continental area by the Cambrian marine transgression. Their ancestors are thus to be looked for beneath the existing oceans. The fossils now known from the American Algonkian may have been of fresh or brackish water types; littoral forms were occasionally imported among them from the series continuously developing in the seas. Walcott's studies of the Cambrian faunas of China are continued, with illustrations of new species of trilobites (vol. lvii., No. 4). Evidence is given (*ibid.*, No. 3) that certain medusiform fossils from the Middle Cambrian of British Columbia are in reality holothurians, being characterised by a large spiral alimentary canal. The descriptions and illustrations of these forms possess great interest for all workers among Older Palæozoic strata.

G. A. J. C.

STEREOSCOPIC VISION AND INSTRUMENTS.

WE have received a copy of a brochure entitled "Stereoskopisches Sehen und Messen" (pp. 40, price 1 mark), by Carl Pulfrich. This is the German version, or rather original, of the article "Stereoscope" in the recent new edition of the "Encyclopædia Britannica." A little more detail is given here and there in the German pamphlet than in the "Encyclopædia" article, and the former concludes with a very useful bibliography of papers published in the present century relating to binocular vision, which is not given in the "Encyclopædia." This is to be taken as supplementary to the bibliography in von Rohr's well-known work "Die binokularen Instrumente" (see Supplement to NATURE, March 5, 1908) of memoirs published up to 1900.

The pamphlet gives a concise, but clear and interesting, account of the more important points in the theory of stereoscopic vision; but its main value lies in the brief description which follows of the important modern developments and applications of stereoscopic methods, to which the author has himself so largely contributed. Not the least interesting among these are the well-known stereocomparator and the so-called "blink" microscope, the latter of which has proved so valuable in the detection of new planets and variable stars. We think it is desirable that attention should be drawn to the very imperfect, not to say unintelligible, translation of Pulfrich's text which constitutes the article in the "Encyclopædia Britannica" above referred to. It is surprising that both translator and editor should have allowed passages to pass which are so far astray from the original. Thus we read: "The reason for this [double images] is that when P (or H') is fixed, the images of H' (or P) are always separated from one another by the centre of the yellow spot." Fixed should be "focussed" (no doubt "fixiert," but the original is here paraphrased). Again: "The power of perception of depth in man is most accurate. This has been ascertained by the approximately equal keenness of vision of all normal-sighted people and by the interpupillary distance." This is quite incomprehensible until one learns that the words in italics (ours) are a perversion of "Es wird bestimmt." "Parallax" (Parallaxe) appears as "parallel axis."

It is impossible briefly to convey an idea of the confusion in the mind of the reader caused by numerous errors of this description; but we would strongly recommend all those interested in the subject-matter of the article to refer to Pulfrich's German memoir.

THE TECHNICAL COLLEGE, BRADFORD.

AN important extension of the buildings of the Bradford Technical College was opened by Lord Rotherham on October 25. The extension takes the form of a model experimental mill, in which all processes involved in the production of woollen and worsted cloth, from the raw material to the finished article, can be carried out on a practical scale. The building comprises a three-storey front block 175 feet long, devoted to lecture-rooms, textile testing-room, museum, experimental rooms, &c. Behind this are two large sheds, each 90 feet by 70 feet, one containing the combing, carding, and spinning machinery, and the other the looms. The equipment for the production of yarns of various types is very complete, consisting of Preparing Box, Worsted Carding Engine, Noble Comb, French

Comb, French, Cone, and Open Drawing Sets, Flyer, Cap and Ring Spinning Frames. In a separate shed are warping mills and dressing frames, while the power looms include examples of all types. The wool-washing room contains three bowls of a total length of about 80 feet. The practical dyehouse and finishing rooms each have an area of about 300 square yards, and are equipped with full-size machines for the treatment of loose wool, slubbing, yarns, and piece goods.

A detached building houses the power plant, which includes a 30 foot by 8 foot boiler, with superheater, economiser, &c. The engine-house contains four prime movers, a suction gas engine of 125 horse-power, a slow-speed cross-compound engine of 200 horse-power, a high-speed inverted vertical engine of 75 horse-power, and a steam turbine of about the same power. Each of the three engines drives a direct-current generator, while the turbine is coupled to a three-phase alternator. Both engine- and boiler-houses are fitted with a complete set of testing apparatus; but while primarily intended for educational work, the power plant will provide light and electrically transmitted power for three large buildings—the main college block, the extension, and the school of art.

