Mr. Marr, though in several matters of detail different results are reached. Other important papers complete what is a particularly interesting issue of the *Journal*.

THE additions to the Zoological Society's Gardens during the past week include two Maholi Galagos (*Galago maholi*), a Bosch Bok (*Tragelaphus sylvaticus*, ♂), two Cape Zorillas (*Ictonyx zorilla*), a Hoary Snake (*Pseudaspis cana*), two Rough-keeled Snakes (*Dasypeltis scabra*), twelve Crossed Snakes (*Psammophis crucifer*), two Rufescent Snakes (*Leptodera hotambœia*), two Smooth-bellied Snakes (*Homalosoma lutrix*), two Puff Adders (*Bitis arietans*) from Port Elizabeth, Cape Colony, presented by Mr. J. E. Matcham; a Fat-tailed Sheep (*Ovis aries*, ♂, var.) from Cape Colony, presented by the Hon. Sir James Sivewright, K.C.M G.; an African Civet (*Viverra civetta*) from West Africa, presented by Lieut. Carroll and Major Arthur Festing; a —— Gannet (*Sula*, sp. inc.), captured at sea, presented by Captain Ernest W. Burnett; two Alligators (*Alligator mississippiensis*) from North America, presented by Mr. O. Moser; a Common Viper (*Vipera berus*), two Common Snakes (*Tropidonotus natrix*), British, presented Mr. W. F. Blandford; twelve African Walking Fish (*Periophthalmus koelreuteri*) from West Africa, presented by Dr. H. O. Forbes; a Reticulated Python (*Python reticulatus*) from Malacca, two Indian Pythons (*Python molurus*) from India, deposited; an Indian Chevrotain (*Tragulus meminna*, ♂) from India, purchased; a Burrhel Wild Sheep (*Ovis burrhel*, ♀), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES IN SEPTEMBER:—

September 5. 16h. 44m. to 17h. 41m. Occultation of 66 Arietis (mag. 6·1) by the moon.
8. 10h. 52m. to 11h. 42m. Occultation of DM + 24° 1033 (mag. 6) by the moon.
9. 1h. 31m. to 2h. 19m. Occultation of Mars by the moon.
10. 14h. 5m. to 14h. 30m. Occultation of 79 Geminorum (mag. 6·5) by the moon.
12. 11h. 27m. Minimum of Algol (β Persei).
15. Venus. Illuminated portion of disc 0·521. Diameter 23″·2.
15. Mars. Illuminated portion of disc 0·880. Diameter 6″·8.
15. 8h. 16m. Minimum of Algol (β Persei).
17. Saturn. Outer minor axis of outer ring, 16″·43.
21. 3h. Mercury at greatest western elongation (17° 51′).
21. 5h. Venus at greatest eastern elongation (46° 27′).
26. Vesta 20′ S. of Saturn.
28. 13h. 39m. to 14h. 44m. Occultation of 16 Piscium (mag. 5·6) by the moon.

The planet Mercury will be favourably presented as a morning star between about September 18 and 27. The time of his rising compared with that of the sun will be as under:—

Date.	Mercury rises. h. m.	Sun rises. h. m.	Interval. h. m.
September 18	4 3	5 40	1 37
19	4 3	5 42	1 39
20	4 2	5 43	1 41
21	4 3	5 45	1 42
22	4 4	5 46	1 42
23	4 6	5 48	1 42
24	4 9	5 49	1 40
25	4 13	5 51	1 38
26	4 16	5 53	1 37
27	4 20	5 55	1 35

THE GREAT TELESCOPE FOR THE PARIS EXHIBITION.—We gather from an article in *La Nature*, August 27, that M. Gautier, the well-known optician, is making good progress with the construction of the giant telescope intended for the Great Exhibition at Paris in 1900. The aperture will be 1·25 metres (49·2 inches), and the focal length 60 metres (196 feet 10 inches), while the estimated cost is 1,400,000 francs. An equatorial mounting and dome for such a gigantic instrument may well be considered impracticable, and accordingly the telescope itself will be rigidly fixed in a horizontal position on supports of masonry, and will receive the light of the heavenly bodies after reflection from a movable plane mirror 2 metres in diameter. The plane mirror is 13 inches thick, and weighs 3600 kilogrammes; and it is curious that of twelve discs cast for the purpose, the first one turned out to be the best. This has been in process of grinding for seven months, and is not yet finished.

There will be two objectives, one photographic and one visual, which will be easily interchangeable at will. It is expected that a magnifying power of 6000 will be usefully employed, and that occasionally a power of 10,000 may be used. As the highest power available in the largest existing telescope does not exceed 4000, the new instrument, if it be the success that every one will wish, should have a wide field of usefulness.

A NEW VARIABLE STAR.—In *Ast. Nach.*, No. 3512, Prof. Ceraski, Director of the Moscow Observatory, announces the discovery, by Madame Ceraski, of a new variable star. The variability was detected by a comparison of photographs, and has been confirmed by visual observations. Its estimated position is in R.A. 21h. 6·9m., Decl. + 82° 28′ (1855); that is, not far from 76 Draconis. The range of variation is not stated, but it is mentioned that on July 25 it was of the tenth magnitude.

MINOR METEORIC RADIANTS.—In view of the large amount of attention which will probably be directed to meteoric displays during the next few years, Mr. Denning summarises in *Ast. Nach.*, No. 3513, the positions of the radiant points of the minor showers visible during the principal meteoric epochs. The catalogue comprises fifty radiants observable at each of the six periods corresponding to the displays of Quadrantids, Lyrids, Perseids, Orionids, Leonids and Geminids. As the Andromedes fall near and between the Leonids and Geminids, a separate list is unnecessary for this epoch. It is seen from the table that some of the positions for radiants are almost the same at different epochs, and Mr. Denning again draws attention to his conclusion that "certain radiants are actively maintained (though possibly with varying or intermittent intensity) over considerable intervals of time, during which their positions are quite stationary among the stars." The list will be invaluable to those who take up observations of shooting-stars.

