of their intimate financial connexion with the eastern states. The approach of the crisis was heralded by many signs. Deposits were shifted from bank to bank, there were small runs on several of the savings banks guaranteed by the government, mortgagees required additional security from their debtors, bankruptcies became frequent, and some of the banks began to accumulate gold against the evil day. The building societies and financial institutions in receipt of deposits, or so many of them as were on an unsound footing, failed at an early period of the depression, so also did the weaker banks. There was distrust in the minds of the depositors, especially those whose holdings were small, and most of the banks were, at a very early period, subjected to the strain of repaying a large proportion of their deposits as they fell due. For a time the money so withdrawn was hoarded, but after a while it found its way back again into the banks. The crisis was by no means a sudden crash, and even when the failures began to take place they were spread over a period of sixteen weeks.

Bank crisis of 1893.

The first noticeable effect of the crisis was a great scarcity of employment. Much capital was locked up in the failed banks, and was therefore not available for distribution amongst wage-earners. Wages fell precipitately, as also did rents. There was an almost entire cessation of building, and a large number of houses in the chief cities remained untenanted, the occupants moving to lodgings and more than one family living in a single house. Credit became greatly restricted, and all descriptions of speculative enterprise came to an end. The consuming power of the population was greatly diminished, and in the year following the crisis the imports into Australia from abroad diminished by four and three-quarter millions. In fact, everywhere the demand for goods, especially of those for domestic consumption, fell away; and there was a reduction in the average number of persons employed in the manufacturing industries to the extent of more than 20%. The lack of employment in factories naturally affected the coal mining industry, and indeed every industry in the states, except those connected with the export trade, was severely affected. During the crisis banks having a paid-up capital and reserves of £5,000,000 and deposits of £53,000,000 closed their doors. Most of these, however, reopened for business before many weeks. The crisis was felt in the large cities more keenly than in the country districts, and in Melbourne more severely than in any other capital. The change of fortune proved disastrous to many families, previously to all appearances in opulent circumstances, but by all classes alike their reverses were borne with the greatest bravery. In its ultimate effects the crisis was by no means evil. Its true meaning was not lost upon a business community that had had twenty years of almost unchecked prosperity. It required the chastening of adversity to teach it a salutary lesson, and a few years after, when the first effects of the crisis had passed away, business was on a much sounder footing than had been the case for very many years. One of the first results was to put trade on a sound basis and to abolish most of the abuses of the credit system, but the most striking effect of the crisis was the attention which was almost immediately directed to productive pursuits. Agriculture everywhere expanded, the mining industry revived, and, if it had not been for the low prices of staple products, the visible effects of the crisis would have passed away within a very few years.

Another matter which deserves attention was the great drought which culminated in the year 1902. For some years previously the pastoral industry had been declining and the number of sheep and cattle in Australia had greatly diminished, but the year 1902 was one of veritable drought. The failure of the crops was almost universal and large numbers of sheep and cattle perished for want of food. The truth is, pastoralists for the most part carried on their industry trusting very greatly to luck, not making any special provisions against the vicissitudes of the seasons. Enormous quantities of natural hay were allowed every year to rot or be destroyed by bush fires, and the bountiful provision made by nature to carry them over the seasons of dry weather absolutely neglected; so that when the destructive season of 1902 fell upon them, over a large area of territory there was no food for the stock. The year 1903 proved most bountiful, and in a few years all trace of the disastrous drought of 1902 passed away. But beyond this the pastoralist learnt most effectually the lesson that, in a country like Australia, provision must be made for the occasional season when the rainfall is entirely inadequate to the wants of the farmer and the pastoralist.

Drought of 1902.

The question of federation was not lost sight of by the framers of the original constitution which was bestowed upon New South Wales. In the report of the committee of the legislative council appointed in 1852 to prepare a constitution for that colony, the following passage occurs:—"One of the most prominent legislative measures required by the colony, and the colonies of the Australian group generally, is the establishment at once of a general assembly, to make laws in relation to those intercolonial questions that have arisen or may hereafter arise among them. The questions which would claim the

Federation.

exercise of such a jurisdiction appear to be (1) intercolonial tariffs and the coasting trade; (2) railways, roads, canals, and other such works running through any two of the colonies; (3) beacons and lighthouses on the coast; (4) intercolonial gold regulations; (5) postage between the said colonies; (6) a general court of appeal from the courts of such colonies; (7) a power to legislate on all other subjects which may be submitted to them by addresses from the legislative councils and assemblies of the colonies, and to appropriate to any of the above-mentioned objects the necessary sums of money, to be raised by a percentage on the revenues of all the colonies interested." This wise recommendation received very scant attention, and it was not until the necessities of the colonies forced them to it that an attempt was made to do what the framers of the original constitution suggested. Federation at no time actually dropped out of sight, but it was not until thirty-five years later that any practical steps were taken towards its accomplishment. Meanwhile a sort of makeshift was devised, and the Imperial parliament passed a measure permitting the formation of a federal council, to which any colony that felt inclined to join could send delegates. Of the seven colonies New South Wales and New Zealand stood aloof from the council, and from the beginning it was therefore shorn of a large share of the prestige that would have attached to a body speaking and acting on behalf of a united Australia. The council had also a fatal defect in its constitution. It was merely a deliberative body, having no executive functions and possessing no control of funds or other means to put its legislation in force. Its existence was well-nigh forgotten by the people of Australia until the occurrence of its biennial meetings, and even then but slight interest was taken in its proceedings. The council held eight meetings, at which many matters of intercolonial interest were discussed. The last occasion of its being called together was in 1899, when the council met in Melbourne. In 1889 an important step towards federation was taken by Sir Henry Parkes. The occasion was the report of Major-General Edwards on the defences of Australia, and Sir Henry addressed the other premiers on the desirability of a federal union for purposes of defence. The immediate result was a conference at Parliament House, Melbourne, of representatives from each of the seven colonies. This conference adopted an address to the queen expressing its loyalty and attachment, and submitting certain resolutions which affirmed the desirability of an early union, under the crown, of the Australasian colonies, on principles just to all, and provided that the remoter Australasian colonies should be entitled to admission upon terms to be afterwards agreed upon, and that steps should be taken for the appointment of delegates to a national Australasian convention, to consider and report upon an adequate scheme for a federal convention. In accordance with the understanding arrived at, the various Australasian parliaments appointed delegates to attend a national convention to be held in Sydney, and on the 2nd March 1891 the convention held its first meeting. Sir Henry Parkes was elected president, and he moved a series of resolutions embodying the principles necessary to establish, on an enduring foundation, the structure of a federal government. These resolutions were slightly altered by the conference, and were adopted in the following form:—

1. The powers and rights of existing colonies to remain intact, except as regards such powers as it may be necessary to hand over to the Federal government.

2. No alteration to be made in states without the consent of the legislatures of such states, as well as of the federal parliament.

3. Trade between the federated colonies to be absolutely free.

4. Power to impose customs and excise duties to be in the Federal government and parliament.

5. Military and naval defence forces to be under one command.

6. The federal constitution to make provision to enable each state to make amendments in the constitution if necessary for the purposes of federation.

Other formal resolutions were also agreed to, and on the 31st of March Sir Samuel Griffith, as chairman of the committee on constitutional machinery, brought up a draft Constitution Bill, which was carefully considered by the convention in committee of the whole and adopted on the 9th of April, when the convention was formally dissolved. The bill, however, fell absolutely dead, not because it was not a good bill, but because the movement out of which it arose had not popular initiative, and therefore failed to reach the popular imagination.

Although the bill drawn up by the convention of 1891 was not received by the people with any show of interest, the federation movement did not die out; on the contrary, it had many enthusiastic advocates, especially in the colony of Victoria. In 1894 an unofficial convention was held at Corowa, at which the cause of federation was strenuously advocated, but it was not until 1895 that the movement obtained new life, by reason of the proposals adopted at a meeting of premiers convened by Mr G.H. Reid of New South Wales. At this meeting all the colonies except New Zealand were represented, and it was agreed that the parliament of each colony should be asked to pass a bill enabling the people to choose ten persons to represent the colony on a federal convention; the work of such convention being the framing of a federal constitution to be submitted to the people for approval by means of the referendum. During the year 1896 Enabling Acts were passed by New South Wales, Victoria, Tasmania, South Australia and Western Australia, and delegates were elected by popular vote in all the colonies named except Western Australia, where the delegates were chosen by parliament. The convention met in Adelaide on the 22nd of March 1897, and, after drafting a bill for the consideration of the various parliaments, adjourned until the 2nd of September. On that date the delegates reassembled in Sydney, and debated the bill in the light of the suggestions made by the legislatures of the federating colonies. In the course of the proceedings it was announced that Queensland desired to come within the proposed union; and in view of this development, and in order to give further opportunity for the consideration of the bill, the convention again adjourned. The third and final session was opened in Melbourne on the 20th of January 1898, but Queensland was still unrepresented; and, after further consideration, the draft bill was finally adopted on the 16th of March and remitted to the various colonies for submission to the people.

The constitution was accepted by Victoria, South Australia and Tasmania by popular acclamation, but in New South Wales very great opposition was shown, the main points of objection being the financial provisions, equal representation in the Senate, and the difficulty in the way of the larger states securing an amendment of the constitution in the event of a conflict with the smaller states. As far as the other colonies were concerned, it was evident that the bill was safe, and public attention throughout Australia was fixed on New South Wales, where a fierce political contest was raging, which it was recognized would decide the fate of the measure for the time being. The fear was as to whether the statutory number of 80,000 votes necessary for the acceptance of the bill would be reached. This fear proved to be well founded, for the result of the referendum in New South Wales showed 71,595 votes in favour of the bill and 66,228 against it, and it was accordingly lost. In Victoria, Tasmania and South Australia, on the other hand, the bill was accepted by triumphant majorities. Western Australia did not put it to the vote, as the Enabling Act of that colony only provided for joining a federation of which New South Wales should form a part. The existence of such a strong opposition to the bill in the mother colony convinced even its most zealous advocates that some changes would have to be made in the constitution before it could be accepted by the people; consequently, although the general election in New South Wales, held six or seven weeks later, was fought on the federal issue, yet the opposing parties seemed to occupy somewhat the same ground, and the question narrowed itself down to one as to which party should be entrusted with the negotiations to be conducted on behalf of the colony, with a view to securing a modification of the objectionable features of the bill. The new parliament decided to adopt the procedure of again sending the premier, Mr Reid, into conference, armed with a series of resolutions affirming its desire to bring about the completion of federal union, but asking the other colonies to agree to the reconsideration of the provisions which were most generally objected to in New South Wales. The other colonies interested were anxious to bring the matter to a speedy termination, and readily agreed to this course of procedure. Accordingly a premiers' conference was held in Melbourne at the end of January 1899, at which Queensland was for the first time represented. At this conference a compromise was effected, something was conceded to the claims of New South Wales, but the main principles of the bill remained intact. The bill as amended was submitted to the electors of each colony and again triumphantly carried in Victoria, South Australia and Tasmania. In New South Wales and Queensland there were still a large number of persons opposed to the measure, which was nevertheless carried in both colonies. New South Wales having decided in favour of federation, the way was clear for a decision on the part of Western Australia. The Enabling Bill passed the various stages in the parliament of that colony, and the question was then adopted by referendum.

In accordance with this general verdict of all the states, the colonial draft bill was submitted to the imperial government for legislation as an imperial act; and six delegates were sent to England to explain the measure and to pilot it through the cabinet and parliament. A bill was presented to the British parliament which embodied and established, with such variations as had been accepted on behalf of Australia by the delegates, the constitution agreed to at the premiers' conference of 1899 and speedily became law. Under this act, which was dated the 9th of July 1900, a proclamation was issued on the 17th of September of the same year, declaring that, on and after the 1st of January 1901, the people of New South Wales, Victoria, South Australia, Queensland, Tasmania and Western Australia should be united in a federal commonwealth under the name of the Commonwealth of Australia.