The new buildings have been erected at the cost of about 20,000*l.*, and for the equipment an additional sum of about 14,000*l.* has been provided, which sum would have been much increased but for the generosity of most of the machine makers, who have supplied the equipment on very favourable terms. Much of the machinery throughout the building has been specially designed, so that while of a thoroughly practical character, experimental work not possible in a mill can be carried out.

ZOOLOGY AT THE BRITISH ASSOCIATION.¹

SECTION D presented a full and varied programme, and the attendance at the several sessions was above the average of recent meetings. This meeting was undoubtedly one of the best of recent years.

As in previous years, there were two lectures of a semi-popular character, which were highly appreciated. Mr. Fred Enock lectured on the "fairy flies" (Mymaridae), hymenopterous insects of small size and with peculiar delicate wings, without veins, but fringed with long hairs. Mr. Enock, who has devoted many years to the study of this family, illustrated his account by means of a beautiful series of original drawings, shown by the lantern. He described the principal characters of the male and female, and traced the life-history of *Anagrus incarnatus*, the eggs of which are laid in the egg of the frog-hopper.

In his lecture on the fossil reptiles of the Oxford Clay of Peterborough, Dr. C. W. Andrews gave an account of the remarkable assemblage of reptiles occurring in that deposit. The beds in which the remains were found are of Middle Jurassic age, and were probably laid down not far from land and near the mouth of a large river. The horizon at which the remains occur is that characterised by ammonites of the "ornate" group, *Cosmoceras gulelmi* being a common species. Among the remains are those of land reptiles carried down by the river and of many marine forms of several distinct orders. Cetiosaurus, a terrestrial dinosaur allied to Diplodocus, attained a length of 60 feet, the greater part being made up of the greatly elongated neck and tail. Another, but smaller, dinosaur, Stegosaurus, and a pterodactyl, Rhamphorhynchus, were also found. The marine reptiles were more numerous, and of astonishing variety of form; for instance, ichthyosaurs, plesiosaurs of many types, and numerous marine crocodiles of the genera Metriorhynchus and Stenosauros. The ichthyosaur Ophthalmosaurus was remarkable for the fact that in the adult the teeth were extremely small, and in some cases perhaps absent, so that the food of this animal must have been very different from that of its relatives. In many cases the skeletons were found in a nearly complete condition; in others the carcasses seem to have been torn to pieces by predaceous reptiles, the bones being deeply scored by their teeth. Dr. Andrews exhibited a series of lantern-slides showing the actual remains and reconstructions based upon these. He stated that the

¹ "Some Recent Work on Sex" and an account of the discussion on the origin of mammals will form the subject of separate notices.

collection is almost entirely due to Mr. A. N. Leeds, who for the last forty years has closely watched the clay-pits, and has collected most of the specimens, a large series of which is exhibited in the gallery of fossil reptiles in the Natural History Museum at South Kensington.

Momentum in Evolution.

In his opening remarks on this subject Prof. Dendy mentioned that Dr. Smith Woodward, in 1909, had directed attention to the fact that many groups of the animal kingdom, in the course of their evolution, have shown a strongly marked tendency to enormous increase in size, often accompanied by the development of grotesque and apparently useless excrescences. Prof. Dendy instanced as analogous phenomena the extraordinary development of the beak and helmet in the hornbills and of the tusks in the babirusa. In these, and in many other cases which could be adduced, either the entire body or some particular organ appears to have acquired some sort of momentum, by virtue of which it has continued to grow far beyond the limits of utility, although perhaps in some cases a new use may have been found which has assisted the species in maintaining itself in the struggle for existence. An enormous increase in mere bodily size, however, seems in the long run to be always fatal to the race, the place of which will be taken by smaller and more active forms. Prof. Dendy thought there was some ground for believing that a race of animals may acquire a momentum of the kind referred to which may lead ultimately to its destruction, that there is some brake applied to the growth of organs and organisms, but that there are occasions on which the brake may be removed, with results which ultimately prove fatal. He pointed out that the growth of different parts of the animal body is controlled by internal secretions, or hormones, the products of various glands. Disease of the pituitary body leads to acromegaly, one of the symptoms of which is great enlargement of certain parts. Prof. Dendy held that there is good reason for believing that, in the absence of certain specific secretions, the growth of the various organs will continue far beyond the normal limits. He saw no reason why this principle should not be extended to the race, and, paradoxical as it might seem, he thought it possible to explain the growth of the organism as a whole and of its various organs beyond the limits of utility as an indirect result of natural selection.

