of the German African Society to Tripoli, and thence by Egypt and Abyssinia to Galla Land. Herr Stecker's observations referred largely to natural history, of which he was a student.

LIEUT. WISSMANN, the African traveller, who was obliged to spend the winter at Madeira on account of ill-health, there had an opportunity of writing the report of his second journey to Africa. The book has just been published by Brockhaus. At present Lieut. Wissmann is engaged on an account of his first expedition to the south of the Congo Basin, in company with Dr. Pogge.

DRS. FRIEDERICH KURTZ AND WILHELM BODENBENDER, both Professors at the Cordoba University (Argentine Republic), have started on a scientific expedition to the East Andes.

FORESTRY IN THE CAPE COLONY.

THE Report of Consul Siler, the United States representative at Cape Colony, which has been just issued, contains a full account of the present state of forestry in that country. He says that of the 214,000 square miles which are comprised in Cape Colony, there are something over 350 square miles covered with large forest trees. These forests lie almost all together near the sea, running nearly parallel to the coast, in the temperate regions of the southern mountain chains. Till recent years the system of felling pursued was a most wasteful and unsystematic one. Far from confining the operations of the woodcutters to certain limited sections or areas, the authorities permitted them to roam about at pleasure, and to pick and choose from among the forests what trees they should cut down. This license had its natural effect: only the choicest trees were cut, and even of these only selected portions were taken away, the rejected parts being left to cumber the ground. It has been estimated by those skilled in woodcraft that by this pernicious system 30 cubic feet of wood were wasted to each one utilized; and thus it is that many forests have totally disappeared, and even those that were not so easily accessible have been sadly impoverished. Till 1880 no steps were taken to preserve this natural wealth that was being so shamefully abused. In that year, however, the question was strongly urged on the attention of the Colonial Parliament. One of the chief defects of the system was pointed out—namely, the total absence of skilled caretakers, those then in charge having received no technical education whatever; and to meet this in some measure Parliament at once voted a sum of money to pay a trained superintendent. The choice fell on Count de Vasselot, who had had wide experience in French forestry at Nancy, and he at once proceeded to lay the foundations of the present forest department at the Cape. One of his first steps was to divide the forests into districts, which he again subdivided into sections, and to direct that felling should proceed in sections, the re-growth of the first section being given time to develop into mature trees before the axe was again used in that section. By this system the entire shutting up of any forest for a time is done away with. At present the period for the "revolution" of fellings is fixed at forty years. The tariffs now vary for standing timber from 2 cents to 6 cents per cubic foot of sound wood; with the exception of stinkwood (*Oreodaphne bullata*), which, being very hard and very valuable, was almost threatened with extermination, for which the price is 24 cents per cubic foot. Poles from 6 inches to 10 inches in diameter are sold at the rate of 2 cents per running foot; spars from 4 inches to 6 inches in diameter at 12 cents per 100 running feet.