The six colonies entering the Commonwealth were denominated original states, and new states might be admitted, or might be

Provisions of the Act of 1900.

formed by separation from or union of two or more states or parts of states; and territories (as distinguished from states) might be taken over and governed under the legislative power of the Commonwealth. The legislative power is vested in a federal parliament, consisting of the sovereign, a senate, and a house of representatives, the sovereign being represented by a governor-general. The Senate was to consist of the same number of members (not less than six) for each state, the term of service being six years, but subject to an arrangement that half the number would retire every three years. The House of Representatives was to consist of members chosen in the different states in numbers proportioned to their population, but never fewer than five. The first House of Representatives was to contain seventy-five members. For elections to the Senate the governors of states, and for general elections of the House of Representatives the governor-general, would cause writs to be issued. The Senate would choose its own president, and the House of Representatives its speaker; each house would make its own rules of procedure; in each, one-third of the number of members would form a quorum; the members of each must take oath, or make affirmation of allegiance; and all alike would receive an allowance of £400 a year. The legislative powers of the parliament have a wide range, many matters being transferred to it from the colonial parliaments. The more important subjects with which it deals are trade, shipping and railways; taxation, bounties, the borrowing of money on the credit of the Commonwealth; the postal and telegraphic services; defence, census and statistics; currency, coinage, banking, bankruptcy; weights and measures; copyright, patents and trade marks; marriage and divorce; immigration and emigration; conciliation and arbitration in industrial disputes. Bills imposing taxation or appropriating revenue must not originate in the Senate, and neither taxation bills nor bills appropriating revenue for the annual service of the government may be amended in the Senate, but the Senate may return such bills to the House of Representatives with a request for their amendment. Appropriation laws must not deal with other matters. Taxation laws must deal with only one subject of taxation; but customs and excise duties may, respectively, be dealt with together. Votes for the appropriation of the revenue shall not pass unless recommended by the governor-general. The constitution provides means for the settlement of disputes between the houses, and requires the assent of the sovereign to all laws. The executive power is vested in the governor-general, assisted by an executive council appointed by himself. He has command of the army and navy, and appoints federal ministers and judges. The ministers are members of the executive council, and must be, or within three months of their appointment must become, members of the parliament. The judicial powers are vested in a high court and other federal courts, and the federal judges hold office for life or during good behaviour. The High Court has appellate jurisdiction in cases from other federal courts and from the supreme courts of the states, and it has original jurisdiction in matters arising under laws made by the federal parliament, in disputes between states, or residents in different states, and in matters affecting the representatives of foreign powers. Special provisions were made respecting appeals from the High Court to the sovereign in council. The constitution set forth elaborate arrangements for the administration of finance and trade during the transition period following the transference of departments to the Commonwealth. Within two years uniform customs duties were to be imposed; thereafter the parliament of the Commonwealth had exclusive power to impose customs and excise duties, or to grant bounties; and trade within the Commonwealth was to be absolutely free. Exceptions were made permitting the states to grant bounties on mining and (with the consent of the parliament) on exports of produce or manufactures—Western Australia being for a time partially exempted from the prohibition to impose import duties.

The constitution, parliament and laws of each state, subject to the federal constitution, retained their authority; state rights were carefully safeguarded, and an inter-state commission was given powers of adjudication and of administration of the laws relating to trade, transport and other matters. Provision was made for necessary alteration of the constitution of the Commonwealth, but so that no alteration could be effected unless the question had been directly submitted to, and the change accepted by the electorate in the states. The seat of government was to be within New South Wales, not less than 100 m. distant from Sydney, and of an area not less than 100 sq. m. Until other provision was made, the governor-general was to have a salary of £10,000, paid by the Commonwealth. Respecting the salaries of the governors of states, the constitution made no provision.

The choice of governor-general of the new Commonwealth fell upon Lord Hopetoun (afterwards Lord Linlithgow), who had won golden opinions as governor of Victoria a few years before; Mr (afterwards Sir Edmund) Barton, who had taken the lead among the Australian delegates, became first prime minister; and the Commonwealth was inaugurated at the opening of 1901. The first parliament under the constitution was elected on the 29th and 30th of March 1901, and was opened by the prince of Wales on the 9th of May following. In October 1908 the Yass-Canberra district, near the town of Yass, N.S.W., was at length selected by both federal houses to contain the future federal capital.

Labour movement.

The Labour movement in Australia may be traced back to the early days when transportation was in vogue, and the free immigrant and the time-expired convict objected to the competition of the bond labourer. The great object of these early struggles being attained, Labour directed its attention mainly to securing shorter hours. It was aided very materially by the dearth of workers consequent on the gold discoveries, when every man could command his own price. When the excitement consequent on the gold finds had subsided, there was a considerable reaction against the claims of Labour, and this was greatly helped by the congested state of the labour market; but the principle of an eight-hours day made progress, and was conceded in several trades. In the early years of the ’seventies the colonies entered upon an era of well-being, and for about twelve years every man, willing to work and capable of exerting himself, readily found employment. The Labour unions were able to secure in these years many concessions both as to hours and wages. In 1873 there was an important rise in wages, in the following year there was a further advance, and another in 1876; but in 1877 wages fell back a little, though not below the rate of 1874. In 1882 there was a very important advance in wages; carpenters received 11s. a day, bricklayers 12s. 6d., stone-masons 11s. 6d., plasterers 12s., painters 11s., blacksmiths 10s., and navvies and general labourers 8s., and work was very plentiful. For five years these high wages ruled; but in 1886 there was a sharp fall, though wages still remained very good. In 1888 there was an advance, and again in 1889. In 1890 matters were on the eve of a great change and wages fell, in most cases to a point 20% below the rates of 1885. During the whole period from 1873 onwards, prices, other than of labour, were steadily tending downwards, so that the cost of living in 1890 was much below that of 1873. Taking everything into consideration the reduction was, perhaps, not less than 20%, so that, though the nominal or money wages in 1873 and 1890 were the same, the actual wages were much higher in the latter year. Much of the improvement in the lot of the wage-earners has been due to the Labour organizations, yet so late as 1881 these organizations were of so little account, politically, that when the law relating to trades unions was passed in New South Wales, the English law was followed, and it was simply enacted that the purposes of any trades union shall not be deemed unlawful (so as to render a member liable to criminal prosecution for conspiracy or otherwise) merely by reason that they are in restraint of trade. After the year 1884 Labour troubles became very frequent, the New South Wales coal miners in particular being at war with the colliery owners during the greater part of the six years intervening between then and what is called the Great Strike. The strong downward tendency of prices made a reduction of wages imperative; but the labouring classes failed to recognize any such necessity, and strongly resented any reductions proposed by employers. It was hard indeed for a carter drawing coal to a gasworks to recognize the necessity which compelled a reduction in his wages because wool had fallen 20%. Nor were other labourers, more nearly connected with the producing interests, satisfied with a reduction of wages because produce had fallen in price all round. Up to 1889 wages held their ground, although work had become more difficult to obtain, and some industries were being carried on without any profit. It was at such an inopportune time that the most extensive combination of Labour yet brought into action against capital formulated its demands. It is possible that the London dockers’ strike was not without its influence on the minds of the Australian Labour leaders. That strike had been liberally helped by the Australian unions, and it was confidently predicted that, as the Australian workers were more effectively organized than the English unions, a corresponding success would result from their course of action. A strike of the Newcastle miners, after lasting twenty-nine weeks, came to an end in January 1890, and throughout the rest of the year there was great unrest in Labour circles. On the 6th of September the silver mines closed down, and a week later a conference of employers issued a manifesto which was met next day by a counter-manifesto of the Intercolonial Labour Conference, and almost immediately afterwards by the calling out of 40,000 men. The time chosen for the strike was the height of the wool season, when a cessation of work would be attended with the maximum of inconvenience. Sydney was the centre of the disturbance, and the city was in a state of industrial siege, feeling running to dangerous extremes. Riotous scenes occurred both in Sydney and on the coal-fields, and a large number of special constables were sworn in by the government. Towards the end of October 20,000 shearers were called out, and many other trades, principally concerned with the handling or shipping of wool, joined the ranks of the strikers, with the result that the maritime and pastoral industries throughout the whole of Australia were most injuriously disturbed. The Great Strike terminated early in November 1890, the employers gaining a decisive victory. The colonies were, however, to have other and bitter experiences of strikes before Labour recognized that of all means for settling industrial disputes strikes are, on the whole, the most disastrous that it can adopt. The strikes of the years 1890 and 1892 are just as important on account of their political consequences as from the direct gains or losses involved.

The Great Strike of 1890.

As one result of the strike of 1890 a movement was set afoot by a number of enthusiasts, more visionary than practical, that has resulted in a measure of more or less disaster. This was the planting of a colony of communistic Australians in South America. After much negotiation the leader, Mr William Lane, a Brisbane journalist, decided on Paraguay, and he

Political

consequences. tramped across the continent, preaching a new crusade, and gathering in funds and recruits in his progress. On the 16th of July 1893 the first little army of "New Australians" left Sydney in the "Royal Tar," which arrived at Montevideo on the 31st of August. Other consignments of intending settlers in "New Australia" followed; but though the settlement is still in existence it has completely failed to realize the impracticable ideals of its original members. The Queensland government assisted some of the disillusioned to escape from the paradise which proved a prison; some managed to get away on their own account; and those that have remained have split into as many settlements almost as there are settlers. Another effect of the Great Strike was in a more practical direction. New South Wales was the first country which endeavoured to settle its labour grievances through the ballot-box and to send a great party to parliament as the direct representation of Labour, pledged to obtain through legislation what it was unable to obtain by strikes and physical force. The principle of one-man one-vote had been persistently advocated without arousing any special parliamentary or public enthusiasm until the meeting of the Federal Convention in 1891. The convention was attended by Sir George Grey, who was publicly welcomed to the colony by New Zealanders resident in Sydney, and by other admirers, and his reception was an absolute ovation. He eloquently and persistently advocated the principle of one-man one-vote as the bed-rock of all democratic reform. This subsequently formed the first plank of the Labour platform. Several attempts had been made by individuals belonging to the Labour party to enter the New South Wales parliament, but it was not until 1891 that the occurrence of a general election gave the party the looked-for opportunity for concerted action. The results of the election came as a complete surprise to the majority of the community. The Labour party captured 35 seats out of a House of 125 members; and as the old parties almost equally divided the remaining seats, and a fusion was impossible, the Labour representatives dominated the situation. It was not long, however, before the party itself became divided on the fiscal question; and a Protectionist government coming into power, about half the Labour members gave it consistent support and enabled it to maintain office for about three years, the party as a political unit being thus destroyed. The events of these three years taught the Labour leaders that a parliamentary party was of little practical influence unless it was able to cast on all important occasions a solid vote, and to meet the case a new method was devised. The party therefore determined that they would refuse to support any person standing in the Labour interests who refused to pledge himself to vote on all occasions in such way as the majority of the party might decide to be expedient. This was called the "solidarity pledge," and, united under its sanction, what was left of the Labour party contested the general election of 1894. The result was a defeat, their numbers being reduced from 35 to 19; but a signal triumph was won for solidarity. Very few of the members who refused to take the pledge were returned and the adherents of the united party were able to accomplish more with their reduced number than under the old conditions.

> The two features of the Labour party in New South Wales are its detachment from other parties and the control of the caucus. The caucus, which is the natural corollary of the detachment, determines by majority the vote of the whole of the members of the party, independence of action being allowed on minor questions only. So far the party has refrained from formal alliance with the other great parties of the state. It supports the government as the power alone capable of promoting legislation, but its support is given only so long as the measures of the government are consistent with the Labour policy. This position the Labour party has been able to maintain with great success, owing to the circumstance that the other parties have been almost equally balanced.