THE INTERNATIONAL CONGRESS OF ZOOLOGISTS.

THE fourth International Congress of Zoologists, under the patronage of H.R.H. the Prince of Wales and the presidency of the Right Hon. Sir John Lubbock, Bart., M.P., F.R.S., which met last week at Cambridge, may be chronicled as a success, as well from the social as the scientific point of view. The discussions were animated, the sectional papers of general interest, and the attendance was large and representative. The severity of the zoological discussions was relieved by frequent social festivities, of which the reception at the Guildhall by the Mayor of Cambridge on Monday, and the open air party at the Botanic Gardens on Thursday afternoon, were especially noteworthy.

The Congress is a triennial one, and has already been held at Paris, Moscow and Leyden. This is the first occasion that the Congress has met on English soil, and it is gratifying to find that more members were in attendance last week than were present at any of the three preceding Congresses. The programme for the week was drawn up in such a way that the topics of general interest were discussed in the mornings before the whole body of the members, while those of more limited interest were divided into four sections—(A) General Zoology, (B) Vertebrata, (C) Invertebrata, excepting Arthropoda, (D) Arthropoda, and were read in the afternoons.

Tuesday, August 23.—Sir John Lubbock, in opening the Congress, expressed his regret at the absence through continued ill-health of Sir William Flower, who, at the Leyden meeting in 1895 was made President-Elect for the present Congress.

He then delivered the presidential address, which was printed *in extenso* in our last week's issue.

Profs. Milne-Edwards, Jentink, Collett, Haeckel, von Graff, Hertwig, Marsh, Mitsukuri, Salensky and Vaillant were elected Vice-Presidents; and Dr. Hoek, Dr. Gadow, Dr. Plate and M. Janet were elected Secretaries of the Sections. The meeting then proceeded to receive the reports of committees appointed at the third Congress to consider various matters of zoological importance. The committee on zoological nomenclature, having been unable to come to a unanimous decision, applied for power to add to their number, which was granted. The question of zoological nomenclature was, therefore, not discussed at the Congress, but was referred back for consideration by the augmented committee. Dr. P. Hoek announced, on behalf of another committee, that favourable arrangements were about to be made with the international postal authorities for the transmission of animals and plants not intended as merchandise.

In the afternoon, in Section A, Mr. Stanley Gardiner read a paper on the "Building of Atolls," suggesting that the depths at which corals and nullipores live is determined by the depth to which light can penetrate sea-water, the food of corals being derived entirely from the commensal algæ. The form of the atoll-reef was shown to be due to the continuous addition of marginal buttresses and the dissolution of the central parts. In this, and in other respects, the author supports the theory of atoll-formation propounded by Sir John Murray. Prof. Mitsukuri, discoursing on "Zoological matters in Japan," pointed out that the transition from comparative barbarism to the present degree of scientific culture has not been as sudden as is generally supposed. He quoted some scientific works published in Japan in the ninth century, and called attention to the foundation of the Botanical Gardens of the University of Tokyo in 1681. He gave an account of the zoological laboratories at Tokyo, and of the marine station which has recently been erected near that town. Prof. Salensky read a paper on "Heteroblasty," by which name he designates the origin from different embryonic sources of organs, similar in position and function, in nearly related animals. He adduced as examples the development of the alimentary tract from the ectoderm in insects; the development of the peribranchial cavities in buds and embryos of Ascidians, and the development of the heart in Ascidians and Vertebrates.

In Section B, Prof. Milne-Edwards read a paper on the "Extinct Animals of Madagascar," in which he referred to the valuable collections made by M. Grandidier and Dr. Forsyth-Major. He compared the *Æpyornis* with the *Dinornis* of New Zealand, and drew a parallel between the extinct fauna of Madagascar and that of the Australasian area.

Prof. O. C. Marsh made a communication on the "Value of Type Specimens and the Importance of their Preservation," dealing more especially with the extinct Vertebrata. He pointed out that the value of type specimens depends on the maturity of the animal and the state of preservation and completeness of the parts. Type specimens must show characteristic features. The association of fragments to supplement an incomplete type is a practice fraught with great danger of confusion to subsequent investigators. Prof. Marsh advocated depositing types in large endowed museums as affording better chances of safe preservation than local museums; and he regarded it as a wise regulation that type specimens should not be permitted to leave the museum in which they are deposited.

Dr. Van Bemmelen showed that in *Ornithorhynchus* the temporal arch has two roots instead of one, a fact which suggests forcibly the articulation of the mandible with a persistent quadrate, as in reptiles. Prof. Seeley pointed out that the discovery had previously been made by himself.

Mr. Graham Kerr described the habits and development of *Lepidosiren*, and exhibited a splendid collection of specimens which he collected during his recent stay in Paraguay.

In Section C, Prof. Plate gave an account of the "Comparative Anatomy of the Chitons," showing that in these molluscs, generally believed to be the most primitive of existing Gastropods, there is a far greater diversity of internal organisation than might be suspected from their uniform appearance. Prof. Plate also described a newly discovered Protozoan which lives as a parasite in the mantle cavity of *Chiton*. Mr. E. S. Goodrich demonstrated the structure of the complex nephridial organs which occur in the Polychæte worm *Glycera*. Mr. C. F. Rousselet described a new method of preserving Rotifers in the extended condition, by narcotising them by the slow addition of a weak solution of cocain, and then killing them by a weak solution of osmic acid. The specimens are best mounted in formol. Some excellent specimens prepared in this way were exhibited.

In a paper read in Section D, on "Some points in the classification of Insects," Dr. David Sharp pointed out that in some insects the wings are developed outside the body, while in the others they do not appear at all, or are developed inside the body and are subsequently everted; and he claimed that in a classificatory scheme the perfection or imperfection of the metamorphosis should be subordinated to this feature. He proposed, therefore, to divide the insects into four groups, the *Apterygota*, quite wingless and in all probability descended from wingless ancestors, the *Anapterygota*, which, though wingless and parasitic, exhibit an acquired ametabolism as regards the wings, the *Exopterygota*, in which the wings are developed outside the body, and the *Endopterygota*, comprising the vast majority of existing hexapod insects, in which the wings develop inside the body. With regard to the geological antiquity of the groups, there is evidence to show that the exopterygotous insects are the most primitive, they only extending as far back as the Palæozoic.

