

experiments in which Hankel used it are alluded to in the article ELECTRICITY.

In the quadrant electrometer of Sir Wm. Thomson, which is the most delicate electrometric instrument hitherto invented, the moving body is a horizontal flat needle of aluminium foil, surrounded by a fixed flat cylindrical box (fig. 14), which is divided into four insulated quadrants A, B, C, D. The opposite pairs A, D and B, C are connected by thin platinum wires. The two bodies whose potentials are to be compared are connected with the two pairs of quadrants. If A and B be their potentials, and C the potential of the needle, it may be shown (see Maxwell, *Electricity and Magnetism*, § 219) that the couple tending to turn the needle from A to B is

$$a(A - B) \left\{ C - \frac{1}{2}(A + B) \right\} \dots \dots (6)$$

where a is a constant depending on the dimensions of the instrument. If C be very great compared with $\frac{1}{2}(A + B)$, as it usually is, then the couple is

$$aC(A - B) \dots \dots \dots (7)$$

simply; in other words, the couple varies as the difference between the potentials of the quadrants. Some idea of the general distribution of the parts of the actual instrument may be gathered from fig. 15, which gives an elevation and a section of the instrument. The case forms a Leyden jar as usual in Thomson's electrometers; the internal coating in this instance is formed by a quantity of concentrated sulphuric acid, which also keeps the inside of the instrument dry. The quadrants are suspended by glass pillars from the lid of the jar, and one of these pillars is supported on a sliding piece, arranged on strict kinematical principles, so as to be movable in a horizontal direction by means of a micrometer screw Y. This motion is used to adjust the position of the needle, when charged, so that its axis may fall exactly between the quadrants A, C, and B, D. A glass stem C, rising from the lid of the jar into a superstructure called the "lantern," supports a metal piece Z, to which is fastened a metal framework fitted with supports and adjustments for the bifilar suspension of the needle. A fine platinum wire drops from the needle into the sulphuric acid, thus connecting the needle with the inside coating of the jar. This tail wire is also furnished with a vane, which works in the acid and damps the oscillations of the needle. A stout aluminium wire rises from the needle, carries a light concave mirror T, and ends in a cross piece to which are attached the suspension fibres. The aluminium stem and the platinum tail wire are defended from electrical disturbances by a guard tube, which is in metallic connection with the piece Z, and also, by means of a platinum wire, with the acid; it is through this, by means of the "temporary electrode" P, that the inside of the jar is charged. The two principal electrodes are P and M. Connected with Z is a metal disc S, attracting the aluminium balance of a gauge like that of the absolute electrometer. This gauge is well seen in the bird's-eye view given in fig. 16. A

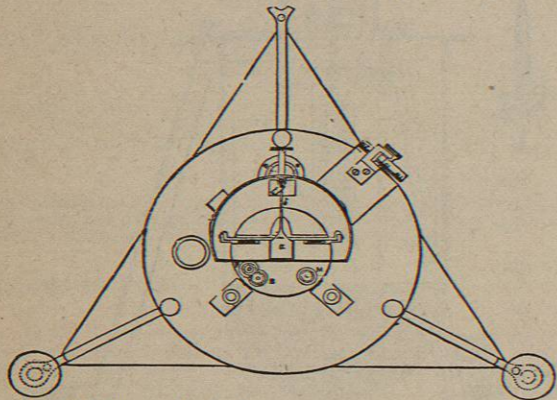


FIG. 16.—Thomson's Quadrant Electrometer.—Bird's-eye view.

replenisher, like that in the absolute electrometer, is fitted to the lid of the jar, and by means of it the potential of the needle can be adjusted till the hair of the gauge is in the sighted position.

The deflections of the instrument are read off by means of an image formed by the mirror T on a scale at the distance of a metre or so, the object being a wire which is stretched below the scale in a slit illuminated by a lamp. Within certain limits the deflections are proportional to the deflecting couple, i.e., to the difference between the potentials of the quadrants A, D and B, C; but where this is not so, the instrument can easily be graduated experimentally.

For many purposes, especially in the lecture room, an instrument

so complicated as the above is unnecessary and undesirable. simpler form (fig. 17) of quadrant electrometer is now manufactured by Elliot Brothers, and answers most ordinary purposes very well.

Capillary Electrometers.—Electrometers have recently been constructed by taking advantage of the fact that the surface tension of mercury is greatly affected by the hydrogen deposited on it when it is the negative electrode in contact with dilute sulphuric acid (see ELECTROLYSIS, p. 109). A quantity of mercury is placed in the bottom of a test tube, and communicates with a platinum electrode let in through the bottom of the tube; on the mercury is poured dilute sulphuric acid, and into this dips a tube drawn out into a capillary ending. This tube contains mercury down to a certain mark on the capillary part, the remainder being occupied with acid which is continuous with that in the test tube. So long as the mercury in the test tube is simply in metallic connection with that in the upper tube, the position of the mercury in the capillary part is stationary; but if an electromotive force be introduced into the external circuit, acting towards the test tube, then hydrogen is deposited on the small mercury surface, its surface tension increases, and the pressure in the tube must be considerably increased to maintain the mercury at the mark. This increase of pressure is proportional to the electromotive force within certain limits, hence we can use this arrangement as an electrometer.