When a useful organ is first beginning to develop or to take on some new function for which an increase in size will be advantageous, natural selection will favour those individuals in which it grows most rapidly and attains the largest size in the individual lifetime. If growth is normally inhibited by some specific secretion, natural selection will favour those individuals in which the glands which produce this secretion are least developed or least efficient, and, this process being repeated from generation to generation, these glands may ultimately be eliminated, or at any rate cease to produce the particular hormone in question. Moreover, this elimination may take place long before the organ the growth of which is being favoured by natural selection has reached the optimum size. When it has reached this optimum it is certainly desirable that it should grow no larger; but there is no longer any means by which growth can be checked. The inhibiting hormone can no longer be produced; the brake has been taken off, and further growth takes place irrespective of utility, until, when the size of the organ, or it may be of the entire organism, becomes incompatible with the well-being of the individual, natural selection again steps in and eliminates the race. Is it not possible that, the normal checks to growth being thus removed along certain lines by the action of natural selection, a definite direction may be given to the course of evolution which the organism will continue to follow to the bitter end, irrespective of natural selection?

The Food Supply of Aquatic Animals.

Dr. W. J. Dakin directed attention to some of the recent work on the nutrition of marine organisms, first citing the work of Pütter, who showed that there is more organic carbon present in solution in sea water than in the plankton contained in that water. With the view of showing that aquatic animals do use the food in solution, Dr. Dakin adduced the following observations. A specimen of the

sponge *Suberites*, of 60 grams weight, requires as food 22 milligrams of carbon per day, to obtain which the sponge would need to capture 7,400,000,000 *Thalassiosira nana* (or an equivalent of other organisms), and would therefore need to filter several thousand times its own volume of water per hour; but if the food in solution in the sea water be also used, a much more rational quantity of water would suffice to supply the animal's needs. Extraordinarily large numbers of copepods would be required to provide the food of the larger Rhizostomes; but it seems impossible that copepods are captured in such large numbers, for copepod remains are so seldom found in the medusæ. Goldfish living in tap water, without solid food, were able to exist forty-one days; but with soluble organic bodies added to the water the fishes lived seventy-eight days, and the amount of oxygen consumed was found to be in excess of that calculated from the loss in weight of the fish, that is, some oxygen must have been used for the oxidation of substances in addition to those stored in the tissues. Many other facts, e.g. that crabs, living in sponges, with only filtered water at their disposal, and that *Daphnia* can be kept living and growing in solutions containing only dissolved food matter, seem to be in favour of Pütter's theory. Dr. Dakin believed that, though solid food is necessary, food in solution forms part of the normal food supply of aquatic organisms.

Prof. Hartog remarked that there was still much to discover regarding the nutritive apparatus of the lower invertebrates, and that, if Pütter's theory be true, the accessory intestine of some worms and echinoderms, and the rectal pumping apparatus of worms and Crustacea, may serve not only a respiratory, but a nutritive, function. Prof. Herdman suggested that the figures advanced by Pütter were not sufficient either to prove or disprove his contentions, and that renewed investigations are necessary. He also pointed out that copepods, which for a long time were believed not to take solid food, feed on minute diatoms, which, owing to their very small size, had until recently not been observed in the gut of these Crustacea. Prof. Dendy referred to the crabs which live in cavities of sponges, and stated that in most of these cases the crab probably feeds on the sponge, and the latter regenerates as quickly as it is eaten away. Dr. Gemmill stated that one of the difficulties in the way of his accepting Pütter's theory arose from the fact that he was not aware of any soluble organic food material likely to be present in sea water which would not be immediately attacked and broken down by bacteria. Mr. D. J. Scourfield pointed out the great difficulty of estimating the numbers of organisms, and therefore of solid food, present in water, remarking that the rate of increase of smaller organisms, e.g. algæ, bacteria, is so enormous that their presence in sufficient numbers in any one catch is not necessary for the explanation of the feeding of the larger organisms, for the small organisms may very soon become so abundant as to provide the necessary amount of food for the larger ones.

The Systematic Position of the Cyclostomes.