Parliamentary Labour party. The movement towards forming a parliamentary Labour party was not confined to New South Wales; on the contrary, it was common to all the states, having its origin in the failure of the Great Strike of 1890. The experience of the party was also much the same as in New South Wales, but its greatest triumphs were achieved in South Australia. The Labour party has been in power in Queensland, Western Australia and South Australia, and has, on many occasions, decided the fate of the government on a critical division in all the states except Tasmania and Victoria. Different ideals dominate the party in the different states. The one ideal which has just been described represents the Labour party from the New South Wales standpoint. The only qualification worth mentioning is the signing of the pledge of solidarity. The other ideal, typified by the South Australian party, differs from this in one important respect. To the Labour party in that state are admitted only persons who have worked for their living at manual labour, and this qualification of being an actual worker is one that was strongly insisted upon at the formation of the party and strictly adhered to, although the temptation to break away from it and accept as candidates persons of superior education and position has been very great. On the formation of the Commonwealth a Labour party was established in the federal houses. It comprises one-third of the representation in the House of Representatives, and perhaps a still larger proportion in the Senate. The party is, however, formed on a broader basis than the state parties, the solidarity pledge extends only to votes upon which the fate of a government depends. Naturally, however, as the ideals of the members of the party are the same, the members of the Labour party will be generally found voting together on all important divisions, the chief exception being with regard to free trade or protection. The Labour party held power in the Commonwealth for a short period, and has had the balance of power in its hands ever since the formation of the Commonwealth.

(T. A. C.)

Recent legislation. Australian legislation in the closing years of the 19th century and the first decade of the 20th bore the most evident traces of the Labour party's influence. In all the colonies a complete departure from principles laid down by the leading political economists of the 19th century was made when acts were passed subjecting every branch of domestic industry to the control of specially constituted tribunals, which were empowered among other important functions to fix the minimum rate of wages to be paid to all grades of workmen. (See also the articles Arbitration and Conciliation; Trade Unions; Labour Legislation.)

Victoria. Victoria was the pioneer in factory legislation, the first Victorian act of that character dating from 1873. In 1884 a royal commission, appointed two years earlier to inquire into the conditions of employment in the colony and certain allegations of "sweating" that had then recently been made, reported that:—"The most effective mode of bringing about industrial co-operation and mutual sympathy between employers and employed, and thus obviating labour conflicts in the future, is by the establishment of courts of conciliation in Victoria, whose procedure and awards shall have the sanction and authority of law." This report led to the passing of a number of acts which, proving ineffectual, were followed by the Factories and Shops Act of 1896, passed by the ministry of Mr (afterwards Sir Alexander) Peacock. This measure, together with several subsequent amending acts, of which the most important became law in 1903, 1905 and 1907, forms a complete industrial code in which the principle of state regulation of wages is recognized and established. Its central enactment was to bring into existence (1) "Special Boards," consisting of an equal number of representatives of employers and workmen respectively in any trade, under the presidency of an independent chairman, and (2) a Court of Industrial Appeals. A special board may be formed at the request of any union of employers or of workmen, or on the initiative of the Labour department. After hearing evidence, which may be given on oath, the special board issues a "determination," fixing the minimum rate of wages to be paid to various classes of workers of both sexes and different ages in the trade covered by the determination, including apprentices; and specifying the number of hours per week for which such wages are payable, with the rates for overtime when those hours are exceeded. The determination is then gazetted, and it becomes operative over a specified area, which varies in different cases, on a date fixed by the board. Either party, or the minister for Labour, may refer a determination to the court of industrial appeals, and the court, in the event of a special board failing to make a determination, may itself be called upon to frame one. The general administration of the Factories and Shops Acts, to which the special boards owe their being, is vested in a chief inspector of factories, subject to the control of the minister of Labour in matters of policy. Before the end of 1906 fifty-two separate trades in Victoria had obtained special boards, by whose determinations their operations were controlled.

South Australia. Queensland. A similar system was introduced into South Australia by an act passed in 1900 amending the Factory Act of 1894, which was the first legislation of the sort passed in that state.

In Queensland, where the earliest factory legislation dates from 1896, keen parliamentary conflict raged round the proposal in 1907 to introduce the special boards system for fixing wages. More than one change of government occurred before the bill became law in April 1908.

New South Wales. In New South Wales, whose example was followed by Western Australia, the machinery adopted for fixing the statutory rate of wages was of a somewhat different type. The model followed in these two states was not Victoria but New Zealand, where an Industrial Conciliation and Arbitration Act was passed in 1894. A similar measure, under the guidance of the attorney-general, the Hon. B.R. Wise, was carried after much opposition in New South Wales in 1901, to remain in force till the 30th of June 1908. By it an arbitration court was instituted, consisting of a president and assessors representing the employers' unions and the workers' unions respectively; in any trade in which a dispute occurs, any union of workmen or employers registered under the act was given the right to bring the matter before the arbitration court, and if the court makes an award, an application may be made to it to make the award a "common rule," which thereupon becomes binding over the trade affected, wherever the act applies. The award of the court is thus the equivalent of the determination of a special board in Victoria, and deals with the same questions, the most important of which are the minimum rates of wages and the number of working hours per week. The act contained stringent provisions forbidding strikes; but in this respect it failed to effect its purpose, several strikes

occurring in the years following its enactment, in which there were direct refusals to obey awards.

Western Australia.

In the years 1900 and 1902 acts were passed in Western Australia still more closely modelled on the New Zealand act than was the above-mentioned statute in New South Wales. Unlike the latter, they reproduced the institution of district conciliation boards in addition to the arbitration court; but these boards were a failure here as they were in New Zealand, and after 1903 they fell into disuse. In Western Australia, too, the act failed to prevent strikes taking place. In 1907 a serious strike occurred in the timber trade, attended by all the usual accompaniments, except actual disorder, of an industrial conflict.

Federal Arbitration Act of 1904.

In all this legislation one of the most hotly contested points was whether the arbitration court should be given power to lay it down that workers who were members of a trade union should be employed in preference to non-unionists. This power was given to the tribunal in New South Wales, but was withheld in Western Australia. It was the same question that formed the chief subject of debate over the Federal Conciliation and Arbitration Act, which, after causing the defeat of more than one ministry, passed through the Commonwealth parliament in 1904. It was eventually compromised by giving the power, but only with safeguarding conditions, to the Federal arbitration court. This tribunal differs from similar courts in the states inasmuch as it consists of a single member, called the "president," an officer appointed by the governor-general from among the justices of the High Court of Australia. The president has the power to appoint assessors to advise him on technical points; and considerable powers of devolution of authority for the purpose of inquiry and report are conferred upon the court, the main object of which is to secure settlement by conciliatory methods. The distinctive object of the Federal Act, as defined in the measure itself, is to provide machinery for dealing with industrial disputes extending beyond any one state, examples of which were furnished by the first two important cases submitted to the court—the one concerning the merchant marine of Australia, and the other the sheep shearers, both of which were heard in 1907. An additional duty was thrown on the Federal arbitration court by the Customs and Excise Tariff Acts of 1906, in which were embodied the principles known as the "New Protection." By the Customs Act the duty was raised on imported agricultural implements, while as a safeguard to the consumer the maximum prices for the retail of the goods were fixed. In order to provide a similar protection for the artisans employed in the protected industries, an excise duty was imposed on the home-produced articles, which was to be remitted in favour of manufacturers who could show that they paid "fair and reasonable" wages, and complied with certain other conditions for the benefit of their workmen. The chief authority for determining whether these conditions are satisfied or not is the Federal arbitration court.

Old age pensions.

The same period that saw this legislation adopted was also marked by the establishment of old age pensions in the three eastern states, and also in the Commonwealth. By the Federal Act, passed in the session of 1908, a pension of ten shillings a week was granted to persons of either sex over sixty-five years of age, or to persons over sixty who are incapacitated from earning a living. The Commonwealth legislation thus made provision for the aged poor in the three states which up to 1908 had not accepted the principle of old age pensions, and also for those who, owing to their having resided in more than one state, were debarred from receiving pension in any.

Tariff.

An important work of the Commonwealth parliament was the passing of a uniform tariff to supersede the six separate tariffs in force at the establishment of the Commonwealth, but many other important measures were considered and some passed into law. During the first six years of federation there were five ministries; the tenure of office under the three-yearly system was naturally uncertain, and this uncertainty was reflected in the proposals of whatever ministry was in office. The great task of adjusting the financial business of the Commonwealth on a permanent basis was one of very great difficulty, as the apparent interests of the states and of the Commonwealth were opposed. Up till 1908 it had been generally assumed that the constitution required the treasurer of the Commonwealth to hand over to the states month by month whatever surplus funds remained in his hands. But in July 1908 a Surplus Revenue Act was passed which was based on a different interpretation of the constitution. Under this act the appropriation of these surplus funds to certain trust purposes in the Federal treasury is held to be equivalent to payment to the states. The money thus obtained was appropriated in part to naval defence and harbours, and in part to the provision of old age pensions under the Federal Old Age Pension Act of 1908. The act was strongly opposed by the government of Queensland, and the question was raised as to whether it was based on a true interpretation of the constitution. The chief external interest, however, of the new financial policy of the Commonwealth lay in its relation towards the empire as a whole. At the Imperial Conference in London in 1907 Mr Deakin, the Commonwealth premier, was the leading advocate of colonial preference with a view to imperial commercial union; and though no reciprocal arrangement was favoured by the Liberal cabinet, who temporarily spoke for the United Kingdom, the colonial representatives were all agreed in urging such a policy, and found the Opposition (the Unionist party) in England prepared to adopt it as part of Mr Chamberlain's tariff reform movement. In spite of the official rebuff received from the mother-country, the Australian ministry, in drawing up the new Federal tariff, gave a substantial preference to British imports, and thus showed their willingness to go farther. (See the article British Empire.)

(R. J. M.)

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1 The literature of the geology of Australia is enumerated, to 1884, in the bibliography by Etheridge and Jack. A general summary of the stratigraphical geology was given by R. Tate, *Rep. Austral. Assoc. Adv. Sci.* vol. v. (1893), pp. 1-69. References to the chief sources of information regarding the states is given under each of them. A geological map of the whole continent, on the scale of 50 m. to the inch, was compiled by A. Everett, and issued in 1887 in six sheets, by the Geological Survey of Victoria.

2 The statistical portion of this article includes Tasmania, which is a member of the Australian Commonwealth.

3 In his *Discoveries in Central Australia*, E.T. Eyre has ingeniously attempted to reconstruct the routes taken by the Australians in their advance across the continent. He has relied, however, in his efforts to link the tribes together, too much on the prevalence or absence of such customs as circumcision—always very treacherous evidences—to allow of his hypothetical distribution being regarded very seriously. The migrations must have always been dependent upon physical difficulties, such as waterless tracts or mountain barriers. They were probably not definite massed movements, such as would permit of the survival of distinctive lines of custom between tribe and tribe; but rather spasmodic movements, sometimes of tribes or of groups, sometimes only of families or even couples, the first caused by tribal wars, the second to escape punishment for some offence against tribal law, such as the defiance of the rules as to clan-marriages.

4 *The Languages of India* (1875).

5 The existence of "Group Marriage" is a much-controverted point. This custom, which has been defined as the invasion of actual marriage by allotting permanent paramours, is confined to a special set of tribes.

6 Australia, it may be noted, has woman's suffrage in all the states (Victoria, the last, adopting it in November 1908), and for the federal assembly.