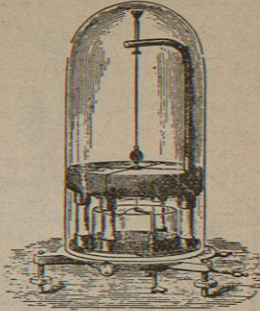


FIG. 17.—Quadrant Electrometer.

Electrometric Measurement.—Several examples of electrometric measurement will be found in the article ELECTRICITY (pp. 18, 37, 38, 42, 46, &c.). We recommend in this connection the study of the sections on atmospheric electricity in Sir Wm. Thomson's *Report of Papers on Electricity and Magnetism*, and sections 220 and 229 in Clerk Maxwell's *Electricity and Magnetism*. We have been drawing throughout on Thomson's *Report on Electrometers and Electrometric Measurements*, but it will not be amiss to draw attention to it once more. (G. CH.)

ELEMI. The resin thus termed in modern pharmacy is obtained by incising the trunk of a species of *Canarium* found in the Philippine Islands. It is a soft, more or less translucent, adhesive substance, of granular consistency and fennel-like smell, and colourless when pure, but sometimes grey or blackish from the presence of carbonaceous and other impurities. When exposed to the air it becomes yellowish in tint, and harder. It consists mainly of essential oil, and of an amorphous and a crystalline resin, the former easily soluble in cold, and the latter only in hot alcohol. Elemi is used chiefly in the manufacture of spirit and turpentine varnishes, which it enables to dry without cracking. As a constituent of a stimulating ointment, it has found a place in British pharmacopœias. In the Philippines it is employed for caulking ships, and is kneaded with rice-husks for torches (see Jagor, *Reisen in den Philippinen*, p. 79, Berlin, 1873). The word elemi, like the older term *animi*, appears to have been derived from *enhæmon* (Greek, *ἔναμον*), the name of a styptic medicine said by Pliny to contain tears exuded by the olive-tree of Arabia. This tree, according to Flückiger and Hanbury, is probably to be identified with the *Boswellia Frereana* of Birdwood, which flourishes in the neighbourhood of Bunder Marayah, west of Cape Gardafui (see S. B. Miles, *Journ. R. Geog. Soc.*, xlii. p. 64). Mexican or Vera Cruz elemi, formerly imported into England, is afforded by the species *Amyris elemifera*, Royle; Mauritian elemi by another tree, *Colophonia Mauritiæna*, D.C.; and Brazilian elemi by several species of *Icica*. For a paper "On the Chemistry of Elemi," see Flückiger, *Year-Book of Pharmacy*, 1874, p. 496.

ELEPHANT (*Elephantidæ*), a family of pachydermatous mammals belonging to the order Proboscidea, containing only a single existing genus and two species—the sole surviving representatives of the entire order. The elephants are characterized by great massiveness of body, constituting

then the largest of living terrestrial mammals, by peculiarities in their dentition, and by the possession of a lengthened proboscis or trunk. The latter organ is a huge prolongation of the nose and upper lip, measuring usually from 6 to 8 feet in length, and almost wholly composed of a mass of muscles, numbering, according to Cuvier, nearly 40,000, and curiously interlaced, so as to produce the greatest diversity of motion. Its extremity contains the two openings of the nostrils by which the elephant breathes when swimming, as it sometimes does, with only the tip of its trunk above the surface, and through which it can fill the channels of its trunk with water, the flexibility of that organ enabling it to pour the liquid into its mouth or to squirt it over the surface of its body. By a peculiar valvular arrangement the water is prevented from penetrating into the bony nostrils. The extremity of the trunk is produced on the upper surface into a finger-like process, and ends beneath in a thick tubercle which acts the part of thumb to the prolongation above, while the whole is exquisitely endowed with the sense of touch, and so forms an organ of prehension comparable in many respects to the human hand. With it the elephant collects its food and drink, discovers the snares that are often set in its path, strikes its antagonist to the ground, and gives vent to its rage in a shrill trumpet-like sound, hence the French name of *trompe* for the proboscis, corrupted in our language into *trunk*. Without it the animal is helpless, being unable even to feed itself; and, as if conscious of the vital importance of this organ, the elephant is exceedingly cautious in using it, preferring when in combat with the tiger to fight with its trunk carried aloft, out of reach of its antagonist's claws. When the trunk is injured the elephant becomes furious with rage and pain, and can no longer be controlled by its rider.