Dr. W. W. F. Woodland introduced a discussion on this subject. He described in considerable detail the innervation, musculature, and cartilages (especially the lingual) of the head of cyclostomes, and held that recent work showed that the sub-ocular arch and lingual cartilages could not be regarded as homologous with the palato-pterygo-quadrato bar and glosso-hyal element of gnathostomes. As the musculature of the piston cartilage is innervated by the mandibular nerve, and not by the hypoglossal, modern upholders of the gnathostome ancestry have revived the opinion that the piston cartilage represents the much modified and displaced mandible of gnathostomes, the so-called hyoid representing a quadrato element. Dr. Woodland pointed out that the piston cartilage is not paired, that it does not surround the mouth as mandibular elements should, and held it difficult to believe that it could be a reduced jaw apparatus. The development of the piston musculature and cartilage in the mid-ventral line is inconsistent with the view that they were formerly paired laterally placed mandibular muscles and rami, and the extension of the myotomes laterally in an unbroken series to the extreme end of the head proves that a jaw

apparatus could never have been developed. Dr. Woodland believes, with Balfour, that the branchial skeleton of cyclostomes is not homologous with that of gnathostomes, since, for one reason, in the former the skeleton is developed external to the ventral aorta and the gill vessels, while in the latter it is internal. He concluded that, considering the visceral arches as a whole, it is incredible, if the cyclostomes have originated from a gnathostome stock, that the first two visceral arches should exhibit the differences in development (in time and form) and relationships to nerves and muscles shown by the sub-ocular arch, piston, and styloid cartilages, &c., when compared with the jaw and hyoid arches of gnathostomes.

Prof. Dendy, while agreeing generally with Dr. Woodland's position, pointed out that the lampreys and hags differ markedly from each other. The brain of *Petromyzon* is primitive, and in *Geotria* there are two pineal eyes—a very primitive character; the brain of *Myxine* is highly modified, and pineal organs are wanting. These and other facts suggest that the two subdivisions of the cyclostomes have either had a separate origin or have diverged early from one another.

Mr. E. S. Goodrich held that the absence of jaws in cyclostomes was not proved; the piston apparatus is supplied by the fifth nerve, and this region would therefore seem to be homologous with the mandibular region of the gnathostomes. The gill arches of larval lampreys resemble those of gnathostomes, and though the relations of the branchial basket of lampreys and the gill arches of gnathostomes are not identical ventrally, their relations dorsally are very similar, and therefore the homology of these structures is not disproved. Mr. Goodrich suggested that the piston cartilage of *Petromyzon* might be homologous with the median cartilages of the branchial apparatus of gnathostomes. He demurred to the suggestion that lampreys and hags have been independently derived from the primitive vertebrate stem, for the two series present certain common characters, e.g. the structure of the gills and heart, asymmetry of the vascular system, horny teeth and piston apparatus, hypophysial sac in relation to the nasal organ, which it is unlikely can have been developed independently. He regarded the cyclostomes as monophyletic, and as having diverged very early into two branches, the lampreys and the hags.

Communications on Protozoa.

Prof. Herdman contributed a note on the occurrence of the peridinium *Amphidinium operculatum* at Port Erin. This flagellate organism had not been previously recognised in British waters, and was known only from the coasts of Norway and Belgium. It was first observed at Port Erin early last year, forming brown patches in the troughs of the ripple marks on the beach about half-tide level. The patches varied in size, but were observed for about three weeks. Examination of the sea water in the neighbourhood of the patches showed that the organism was not living in the water; it lived only in the wet sand. The brown patches consisted of an almost pure culture of *Amphidinium*, the only admixture being a very few examples of a diatom (*Navicula*). Later in the year brown patches of similar appearance were again observed on the sand, but on examination they were found to consist entirely of *Navicula*. The *Amphidinium* had disappeared, but the *Navicula* had multiplied abundantly. Prof. Herdman cited this as a striking instance of the change in the organisms inhabiting the beach, a change which might readily be, and no doubt had long been, overlooked.

Major C. F. Bishop described his recent examinations of sheep suffering from louping ill, and of ticks which had fed on the sheep. On a film made of blood squeezed from a tick, taken from a sheep which was said to be a typical case of louping ill, he found a single "trypanosome," about 22μ long, in which the trypomonucleus was nearly central and anterior to it the large kinetonucleus. Trypanosomes have not yet been found in any of the sheep examined, but Major Bishop considered it probable that the organism described was connected with the disease in the sheep. He also described other forms which he considered to be blood parasites, and regarded as flagellates, in films of blood from sheep.

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A New Hydroid, Epizoic on a New Parasitic Copepod.