Mr. M. C. Piepers summarised the results of his observations on the colours of insects in a paper entitled "Evolution of Colour in Lepidoptera," in which he concludes that there has taken place, and is still in progress, a process of colour-change affecting not only the metamorphosis of a given species, but also the evolution of the species and genera of a family. He would explain colour-polymorphism as a phenomenon of arrestation of this continuous evolution at varying stages, and sexual colour-differences as due to unequal advances by the two sexes in the same direction. The existing Pieridæ are, according to this view, evolved from a reddish ancestor. With advancing evolution the colour has become paler; first orange, then yellow, and in the most highly evolved species a pure white. Albino specimens of a species normally yellow are to be regarded as sports which have advanced further in this evolutionary scale than the majority. The progression of colour-change is not, however, the same in all families of Lepidoptera. In some, for instance, the primitive colour is red, and the successive stages are gradually darker, culminating in black.

A communication was also read from M. Bordage, giving the results of experiments made by him to determine the relation of the colour of the chrysalids of certain species of Lepidoptera to the colour of their environment. The chrysalids of *Papilio demolens* and *P. disparalis* appeared to be completely insensitive to the colour of their surroundings; but the experimenter has witnessed distinct, though feeble, efforts to respond on the part of *Atella phalanta*, *Euploea goudotii*, and *Danais chrysippus*. The intensity of the light and the brightness or dulness of the surroundings appear to be more important factors than the actual colour of the latter. The age of the chrysalis also materially affects the result.

On *Wednesday* morning a general meeting of the Congress was held to discuss the position of the Sponges in the animal kingdom. Prof. Yves Delage, in opening the discussion, proposed to confine his attention to the determination of the value to be attached to the differences between the sponges and the Cœlenterates, with the object of deciding whether the sponges ought to constitute a subdivision of the Cœlenterates or to stand apart from them as a separate phylum. He dismissed shortly such features as the presence of collar-cells and the absence of nematocysts, but laid special stress upon the structure of the sponge larva and the relations of the parts of the blastula to the permanent tissues of the adult. He described how the sponge blastula consisted in its upper part of small clear cells with flagella, and in its lower part of larger, granular, brownish cells destitute of flagella; and how the former layer, having the histological characters of ectoderm cells, have the development of an endoderm, being invaginated into the interior of the other cells. After mentioning recent experiments on the effect of salts of lithium and of varying temperatures on the mode of invagination of the blastula in Echinoderms, he said he was inclined to regard the so-called ectoderm as really an ectoderm, and the cells which resemble endoderm cells as really endodermal. The sponges and Cœlenterates run parallel in their development from the ovum to the blastula stage, but then take diverging courses. He would advocate, therefore, the recognition of the sponges as a phylum distinct from the Cœlenterates.

Prof. Delage was followed by Mr. E. A. Minchin, who commenced with an historical review of the subject. After pointing out that the animal nature of sponges was not definitely established until the middle of the present century, he proceeded to explain that the early theory that sponges were Protozoa was abandoned as soon as histological methods improved, and it became known that sponges were composed of tissues, made up of differentiated cells. Three views are, he said, at the present day advocated by different authorities: (1) that sponges are Cœlenterates; (2) that they are Metazoa, but not Cœlenterates; and (3) that sponges are not Metazoa, but constitute a phylum independent of both the Protozoa and Metazoa. The question might be attacked by two methods, the comparative anatomy of adult forms and the tracing of the germ-layers of the larva into the permanent tissues of the adult. He then gave a minute account of the development of *Clathrina blanca*, based on his own researches, and indicated with the assistance of wall-diagrams the fate of the flagellated and the granular cells. The conclusion he arrived at was that the sponges cannot be considered as Cœlenterates; for, if the larvæ of sponges and Cœlenterates are assumed to correspond, neither the architecture nor the composition of the adults is in any way comparable; while if the comparison is based on adult structures, then the larval development of sponges is altogether anomalous and dissimilar to any other known development, since the ectoderm acquires an internal position and becomes surrounded by the endoderm. The evolution of the sponges from the Protozoa must therefore have been quite independent of that of the Cœlenterates; and it is probably in the direction of the Choanoflagellate Protozoa that we must look for the ancestral stock of the sponges, since collar-cells are not known to exist except in these groups. In the discussion which followed, Prof. Hæckel expressed himself as still in favour of the cœlenterate theory; Dr. Vosmaer regretted that he had been asked to speak, because it forced him into a confession of ignorance regarding the point at issue; and Mr. Saville-Kent urged that the vexed problem of sponge affinities should be fairly approached from the protozoic as well as from the cœlenterate basis. The very fact of the possession in common by the sponges and by the flagelliferous Protozoa of these very peculiarly modified cells, found nowhere else throughout the animal kingdom, suggested forcibly a close phylogenetic relationship between these two groups. Prof. Schulze doubted whether the recent embryological discoveries were sufficient to justify the removal of the sponges from the Cœlenterates.

In the afternoon in Section A, Prof. Haeckel, in a paper entitled "Phylogenetic Classification," developed the principles which he had first enunciated in his "General Morphology," and more recently in his "Systematic Phylogeny" (1896). He regarded the *Vertebrates*, *Tunicates*, *Echinoderms*, *Molluscs*, *Cnidaria*, and *Sponges* as true phyla (*i.e.* monophyletic groups, arising from a common stem), but grouped the Annelida with the Arthropoda in the phylum *Articulata*, and the Cestoda and Trematoda with the Cœlenterata.