The teeth of the elephant consist of two incisors, or tusks, as they are called, in the upper jaw, and six molars on each side of either jaw. The permanent tusks are preceded by small milk teeth, which, however, give place to their successors before the end of the second year. The tusks, proceeding from a permanent pulp, continue to grow during the elephant's lifetime, and sometimes attain enormous size, examples having been known to weigh from 150 to upwards of 200 lb each. They consist almost entirely of ivory—a remarkably fine and elastic form of dentine—and are hollow for a considerable part of their length. They are also deeply imbedded in the skull; thus a tusk, about 8 feet long and 22 inches in girth, was found by Sir Samuel Baker to be imbedded to a depth of 31 inches. The tusks are invariably best developed in the male sex, and are regarded by Darwin as sexual weapons. Their almost vertical position, however, and the inability of the elephant to raise its head above the shoulder, render their use as offensive weapons somewhat difficult; nevertheless they are certainly employed as such in fighting with the tiger, the mode of using them depending, says Darwin, "on their direction and curvature"—thus the elephant has been known to toss a tiger to a distance of 30 feet with its tusks, when these were turned upward and outward, while it seeks to pin its foe to the ground when these organs have the usual downward direction. The tusks are largest in the African species, which feeds principally on the foliage and the succulent roots of trees, and in this species they are often used as levers in uprooting mimosa trees, whose crown of foliage is beyond the reach of the upturned trunk. In Ceylon, on the other hand, where the elephant lives chiefly on grass and herbage, tusks are generally absent in both sexes. The bullets occasionally found imbedded in the solid ivory have evidently been shot into the upper part of the tusk, and, getting lodged in the pulp cavity, have been carried down by the growth of successive layers of ivory

into the solid part of the tooth. The molar teeth consist of a series of transverse plates, composed of dentine, and coated with a layer of enamel, the whole bound together by the substance known as *crusta petrosa*, or cement. Each of these materials, possessing a different degree of hardness, wears away at a different rate from the others, and the uneven surface necessary for the proper trituration of the food is thus produced. Although the elephant may be said to have altogether six molars on each side of either jaw, at no time can more than one and a portion of a second be seen. These molars are not deciduous in the ordinary sense, but they grow from behind forward, and as the anterior part of the front molar gets worn away by degrees, its successor is gradually cutting its way through the gum, from which, however, it does not wholly emerge until the tooth in front has almost disappeared. This progression of the molar teeth continues throughout the greater part of the elephant's life, so that it may be said to be always teething. Six of such molars, each composed of a greater number of plates than its predecessor, are said to suffice it for life. The massiveness of the skull, and its height in front, to which the elephant owes something of its sagacious aspect, is due not to the great size of the brain—which is relatively small—but to the enormous development of the bones of the cranium, rendered necessary in order to give attachment to the powerful muscles of the head and trunk. The presence of large air cells, however, in the cranial bones, renders the skull light in proportion to its enormous bulk. The eyes in the elephant are small, and its range of vision, owing to the shortness and slight flexibility of its neck, is somewhat circumscribed; this, however, is of secondary importance to an animal living generally in dense forests, where the prospect is necessarily limited, and in the elephant is compensated for by exceeding keenness in the senses of hearing and smell. Its stomach resembles that of the camel in having a chamber which can be cut off from the proper digestive cavity for the storing of water; this is capable of holding 10 gallons. The contents of this chamber it is able to convey into its trunk, should it wish to indulge its body in the luxury of a shower bath. The elephant is an unwieldy creature, weighing fully 3 tons, and supported on colossal limbs, which from their straightness and apparent want of flexibility—an effect produced by the greater nearness of the knee and elbow to the ground than in most animals—were for centuries supposed either to be jointless, or to have such joints as could not be used. Such evidently was Shakespeare's belief when he wrote—

"The elephant hath joints, but not for courtesy;
His legs are for necessity, not flexure."

This delusion was further supported by the fact that the elephant often sleeps standing, its huge body leaning against a tree or rock. In lying down it does not place the hind legs beneath it, as is generally the case, but extends them backwards after the manner of a person kneeling. By this method the elephant can raise its huge weight with little perceptible effort. The feet are furnished with five toes, completely enveloped in a tegumentary cushion, and with four or five nails on each of the front feet, and three or four on the hind ones, according to the species. The skin of the elephant is thick and soft, and of a dark brown colour. With the exception of a few hairs on certain parts of its body, it is naked, although individuals found in the elevated districts of Northern India are said to be more hairy than those inhabiting warmer regions, while the young everywhere, according to Tennent, are at first covered with a woolly fleece, especially about the head and shoulders, approximating in this respect to the mammoth which inhabited the alæarctic region during Pleistocene times. From such facts Darwin regards it as

probable that existing elephants have lost their hairy covering through exposure to tropical heat. The elephant continues to grow for upwards of 30 years, and to live for more than 100, there being well-authenticated cases of elephants that lived over 130 years in captivity. The female is capable of breeding after 15 years, and produces a single young one, rarely two, at a birth, the period of gestation extending over nearly 21 months. The young elephant sucks with its mouth, and not, as was formerly supposed, with its trunk.