Prof. H. F. Jungersen (Copenhagen) described a new hydroid, *Ichthyocodium sarcotretis*, which covers more or less of the exterior of the parasitic copepod *Sarcotretes scopeli*, n.sp., which is deeply sunk into the body of the fish *Scopelus glacialis*. The hydroid consists of polyps, without tentacles, arising from a network of delicate tubes. From the base of the polyps arise medusa-buds which develop into free medusæ (*Anthomedusæ*). This new hydroid is a corynid, related to *Hydrichthys mirus*, Fewkes, epizoic on the fish *Seriola zonata*. Prof. Jungersen gave a full description of the characters and life-history of the copepod, which belongs to the family *Lernæidæ*. There is first a "cyclops stage," capable of moving about on the host and attaching itself by means of its strong cheliform antennæ; the pupa stage is passively fixed to the host by means of a hardened secretion from the rostrum. Within the last pupal phase the copulatory form was observed. The latter probably is for a time free-living; after impregnation the female assumes parasitic life anew, but in a more intense form; it pierces the skin of a *Scopelus*, and, gradually growing, it penetrates the muscles, and finally reaches the intestine. This copepod is found on examples of *Scopelus* from the eastern part of the Atlantic, and the triple association—hydroid, copepod, fish—seems to be a regular one. The loss of tentacles of the hydroid polyps seems to indicate that the hydroid in some way or other depends on the fish for obtaining its food.

Variation in the Medusa *Moerisia lyonsi*.

Mr. C. L. Boulenger gave an account of variations in this Egyptian lacustrine medusa. About 15 per cent. of the individuals examined were abnormal. The abnormal examples fall into two groups: (1) those which deviate from the normal four-rayed symmetry, and (2) those with the normal number of radial canals and primary tentacles, but possessing, in addition, secondary tentacles which are not connected with the stomach by means of radial canals. Some of these multitentacular forms are asymmetrical, and it seems that each quadrant is capable of forming secondary tentacles quite independently of the other quadrants.

The Crop of the Leech.

Prof. Marcus Hartog directed attention to the structure of the septa in the crop of the leech. The crop is divided into chambers separated by distinct simple septa passing inwards from the obvious external constrictions and perforated by a central aperture, circular under ordinary conditions, but vertically elongated in distension. The septum is puckered at the free edge, and contains a circular sphincter, but no divaricator fibres. This structure has probably been so long overlooked because it is inconspicuous in ordinary dissections, and is not easily recognisable in the usual thin transverse sections; it is well seen on examining successive thick slices of a hardened, distended leech.

The Lantern of Aristotle as an Organ of Locomotion.

Dr. J. F. Gemmill gave an account of his observations on the locomotor function of the lantern of Aristotle in the sea-urchins *Echinus esculentus* and *E. miliaris*. The animal progresses, when out of the water, by a series of steps or lurches, more or less well defined, in each of which the urchin is raised on the tips of the teeth as on a powerful central stilt. The steps have a length varying from half an inch downwards, and are repeated at intervals of fifty seconds or less, according to the size of the urchin. There is a rhythmic backward and forward swing of the lantern in the direction of progression. The backward swing is accompanied by powerful protrusion of the tightly closed teeth against the supporting surface, which causes pushing or poling forward of the urchin. The movement is aided by pushing on the part of the spines, and, after a certain stage, by the action of gravity. The forward swing of the lantern is marked by retraction, with opening of the teeth, and serves to bring the latter into position for initiating a new lurch. Experiments on loading, recording surfaces, inversion, equatorial section, rotation, removal of spines, &c., were also briefly noted, and examples of tracks

left by the spines and teeth on a smooth plasticine surface were exhibited with the help of the lantern.

Healthy urchins, moving under water over approximately horizontal surfaces, do not, as a rule, use the lantern for movement, the greater part of their weight being neutralised by the water. There are, however, certain conditions, both normal and experimental, in which the lantern plays an important part in locomotion. Dr. Gemmill brought forward evidence in favour of the view that the locomotor action of the lantern is a particular manifestation of a fundamental rhythmic activity, which can also subserve feeding, boring, respiration, and circulation, and possibly, in addition, the maintenance of turgescence within the ampullæ of the water-vascular system.

Dr. Gemmill also gave a lantern demonstration on the development of the star-fish, *Solaster endeca*.

Echinoderm Hybrids.