Prof. von Graff then demonstrated with the aid of a large map the geographical distribution of the land Planarians; and Mr. G. C. Bourne gave an account of the "Structure and Formation of the Calcareous Skeleton in the Anthozoa," showing that the corallum of the madrepores is not formed by the calcification of ectoderm cells *in situ*, but is a secretory product of the cells.

In Section B, Profs. Heymans and Van der Stricht gave an account of the ultimate ramifications of the nerves of *Amphioxus*, which they had succeeded in tracing out by adopting the elaborate methods of staining which histologists have of late years found to yield such excellent results in the investigation of nervous tissues of mammals.

Prof. Ewart exhibited by means of the lantern some photographs of the zebra-horse hybrids which he has bred in his attempt to prove or disprove the theory of telegony. He described the striping of the various species of zebra and of his hybrids, and showed that the latter do not closely resemble their sire, a Somali zebra, in the pattern of their coat. The dams of three of these hybrids have since borne foals to horses of their own breed, and one of these foals, now dead, is plainly striped, the second faintly so, while the third shows no striping at all. Prof. Ewart is not yet prepared to accept telegony as a scientifically established fact, since the colour-markings of these foals might be explained on the hypothesis of "reversion."

A paper on the "Tsetze Disease in Mammals," by Prof. Kanthack and Mr. Durham, was read and illustrated by slides, showing the living hæmatozoan and its relation to the blood corpuscles. The rapid spread of the disease is due to the Tsetze-fly carrying the organisms from infected ungulates to healthy ones as they pass through those deadly regions of Africa known as "fly-belts." The organisms cannot live in the blood more than three or four days, but reproduction is rapid, taking place in the lymphatic glands and the red marrow; and thus a plentiful supply is kept up until the host succumbs. Death appears to be due either to the fatal action of some toxin excreted by the organism, or to direct interference with the corpuscle-forming organs of the body. The mere presence of the organisms in the blood is not sufficient to cause death. The authors have not been able to discover any means of securing immunity for domesticated animals; but, since the wild mammals of South Africa though frequently found to be infected do not die of the disease, they are sanguine of ultimate success in this direction.

Mr. W. Saville-Kent, who a few years ago showed that the lizard *Chlamydosaurus* had a habit of frequently running about upon its hind legs, explained that the habit was not confined to this genus. He had found it to be common to certain species of *Iguana*, *Tupinambis* and *Basiliscus*.

In Section C, Prof. F. Vejdowsky brought forward some observations on the ova of *Rhynchelmis*, substantiating the view expressed by him elsewhere, that the dynamic body known as the "centrosome" originates by the differentiation of the middle part of the "attraction sphere" of the preceding division. Prof. Hickson gave a demonstration on the medusæ of *Millepora*, and Prof. Pelseneer communicated two short papers.

In Section D, M. Ch. Janet propounded a theory that in the head of insects parts belonging to six primitive segments can be recognised. The anterior three are characterised by the protocerebrum, deutocerebrum and tritocerebrum respectively, and the other three by the appendages—mandible, maxilla and labium. The antennæ are regarded by the author as belonging to the second segment. These results are based mainly upon a minute study of the musculature of the head of the ant.

M. A. Dollfus discoursed on the geographical distribution of the Isopods of Northern Africa; M. E. Olivier gave a general account of the Lampyridæ of the Antilles; and Prof. E. Bouvier communicated the results of his studies on the external characters of *Peripatus*.

On *Thursday* morning, at the Guildhall, an interesting debate on the "Origin of Mammals" was opened by Prof. Seeley, of London, and Prof. Osborn, of New York. Prof. Seeley said that as the Iguanodont reptiles had been regarded as the ancestors of birds, so the Theriodont reptiles had been considered the ancestors of mammals. The discovery of the complete skeleton of *Pareiasaurus* showed that *Theriodesmus* was not a mammal, as had been supposed; and in the same way, the discovery of the Gomphodont reptiles had necessitated the removal of *Tritylodon* from the mammals to the reptiles. *Pareiasaurus*, *Dicynodon* and *Cynognathus* showed different affinities in different parts of the skeleton, and from the skull of the two former no indication could be inferred of the mammalian resemblances seen in other parts of their skeletons. The Anomodontia appeared to show affinities with the lower living reptiles as well as with more than one type of mammal. The form of the brain if it were available would be evidence of affinity of some value, but the brain-cavity of Anomodonts is imperfectly known, and there is no evidence that the brain filled it. Prof. Seeley invited comparison of the quadrate region of the skull in the Dicynodonts and *Ornithorhynchus*, but remarked on the absence of prepubic bones in the Anomodonts. He showed that the Theriodont division of the Anomodonts approached the mammalia in the characters of the teeth and the very small size of the quadrate bone; while, on the other hand, they suggested affinities with the Labyrinthodont reptiles in the presence of such cranial bones as the supratemporal, and of intercentra in the vertebræ. Although the parts of the pectoral and pelvic girdles bore a close comparison with those of the Monotremes, and although in many Theriodonts the skull was typically mammalian in form, the mandibular ramus never consisted of a single piece as in mammals. The Anomodonts were not the parents of mammals, but a collateral and closely related group; and the common parent of both might be sought in rocks older than the Permian, perhaps in Silurian or Devonian strata.

Prof. Osborn said that in order to clear the ground for a

successful attack upon the difficult problem of the origin of mammals it was necessary first to reject the hypothesis, brilliantly formulated by Huxley in 1880, of a genetic succession between Monotreme, Marsupial and Placental types, since this could not be supported by either palæontology or comparative anatomy. He explained the law of adaptive or functional radiation whereby mammals have repeatedly diverged from small unspecialised focal types into aquatic, arboreal, volant, herbivorous and carnivorous orders, and pointed out that the balance of evidence among the mammals, as among the reptiles, is in favour of all aquatic types being secondarily evolved out of land types. All carnivorous and herbivorous types were over-specialised, or in a *cul de sac* of development, so that it was probable that the Promammal was a small terrestrial animal, either insectivorous or omnivorous in its habits. There was abundant evidence that many of the small mammals of the Middle and Upper Jurassic were not Marsupials, but insectivorous Placentals, fulfilling all the conditions required for the ancestry of the living Insectivora and the Creodonta, and, through the latter, of all the higher existing types of mammals, including man. Leaving the mammals, he remarked that the Theriodonts and Gomphodonts were surprisingly Promammalian in type, and that we were strongly tempted to connect the latter division, which is herbivorous, directly with the herbivorous Monotremes and Multituberculates. The large size and high specialisation of these types was, however, opposed to this view. In concluding he said that South Africa was at the present time a centre of the highest interest, and that for further developments of the problem of the origin of mammals we must probably look to the rich fauna of the Karoo beds.