Elephants are polygamous, associating together in considerable herds, under the guidance of a single leader, whom they implicitly follow, and whose safety, when menaced, they are eager to secure. These herds often do great damage to rice and other grain fields in cultivated districts, trampling under foot what they cannot eat. A slight fence is, however, generally sufficient to prevent their inroads, the elephant regarding all such structures with the greatest suspicion, connecting them probably, in some way, with snares and pitfalls. At times this usually inoffensive animal is subject to fits of temporary fury, and an elephant in "must," as this frenzied condition is termed, is regarded as the most dangerous of animals. When an elephant, from whatever cause, leaves the herd to which it belongs, it is not allowed to join the ranks of another, but ever after leads a solitary life. Those individuals are known as "rogues;" being soured in temper by exclusion from the society of their kind, they become exceedingly ferocious, attacking without provocation whatever crosses their path.

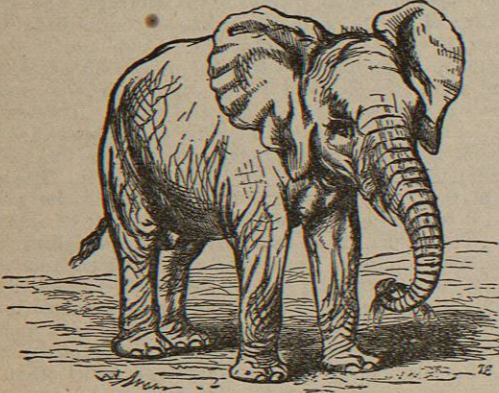


FIG. 1.—African Elephant (*Elephas africanus*).
(From specimen in Zoological Gardens, London.)

There are two existing species of elephants—the African and the Asiatic. The African Elephant (*Elephas africanus*) differs in so many important particulars from the Asiatic form as to have been placed by many naturalists, and apparently with sufficient reason, in a separate genus—*Loxodon*. The enamel on the crown of its molar teeth is arranged across the surface in lozenge-shaped figures, instead of the nearly parallel transverse ridges of the other species. Its ears are enormously large, completely covering the shoulder when thrown back; they have been known to measure 3½ feet in length and 2½ feet in width. Its forehead also is convex, and its back concave, while in the other the forehead is almost flat, and the back convex. The African elephant ranges over the whole of Africa south of the Sahara, with the exception of the Cape, where it formerly abounded, but from which it has been driven by man. In height it somewhat exceeds the Asiatic species, although never standing more than 11 feet high at the shoulder. Its tusks are also heavier, and occur in both

sexes, although in the female they are comparatively small, a male tusk usually weighing about 50 lb, while that of the female rarely exceeds 10 lb. "The tusks of the African elephant," says Baker, "are seldom alike. As a man uses his right hand in preference to his left, so the elephant works with a particular tusk which is termed by the traders el-hadām (the servant); this is naturally more worn than the other, and is usually about 10 lb lighter." They roam among the long grass on the open plains, in the neighbourhood of water, of which both species are excessively fond, feeding on the leaves and roots of trees, and using their tusks to overthrow such as are too strong to be pulled down by their powerful trunks. The traveller just quoted states that he has observed trees 4 feet 6 inches in circumference, and about 30 feet high, thus uprooted. He was assured by the natives, however, that in such cases the elephants assisted each other. Until comparatively recent times the natives of Africa hunted the elephant exclusively for its flesh, of which they are particularly fond; but since the arrival of the Arab traders, the natives, who formerly regarded the tusks as mere bones, and left them to rot along with the rest of the skeleton, have discovered the value of ivory, and this has led to the destruction of these animals on a much larger scale than formerly. England alone imports 1,200,000 lb of ivory annually, in order to obtain which, the lives of probably 30,000 elephants are sacrificed; and it has been estimated by a recent writer on this subject that, in order to supply the demand for ivory throughout the world, at least 100,000 individuals are annually slain. As the elephant is the slowest breeder of all known animals, should the slaughter continue on its present scale, the total extinction of tusk-bearing elephants

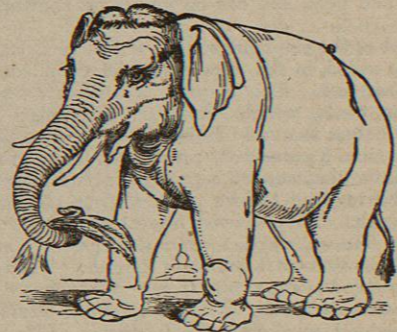


FIG. 2.—Asiatic Elephant (*Elephas indicus*).

is probably not far distant. The African elephant was in ancient times domesticated by the Carthaginians, who employed it in their wars with Rome. It was this species which crossed the Alps with Hannibal, and which the Romans, after the conquest of Carthage, made use of in war, in the amphitheatre, and in military pageants. No African race has since succeeded in reclaiming this highly intelligent and naturally docile animal—a fact often quoted in proof of the general inferiority of the negro race. Although common in Europe during the ascendancy of the Roman empire, for centuries after it was almost unknown; and it was only in 1865 that the Zoological Society of London obtained a pair for their gardens. These are still living.