The Consul illustrates the general system of managing and preserving the forests now followed in the colony by a minute description of that used in Knysua, the most extensive and most valuable of all the Cape forests. The total area of the Knysua may be roughly stated to be 100,000 acres, and of this magnificent forest almost three-fourths have been impoverished and in fact exhausted by the indiscriminate and reckless system of felling pursued in the past. At present the staff to conserve and replant this forest consists of one conservator, three superior grade officers, and six rangers or guards. Each higher grade officer has the superintendence of a tract of woodland varying in extent from 10,000 to 30,000 acres, in which he surveys the large timber, fixes the limits of the blocks or series, and plans out the boundaries of the various sections. No works are sanctioned without the consent of the Superintendent of Woods and Forests, and, if he has given his approval, the sections are surveyed and the trees fit for felling are marked with an official stamp. The duties of the rangers are to ride about their districts and endeavour to discover any breaches of the forest regulations, and in cases of successful prosecution they are rewarded according to the zeal and ability displayed by them. Besides the officers above-named, there are thirteen foresters distributed over the different woods, whose duty it is to plant, and, if necessary, transplant trees, and to take care of young trees. These men are paid at the rate of $20 a month, are provided with free quarters and ten acres of garden land, and are paid a bonus of $2.50 per 1000 for planting nursery plants, $2.50 per 1000 for 1-foot trees in the forest, or for nursery work and transplanting $5 per 1000 trees. This bonus cannot in the case of any individual forester exceed $200 in the year, without special permission. Each forester is expected to raise at least 40,000 young trees annually. So far as can at present be judged, seeing that the system has had but a few years' trial, it has undoubtedly proved a success. To show the amount of work that some of these foresters get through, it may be mentioned that in King William's Town forests in the year 1885 six foresters planted in the course of the year 138,080 plants in the nursery, and transplanted from the nursery into the forests 63,885 young trees. With the object of encouraging these valuable efforts to preserve the forests and to increase the area under timber, the Colonial Government has laid out several large tracts of land into plantations and nurseries, and although these are but of very recent formation they have already proved their utility in the reafforesting of the country. At the Government nurseries there are at the present moment over one million plants flourishing. In the working of these nurseries and plantations, convict labour has been utilized as largely as possible, and by this means the cost of the convict prisons has largely diminished. One other work in this connection of the Colonial Government is worthy of remark. At the plantation of Tokai, on the Table Mountain range, 150 species of extra-tropical trees have been introduced, and from them plants have been raised, with which it is proposed to reafforest the whole Table Mountain slopes, and already, in the short space of two seasons, 1000 acres have been replanted. From all the Government nurseries plants can be purchased at a nominal rate, and this, together with a recent Act whereby public bodies receive Government aid to the extent of one-half their expenditure on replanting, has given a strong stimulus to, and has aroused general interest in, the science of arboriculture among the colonists. Following the example of many American States, their first "arbor day," in 1886, was proclaimed a public holiday; and so great was its success that it is very likely to become a permanent institution. The Consul concludes his Report by saying that it is confidently hoped that with such machinery at work and with a growing interest in the advantages of tree-cultivation, in the future, Cape Colony will be independent of foreign markets for her timber supply; and that it is probable that the presence of forests, by increasing the rainfall, will bring tracts which are at present barren into cultivation.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, March 22.—"On the Skull, Brain, and Auditory Organ of a new Species of Pterosaurian (*Scaphognathus Purdoni*) from the Upper Lias, near Whitby, Yorkshire." By E. T. Newton, F.G.S., F.Z.S., Geological Survey. Communicated by Dr. Archibald Geikie, F.R.S.

The fossil Pterodactyl skull, which is the subject of this communication, was obtained from the Upper Lias of Lofthouse, near Whitby, by the Rev. D. W. Purdon, of Wolverhampton. It is the first Pterodactyl found in the Yorkshire Lias, and is a new form, allied to the Continental Jurassic species *Scaphognathus* (*Pterodactylus*) *crassirostris* of Goldfuss. The structure of the skull, including the back, base, and palatal regions, is better shown than in any previously discovered specimen; and in addition to this the brain and parts of the auditory organs have been exposed.

In its present condition the skull is about five and a half inches long; but apparently about two inches of the front are wanting. The elongated snout gives the skull a very bird-like appearance; but its most striking features are the five apertures, surrounded by bone, seen on each side. The orbit is the largest of these apertures; in front of this, and next in size, is the ant-orbital fossa; still further forward is the somewhat smaller external

nostril. Behind the orbit is the temporal space, divided by a bony bar into the supra- and infra-temporal fossæ.