In the discussion which followed, Prof. Marsh said that the mammals themselves comprised so many different groups that it was a fair question whether all these had a common origin. The supposed resemblance between the teeth of the Anomodont reptiles and those of mammals was not confined to one group. The extinct crocodile *Notosuchus* recently found in Patagonia has the three kinds of teeth well developed; and in the genus *Triceratops*, of the Dinosaurs, all the teeth have two roots—a supposed mammalian character; but no one had yet attempted to derive the mammals from the Crocodiles or the Dinosaurs. Prof. Marsh declined to admit that any reptiles possess a true double condyle, since in the known forms the two parts are in contact below, forming essentially a single cordate condyle, as in some of the Chelonia. Again, all reptiles have a quadrate bone, which may be small and partly enclosed in the squamosal, but never lost. No known mammal has a true quadrate, and the attempts to identify that bone in the mammalian skull have not been successful. Most important of all, the lower jaw of all reptiles is composed of several pieces, even the Anomodonts showing the sutures distinctly. There was, said Prof. Marsh, a great gulf between mammals and reptiles which it was at present difficult to bridge over. Prof. Haeckel then spoke in high terms of the excellent palæontological work which was being carried on in America, and the value of the recent discovery of annectent forms. He was inclined to adhere to the view of the origin of all Placental mammals from Marsupials. Mr. A. Sedgwick said that no assistance could be looked for in the direction of embryology, and in support of this statement showed that although we regard the horses as descended from pentadactyle ancestors, the embryos show no more details of limb structure than the adult; and that although birds are admitted to have lost their teeth in the process of evolution, no rudiments of teeth are found in the embryo. He referred to the profound modification of embryonic development which varying amounts of yolk in the egg may cause; and he doubted whether any of the extinct forms known to us ought to be considered as ancestors of existing forms. He would like to see all the lines of the genealogical tree running down to the Pre-Cambrian without joining. Prof. Hubrecht also spoke on behalf of the embryologists, and pointed out that the one great distinction between the Ichthyopsida on the one hand, and the Sauropsida and Mammalia on the other, was the presence of the amniotic envelope in embryos of the latter and its absence in the former. Our ignorance of the development of the extinct forms prevented him from accepting the doctrine of descent as propounded by palæontologists. He referred to Prof. Hill's discovery of a definite deciduous placenta in *Perameles*, and to the less complete placenta of *Phascolarctos*, and concluded by expressing his doubts as to the intermediate position occupied by the Marsupials between the Monotremes and the Placental mammals.

Prof. Newton said that he took a more hopeful view of the question than the last two speakers, and that he looked in the direction of comparative anatomy and palæontology, rather than embryology, for the solution of the problem of the "Origin of Mammals."

In the afternoon at the Senate House the honorary degree of Doctor of Science was conferred on several members of the Congress and of the Congress of Physiologists. The speeches delivered by the Public Orator upon this occasion are printed at the end of this report. Prof. Kowalevski, whom it was also proposed to honour, was unfortunately prevented from attending the Congress.

A paper on "Fishery Statistics," by Prof. McIntosh, was read in Section B.

On *Friday* morning, Prof. Haeckel, discoursing on "The Descent of Man," said that the monophyletic origin of all Mammalia from the Monotremata upwards to Man is at present no more a vague hypothesis, but a positively established fact. All the living and extinct Mammalia which we know, are descended from one single ancestral form, which lived in the Triassic or Permian period; and this form must be derived from some Permian or perhaps Carboniferous reptile (allied to the Progonosauria and Theriodontia), and the latter from a Carboniferous Amphibian (Stegocephalia). These latter are descended from Devonian fishes, and these again from lower Vertebrates. Much more difficult is the question of the origin of the great Vertebrate-Stem, and its descent from Invertebrates. But these questions are not so important as the fact that Man is a member of the Primate-Order (Linné), and that all Primates descend from one common stem (Huxley). Zoology may be proud to have proved this fact, based on the theories of Lamarck (1809) and of Darwin (1859).

Prof. Marey explained why the subject of animal locomotion could not be investigated from the physiological standpoint only, but that a minute study of comparative anatomy was also essential. He exhibited numerous instantaneous photographs of horses in successive phases of movement.

Mr. W. L. Duckworth gave an account of the anatomical researches he is at present making on the Gorilla and other Anthropoid apes.

M. E. Dubois made some "Remarks on the brain-cast of *Pithecanthropus erectus*." He called attention to the scaphocephalic nature of the skull, and the consequent narrowness of the frontal region of the brain and the strong impressions of the frontal convolutions on the interior of the calvarium. The author repudiated the suggestion that the skull was a microcephalic anomaly. The femur which was found associated with the skull suggested bipedal locomotion, but there were indications in that bone of an arboreal habit such as are not found in the human femur. He showed how by comparison of human thigh bones with known corresponding body-weight he had estimated from the size of the femur of *Pithecanthropus* that its body-weight must have been 70 to 75 kilos. He then deduced the size of the whole brain (850 c.c,) from that of the internal cast of the calvarium, and from this the weight of the brain (750 grams). His ultimate conclusion was that in a man, an anthropoid ape and a *Pithecanthropus* of the same body-weight, the brain of *Pithecanthropus* would be twice as large as that of the ape, and half the size of that of the man.