AUSTRASIA. The word *Austria* signifies the realm of the east (Ger. *Ost Reich*). In Gregory of Tours this word is still used vaguely, but the sense of it is gradually defined, and finally the name of *Austria* or *Austrasia* was given to the easternmost part of the Frankish kingdom. It usually had Metz for its capital, and the inhabitants of the kingdom were known as the *Austrasii*. Retrospectively, later historians have given this name to the kingdom of Theuderich I. (511-534), of his son Theudebert (534-548), and of his grandson Theudebald (548-555); then, after the death of Clotaire I., to the kingdom of Sigebert (561-575), and of his son Childebert (575-597). They have even tried to interpret the long struggle between Fredegond and Brunhilda as a rivalry between the two kings of Neustria and Austrasia. When these two words are at last found in the texts in their precise signification, Austrasia is applied to that part of the Frankish kingdom which Clotaire II. entrusted to his son Dagobert, subject to the guardianship of Pippin and Arnulf (623-629), and which Dagobert in his turn handed on to his son Sigebert (634-639), under the guardianship of Cunibert, bishop of Cologne, and Ansegisel, mayor of the palace. After the death of Dagobert, Austrasia and Neustria almost always had separate kings, with their own mayors of the palace, and then there arose a real rivalry between these two provinces, which ended in the triumph of Austrasia. The Austrasian mayors of the palace succeeded in enforcing their authority in the western as well as in the eastern part, and in re-establishing to their own advantage the unity of the Frankish kingdom. The mayor Pippin the Short was even powerful enough to take the title of king over the whole.

At the time of Charlemagne, the word Austrasia underwent a change of meaning and became synonymous with *Francia orientalis*, and was applied to the Frankish dominions beyond the Rhine (Franconia). This Franconia was in 843 included in the kingdom of Louis the German, and was then increased by the addition of the territories of Mainz, Spires and Worms, on the right bank of the river.

See A. Huguenin, *Histoire du royaume mérovingien d'Austrasie* (Paris, 1857); Aug. Digot, *Histoire du royaume d'Austrasie*, 4 vols. (Nancy, 1863); L. Drapeyron, *Essai sur l'origine, le développement et les résultats de la lutte entre la Neustrie et l'Austrasie* (Paris, 1867); Auguste Longnon, *Atlas historique*, 1st and 2nd parts.

(C. Pf.)

AUSTRIA. (Ger. *Österreich*), a country of central Europe, bounded E. by Russia and Rumania, S. by Hungary, the Adriatic Sea and Italy, W. by Switzerland, Liechtenstein and the German empire (Bavaria), and N. by the German empire (Saxony and Prussia) and Russia. It has an area of 115,533 sq. m., or about twice the size of England and Wales together. Austria is one of the states which constitute the Austro-Hungarian (Habsburg) monarchy (see Austria-Hungary: *History*), and is also called Cisleithania, from the fact that it contains the portion of that monarchy which lies to the west of the river Leitha. Austria does not form a geographical unity, and the constituent parts of this empire belong to different geographical regions. Thus, Tirol, Styria and Carinthia belong, like Switzerland, to the system of the Alps, but these provinces together with those lying in the basin of the Danube form, nevertheless, a compact stretch of country. On the other hand Galicia, extending on the eastern side of the Carpathians, belongs to the great plain of Russia; Bohemia stretches far into the body of Germany; while Dalmatia, which is quite separated from the other provinces, belongs to the Balkan Peninsula.

Coasts.—Austria has amongst all the great European countries the most continental character, in so far as its frontiers are mostly land-frontiers, only about one-tenth of them being coast-land. The Adriatic coast, which stretches for a distance of about 1000 m., is greatly indented. The Gulf of Trieste on the west, and the Gulf of Fiume or Quarnero on the east, include between them the peninsula of Istria, which has many sheltered bays. In the Gulf of Quarnero are the Quarnero islands, of which the most important are Cherso, Veglia and Lussin. The coast west of the mouth of the Isonzo is fringed by lagoons, and has the same character as the Venetian coast, while the Gulf of Trieste and the Istrian peninsula have a steep coast with many bays and safe harbours. The principal ports are Trieste, Capodistria, Pirano, Parenzo, Rovigno and Pola, the great naval harbour and arsenal of Austria. The coast of Dalmatia also possesses many safe bays, the principal being those of Zara, Cattaro and Ragusa, but in some places it is very steep and inaccessible. On the other hand a string of islands extends along this coast, which offer many safe and easily accessible places of anchorage to ships during the fierce winter gales which rage in the Adriatic. The principal are Pago, Pasman, Isola Lunga and Isola Incoronata, Brazza, Lesina, Curzola and Meleda.

The political divisions of Austria correspond, for the most part, so closely to natural physical divisions that the detailed account of the physical features, natural resources and the movement of the population has been given under those separate headings. In this general article the geography of Austria—physical, economical and political—has been treated in its broad aspects, and those points insisted upon which give an adequate idea of the country as a whole.

Mountains.—Austria is the most mountainous country of Europe after Switzerland, and about four-fifths of its entire area is more than 600 ft. above the level of the sea. The mountains of Austria belong to three different mountain systems, namely, the Alps (*q.v.*), the Carpathians (*q.v.*), and the Bohemian-Moravian Mountains. The Danube, which is the principal river of Austria, divides the Alpine region, which occupies the whole country lying at its south, from the Bohemian-Moravian Mountains and their offshoots lying at its north; while the valleys of the March and the Oder separate the last-named mountains from the Carpathians. Of the three principal divisions of the Alps—the western, the central and the eastern Alps—Austria is traversed by several groups of the central Alps, while the eastern Alps lie entirely within its territory. The eastern Alps are continued by the Karst mountains, which in their turn are continued by the Dinaric Alps, which stretch through Croatia and Dalmatia. The second great mountain-system of Austria, the Carpathians, occupy its eastern and north-eastern portions, and stretch in the form of an arch through Moravia, Silesia, Galicia and Bukovina, forming the frontier towards Hungary, within which territory they principally extend. Finally, the Bohemian-Moravian Mountains, which enclose Bohemia and Moravia, and form the so-called quadrilateral of Bohemia, constitute the link of the Austrian mountain-system with the hilly region (the *Mittelgebirge*) of central Europe. Only a little over 25% of the area of Austria is occupied by plains. The largest is the plain of Galicia, which is part of the extensive Sarmatic plain; while in the south, along the Isonzo, Austria comprises a small part of the Lombardo-Venetian plain. Several smaller plains are found along the Danube, as the Tulner Becken in Lower Austria, and the Wiener Becken, the plain on which the capital is situated; to the north of the Danube this plain is called the Marchfeld, and is continued under the name of the Marchebene into Moravia as far north as Olmütz. Along the other principal rivers there are also plains of more or less magnitude, some of them possessing tracts of very fertile soil.

Rivers.—Austria possesses a fairly great number of rivers, pretty equally distributed amongst its crown lands, with the exception of Istria and the Karst region, where there is a great scarcity of even the smallest rivers. The principal rivers are: the Danube, the Dniester, the Vistula, the Oder, the Elbe, the Rhine and the Adige or Etsch. As the highlands of Austria form part of the great watershed of Europe, which divides the waters flowing northward into the North Sea or the Baltic from those flowing southward or eastward into the Mediterranean or the Black Sea, its rivers flow in three different directions—northward, southward and eastward. With the exception of the small streams belonging to it which fall into the Adriatic, all its rivers have their mouths in other countries, and its principal river, the Danube, has also its source in another country. When it enters Austria at the gorge of Passau, where it receives the Inn, a river which has as large a body of water as itself, the Danube is already navigable. Till it leaves the country at Hainburg, just before Pressburg, its banks are pretty closely hemmed by the Alps, and the river passes through a succession of narrow defiles. But the finest part of its whole course, as regards the picturesqueness of the scenery on its banks, is between Linz and Vienna. Where it enters Austria the Danube is 898 ft. above the level of the sea, and where it leaves it is only 400 ft.; it has thus a fall within the country of 498 ft., and is at first a very rapid stream, becoming latterly much slower. The Danube has in Austria a course of 234 m., and it drains an area of 50,377 sq. m. Its principal affluents in Austria, besides the Inn, are the Traun, the Enns and the March. The Dniester, which, like the Danube, flows into the Black Sea, has its source in the Carpathians in Eastern Galicia, and pursues a very winding course towards the south-east, passing into Russia. It has in Austria a course of 370 m. of which 300 are navigable, and drains an area of 12,000 sq. m. The Vistula and the Oder both fall into the Baltic. The former rises in Moravia, flows first north through Austrian Silesia, then takes an easterly direction along the borders of Prussian Silesia, and afterwards a north-easterly, separating Galicia from Russian Poland, and leaving Austria not far from Sandomir. Its course in Austria is 240 m., draining an area of 15,500 sq. m. It is navigable for nearly 200 m., and its principal affluents are the Dunajec, the San and the Bug. The Oder has also its source in Moravia, flows first east and then north-east through Austrian Silesia into Prussia. Its length within the Austrian territory is only about 55 m., no part of which is navigable. The only river of this country which flows into the North Sea is the Elbe. It has its source in the Riesengebirge, not far from the Schneekoppe, flows first south, then west, and afterwards north-west through Bohemia, and then enters Saxony. Its principal affluents are the Adler, Iser and Eger, and, most important of all, the Moldau. The Elbe has a course within the Austrian dominions of 185 m., for about 65 of which it is navigable. It drains an area of upwards of 21,000 sq. m. The Rhine, though scarcely to be reckoned a river of the country, flows for about 25 m. of its course between it and Switzerland. The principal river of Austria which falls into the

Adriatic is the Adige or Etsch. It rises in the mountains of Tirol, flows south, then east, and afterwards south, into the plains of Lombardy. It has in Austria a course of 138 m., and drains an area of 4266 sq. m. Its principal affluent is the Eisak. Of the streams which have their course entirely within the country, and fall into the Adriatic, the principal is the Isonzo, 75 m. in length, but navigable only for a short distance from its mouth.

Lakes.—Austria does not possess any great lakes; but has numerous small mountain lakes situated in the Alpine region, the most renowned for the beauty of their situation being found in Salzburg, Salzkammergut, Tirol and Carinthia. There should also be mentioned the periodical lakes situated in the Karst region, the largest of them being the Lake of Zirknitz. The numerous and large marshes, found now mostly in Galicia and Dalmatia, have been greatly reduced in the other provinces through the canalization of the rivers, and other works of sanitation.

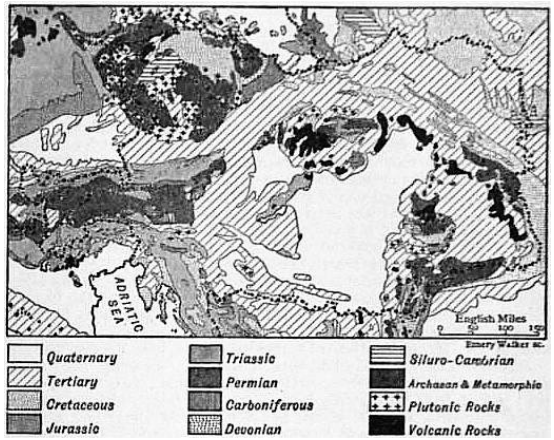
Mineral Springs.—No other European country equals Austria in the number and value of its mineral springs. They are mostly to be found in Bohemia, and are amongst the most frequented watering-places in the world. The most important are, the alkaline springs of Carlsbad, Marienbad, Franzensbad and Bilin; the alkaline acidulated waters of Giesshubel, largely used as table waters; the iron springs of Marienbad, Franzensbad and of Pyrawarth in Lower Austria; the bitter waters of Pullna, Saidschitz and Sedlitz; the saline waters of Ischl and of Aussee in Styria; the iodine waters of Hall in Upper Austria; the different waters of Gastein; and lastly the thermal waters of Teplitz-Schönau, Johannisbad, and of Römerbad in Styria. Altogether there are reckoned to exist over 1500 mineral springs, of which many are not used.

(O. Br.)