Mr. H. M. Fuchs presented observations on the experimental control of dominance in echinoderm hybrids, using *Echinus miliaris* and *E. acutus*. Dr. Shearer and Mr. de Morgan had found that when these two species are crossed the characters of the hybrid larvæ are always the same as those of the maternal parent, and this was found by Mr. Fuchs to hold good also when the eggs were kept, during the cleavage period, in sea water with increased and decreased OH ions.¹

The Gonads of the Urchin Echinocardium cordatum.

Prof. Caullery (Paris) traced the annual cycle of changes in the gonads of this urchin. From July to the end of the year the gonads are almost entirely composed of large cells, each of which contains a vacuole and numerous spherules of reserve substance. In males these cells exhibit, among the reserve material, numerous spermatozoa, agglutinated into pockets, which have been ingested by the cells; in females, fragments of degenerating ova are seen between the cells. At the periphery of the gonad there are either small masses of spermatogonia or oocytes. Growth of the genital products takes place, in part owing to the presence of the reserve-laden cells, at the end of winter, and the period of maturity, at Wimereux, extends from April to the end of May. The reserve-containing cells are gradually pushed towards the centre of the acini, and in some localities, e.g. Naples, disappear, but at Wimereux they do not fully disappear. Up to the end of May there have been formed, in the testes, for example, only the sexual cells, but henceforward there are produced numerous cells, each of which elaborates groups of granules and contains a large vacuole. This is the new reserve tissue, which soon forms a continuous peripheral layer. By the end of June the sexual elements in course of formation exhibit signs of degeneration, e.g. fragmentation of the oocytes and pycnosis of the spermatogonia, but ripe sexual products are for some time longer emitted. After July the emission ceases, and the sperms remaining in the testis become agglutinated and are ingested by the reserve cells, which gradually occupy the whole gonad. In starfishes there is no reserve tissue, and the gonads, after having almost filled the arms, become so much reduced as to be almost imperceptible.

Observations on Boring Molluscs.

Mr. W. T. Elliott and Miss B. Lindsay described observations on *Zirphæa* (*Pholas*) *crispata* and *Saxicava rugosa*, made on the shore at St. Andrews, which confirm the statement of Prof. McIntosh that the method of boring of these molluscs is mechanical, and not chemical. Both molluscs work by means of a partial vacuum produced by cooperation between the mantle and foot, supplemented by scraping movements of the shell, which in *Zirphæa* are continuous and progressive during the time of boring. Reference was made to the importance of boring organisms in connection with coast erosion.

¹ These experiments were prompted by recent work of H. D. Tennent (1909, 1910) who crossed *Hippone* ♂ × *Toxopneustes*, ♀ and T. ♂ × H. ♀, obtaining in both cases larvæ with a preponderance of *Hippone* characters. By keeping the eggs, during the cleavage period, in sea water with increased and decreased concentration of OH ions he claims to have altered this dominance and states that a decrease of OH ions gave *Toxopneustes* characters.

The Species of Balanus Collected by the "Siboga."

Dr. P. P. C. Hoek (Haarlem) gave an account of some of the species of *Balanus* collected in the Malay Archipelago during the cruise of the *Siboga*. Of the twenty-seven species collected, nineteen are new. Few species were brought up from great depths; most of them were taken at a not greater depth than 90 metres. Some were brought up from 564, 289, 216, 275, 304, and 390 metres respectively, but the species represented in the first three cases were collected also at a depth of less than 100 metres. Dr. Hoek described some of the features, especially the labrum, which he had used in classification.

The Renal Organs of Squilla.

Dr. W. N. F. Woodland described the renal organs—maxillary glands—of *Squilla*. In an *Erichthus* larva 2 mm. long the gland consists of a short narrow tube, opening externally on the maxilla and ending internally in a slightly dilated end sac. In an older larva, 12 mm. long, the gland has become divided into two thin-walled compartments—the kidney proper and the end sac—lying side by side and communicating by a small aperture at their posterior ends. A little later the walls of the gland become invaginated, forming internal lamellar folds containing extensions of the hæmocœle, a process which continues so extensively that, in the adult, the cavity of the gland is almost entirely broken up into a network of spaces. Other features of the internal anatomy were also referred to, namely, the presence of a well-developed nauplius eye, rectal glands, and a very short proctodæum, which forms a wide cloaca-like cavity.

A Reconstructed Trilobite.