The Asiatic Elephant (*Elephas indicus*) inhabits the wooded parts of the Oriental region, from India and Ceylon eastward to the frontiers of China, and to Sumatra and Borneo. It chiefly abounds in the jungle, and probably on this account is less active and fierce than the African form. It is not, however, partial, as was at one time supposed, to low grounds and sultry heat, abounding in India and Ceylon, principally among the hilly and even mountainous districts.

where the cold is often considerable. It is exceedingly sure-footed, and shows remarkable sagacity in its choice of a route over mountain districts. It feeds largely on grass, and, according to Tennent, the stems of plantain, stalks of sugar-cane, and the feathery tops of bamboo are irresistible luxuries, and fruits of every description are eaten voraciously. The tusks grow to a considerable size in the male, but are wanting in the female; while in the Ceylon elephant, which by Schlegel, Tennent, and others is considered as forming, with the Sumatran elephant, a distinct species (*Elephas sumatranus*), tusks are also absent in the female, and only exceptionally present in the male. The latter, however, generally has a pair of upper incisors, known as "tusches," about a foot long, and one or two inches in diameter. The domestication of the Asiatic elephant dates from time immemorial, the earliest records in which it is mentioned showing that it was then chiefly employed in war. Elephants thus figured in the armies of the kings of India, when these monarchs sought to repel the invasions of Alexander the Great and of Tamerlane; but, however formidable looking, they could not withstand the impetuous dash of well-armed and well-disciplined troops. The sabres of the invaders, aimed at their trunks, rendered the elephants totally unmanageable, and, in the confusion that ensued, they generally did more harm to their own side than to the enemy. Great wooden towers, capable of accommodating 32 soldiers, were usually fastened to the back of the war elephant, and under cover of these the archers aimed their shafts. Since the introduction of firearms, the elephant has become still less serviceable as an "arm of war," and is now only employed in dragging heavy artillery, and in the transport of baggage.

Elephants have been known to breed in captivity, and were thus bred, according to Aelian, in ancient Rome, but such an event in India or Ceylon is of the rarest occurrence, although in Ava, probably owing to the fact that the females are allowed to roam in the woods in a semi-wild state, such births are common. Domesticated individuals, in India and Ceylon, have thus been all reclaimed from the wild state, and the gaps caused by death can only be filled by fresh captures. Single wild males are often caught through the agency of tame females acting as decoys. When it is sought to capture whole herds, the Hindus and Singalese construct, in the heart of the forest, a vast inclosure known as a *keddah* or *corral*, formed of the trunks and branches of trees, with an opening on one side, into which the herd is driven. This, however, can only be accomplished by thousands of beaters making an extensive circuit round the haunts of the elephants, and gradually narrowing the circle until a comparatively limited area is completely inclosed. Around this, in order to diminish the chances of escape, fires are kindled at frequent intervals, and at last the beaters, with a general rush, and carrying lighted torches, close in upon the elephants, and the affrighted creatures, seeing no way clear except in the direction of the inclosure, make for it with all speed, and enter the corral. Once they are inside, the entrance is barricaded, and the entrapped elephants rush wildly about in the vain hope of finding a means of escape. When completely exhausted, they seek the centre of the inclosure, and there await motionless the progress of events. Several tame elephants, each bearing a *mahout* or keeper, and with a *nooser* following behind on foot, then enter the corral, and, the tame elephants mingling freely with the wild captives, the latter are put off their guard, and an opportunity is given to the attendant on foot to pass the noose of a rope, the other end of which is attached to the neck of one of the tame elephants, over each of its legs in succession. It is then securely tied to the trunk of a tree. The process of training, in which kindness and severity

both play a part, occupies a comparatively short period, being greatly hastened by the sagacious co-operation of tame individuals. "This assistance," says Tennent, "can generally be dispensed with after two months, and the captive may then be ridden by the driver alone, and after three or four months he may be intrusted with labour, so far as regards docility." Males are generally more difficult to tame than females, and "rogues" are the most difficult of all; the worst, however, may be reclaimed by patience and kindness. In captivity elephants are subject to a great variety of diseases, and their rate of mortality is exceedingly high, more than half of those employed in the Government service of Ceylon dying after a single year of servitude. Their great strength, sagacity, and docility render them valuable as beasts of burden, and they have been largely employed in the East in road-making and bridge-building, being used for dragging timber, moving stones, &c. A powerful elephant is able, it is said, to lift and carry on its tusk a log of wood weighing half a ton. Having regard to the great expense of their maintenance, a working elephant consuming daily about 2 cwt. of green stuff and half a bushel of grain, as well as to their frequent illnesses, their employment is now considered less economical than that of horses, and consequently their use as beasts of burden is gradually decreasing. In India, however, the elephant is largely employed in hunting the tiger, the sportsman stalking this feline game from the comparative security of the *howdah* fixed on its back, while its motions are directed by the *mahout* seated on its neck.