In the afternoon in Section A, Prof. MacBride read a paper on the "Origin of Echinoderms." He pointed out that the type of larva common to the Asteroids, Ophiuroids, Echinoids, and Holothuroids probably represented a free-swimming bilateral ancestor of simple organisation. The main object of his paper was to consider the transformation of the bilateral into the radial form. Since the right water-vascular rudiment remained small, a main factor in the metamorphosis was the unequal development of the two sides. Where, as in Crinoids, a fixed stage succeeded the pelagic stage, bilateral symmetry ceased to be of importance to the animal; but a radial arrangement of external organs was advantageous, and hence incipient inequalities in the sides would be made use of to produce the radial arrangement.

Sir Herbert Maxwell then read a paper on "Recent Legislation on Protection of Wild Birds in Great Britain," in which he pointed out that with regard to migratory birds the question of protection was of international importance, and he referred to the recent letters in *The Times* complaining of the diminution in the number of swallows in our southern counties owing to their wholesale slaughter in the south of France. He discussed the relative merits of absolute protection in certain areas, the

establishment of a close time over the whole country, and the protection of the eggs, and concluded by an account of the efforts of the Wild Birds Protection Society.

In Section B, Prof. Hubrecht gave an account of his researches on the origin of red blood corpuscles in the placenta of *Tarsius*, and explained that the corpuscles are the liberated nucleoli of proliferating syncytia of the embryonic epiblast. The genesis of red corpuscles in the placenta had previously been described in the rabbit and bat; but the discovery had not been confirmed, and the fact was not credited. The figures already published by the opponents to the view now advocated show that the appearances presented in Prof. Hubrecht's slides had previously been seen. But while these observers regarded the imperfect corpuscles visible as undergoing disintegration, Prof. Hubrecht considers them as in process of formation. In the discussion which followed, Mr. A. Sedgwick pointed out the important bearing upon the phenomenon of telegony of this introduction into the maternal blood of corpuscles derived from embryonic tissue. Prof. Hubrecht, in replying to a question by Dr. Gadow, said that he still upheld the view that *Tarsius* should, on account of the peculiarity of its placenta, be separated from the lemurs and included among the monkeys. Prof. Osborn exhibited photographs of a fossil Hyracoid from the Lower Pliocene of Samos. The specimen consists of a fairly well preserved skull contained in the Stuttgart Museum, and Prof. Osborn proposes to name it *Pliohyrax fraasii*, after Prof. Fraas, who handed over the specimen to him for description. The skull is of large size, and is twice as long as that of *Dendrohyrax*, the largest living hyrax. The dental formula is complete, viz. i 3, c 1, pm 4, m 3. The large median incisors are separated by a diastema from the other two, which are small and in continuous series with the canine and pre-molars. The first tooth in the maxilla, identified by Prof. Osborn as the canine, closely resembles in shape the anterior pre-molar immediately behind it. It has two roots and two cusps. The zygoma appears to have been extremely short, and the infra-orbital foramen is as far back as the fourth pre-molar.

Prof. Vaillant then described the minute structure of the dermal spines of the Apogonini and some other acanthopterygian fishes.

Prof. Salensky read a paper on the development of the "Ichthyopterygium." After criticising the "Archipterygium" theory of Gegenbaur and the views of Balfour and Dohrn, he explained that his own researches on the cartilages and muscles of larval specimens of the Sterlet (*A. ruthenus*) brought him in accord with the views of Mollier, and concluded that the serial rays of the fin could be correlated with certain of the primitive body-segments.

In Section C, a paper on the tapeworms of the Monotremes and Marsupials was communicated by Dr. Zschokke (Basel), who proposed to create a new genus *Linstowia* for the reception of the parasites of *Echidna* and *Perameles*. MM. Mesnil and Caullery described the discoveries made by them on the polymorphism of the sedentary Polychæte *Dodecaceria concharum*, and concluded with a discussion of the phenomenon of "épitoquie" in Annelid worms generally. Six other short papers were also read.

On *Saturday* morning, at a general meeting convened at the Guildhall, it was decided that the fifth Congress, in 1901, should be held in Germany; the selection of the town and the president to be left to the German Zoological Society, acting in conjunction with the Permanent Committee of the Zoological Congress at Paris.

The following speeches were delivered by the Public Orator, Dr. Sandys, Fellow and Tutor of St. John's College, in presenting to the Vice-Chancellor the several representatives of the International Congresses of Zoology and Physiology, on whom honorary degrees were conferred on August 25.

(1) In ipso limine laudis nostrae nihil auspicatius arbitramur, quam tot viros, de zoologiae et physiologiae studiis bene meritos, a tot orbis terrarum partibus ad nos advectos, Academiae nomine iubere salvere. Dum omnibus Collegia nostra, omnibus etiam corda nostra pandimus, unum certe animo prope fraterno contemplamur, qui a fratribus nostris transmarinis ad nos transmissus, cordis praesertim de motu reciproco et olim et nuper plurima protulit. Idem in musculorum et "nervorum" (ut aiunt) physiologiam multum inquisivit, neque psychologiae provinciam vicinam inexploratam reliquit. Huius imprimis exemplo et auctoritate factum est, ut etiam trans aequor Atlanticum physiologiae studia nunc maxime floreant, utque matris almae Cantabrigiensis filia transmarina, nomine eodem nuncupata, studiorum illorum sedes iampridem constituta sit.

Duco ad vos HENRICUM PICKERING BOWDITCH.

(2) E Germanis quidam oriundus, partris iucundi filius, laudem ideo maximam est adeptus, quia, Italiae in litore hospitali, orbis terrarum in sinu amoenissimo, vivarium Oceani spoliis reservatum gentibus patefecit, quod quasi aquarum castellum appellaverim, unde doctrinae rivuli in omnes terras late diffluxerunt. Vivarii illius conditorem inter hospites nostros diu numeravimus; eidem alumnos nostros animo laeto commendavimus; ab eodem scientia varia instructos animo grato rursus accepimus. Ipse animalium in partu praesertim explorando laboris immensi prodigus, neque minorem quam in vivario illo condendo fortitudinem ostendit, neque fortunam minus prosperam expertus est. Per totam certe vitam feliciter confirmavit verba ab ipso Plinio, historiae naturalis auctore locupletissimo, vitae suae in die novissimo prope Neapolim pronuntiata:—"fortes fortuna iuvat."