Geology.—The Austro-Hungarian Monarchy is traversed by the great belt of folded beds which constitutes the Alps and the Carpathians; a secondary branch proceeding from the main belt runs along the Adriatic coast and forms the Julian and Dinaric Alps. In the space which is thus enclosed, lies the Tertiary basin of the Hungarian plain; and outside the belt, on the northern side, is a region which, geologically, is composite, but has uniformly resisted the Carpathian folding. In the neighbourhood of Vienna a gap in the folded belt—the gap between the Alps and the Carpathians—has formed a connexion between these two regions since the early part of the Miocene period. On its outer or convex side the folded belt is clearly defined by a depression which is generally filled by modern deposits. Beyond this, in Russia and Galicia, lies an extensive plateau, much of which is covered by flat-lying Miocene and Pliocene beds; but in the deep valleys of the Dniester and its tributaries the ancient rocks which form the foundation of the plateau are laid bare. Archaean granite is thus exposed at Yampol and other places in Russia, and this is followed towards the west by Silurian and Devonian beds in regular succession—the Devonian being of the Old Red Sandstone type characteristic of the British Isles and of Northern Russia. Throughout, the dip is very low and the beds are unaffected by the Carpathian folds, the strike being nearly from north to south. After Devonian times the region seems to have been dry land until the commencement of the Upper Cretaceous period, when it was overspread by the Cenomanian sea, and the deposits of that sea lie flat upon the older sediments.

Some 25 or 30 m. of undulating country separate the Dniester from the margin of the Carpathian chain, and in this space the Palaeozoic floor sinks far beneath the surface, so that not even the deep-cut valley of the Pruth exposes any beds of older date than Miocene. Towards the north-west, also, the Palaeozoic foundation falls beneath an increasing thickness of Cretaceous beds and lies buried far below the surface. At Lemberg a boring 1650 ft. in depth did not reach the base of the Senonian. West of Cracow the Cretaceous beds are underlaid by Jurassic and Triassic deposits, the general dip being eastward. It is not till Silesia that the Palaeozoic formations again rise to the surface. Here is the margin, often concealed by very modern deposits, of the great mass of Archaean and Palaeozoic rocks which forms nearly the whole of Bohemia and Moravia. The Palaeozoic beds no longer lie flat and undisturbed, as in the Polish plain. They are faulted and folded. But the folds are altogether independent of those of the Carpathians; they are of much earlier date, and are commonly different in direction. The principal biding took place towards the close of the Carboniferous period, and the *massif* is a fragment of an ancient mountain chain, the *Variscische Gebirge* of E. Suess, which in Permian and Triassic times stretched across the European area from west to east.

In Bohemia and Moravia the whole of the beds from the Cambrian to the Lower Carboniferous are of marine origin; but after the Carboniferous period the area appears to have been dry land until the beginning of the Upper Cretaceous period, when the sea again spread over it. The deposits of this sea are now visible in the large basin of Upper Cretaceous beds which stretches from Dresden southeastward through Bohemia. Since the close of the Cretaceous period the Bohemian *massif* has remained above the sea; but the depression which lies immediately outside the Carpathian chain has at times been covered by an arm of the sea and at other times has been occupied by a chain of salt lakes, to which the salt deposits of Wieliczka and numerous brine springs owe their origin.



Geological Map of Austria-Hungary.

The large area which is enclosed within the curve of the Carpathians is for the most part covered by loess, alluvium and other modern deposits, but Miocene and Pliocene beds appear around its borders. In the hilly region of western Transylvania a large mass of more ancient rocks is exposed; the Carboniferous system and all the Mesozoic systems have been recognized here, and granite and volcanic rocks occur. In the middle of Hungary a line of hills rises above the plain, striking from the Platten See towards the north-east, where it merges into the inner girdle of the Carpathian chain. These hills are largely formed of volcanic rocks of late Tertiary age; but near the Platten See Triassic beds of Alpine type are well developed. The Tertiary eruptions were not confined to this line of hills. They were most extensive along the inner border of the Carpathians, and they occurred also in the north of Bohemia. Most of the eruptions took place during the Miocene and Pliocene periods.

The mineral wealth of Austria is very great. The older rocks are in many places peculiarly rich in metalliferous ores of all kinds. Amongst them may be mentioned the silver-bearing lead ores of Erzgebirge and of Přibram in Bohemia; the iron ores of Styria and Bukovina; and the iron, copper, cobalt and nickel of the districts of Zips and Gomor. The famous cinnabar and mercury mines of Idria in Carniola are in Triassic beds; and the gold and silver of northern Hungary and of Transylvania are associated with the Tertiary volcanic rocks. The Carboniferous coal-fields of Silesia and Bohemia are of the greatest importance; while Jurassic coal is worked at Steyerdorf and Funfkirchen in Hungary, and lignite at many places in the Tertiary beds. The great salt mines of Galicia are in Miocene deposits; but salt is also worked largely in the Trias of the Alps. (See also Alps; Carpathians; Hungary and Tirol.)

(P. La.)

Climate.—The climate of Austria, in consequence of its great extent, and the great differences in the elevation of its surface, is very various. It is usual to divide it into three distinct zones. The most southern extends to 46° N. lat., and includes Dalmatia and the country along the coast, together with the southern portions of Tirol and Carinthia. Here the seasons are mild and equable, the winters are short (snow seldom falling), and the summers last for five months. The vine and maize are everywhere cultivated, as well as olives and other southern products. In the south of Dalmatia tropical plants flourish in the open air. The central zone lies between 46° and 49° N. lat., and includes Lower and Upper Austria, Salzburg, Styria, Carinthia, Carniola, Central and Northern Tirol, Southern Moravia and a part of Bohemia. The seasons are more marked here than in the preceding. The winters are longer and more severe, and the summers are hotter. The vine and maize are cultivated in favourable situations, and wheat and other kinds of grain are generally grown. The northern zone embraces the territory lying north of 49° N. lat., comprising Bohemia, Northern Moravia, Silesia and Galicia. The winters

are here long and cold; the vine and maize are no longer cultivated, the principal crops being wheat, barley, oats, rye, hemp and flax. The mean annual temperature ranges from about 59° in the south to 48° in the north. In some parts of the country, however, it is as low as 46° 40′ and even 36°. In Vienna the average annual temperature is 50°, the highest temperature being 94°, the lowest 2° Fahr. In general the eastern part of the country receives less rain than the western. In the south the rains prevail chiefly in spring and autumn, and in the north and central parts during summer. Storms are frequent in the region of the south Alps and along the coast. In some parts in the vicinity of the Alps the rainfall is excessive, sometimes exceeding 60 in. It is less among the Carpathians, where it usually varies from 30 to 40 in. In other parts the rainfall usually averages from 20 to 24 in.

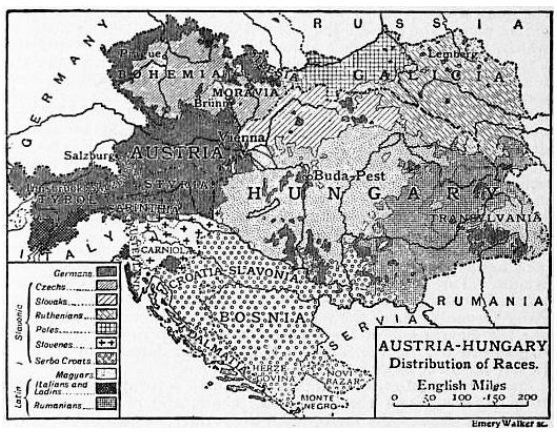
Flora.—From the varied character of its climate and soil the vegetable productions of Austria are very diverse. It has floras of the plains, the hills and the mountains; an alpine flora, and an arctic flora; a flora of marshes, and a flora of steppes; floras peculiar to the clay, the chalk, the sandstone and the slate formations. The number of different species is estimated at 12,000, of which one-third are phanerogamous, or flowering plants, and two-thirds cryptogamous, or flowerless. The crown land of Lower Austria far surpasses in this respect the other divisions of the country, having about four-ninths of the whole, and not less than 1700 species of flowering plants. As stated above, Austria is a very mountainous country and the mountains are frequently covered with vegetation to a great elevation. At the base are found vines and maize; on the lower slopes are green pastures, or wheat, barley and other kinds of corn; above are often forests of oak, ash, elm, &c.; and still higher the yew and the fir may be seen braving the climatic conditions. Corn grows to between 3400 and 4500 ft. above the level of the sea, the forests extend to 5600 or 6400 ft., and the line of perpetual snow is from 7800 to 8200 ft.

Fauna.—The animal kingdom embraces, besides the usual domestic animals (as horses, cattle, sheep, swine, goats, asses, &c.), wild boars, deer, wild goats, hares, &c.; also bears, wolves, lynxes, foxes, wild cats, jackals, otters, beavers, polecats, martens, weasels and the like. Eagles and hawks are common, and many kinds of singing birds. The rivers and lakes abound in different kinds of fish, which are also plentiful on the sea-coast. Among the insects the bee and the silkworm are the most useful. The leech forms an article of trade. In all there are 90 different species of mammals, 248 species of birds, 377 of fishes and more than 13,000 of insects.

Divisions.—Austria is composed of seventeen "lands," called also "crown lands." Of these, three—namely, Bohemia, Galicia and Lodomeria, and Dalmatia—are kingdoms; two—Lower and Upper Austria—archduchies; six—Salzburg, Styria, Carinthia, Carniola, Silesia and Bukovina—duchies; two—Görz-Gradisca and Tirol—countships of princely rank (*gefurstete Grafschaften*); two—Moravia and Istria—margraviates (march counties). Vorarlberg bears the title simply of "land." Trieste, with its district, is a town treated as a special crown land. For administrative purposes Trieste, with Görz-Gradisca and Istria, constituting the Küstenland (the Coast land) and Tirol and Vorarlberg, are each comprehended as one administrative territory. The remaining lands constitute each an administrative territory by itself.

Population.—Austria had in 1900 a population of 26,107,304 inhabitants,[1] which is equivalent to 226 inhabitants per sq. m. As seen from the table below, the density of the population is unequal in the various crown lands. The most thickly populated province is Lower Austria; the Alpine provinces are sparsely populated, while Salzburg is the most thinly populated crown land of Austria. As regards sex, for every 1000 men there were 1035 women, the female element being the most numerous in every crown land, except the Küstenland, Bukovina and Dalmatia. Compared with the census returns of 1890, the population shows an increase of 2,211,891, or 9.3% of the total population. The increase between the preceding census returns of 1880 and 1890 was of 1,750,093 inhabitants, or 7.9% of the total population. A very important factor in the movement of the population is the large over-sea emigration, mostly to the United States of America, which has grown very much during the last quarter of the 19th century, and which shows a tendency to become still larger. Between 1891 and 1900 the number of over-sea emigrants was 387,770 persons. The movement of the population shown in the other vital statistics—births, marriages, deaths—are mostly satisfactory, and show a steady and normal progress. The annual rate per thousand of population in 1900 was: births, 37.0; still-births, 1.1; deaths, 25.2; marriages, 8.2. The only unsatisfactory points are the great number of illegitimate births, and the high infant mortality. Of the total population of Austria 14,009,233 were scattered in 26,321 rural communities with less than 2000 inhabitants; while the remainder was distributed in 1742 communities with a population of 2000-5000; in 260 communities with a population of 5000-10,000; in 96 towns with a population of 10,000-20,000; in 41 towns with a population of 20,000-50,000; in 6 towns with a population of 50,000-100,000; and in 6 towns with a population of over 100,000 inhabitants. The principal towns of Austria are Vienna (1,662,269), Prague (460,849), Trieste (132,879), Lemberg (159,618), Graz (138,370), Brünn (108,944), Cracow (91,310), Czernowitz (67,622), Pilsen (68,292) and Linz (58,778).