Dr. Malcolm Laurie gave an account of the anterior end of a trilobite (*Calymene*), which he has studied by means of grinding away definite and very thin layers of the fossil, photographing each exposed surface and reconstructing the specimen in wax on an enlarged scale. He exhibited the reconstruction, and pointed out that, although the mouth has been considered as opening behind the hypostome, the size and form of the latter render it improbable that the mouth opened behind it. Apparently the anterior margin of the hypostome projected ventrally, while the inturned margin of the neighbouring carapace also projected ventrally, the two forming lower and upper lips respectively to the mouth. In a line between the lateral margin of the glabella and the eyes there is a long conical structure, more than two-thirds the length of the carapace, divided into joints by annular thickenings. It is impossible to state certainly whether this is *in situ*, but its structure resembles that of an antenna. If it be such it must have been attached to the body behind the hypostome, as otherwise it could not have been withdrawn when the animal rolled itself up. This appears to be another instance of a post-oral appendage assuming an antennary function, as in *Phrynos* and *Thelyphonus*.

British Symphyla and Diplopoda.

Mr. R. S. Bagnall gave a rapid survey of the British Symphyla, pointing out the characters of the genera *Scutigere* and *Scolopendrella* and of some of their species. A year ago only one species of the former was known from Britain; in 1904, when Hansen's monograph of the order appeared, eight European forms were recognised; of these, six have now been found in the north of England, and there have also been discovered four other well defined and apparently new forms. Mr. Bagnall recognises four species of *Scutigere* and seven of *Scolopendrella*. He also recorded four diplopods from the north of England, each of which represents a genus previously unknown to the British fauna, and, from the same locality, a new pauropod, the first British example of the *Eurypauropodidæ*.

Mimicry in African Butterflies and Moths.

Prof. E. B. Poulton exhibited three groups of mimetic butterflies collected at Entebbe, Uganda. These groups were centred round species of the distasteful family *Acraeinae*. Among the mimics were species of *Acraeinae*, showing that members of this family acted as mimics and models, a fact supporting the theory of Fritz Müller as

against that of Bates. There were also acraëne mimics which mimicked other species of the same family, themselves mimics of the primary acraëne models. The rest of the exhibit was concerned with examples from Lagos, among which was a caterpillar of a well-known moth (*Nyctemera*), which before becoming a chrysalis secreted and covered itself with a mass of bubbly froth, which on hardening resembled the cocoons of a braconid parasite, and probably acted as a protection against insectivorous birds or lizards.

The Scent Patches of Lepidoptera.

Dr. F. A. Dixey described the scent patches of certain butterflies and their associated tracheæ. The males of many butterflies possess the power of emitting a scent, which is apparently attractive to the female. The scent patches are best distributed in *Pierinæ* (e.g. the orange tip). The apparatus consists of specialised scales scattered over the upper surface of the wing of the male. The scent is elaborated by cells in the wing membrane; the oil enters the specialised scale at its basal foot-stalk, and escapes by fimbriæ at the distal end of the scale. In other cases (e.g. the clouded yellow) the scent scales are aggregated into patches, so arranged that, in the ordinary position of rest, the patches of the fore- and hind-wings are coincident. The scales of these patches have neither foot-stalk nor fimbriæ. In some species of *Catopsilia* there are two specialised scale patches, which Dr. Dixey found to be provided with a special tracheal supply derived from the larger tubes in the wing veins. On reaching the scent patch the main tracheal trunks were found to break up into branches, the ultimate distribution of which was not ascertained, but appeared to bear a definite relation to the scent scales. Dr. Dixey suggested that the tracheæ were concerned in the dispersion of the perfume through the scales, acting in the manner of a *vis a tergo*.

The Biology of Eels.

Dr. Johs. Schmidt (Copenhagen) gave an account of five years' Danish investigations on the biology of eels. These have shown that the biology and reproduction of the conger and eel are more complicated matters than they seemed after the publication of Grassi's work. In the case of the eel, the youngest stages found are 4 cm. in length, and it is therefore not yet possible to state exactly where in the Atlantic the eel spawns, except that it must be outside the continental slope. All the larval stages, even the youngest (but not the eggs), of the conger are known, and it can now be stated that the conger spawns everywhere in the Mediterranean and in the Atlantic west of Gibraltar; how far west is not yet ascertained, but the half-grown larvæ of *Conger vulgaris* have been taken near the Azores. These investigations have not confirmed the earlier suppositions (of Grassi) that the larval development of eels takes place at the bottom of the sea or in great depths. All the murenoid eggs (several thousands) were taken near the surface of the sea, as were also the youngest pre-leptocephalic stages, e.g. of *Conger vulgaris* and *C. mystax*. The full-grown larvæ of the eel and conger also occurred in the upper layers. Murenoid eggs were found not only in the Mediterranean, but also right across the Atlantic between 20° and 40° N. lat. Evidently, therefore, some eels spawn there, but how far from the surface has not yet been ascertained. Dr. Schmidt illustrated his remarks by charts and a beautiful series of larval and metamorphosing examples of several species.