Duco ad vos ANTONIUM DOHRN.

(3) Gallorum e gente insigni, non vicinitatis tantum vinculis nobiscum coniuncta, ad litora nostra advectum salutamus, patris doctrina multiplici ornati filium, quem ipsum talium conventuum non modo praesidem primum sed etiam auctorem principem atque adeo patrem nominaverim. Avium in scientia diu versatus, etiam ex ipsis saxis avium formas latentes quam sollerter elicuit; rerum naturae museo maximo inter Parisienses praepositus, navium bene nominatarum auxilio, etiam Oceani ipsius e profundo rerum naturae veritatem quam feliciter extraxit. Quid non potuit rerum naturae,—quid non potuit veritatis amor?

"Merses profundo, pulchrior evenit."

Duco ad vos ALPHONSUM MILNE EDWARDS.

(4) Italiam, olim scientiarum matrem, laetamur nunc quoque filiis physiologiae de scientia praeclare meritis gloriari. Unum ex eis hodie salutamus, in Academia Papiensi Ticini prope ripam posita, pathologiae professorem insignem, virum etiam in eis quae oculorum aciem fugiunt observandis perspicacissimum. Idem duas praesertim ob causas in honore merito habetur: primum, quod in corpore humano fila quaedam tenuissima sensibus motibusque transferendis ministrantia, argenti auxilio per ambages suas inextricabiles exploranda et observationi subtiliori praeparanda esse docuit; deinde, quod in sanguine humano parasitis quibusdam diligenter indagatis et inter sese separatis, aëris pestilentiam propulsare, febrium cohortes profligare audacter aggressus est. Camilli mortem pestilentia absumpti Camillus alter ultus est.

Duplex certe honos viro in uno conspicitur, CAMILLO GOLGI.

(5) Germania ad nos misit non modo maris animalium minutorum investigatorem indefessum, sed etiam operis immensi conditorem audacem, in quo animalium omnium ortum ab origine ultima indagare est conatus. Ergo Caroli Darwinii, alumni nostri magni, praedicatorem inter Germanos magnum salutamus. Salutamus etiam virum, qui in ipsa rerum omnium origine recordatus omnia muta mansisse, "donec verba, quibus voces sensusque notarent, nominaque invenere," idem in ipsa animalium origine exploranda ob eam inter alias causam laudatur, quod, ingenio vivido praeditus, tot nomina nova invenerit,—quod totiens (ut Horati verbis denuo utar) "sermonem patrium ditaverit et nova rerum nomina protulerit."

Duco ad vos virum quem nominare satis est, ERNESTUM HAECKEL.

(6) Vir Batavorum inter rura genio felicissimo natus, omnium corda ad sese allexit, Europae gentium prope omnium linguas sibi vindicavit, Oceani denique monstra (ut ita dicam) minutissima et tenuissima, quae *Nemertea* nominantur, accuratissime investiganda sibi sumpsit. Illa vero monstra, si poetis Graecis licet credere, satis antiqua et memoratu satis digna esse constat. Scilicet ipse Nereus erat *νημερτὴς τε καὶ ἥπιος*, Proteus autem *γέρων ἅλιος νημερτής*. Sed haec utcumque sunt, in laudando viro, qui maris monstra illa forma multiplici praedita veracissime descripsit, nihil est facilius quam vera dicere, nihil iucundius quam (ut Homeri verbis utar) *νημερτέα μυθήσασθαι*.

Duco ad vos AMBROSIUM ARNOLDUM WILLELMUM HUBRECHT.

(7) Instituto Lipsiensi physiologiae studiosi quantum ubique debeant, doctissimo cuique satis notum. Instituti illius praesidis olim adiutor egregius, postea Borussiae, nuper Helvetiae in capite physiologiam professus est; physiologiae *φαινόμενα* physicis praesertim rationibus explicare conatus est; adhibito

denique instrumentorum auxilio, quae ipse aut primus invenerat aut in melius mutaverat, multa accuratius investigavit, multa prius ignota patefecit, in regiones novas scientiae suae terminos feliciter propagavit. Ob imperii tanti fines tam late propagatos lauream nostram victori felici libenter decernimus.

Duco ad vos HUGONEM KRONECKER.

(8) In provincia Palatina physiologiae professor Heidelbergensis abhinc annos plus quam triginta corporis cellularum in protoplasmate disputandi materiem satis amplam invenit; abhinc annos plus quam viginti de forma "nervorum" in musculos desinentium multum conscripsit; abhinc annos decem coram Societate Regia Londinensi de ea physiologiae provincia disseruit, in qua vitae suae quasi tabernaculum posuerat. Qui totiens unumquodque duorum lustrorum spatium laboribus suis luculenter illustravit, quasi regulam vitae Horatianum illud videtur sumpsisse :—

"servetur ad imum
qualis ab incepto processerit, et sibi constet."

Ergo etiam in posterum intra decem annos speramus physiologiae e provincia chemica fore ut talium virorum victoriis laurus plurimae referantur.

Duco ad vos WILLELMUM KÜHNE.

(9) Galliae ex Collegio Parisiensi laetamur adesse hodie historiae naturalis professorem illustrem, qui, apparatu exquisito adhibito, physiologiae quaestiones physicarum rationum ope totiens explicavit. Idem non modo cordis palpitationem alternam, sanguinis cursum continuum, musculorum denique contractionem penitus exploravit, sed etiam animalium complurium motus varios lucis ipsius auxilio feliciter illustravit. Talium virorum dignitatem contemplata, Universitas nostra non sine superbia quadam etiam in hunc virum quadrare confitebitur verba illa comoediae Gallicae celeberrimae in extremo posita :— "dignus, dignus est intrare in nostro docto corpore."