White elephants are merely albinos. They are extremely rare, and great store is set upon them among the independent kingdoms of Further India—the chief white elephant at the court of Siam ranking next to the queen, and taking precedence of the heir apparent! Although not an object of worship in those countries, the white elephant is considered a necessary adjunct to royalty, the want of it being regarded as ominous; and in the 16th century a protracted war was waged between Siam, Pegu, and Aracan, in the course of which five kings were killed, for the possession of a particular white elephant.

Although now containing only two living forms, the family of elephants was in past geological periods much richer in species,—fossil remains of no fewer than 14 species of the genus *Elephas*, and a still larger number belonging to the allied genus *Mastodon* having been found in the Tertiary formations, to which their remains are confined. The earliest elephants occur in the Miocene deposits of Northern India. In the Pliocene period they make their appearance in Europe, the most noteworthy species of that time being the *Elephas antiquus*, a southern form, which, surviving the rigours of the Glacial period, continued on into Pleistocene times. During the latter period elephants first appear in America, such forms as the Mammoth (*Elephas primigenius*) ranging over the northern regions of both hemispheres. The mammoth is undoubtedly the most interesting of all the extinct elephants, owing partly to its having co-existed with man, as is proved by the numerous flint implements and other human utensils found along with its remains, and also to the perfect state of preservation in which these have been found. At the beginning of the present century, a Siberian hunter discovered an entire mammoth, frozen in a block of ice, and another has since been found,—both so perfectly preserved that microscopic sections of some of the tissues were able to be made. These specimens showed that this huge creature, unlike existing elephants, was thickly clad in a covering of long dark hair, mixed at the roots with shorter hair of a woolly texture, that it possessed a mane, and that it had tusks of enormous length curved upwards to fully ¾ths of a circle. Its remains are found abundantly in Eng-

land, and throughout the greater part of Northern Europe and Asia. They are specially abundant in Siberia, where the tusks are so plentiful and so well preserved as to form an important article of trade, supplying, it is said, almost the whole of the ivory used in Russia. In Malta the remains of two pigmy elephants—the one $4\frac{1}{2}$ feet high at the shoulder and the other only 3 feet—have been discovered. The mastodons differed from the true elephants chiefly in their dentition, having a greater number of molars, and having these crowned with prominent tubercles arranged in pairs; they had also tusks in both jaws, those in the lower, however, never attaining great length, and often falling out during the lifetime of the mastodon.

See S. de Priezac, *Hist. des éléphants*, Paris, 1650; Petrus ab Hartenfels, *Elephantographia curiosa*, 1715; Bowring, *Siam, its Kingdom and People*, vol. i. p. 219; Livingstone's *Travels, passim*; "Hist. militaire des éléphants," in *Rev. des D. Mondes*, being a résumé of Armandi, *Hist. nat. des éléph.*, 1843; Gaidon, "Les éléphants à la guerre," *ibid.*, 1874; De Blainville, *Ostéographie: Des éléphants*; Clift, "On the fossil remains of two new species of Mastodon," in *Geol. Trans.*, vol. ii. 2d series; Morren, *Mémoire sur les ossements fossiles d'éléphant trouvés en Belgique*; H. Falconer, "Mammoth and Elephant," in *Geol. Journal*, 1865, and *Palaontological Memoirs and Notes*, 1868. (J. GL.)

ELEPHANTA ISLE, called by the natives Gharipur, a small island between Bombay and the mainland, is situated about seven miles from Bombay, $18^{\circ} 57'$ N. lat. and 73° E. long. It is nearly five miles in circumference, and the few inhabitants it contains are employed in the cultivation of rice, and in rearing sheep and poultry for the Bombay market. The island was, till within recent times, almost entirely overgrown with wood; it contains several springs of good water. But it owes its chief celebrity to the mythological excavations and sculptures of Hindu superstition which it contains. Opposite to the landing-place is a colossal statue of an elephant, cracked and mutilated, from which the island received from the Portuguese the name it still bears. At a short distance from this is a cave, the entrance to which is nearly 60 feet wide and 18 high, supported by pillars cut out of the rock; the sides are sculptured into numerous compartments, containing representations of the Hindu deities, but many of the figures have been defaced by the zeal of the Mahometans and Portuguese. In the centre of the excavations is a remarkable bust, thought to represent the Hindu Triad, namely, Brahma the Creator, Vishnu the Preserver, and Siva or Mahadeva the Destroyer, but now supposed by some to be a triform representation of Siva alone. The heads are 6 feet in length, and are well cut, and the faces, with the exception of the under lip, are handsome. The head-dresses are curiously ornamented; and one of the figures holds in its hand a cobra di capella snake, whilst on the cap are, amongst other symbols, a human skull and a young infant. On each side of the Trimurti is a pilaster, the front of which is filled up by a human figure leaning on a dwarf, both much defaced. There is a large compartment to the right, hollowed a little, and covered with a great variety of figures, the largest of which is 16 feet high, representing the double figure of Siva and Parvati, named Viraj, half male and half female. On the right is Brahma, four-faced, on a lotus,—one of the very few representations of this god which now exist in India; and on the left is Vishnu. On the other side of the Trimurti is another compartment with various figures of Siva and Parvati, the most remarkable of which is Siva in his vindictive character, eight-handed, with a collet of skulls round his neck. On the right of the entrance to the cave is a square apartment, supported by eight colossal figures, containing a gigantic symbol of Mahadeva or Siva cut out of the rock. In a ravine connected with the great cave are two other caves, also containing sculptures, which, however, have