The Dorsal Vibratile Organ of the Rockling (Motella).

The dorsal vibratile fin of the rockling, which has been believed to be a lure, is regarded by Dr. J. Stuart Thomson as an organ for producing a current of water over numerous terminal or taste buds situated in the skin of that region of the body, which thus functions as a gustatory organ. These taste organs are distinguished from the lateral line organs by certain structural differences and by the fact that they are innervated by the recurrent facial nerve, the root of which is in the facial lobe of the medulla, which lobe has been described by Herrick as part of the gustatory

tract. Dr. Thomson's experiments indicate the existence of a gustatory reaction in the rockling, some of the most successful responses being obtained on placing *Arenicola* in proximity to, but not in contact with, the taste buds of the region under consideration.

A Remarkable Egg of the Kestrel.

Prof. Patten commented on an egg laid by a tame kestrel, which has been in his possession eight years. The egg is normal in size, but milky-white in colour and almost unspotted except at its larger end; there are spots and blotches of rich purple-brown intermixed with greyish-purple, the whole pigmentation forming a broken zonular band. Dr. Patten suggested that a highly nutritious hearty meal, coming after a fast, and in a warm change of weather, may have toned the bird to such a physiological state that the ovaries became sufficiently active to induce ovulation.

Prof. R. J. Anderson brought forward a number of details regarding the constitution of, and variation in, the manus and pes of Primates, and contributed a note on the manus of a young Indian elephant.

J. H. ASHWORTH

OLD AND NEW VIEWS ON THE TREATMENT OF CONSUMPTION.¹

DR. THEODORE WILLIAMS stated that 255 years had elapsed since William Harvey instituted this festival, and that orations had been delivered in Latin or English ever since in commemoration of benefactors, and with Harvey's exhortation to the fellows and members to study out the secrets of nature by way of experiment, and to continue in mutual love and affection among themselves. He then proceeded to review the various steps of Harvey's great discovery of the circulation of the blood, and remarked that its author, in spite of the severest criticism, lived to see it firmly established in the annals of medicine and to witness the conversion of the greater number of his opponents. The seed sown by this discovery, based on observations and experiments, and put forth with convincing logic by this most accurate observer, had revealed to the world further scientific truths, which have been elaborated by Harvey's successors in the arts of medicine and of surgery, and have brought forth a harvest of improvements—physiological, clinical, pathological, and therapeutical—which added immensely to the total sum of human health and happiness. Dr. Williams instanced as examples the administration of anaesthetics, intravenous and hypodermic injections, and treatment by vaccines, while auscultation and the graphic methods of measuring blood pressure and rhythm might also be counted as outcomes of the knowledge initiated by Harvey's discovery.

Harvey's views on tuberculosis are not known, though his lost "medical observation" may have treated of these; but the lecturer sketched the doctrines held by his contemporaries on this subject, and the treatment in vogue, the former being somewhat obscure and the latter mingling with hygienic and dietetic rules, which were to some extent reasonable, prescriptions containing woodlice, crabs' eyes, the simple powder of crabs' claws, red coral and white amber in the form of powders or julep to "temper the sharpness of the blood." The Royal touch for the King's Evil continued to be believed in until a much later date. Most of the theories of that time assigned the cause of consumption to errors of digestion or in the formation of lymph or chyle or blood, or to defective respiration; but they chiefly dwell on the inflammatory origin, and though long suspected, the *vera causa*, viz. the tubercle bacillus, was never definitely proved until Robert Koch appeared on the scene. Laennec and other observers had meantime given scientific accounts of the morbid anatomy of tubercle, and the treatment had changed from an anti-inflammatory régime depending largely on blood-letting to a tonic and building-up system,

¹ Abstract of the Harveian Oration delivered at the Royal College of Physicians on October 18 by Dr. C. Theodore Williams.