Administrative Territories	Areas in Square Miles.	Population.		Density of Population per sq. m. in 1900.
		1890.	1900.	
AUSTRIA—				
Lower Austria	7,654	2,661,799	3,100,493	405
Upper Austria	4,617	785,831	809,918	175
Salzburg	2,757	173,510	193,247	69
Styria	8,642	1,282,708	1,350,058	156
Carinthia	3,992	361,008	367,344	91
Carniola	3,844	498,958	508,348	132
Küstenland	3,074	695,384	755,183	245
Tirol and Vorarlberg	11,287	928,769	979,878	86
Bohemia	19,997	5,843,094	6,318,280	315
Moravia	8,555	2,276,870	2,435,081	284
Silesia	1,981	605,649	680,529	342
Galicia	30,212	6,607,816	7,295,538	241
Bukovina	4,022	646,591	729,921	181
Dalmatia	4,923	527,426	591,597	120
Total	115,533	23,895,413	26,107,304	226



Races.—From an ethnographical point of view Austria contains a diversity of races; in fact no other European state contains within its borders so many nationalities as the Austrian empire. The three principal races of Europe—the Latin, the Teutonic and the Slavonic—are all represented in Austria. The Slavonic race, numbering 15,690,000, is numerically the principal race in Austria, but as it is divided into a number of peoples, differing from one another in language, religion, culture, customs and historical traditions, it does not

possess a national unity. Besides, these various nationalities are geographically separated from one another by other races, and are divided into two groups. The northern group includes the Czechs, the Moravians, the Slovaks, the Ruthenians and the Poles; while the southern group contains the Slovenes, the Servians and the Croats. Just as their historical traditions are different, so are also the aspirations of these various peoples of the Slavonic race different, and the rivalries between them, as for instance between the Poles and the Ruthenians, have prevented them from enjoying the full political advantage due to their number. The Germans, numbering 9,171,614, constitute the most numerous nationality in Austria, and have played and still play the principal role in the political life of the country. The Germans are in a relative majority over the other peoples in the empire, their language is the vehicle of communication between all the other peoples both in official life and in the press; they are in a relatively more advanced state of culture, and they are spread over every part of the empire. Historically they have contributed most to the foundation and to the development of the Austrian monarchy, and think that for all the above-mentioned reasons they are entitled to the principal position amongst the various nationalities of Austria. The Latin race is represented by the Italians, Ladini and Rumanians.

The following table gives the numbers of different nationalities, as determined by the languages spoken by them in 1900:—

Germans	9,171,614
Czechs and Slovaks	5,955,397
Poles	4,252,483
Ruthenians	3,381,570
Slovenes	1,192,780
Italians and Ladini	727,102
Servians and Croats	711,380
Rumanians	230,963
Magyars	9,516

The Germans occupy exclusively Upper Austria, Salzburg, Vorarlberg, and, to a large extent, Lower Austria; then the north and central part of Styria, the north and western part of Carinthia, and the north and central part of Tirol. In Bohemia they are concentrated round the borders, in the vicinity of the mountains, and they form nearly half the population of Silesia; besides they are found in every part of the monarchy. The Czechs occupy the central and eastern parts of Bohemia, the greatest part of Moravia and a part of Silesia. The Poles are concentrated in western Galicia, and in a part of Silesia; the Ruthenians in eastern Galicia and a part of Bukovina; the Slovenes in Carniola, Görz and Gradisca, Istria, the south of Styria, and the Trieste territory. The Servians and Croats are found in Istria and Dalmatia; the Italians and Ladini in southern Tirol, Görz and Gradisca, Trieste, the coast of Istria, and in the towns of Dalmatia; while the Rumanians live mostly in Bukovina.

Agriculture.—Notwithstanding the great industrial progress made by Austria during the last quarter of the 19th century, agriculture still forms the most important source of revenue of its inhabitants. In 1900 over 50% of the total population of Austria derived their income from agricultural pursuits. The soil is generally fertile, although there is a great difference in the productivity of the various crown-lands owing to their geographical situation. The productive land of Austria covers 69,519,953 acres, or 93.8% of the total area, which is 74,102,001 acres; to this must be added 0.4 of lakes and fishponds, making a total of 94.2% of productive area. The remainder is unproductive, or used for other, not agricultural purposes. The area of the productive land has been steadily increasing—it was estimated to cover about 89% in 1875,—and great improvements in the agricultural methods have also been introduced. Of the whole productive area of Austria, 37.6% is laid out in arable land; 34.6% in woods; 25.2% in pastures and meadows; 1.3% in gardens, 0.9% in vineyards; and 0.4% in lakes, marshes and ponds. The provinces having the largest proportion of arable land are Bohemia, Galicia, Moravia and Lower Austria. The principal products are wheat, rye, barley, oats, maize, potatoes, sugar beet, and cattle turnip. The produce of the ploughed land does not, on the whole, suffice for the home requirements. Large quantities in particular of wheat and maize are imported from Hungary for home consumption. Only barley and oats are usually reaped in quantity for export. The provinces which have the lowest proportion of arable land are Tirol and Salzburg. Besides these principal crops, other crops of considerable magnitude are: buckwheat in Styria, Galicia, Carniola and Carinthia; rape and rape-seed in Bohemia and Galicia, poppy in Moravia and Silesia; flax in Bohemia, Moravia, Styria and Galicia; hemp in Galicia, chicory in Bohemia; tobacco, which is a state monopoly, in Galicia, Bukovina, Dalmatia and Tirol; fuller's thistle in Upper Austria and Styria; hops in Bohemia, including the celebrated hops round Saaz, in Galicia and Moravia; rice in the Küstenland; and cabbage in Bohemia, Galicia, Lower Austria and Styria. The principal garden products are kitchen vegetables and fruit, of which large quantities are exported. The best fruit districts are in Bohemia, Moravia, Upper Austria and Styria. Certain districts are distinguished for particular kinds of fruit, as Tirol for apples, Bohemia for plums, Dalmatia for figs, pomegranates and olives. The chestnut, olive and mulberry trees are common in the south—chiefly in Dalmatia, the Küstenland and Tirol; while in the south of Dalmatia the palm grows in the open air, but bears no fruit.

The vineyards of Austria covered in 1901 an area of 626,044 acres, the provinces with the largest proportion of vineyards being Dalmatia, the Küstenland, Lower Austria, Styria and Moravia. The wines of Dalmatia are mostly sweet wines, and not suitable to be kept for long periods, while those of the other provinces are not so sweet, but improve with age.

Forests.—The forests occupy just a little over one-third of the whole productive area of Austria, and cover 24,157,709 acres. In the forests tall timber predominates to the extent of 85%, and consists of conifers much more than of green or leaved trees, in the proportion of seventy against fifteen out of the 85% of the total forests laid out in tall timber. Exceptions are the forest lands of the Karst region, where medium-sized trees and underwood occupy 80%, and of Dalmatia, where underwood occupies 92.6% of the whole forest land. The Alpine region is well wooded, and amongst the other provinces Bukovina is the most densely wooded, having 43.2% of its area under forests, while Galicia with 25.9% is the most thinly-wooded crown-land of Austria. The forests are chiefly composed of oak, pine, beech, ash, elm, and the like, and constitute one of the great sources of wealth of the country. Forestry is carried on in a thoroughly scientific manner. Large works of afforestation have been undertaken in Carinthia, Carniola and Tirol with a view of checking the periodical inundations, while similar works have been successfully carried out in the Karst region.

Landed Property.—Of the whole territory of the state, 74,102,001 acres, about 29%, is appropriated to large landed estates; 71% is disposed of in medium and smaller properties. Large landed property is most strongly represented in Bukovina, where it absorbs 46% of the whole territory, and in Salzburg, Galicia, Silesia and Bohemia. To the state belongs 4½% of the total territory. The Church, the communities, and the corporations are also in possession of large areas of land; 4% (speaking roundly) of the territory of Austria is held on the tenure of *fidei-commissum*. Of the entire property in large landed estates, 59% is laid out in woods; of the property in *fidei-commissum*, 66% is woodland; of the entire forest land, about 10% is the property of the state; 14.5% is communal property; and 3.8% is the property of the Church. The whole of the territory in large landed estates includes 52% of the entire forest land. The forest land held under *fidei-commissum* amounts to over 9% of the entire forest land.

Live Stock.—Although richly endowed by nature, Austria cannot be said to be remarkable as a cattle-rearing country. Indeed, except in certain districts of the Alpine region, where this branch of human activity is carried on under excellent conditions, there is much room for improvement. The amount of live stock is registered every ten years along with the census of the population.

	1880.	1890.	1900.
Horses	1,463,282	1,548,197	1,711,077
Mules and asses	49,618	57,952	66,638
Cattle	8,584,077	8,643,936	9,506,626
Goats	1,006,675	1,035,832	1,015,682
Sheep	3,841,340	3,186,787	2,621,026
Pigs	2,721,541	3,549,700	4,682,734
Beehives	926,312	920,640	996,139

Austria is distinguished for the number and superiority of its horses, for the improvements of which numerous studs exist all over the country. All kinds of horses are represented from the heaviest to the lightest, from the largest to the smallest. The most beautiful horses are found in Bukovina, the largest and strongest in Salzburg; those of Styria, Carinthia, Northern Tirol and Upper Austria are also famous. In Dalmatia, the Küstenland and Southern Tirol, horses are less numerous, and mules and asses in a great measure take their place. The finest cattle are to be found in the Alpine region; of the Austrian provinces, Salzburg and Upper Austria contain the largest proportion of cattle. The number of sheep has greatly diminished, but much has been done in the way of improving the breeds, more particularly in Bohemia, Moravia, Silesia and Upper and Lower Austria. The main object has been the improvement of the wool, and with this object the merino and other fine-woolled breeds have been introduced. Goats abound mostly in Dalmatia, Bohemia and Tirol. The rearing of pigs is carried on most largely in Styria, Bohemia, Galicia and Upper and Lower Austria. Bees are extensively kept in Carinthia, Carniola, Lower Austria and Galicia. The silk-worm is reared more particularly in Southern Tirol and in the Küstenland,

and the average annual yield is 5,000,000 lb of cocoons. In the Alpine region dairy-farming has attained a great degree of development, and large quantities of butter and cheese are annually produced. Altogether, the rearing of cattle, with all its actual shortcomings, constitutes a great source of revenue, and yields a certain amount for export.

Fisheries.—The fisheries of Austria are very extensive, and are divided into river, lake and sea fisheries. The numerous rivers of Austria swarm with a great variety of fishes. The lake fisheries are mostly pursued in Bohemia, where pisciculture is an art of old standing, and largely developed. The sea fisheries on the coast of Dalmatia and of the Küstenland constitute an important source of wealth to the inhabitants of these provinces. About 4000 vessels, with a number of over 16,000 fishermen are employed, and the average annual catch realizes £240,000.

In the mountainous regions of Austria game is plentiful, and constitutes a large source of income.