been much defaced owing to the action of damp and the falling of the rocks. This interesting retreat of Hindu religious art is said to have been dedicated to Siva, but it contains numerous representations of other Hindu deities. It has, however, for long been a place, not so much of worship, as of archaeological and artistic interest alike to the European and Hindu traveller. It forms a wonderful monument of antiquity, and must have been a work of incredible labour. Archaeological authorities are of opinion that the cave must have been excavated about the tenth century of our era. The island is much frequented by the British residents of Bombay; and during his tour in India in 1875, the Prince of Wales was entertained there at a banquet. (See Rousselet's *L'Inde*, and Fergusson's *History of Architecture*.)

ELEPHANTIASIS (synonyms, *Elephantiasis Arabum*, *Barbados Leg*, *Boucemia*), a term applied to a disease which is characterised by a peculiar over-growth of the skin and subjacent textures. This condition appears to arise from repeated attacks of inflammation of the skin and concurrent obstruction of the veins and lymphatic vessels of the part. It may attack any portion of the body, but most commonly occurs in one of the legs, which becomes so enlarged and disfigured by the great thickening of its textures as to resemble the form of the limb of an elephant, whence the name of the disease is derived. The thickening is due to excessive increase in the connective tissue, which results from the inflammatory process, and which by pressure on the muscles of the limb causes them to undergo atrophy or degeneration. Hence the limb becomes useless. This disease is most frequently seen in tropical climates. When affecting the scrotum it frequently produces a tumor of enormous dimensions. There is in general little pain attending elephantiasis, which is essentially a chronic disease. The health, however, ultimately suffers, and serious constitutional disturbance is apt to arise. In the earlier stages of this disease great relief or even a cure may be effected by the persistent employment of wet bandages applied tightly to the limb from the toes upward, as recommended by Hebra. Ligature of the main artery of the affected limb has also been employed successfully, while amputation, which was formerly the only remedy employed may occasionally be called for. In the case of tumors such as those already referred to the only remedy is excision. This disease is totally different from the so-called *Elephantiasis Græcorum*, or true leprosy, which will be afterwards described.

ELEUSINIA, a festival with mysteries in honour of the goddess Demeter and her daughter Persephone, so named, it was supposed, from the celebration of the most ancient of these festivals at Eleusis. The institutional legend connects the festival at Eleusis directly with the mythical incidents arising out of the rape of Persephone, known eminently as Kore or the Maiden. Mourning bitterly for the loss of her child, who has been borne away by Hades or Aidoneus to the regions beneath the earth, the goddess Demeter wanders over sea and land in a vain search, until she comes to Eleusis. Here seated on a stone, and absorbed in her grief, she is accosted by the daughters of the Eleusinian king Celeus, and by them brought into his house, where she finds a home and becomes the nurse of his only son Demophoon. To make the child immortal she plunges him each night into a bath of fire; but before the work is done, the process is seen by his mother Metanira. Her terror excites the wrath of the mysterious stranger, who, throwing off her garment of humiliation, exhibits herself in all her majesty, and, rebuking the folly which has marred the fortunes of Demophoon, promises to prescribe the rites to be celebrated in the temple which is to be built to her honour on the hill above the fountain. In this temple she

takes up her abode; but the grief from which she had been roused for a while by the jests and sarcasms of the serving maid Iambe again settles down upon her; and the earth, sympathizing with the Mourning Mother, refuses to yield her fruits until Zeus sends Hermes, his messenger, to the unseen land, and the maiden is restored to her mother at Eleusis, a name which means simply the trysting-place. The myth was thus localized in the little town, which retained its religious pre-eminence after it had been included in the Athenian state. Here was to be seen the stone on which the goddess was seated when the daughters of Celeus addressed her; here was the hill on which she bade them raise her shrine, and the well Calichorus, with its overshadowing olive tree, near which she had rested. Here also were the homes of Eumolpus, Triptolemus, and Diocles, whose descendants retained for ages their hereditary functions in the mysteries which attended the great annual festival. In the same way each incident in the legend was reproduced in the feast or in its accessories. Rude and coarse raillery addressed to the passers-by represented the rough jests of the maid Iambe; the posset of barley-meal mingled with water and mint, which the goddess drank in the house of Celeus, was still given to her worshippers; while the torch by which Hecate had guided her during part of her wanderings had its place in the ritual of the feast, every portion of which had thus her august sanction.