Novem virorum insignium seriem, non Senatus tantum nostri praeconio dignatam, sed etiam collegarum suorum omnium plausu comprobatam, claudit hodie professor illustris, STEPHANUS IULIUS MAREY.

Prof. Kowalevsky, the distinguished Professor of Zoology in the Imperial University of St. Petersburg, was unfortunately prevented from being present to receive the honorary degree of Doctor in Science, which it had been proposed to confer on him. In introducing the nine recipients of honorary degrees who were present, the Public Orator adopted the reformed pronunciation of Latin; and his speeches were accordingly readily understood and appreciated by the great concourse of international visitors in the Senate House.

EXPERIMENTS WITH THE TELEPHONE.[1]

EARLY estimates of the minimum current of suitable frequency audible in the telephone having led to results difficult of reconciliation with the theory of the instrument, experiments were undertaken to clear up the question. The currents were induced in a coil of known construction, either by a revolving magnet of known magnetic moment, or by a magnetised tuning-fork vibrating through a measured arc. The connection with the telephone was completed through a resistance which was gradually increased until the residual current was but just easily audible. For a frequency of 512 the current was found to be 7×10^{-8} ampères (the details are given in *Phil. Mag.*, vol. xxxviii. p. 285, 1894). This is a much less degree of sensitiveness than was claimed by the earlier observers, but it is more in harmony with what might be expected upon theoretical grounds.

In order to illustrate before an audience these and other experiments requiring the use of a telephone, a combination of that instrument with a sensitive flame was introduced. The gas, at a pressure less than that of the ordinary supply, issues from a pin-hole burner (the diameter of the pin-hole may be 0·03″) into a cavity from which air is excluded (see Fig. 1). Above the cavity and immediately over the burner, is mounted a brass tube, somewhat contracted at the top where ignition first occurs (*Camb. Proc.*, vol. iv. p. 17, 1880). In this arrangement the flame is in strictness only an indicator, the really sensitive organ being the jet of gas moving within the cavity and surrounded by a similar atmosphere. When the pressure is not too high, and the jet is protected from sound, the flame is rather tall and burns bluish. Under the influence of sound of suitable pitch the jet is dispersed. At first the flame falls, becoming for a moment almost invisible; afterwards it assumes a more smoky and luminous appearance, easily distinguishable from the unexcited flame.

When the sounds to be observed come through the air, they find access by a diaphragm of tissue paper with which the cavity is faced. This serves to admit vibration while sufficiently excluding air. To get the best results the gas pressure must be steady, and be carefully adjusted to the maximum (about 1 inch) at which the flame remains undisturbed. A hiss from the mouth then brings about the transformation, while a clap of the hands or the sudden crackling of a piece of paper often causes extinction, especially soon after the flame has been lighted.

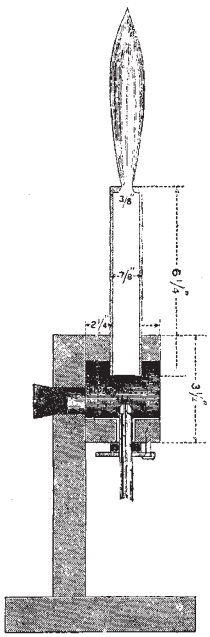

FIG. 1.

When the vibrations to be indicated are electrical, the telephone takes the place of the disc of tissue-paper, and it is advantageous to lead a short tube from the aperture of the telephone into closer proximity with the burner. The earlier trials of the combination were comparative failures, from a cause that could not at first be traced. As applied, for instance, to a Hughes' induction balance, the apparatus failed to indicate with certainty the introduction of a *shilling* into one of the cups, and the performance, such as it was, seemed to deteriorate after a few minutes' experimenting. At this stage an observation was made which ultimately afforded a clue to the anomalous behaviour. It was found that the telephone became dewed. At first it seemed incredible that this could come from the water of combustion, seeing that the lowest part of the flame was many inches higher. But desiccation of the gas on its way to the nozzle was no remedy, and it was soon afterwards observed that no dewing ensued if the flame were all the while under excitation, either from excess of pressure or from the action of sound. The dewing was thus connected with the *unexcited* condition. Eventually it appeared that the flame in this condition, though apparently filling up the aperture from which it issues, was nevertheless surrounded by a descending current of air carrying with it a part of the moisture of combustion. The deposition of dew upon the nozzle was thus presumably the source of the trouble, and a remedy was found in keeping the nozzle warm by means of a stout copper wire (not shown) conducting heat downwards from the hot tube above.

The existence of the downward current could be made evident to private observation in various ways, perhaps most easily by projecting little scraps of tinder into the flame, whereupon bright sparks were seen to pass rapidly downwards. In this form the experiment could not be shown to an audience, but the matter was illustrated with the aid of a very delicate ether manometer devised by Prof. Dewar. This was connected with the upper part of the brass tube by means of a small lateral perforation just below the root of the flame. The influence of sound and consequent passage of the flame from the unexcited to the excited condition was readily shown by the manometer, the pressure indicated being less in the former state of things.

The downward current is evidently closely associated with the change of appearance presented by the flame. In the excited state the gas issues at the large aperture above as from a reservoir at very low pressure. The unexcited flame rises higher, and must issue at a greater speed, carrying with it not only the material supplied from the nozzle, and constituting the original jet, but also some of the gaseous atmosphere in the cavity surrounding it. The downward draught thus appears necessary in order to equalise the total issue from the upper aperture in the two cases.

Although the flame falls behind the ear in delicacy, the combination is sufficiently sensitive to allow of the exhibition of a great variety of interesting experiments. In the lecture the introduction of a threepenny-piece into one of the cups of a

[1] A discourse delivered at the Royal Institution, on June 10, by the Right Hon. Lord Rayleigh, F.R.S.