Minerals.—In the extent and variety of its mineral resources Austria ranks among the first countries of Europe. With the exception of platinum, it possesses every useful metal; thus, besides the noble metals, gold and silver, it abounds in ores of more or less richness in iron, copper, lead and tin. Rich deposits of coal, both pit coal and brown coal are to be found, as well as extensive basins of petroleum, and large deposits of salt. In smaller quantities are found zinc, antimony, arsenic, cobalt, nickel, manganese, bismuth, chromium, uranium, tellurium, sulphur, graphite and asphalt. There are also marble, roofing-slate, gypsum, porcelain-earth, potter’s clay, and precious stones. It is therefore natural that mining operations should have been carried out in Austria from the earliest times, as, for instance, the salt mines of Hallstatt in Upper Austria, which had already been worked during the Celtic and Romanic period. Famous through the middle ages were also the works, especially for the extraction of gold and silver, carried out in Bohemia and Moravia, whose early mining regulations, for instance those of Iglau, were adopted in other countries. But the great industrial development of the 19th century, with its growing necessity for fuel, has brought about the exploitation of the rich coal-fields of the country, and to-day the coal mines yield the heaviest output of any mineral products. To instance the rapid growth in the extraction of coal, it is worth mentioning that in 1825 its output was about 150,000 tons; in 1875, or only after half a century, the output has become 100 times greater, namely, over 15,000,000 tons; while in 1900 it was 32,500,000 tons. Coal is found in nearly every province of Austria, with the exception of Salzburg and Bukovina, but the richest coal-fields are in Bohemia, Silesia, Styria, Moravia and Carniola in the order named. Iron ores are found more or less in all the crown-lands except Upper Austria, the Küstenland and Dalmatia, but it is most plentiful in Styria, Carinthia, Bohemia and Moravia. Gold and silver ores are found in Bohemia, Salzburg and Tirol. Quicksilver is found at Idria in Carniola, which after Almaden in Spain is the richest mine in Europe. Lead is extracted in Carinthia and Bohemia, while the only mines for tin in the whole of Austria are in Bohemia. Zinc is mostly found in Galicia, Tirol and Bohemia, and copper is extracted in Tirol, Moravia and Salzburg. Petroleum is found in Galicia, where ozocerite is also raised. Rock-salt is extracted in Galicia, while brine-salt is produced in Salzburg, Salzkammergut and Tirol. Graphite is extracted in Bohemia, Moravia, Styria and Lower Austria. Uranium, bismuth and antimony are dug out in Bohemia, while procelain earth is found in Bohemia and Moravia. White, red, black and variously-coloured marbles exist in the Alps, particularly in Tirol and Salzburg; quartz, felspar, heavy spar, rock-crystal, and asbestos are found in various parts; and among precious stones may be specially mentioned the Bohemian garnets. The total value of the mines and foundry products throughout Austria in 1875 was £5,000,000. The number of persons employed in the mines and in the smelting and casting works in the same year was 94,019. The total value of the mining products throughout Austria in 1902 was £10,500,000, and the value of the product of the foundries was £3,795,000. Of this amount £3,150,000 represents the value of the iron: raw steel and pig iron. The increase in the value of the mining products during the period 1892-1902 was 40%; and the increase in the product of the furnaces in the same period was 35%. The number of persons employed in 1902 in mining was 140,890; in smelting works 7148; and in the extraction of salt, 7963. The value of the chief mining products of Austria in 1903 was: Brown coal (21,808,583 tons), £4,182,516; coal (12,145,000 tons), £4,059,807; iron ores (1,688,960 tons), £615,273; lead ores, £135,965; silver ores, £119,637; quicksilver ores, £92,049; graphite, £78,437; tin ores, £78,275; copper ores, £22,119; manganese ores, £5368; gold ores, £4407; asphalt, £2250; alum and vitriol slate, £992. The production of petroleum was 660,000 tons, and of salt 340,000 tons. The value of the principal products of the smelting furnaces in 1903 was: Iron (955,543 tons), £2,970,866; coke, £862,137; zinc (metallic), £174,344; silver, £141,594; copper, £57,542; sulphuric acid, £8488; copper vitriol, £5710; mineral colours, £5565; lead, £5067; tin, £4566; gold, £878; iron vitriol, £603; litharge, £384; quicksilver, £218; coal briquettes, £92,000.

Industry.—The manufactures of Austria were much developed during the last quarter of the 19th century, although Austria as a whole cannot be said to be an industrial country. Austria possesses many favourable conditions for a great industrial activity. It possesses an abundance of raw materials, of fuel—both mineral and wood,—of metals and minerals, in fact all the necessaries for a great and nourishing industry; and the rivers can easily be utilized as producers of motive power. It is besides densely populated, and has an adequate supply of cheap labour, while the undeveloped industries of the Balkan states also offer a ready market for its products. The glass manufacture in Bohemia is very old, and has kept up its leading position in the markets of the world up to the present day. Industrial activity is greatly developed in Bohemia, Lower Austria, Silesia, Moravia and Vorarlberg, while in Dalmatia and Bukovina it is almost non-existent. The principal branches of manufactures are, the textile industry, the metallurgic industries; brewing and distilling; leather, paper and sugar; glass, porcelain and earthenware; chemicals; and scientific and musical instruments.

The textile industry in all its branches—cotton, woollen, linen, silk, flax and hemp—is mostly concentrated in Bohemia, Moravia, Silesia and Lower Austria. It is an old industry, and one which has made great progress since 1875. Thus the number of mechanical looms increased more than threefold during this period, and numbered in 1902 about 120,000. In the same year the number of spindles at work was about 3,100,000. Austria had in 1902, 21,837 textile factories with 337,514 workmen. The principal seat of the manufacture of cotton goods is in northern Bohemia, from the Eger to Reichenberg, which can be considered as the Lancashire of Austria, Lower Austria between the Wiener Wald and the Leitha, and in Vorarlberg. Woollen goods are manufactured in the above places, and besides in Moravia, at Brünn and at Iglau; in Silesia; and at Biala in Galicia. Vienna is also distinguished for its manufacture of shawls. The coarser kind of woollen goods are manufactured all over the country, principally in the people’s houses as a home industry. The most important places for the linen industry are in Bohemia at Trautenau; in Moravia and Silesia, while the commoner kinds of linen are mostly produced as a home industry by the peasants in the above-mentioned crown-lands. The manufacture of ribbons, embroidery and lace, the two latter being carried on principally as a house industry in Vorarlberg and in the Bohemian Erzgebirge, also thrives. The industry in stitched stuffs is especially developed in northern Bohemia. Ready-made men’s clothes and oriental caps (fezes) are produced on a large scale in Bohemia and Moravia. The manufacture of silk goods is mainly carried on in Vienna, while the spinning of silk has its principal seat in southern Tirol, and to a smaller extent in the Küstenland.

The metallurgic industry forms one of the most important branches of industry, because iron ore of excellent quality is extracted annually in great quantities. The principal seats of the iron and steel manufactures are in Bohemia, Moravia, Silesia, Upper and Lower Austria, Styria and Carinthia, which contain extensive iron-works. The most important manufactured products are cutlery, firearms, files, wire, nails, tin-plates, scythes, sickles, steel pens, needles, rails, iron furniture, drains, and kitchen utensils. A famous place for its iron manufacture is Steyr in Upper Austria. The manufacture of machinery, for industrial and agricultural purposes, and of railway engines is mainly concentrated in Vienna, Wiener-Neustadt, Prague, Brünn and Trieste; while the production of rolling stock for railways is carried on in Vienna, Prague and Graz. Ship-building yards for sea-vessels are at Trieste and Pola; while for river-vessels the largest yards are at Linz. Among other metal manufactures, the principal are copper works at Brixlegg and other places in Tirol, and in Galicia, tin and lead in Bohemia, and metallic alloys, especially *Packfong* or German silver, an alloy of nickel and copper, at Berndorf in Lower Austria. The precious metals, gold and silver, are principally worked in the larger towns, particularly at Vienna and Prague. Vienna is also the principal seat for scientific and surgical instruments. In the manufacture of musical instruments Austria takes a leading part amongst European states, the principal places of production being Vienna, Prague, Königgrätz, Graslitz and Schönbach.

The glass manufacture is one of the oldest industries in Austria, and is mainly concentrated in Bohemia. Its products are of the best quality, and rule the markets of the world. In the manufacture of earthenwares Austria plays also a leading part, and the porcelain industry round Carlsbad and in the Eger district in Bohemia has a world-wide reputation. The leather industry is widely extended, and is principally carried on in Lower Austria, Bohemia and Moravia. Vienna and Prague are great centres for the boot and shoe trade, and the gloves manufactured in these towns enjoy a great reputation. The manufacture of wooden articles is widespread over the country, and is very varied. In Vienna and other large towns the production of ornamental furniture has attained a great development. The industry in paper has also assumed great proportions, its principal seats being in Bohemia, Moravia, Upper and Lower Austria. Of food-stuffs, besides milling, and other flour products, the principal industry is the manufacture of sugar from beet-root. The sugar industry is almost exclusively carried on in Bohemia, Moravia, Silesia and Galicia. It has attained such large proportions that large districts in those provinces have been converted from wheat-growing districts into fields for the cultivation of beet-root. Brewing is extensively carried on, and the beer produced is of a good quality. The largest brewing establishment is at Schwechat near Vienna, and large breweries are also found at Pilsen and Budweiss in Bohemia, whose products enjoy a great reputation abroad. There were in Austria 1341 breweries, which produced 422,993,120 gallons of beer. in 1902-1903. Distilling is carried on on a large scale in Galicia, Bukovina, Bohemia, Moravia and Lower Austria; the number of distilleries being 1257, which produced 30,435,812 gallons of spirit. Rosoglio, maraschino, and other liqueurs are made in Dalmatia and Moravia. The manufacture as well as the growth of tobacco is a government monopoly, which has 30 tobacco factories with over 40,000 work-people, the largest establishment being at Hainburg in

Lower Austria. Other important branches of industry are the manufacture of chemicals, in Vienna and in Bohemia; petroleum refineries in Galicia, and the extraction of various petroleum products; the manufacture of buttons; printing, lithographing, engraving, and map-making, especially in Vienna, &c.

In 1900 the various manufacturing industries employed in Austria 3,138,800 persons, of whom 2,264,871 were workmen and 103,854 were labourers. Including families and domestic servants, a little over 7,000,000 were dependent on industry for their livelihood.

Commerce.—Austria forms together with Hungary one customs and commercial territory, and the statistics for the foreign trade are given under Austria-Hungary. Owing to its situation, the bulk of the Austrian trade is carried on the railways and on the inland navigable rivers. Only a small portion is sea-borne trade, while the commercial interchange between the provinces lying on the Adriatic coast is very small.

Commercial Navy.—The commercial sea navy of Austria, excluding small coasting vessels and fishing-boats, consisted in 1900 of 154 vessels, with a tonnage of 198,322 tons, of which 123 vessels with a tonnage of 183,949 were steamers. The greatest navigation company is the Austrian Lloyd in Trieste, which in 1900 employed 70 steamers of 165,430 tons. During 1900 the total tonnage of vessels engaged in the foreign trade, which entered all the Austrian ports, was 1,448,764 tons under the Austro-Hungarian flag, and 888,707 under foreign flags; the total tonnage of vessels cleared during the same period was 1,503,532 tons under the Austro-Hungarian flag, and 866,591 under foreign flags.

Government.—Austria is a parliamentary or constitutional (limited) monarchy, its monarch bearing the title of emperor. The succession to the throne is hereditary, in the order of primogeniture, in the male line of the house of Habsburg-Lothringen; and failing this, in the female line. The monarch must be a member of the Roman Catholic Church. The emperor of Austria is also king of Hungary, but except for having the same monarch and a few common affairs (see Austria-Hungary), the two states are quite independent of one another. The emperor has the supreme command over the armed forces of the country, has the right to confer degrees of nobility, and has the prerogatives of pardon for criminals. He is the head of the executive power, and shares the legislative power with the Reichsrat; and justice is administered in his name. The constitution of Austria is based upon the following statutes:—(1) the Pragmatic Sanction of the emperor Charles VI., first promulgated on the 19th of April 1713, which regulated the succession to the throne; (2) the Pragmatic Patent of the emperor Francis II. of the 1st of August 1804, by which he took the title of Emperor of Austria; (3) the Diploma of the emperor Francis Joseph I. of the 20th of October 1860, by which the constitutional form of government was introduced; (4) the Diploma of the emperor Francis Joseph I. of the 26th of February 1861, by which the provincial diets were created; (5) the six fundamental laws of the 21st of December 1867, which contain the exposition and guarantee of the civil and political rights of the citizen, the organization of justice, the organization and method of election for the Reichsrat, &c.