In later times, when Eleusis had lost its political independence, a temple of the goddess at Athens, called the Eleusinion, became to some extent the rival of the shrine at Eleusis; but the dignity of the ancient sanctuary was still marked by the solemn procession yearly made to it from Athens, during the greater of the two Eleusinian festivals. To this feast it would seem that at first Athenians only were admitted, the origin of the lesser festival being ascribed to a request made by Hercules to be initiated before his descent into Hades. Strangers being, it was said, excluded from the mysteries, the lesser Eleusinia were instituted to extend the benefit to all Greeks who might wish to share it. The great feast, celebrated yearly during the month of Boedromion (Sept.—Oct.), lasted nine days. The first day bore the name *ἀγχιμός*, the day of gathering at Athens for those who had been initiated in the lesser mysteries. On the second day, which was named from the cry *Ἀλαδε μύσται*, the mystæ went in procession to the sea-shore and were there purified. The third was, it seems from the scanty notices which we have of it, a day of fasting. On the fourth a basket containing pomegranates and poppy seeds (the latter representing the stupefying power, *Νάρκισσος*, under whose influence the maiden Persephone was stolen away, the former denoting the fecundating principle by which the earth is prepared for the outburst of vegetation after the sleep of winter), was carried on a waggon in a basket, whence the procession received the name *Καλάβου κάβδος*. The waggon was followed by women carrying small cases, *Κίσται μυστικά*, in their hands. On the fifth day, the day of lamps, the torches borne in procession to the temple at Eleusis denoted the wanderings of the goddess in search of her child, through the season of darkness and gloom. The sixth, the most solemn day of all, was known by the name of Iacchus, *Ἰακχος*, who in the Eleusinian legend is described as a son of Demeter, but who, according to the Theban tale, is, under his name Dionysus, the child of Zeus and Semele. The statue of this god, bearing a torch, was carried in solemn procession to Eleusis from the Athenian suburb of Kerameikos (Ceramicus). During the night which followed this celebration those who sought initiation were admitted to the last rites, in the presence of those only who, having been already initiated, were called *ἐπόπται*. After taking

the usual oath of secrecy, they passed from the darkness of night into the lighted interior of the shrine, and there saw the things which none but Epoptæ could look upon, and which they were bound not to reveal. The imagination of later writers, not speaking from personal knowledge, ran riot in description of terrible ordeals and scaring sights undergone by the mystæ before the final splendours burst upon their eyes; while the fancy of Christians invested the preparatory rites with even greater horrors. Probably both the awfulness of the ordeal and the glories of the subsequent revelation were absurdly exaggerated. The whole of this part of the ritual is on its face symbolical of the passage through death to life, first in the case of the fruit-bearing earth, and then of the soul of man.

The real work of the festival was now over. The pilgrimage of the Mourning Mother had been traced from the moment when her child had been torn from her to the hour when by the Eleusinian fountain she was restored to her in all her loveliness. The seventh day was a day of jesting and raillery, denoting most probably the joy involved in the outburst of spring, although the institutional legend ascribed it to the efforts of Iambe or Baubo to dispel the grief of the goddess before the return of the maiden. The eighth day, called Epidauria, is said to have been added because on that day the god Asclepius (*Ἄσκληπιος*), arriving too late for the ceremonial of the sixth day, asked for initiation. This legend is a set-off to the one which was supposed to account for the institution of the lesser Eleusinia for the benefit of Hercules. The pouring of water or wine from two vessels, one held towards the east, the other towards the west, some mystic words being at the same time recited, gave to the ninth and last day its name *Πλημολοία*.

The nature of the mysterious doctrines set forth before those who were initiated in the Eleusinian festival is a question which belongs rather to the subject of mysteries in general. Enough has been already said to show that one great feature in this feast was the dramatic symbolism which described the revivification of the earth after the death of winter. This symbolism assumed forms which would explain their meaning even to the uninitiated. But the revival of nature would be inseparably associated with the thought of the life into which the human soul passes through the gateway of death; and in a festival where everything was dramatic the one truth or fact would be expressed by signs not less than the other. The Eleusinian legend represents Dionysus or Iacchus as the son of Demeter; and in the great Dionysiac festival at Athens the phallus was solemnly carried in procession, as in like state the veiled ship or boat of Athene was borne to the Acropolis. This ship or boat was represented by the mystic cists or chests carried by the pilgrims to Eleusis, and answers to the *yonî*, as the phallus corresponds to the *lingam* of the Hindu. The methods of initiation based on these signs might be gross or spiritual, coarse or refined, according to the genius of the people by whom they were used; nor would it be surprising if both these elements were more or less mingled in all mystical celebrations. There is no reason for supposing that the Eleusinian mysteries involved any more than this symbolical teaching which centres on the two ideas of death and reproduction; there is no valid ground for supposing that it involved less. Hence when Dr Thirlwall expresses a doubt whether the Greek mysteries were ever used "for the exposition of theological doctrines differing from the popular creed," or when Mr Grote asserts it to be altogether improbable that "any recondite doctrine, religious or philosophical, was attached to the mysteries or contained in the holy stories" of any priesthood of the ancient world, the remark is probably right, if by this recondite teaching be meant