The executive power is vested in the council of ministers, at whose head is the minister-president. There are eight ministries, namely, the ministry of the interior, of national defence, of worship and instruction, of finance, of commerce, of agriculture, of justice, and of railways. There are, further, two ministries, without portfolio, for Galicia and Bohemia. The civil administration in the different provinces is carried out by governors or stadtholders (*Statthalter*), to whom are subordinate the heads of the 347 districts in which Austria was divided in 1900, and of the 33 towns with special statute, *i.e.* of the towns which have also the management of the civil administration. Local self-government of the provinces, districts and communities is also granted, and is exercised by various elective bodies. Thus, the autonomous provincial administration is discharged by the provincial committees elected by the local diets; and the affairs of the communities are discharged by an elected communal council.

The legislative power for all the kingdoms and lands which constitute Austria is vested in the Reichsrat. It consists of two Houses: an Upper House (the *Herrenhaus*), and a Lower House (the *Abgeordnetenhaus*). The Upper House is composed of (1) princes of the imperial house, who are of age (14 in 1907); (2) of the members of the large landed nobility, to which the emperor had conferred this right, and which is hereditary in their family (78 in 1907); (3) of 9 archbishops and 8 prince-bishops; and (4) of life members nominated by the emperor for distinguished services (170 in 1907). The Lower House has undergone considerable changes since its creation in 1861, by the various modifications of the electoral laws passed in 1867, 1873, 1892, 1896 and 1907. The general spirit of those modifications was to broaden the electoral basis, and to extend the franchise to a larger number of citizens. The law of the 26th of January 1907 granted universal franchise to Austrian male citizens over twenty-four years of age, who have resided for a year in the place of election. The Lower House consists of 516 members, elected for a period of six years. The members receive payment for their services, as well as an indemnity for travelling expenses. A bill to become law must pass through both Houses, and must receive the sanction of the emperor. The emperor is bound to summon the Reichsrat annually.

According to the imperial Diploma of the 26th February 1861, local diets have been created for the legislation of matters of local interest. These provincial parliaments are 17 in number, and their membership varies from 22 members, which compose the diet of Görz and Gradisca to the 242 members which constitute that of Bohemia. They assemble annually and are composed of members elected for a period of six years, and of members *ex-officio*, namely, the archbishops and bishops of the respective provinces, and the rector of the local university.

Religion.—Religious toleration was secured throughout the Habsburg dominions by the patent of the 13th of October 1781, but Protestants were not given full civil rights until the issue of the *Protestantenpatent* of the 8th of April 1861, after the promulgation of the imperial constitution of the 26th of February. The principle underlying this and all subsequent acts is the guarantee to all religious bodies *recognized by law* of freedom of worship, the management of their own affairs, and the undisturbed possession and disposal of their property. Though all the churches are, in a sense, "established," the Roman Catholic Church, to which the sovereign must belong, is the state religion. The reigning house, however, though strongly attached to the Roman faith, has always resisted the extreme claims of the papacy, an attitude which in Joseph II.'s time resulted, under the influence of Febronianism (*q.v.*), in what was practically a national schism. Thus the emperor retains the right to tax church property, to nominate bishops, and to prohibit the circulation of papal bulls without his permission. By the concordat of August 18, 1855, this traditional attitude was to some extent reversed; but this agreement soon became a dead letter and was formally denounced by the Austrian government after the promulgation of the dogma of papal infallibility.

Of the population of Austria in 1900, 23,796,814 (91%) were Roman Catholics, including 3,134,439 uniate Greeks and 2096 uniate Armenians. There were 12,937 Old Catholics, in scattered communities, 606,764 members of the Eastern Orthodox Church, mainly in Bukovina and Dalmatia, and 698 Armenians, also mainly in Bukovina. The Protestants, who in the 16th century comprised 90% of the population, are now only 1.9%. In 1900, 365,505 of them were returned as belonging to the Augsburg Confession (Lutheran), 128,557 to the Helvetic (Reformed). Other Christian Confessions in Austria are Herrnhuters (Moravian Brethren) in Bohemia, Mennonites in Galicia, Lippovanians (akin to the Russian Skoptsi) in Bukovina, and Anglicans. The Jews compose 4.7% of the population, and are strongest in Galicia, Lower Austria, Bohemia, Moravia and Bukovina. The Roman Catholic Church is divided into eight provinces, seven of the Latin rite—Vienna, Prague, Lemberg, Salzburg, Olmütz, Görz and Zara—with 23 bishoprics, and one of the Greek rite (Lemberg), with two bishoprics. The Armenian bishopric of Lemberg and the Austrian part of the archdiocese of Breslau are under the immediate jurisdiction of the Holy See. The Greek Orthodox Church has one archbishopric (at Czernowitz) and two bishoprics. There are 559 communities of the Jewish religion (253 in Galicia, and 255 in Bohemia). In 1900 there were, belonging to the Roman Catholic Church, 541 monasteries with 7775 monks, and 877 convents with 19,194 nuns; while the Greek Orthodox Church had 14 monasteries with 85 members. The Evangelical Church, according to the constitution granted by imperial decree on the 9th of April 1861 (modified by those of January 6, 1866 and December 9, 1891) is organized on a territorial basis, being administered by 10 superintendents, who are, in their turn, subject to the Supreme Church Council (*K.K. Oberkirchenrat*) at Vienna, the emperor as sovereign being technically head of the Church. The small Anglican community at Trieste is under the jurisdiction of the Evangelical superintendent of Vienna.

Education.—The system of elementary schools dates from the time of Maria Theresa; the present organization was introduced by the education law of May 14, 1869 (amended in 1883). By this law the control of the schools, hitherto in the hands of the Church, was assumed by the state, every local community being bound to erect and maintain public elementary schools. These are divided into *Volksschulen* (national or primary schools) and *Bürgerschulen* (higher elementary schools). Attendance is obligatory on all from the age of six to fourteen (in some provinces six to twelve). Religious instruction is given by the parish priest, but in large schools a special grant is made or a teacher *ad hoc* appointed in the higher classes (law of June 17, 1888). Private schools are also allowed which, if fulfilling the legal requirements, may be accorded the validity of public primary schools. The language of instruction is that of the nationality prevalent in the district. In about 40% of the schools the instruction is given in German; in 26% in Czech; in 28% in other Slavonic languages, and in the remainder in Italian, Rumanian or Magyar. In 1903 there were in Austria 20,268 elementary schools with 78,025 teachers, frequented by 3,618,837 pupils, which compares favourably with the figures of the year 1875, when there were 14,257 elementary schools with 27,677 teachers, frequented by 2,050,808 pupils. About 88% of the children who are of school age actually attend school, but in some provinces like Upper Austria and Salzburg nearly the full 100 attend, while in the eastern parts of

the monarchy the percentage is much lower. In 1900 62% of the total population of Austria could read and write, and 2.9% could only read. In the number of illiterates are included children under seven years of age. For the training of teachers of elementary schools there were in 1900 54 institutions for masters and 38 for mistresses. In these training colleges, as also in the secondary or "middle" schools (*Mittelschulen*), religious instruction is also in the hands of the Roman Catholic Church; but, by the law of June 20, 1870, the state must provide for such teaching in the event of the Protestant pupils numbering 20 or upwards (the school authorities usually refuse to take more than 19 Protestants in consequence).

Besides the elementary schools three other groups of educational establishments exist in Austria: "middle" schools (*Mittelschulen*); "high" schools (*Hochschulen*); professional and technical schools (*Fachlehranstalten* and *Gewerbeschulen*). The "middle" schools include the classical schools (*Gymnasien*), "modern" schools with some Latin teaching (*Realgymnasien*), and modern schools simply (Realschulen)—In 1903 there were 202 *Gymnasien*, 19 *Realgymnasien* and 117 *Realschulen*, with 7121 teachers and 111,012 scholars. The "high" schools include the universities and the technical high schools (*Technische Hochschulen*). Of state universities there are eight:—Vienna, Gratz, Innsbruck, Prague (German), and Czernowitz, in which German is the language of instruction; Prague (Bohemian) with Czech; and Cracow and Lemberg with Polish as the language of instruction. Each university has four faculties—theology, law and political science, medicine, and philosophy. In Czernowitz, however, the faculty of medicine is wanting. Since 1905 an Italian faculty of law has been added to the university of Innsbruck. The theological faculties are all Roman Catholic, except Czernowitz, where the theological faculty is Orthodox Eastern. All the universities are maintained by the state. The number of professors and lecturers was about 1596 in 1903; while the number of students was 17,498.

Justice.—The judicial authorities in Austria are:—(1) the county courts, 963 in number; (2) the provincial and district courts, 74 in number, to which are attached the jury courts,—both these courts are courts of first instance; (3) the higher provincial courts, 9 in number, namely, at Vienna, Graz, Trieste, Innsbruck, Zara, Prague, Brünn Cracow and Lemberg; these are the cours of appeal from the lower courts, and have the supervision of the criminal courts in their jurisdiction; (4) the supreme court of justice and court of cassation in Vienna. The judicial organization is independent of the executive power. There are also special courts for commercial, industrial, shipping, military and other matters. There is also the court of the Empire at Vienna, which has the power to decide in case of conflict between different authorities.

Finance.—The growth of the Austrian budget, is shown by the following figures:—

	1885	1895	1900	1905
Expenditure	£44,121,600	£55,396,916	£66,003,494	£74,013,000
Revenue	£43,714,666	£57,446,091	£66,020,475	£74,079,000

The chief sources of revenue are direct taxes, indirect taxes, customs duties, post and telegraph and post-office savings banks receipts, railway receipts, and profits or royalties on forests, domains and mining. The direct taxes are divided into two groups, real and personal; the former include the land tax and house-rent tax, and the latter the personal income tax, tax on salaries, tax on commercial and industrial establishments, tax on all business with properly audited accounts (like the limited liability companies), and tax on investments. The principal indirect taxes are the tobacco monopoly, stamps and fees, excise duties on sugar, alcohol and beer, the salt monopoly, excise duty on mineral oil, and excise duty on meat and cattle for slaughtering.

The national debt of Austria is divided into two groups, a general national debt, incurred jointly by the two halves of the Austro-Hungarian monarchy for common affairs, and is therefore jointly borne by both parts, and a separate debt owed only by Austria alone. The following table shows the growth of the Austrian debt in millions sterling:—

1885	1890	1895	1900	1905
45.	88.23	119.60	140.68	167.91

At the close of 1903 the debt of Austria was £156,724,000, an increase since 1900 of £16,044,000. This large increase is due to the great expenditure on public works, as railways, navigable canals, harbour works, &c., started by the Austrian government since 1900.

Railways.—As regards internal communications, Austria is provided with an extensive network of railways, the industrial provinces being specially favoured. This has been accomplished in spite of the engineering difficulties owing to the mountainous nature of the country and of the great financial expenses resulting therefrom. The construction of the Semmering railway, opened in 1854, for instance, was the first mountain railway built in the European continent, and marked an epoch in railway engineering. The first railway laid down in Austria was in 1824 between Budweis and Kerschbaum, over a distance of 40 m., and was at first used for horse tramway. The first steam railway was opened in 1837 over a distance of about 10 m. between Floridsdorf (near Vienna) and Wagram. From the first, the policy of the Austrian government was to construct and to work the railways itself; and in granting concessions to private companies it stipulated among its conditions the reversionary right of the state, whereby the line becomes the property of the state without compensation after the lapse of the period of concession. With various modifications, according to its financial means, it vigorously pursued its policy, by both building railways itself, and encouraging private companies to build. In 1905 the total length of railways in Austria was 13,590 m., of which 5017 m. belonged to and were worked by the state, and 3359 m. belonged to private companies, but were worked by the state.

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(O. Br.)

1 The census returns of 1857, and of 1869, which were the first systematic censuses taken, gave the population of Austria as 18,224,500 and 20,394,980 respectively. It must be noticed that between these two dates Austria lost its Lombardo-Venetian territories, with a population of about 5,000,000 inhabitants.

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