On the upper surface of the skull are to be seen the nasals and prefrontals, on each side of the premaxillary process. The frontals form the upper boundaries to the orbits, and are confluent posteriorly with the parietals. Strong buttresses extend outward from the postfrontal and parietal regions to form the supra-temporal bar. There is on each side a large lachrymal bone forming the greater part of the upper and hinder boundary of the ant-orbital fossa. The jugal and quadrate-jugal are of a somewhat unusual form ; the former bounding the lower half of the orbit, and the latter inclosing in an open V the greater part of the infra-temporal fossa. The quadrate is a wide but thin plate seen chiefly at the back of the skull. The base of the cranium is remarkable for its depth and extreme antero-posterior flattening ; and viewed from behind a pair of long rods are seen extending from its lower margin, one on each side, to the inner angles of the quadrates. These bones are regarded as the homologues of the basi-pterygoid processes of the sphenoid, such as are seen in some lizards and birds, as for example in the *Chameleon and Emu.*

From the point of junction of the quadrate and basi-pterygoid process a bone runs along the palate, and dividing anteriorly forms the hinder boundary of the internal nostril, its outer portion joining the maxilla and its inner being continuous with a median bone occupying the position of a vomer. This bony bar, it is thought, represents the palatine and pterygoid bones.

The back of the skull is essentially Lacertilian. A large par-occipital bone extends outwards from the sides of the foramen magnum, and its distal end, expanding, embraces the upper part of the quadrate. The relation which the base of the parocci-pital bears to the semicircular canals shows that it must be chiefly formed by the opisthotic element, as Prof. W. K. Parker has shown to be the case in lizards, and not by the exoccipital as it is in birds.

By removing the frontal and parietal bones of the left side, a cast of the brain cavity has been exposed, which there can be no doubt represents the form of the brain, just as closely as does that of a bird's cranial cavity. In proportion to the size of the entire skull, the brain of this Pterodactyl is very small, being not more than one-eighth of its length. Each cerebral lobe is oval in shape, and about as thick as it is wide. The olfactory lobe is small. Behind the cerebrum is a pair of large optic lobes, occupying a prominent position on the sides of the brain, and extending upwards well to the upper surface, but not meeting above in the middle line. The region of the cerebellum has been broken away, and its exact form therefore is somewhat uncertain ; but, judging from portions which remain, it is tolerably clear that it extended between the optic lobes, and may have reached as far forwards as the cerebrum. Attached to the side of the medulla oblongata is a large flocculus, such as occurs in this position in birds.

It was the finding of the flocculus which led to the discovery of some parts of the auditory apparatus. On clearing away the stone in this region, a small tube filled with matrix was found arching over the pedicle of the flocculus and dipping down between it and the optic lobe. This tube occupies the position of the anterior vertical semicircular canal in the goose. By tracing the canal backwards and downwards it was found to join another similar tube forming an arch behind the flocculus—that is, in just the position of a posterior vertical semicircular canal. By careful excavation below the flocculus, a portion of a third tube was found, arching outwards in a horizontal plane, and this is believed to be the external semicircular canal.

The similarity between the base of the fossil skull and that of the Chameleon led to the inference that the fenestra ovalis would be found to be similarly placed in both, and by clearing away the matrix from the orbit and temporal fossa this inference was proved to be correct. The form and relations of the quadrate bone make it highly probable that this Pterosaurian had no ear-drum.

A comparison of this fossil with the skulls of known Pterosauria leaves no doubt that it is more nearly related to the *Scaphognathus* (*Pterodactylus*) *crassirostris* than to any other species, but as it differs from that form, and is evidently new, it is to be named specifically *Scaphognathus Purdoni*.

The Pterosaurian skull, as exemplified by this Lias fossil, resembles more the Lacertilian than any other type of Reptile skull ; and seeing that the skulls of birds and lizards are in many points very similar, one is not surprised to find in this fossil characters which are also found in both these groups. In considering, therefore, the relation which the Pterosaurian skull bears to those of birds and lizards, the characters should be especially noticed which serve to distinguish between the two groups, thus :—

1. In birds the brain-case is larger in proportion to the size of the skull than it is in lizards.

2. The quadrate, pterygoid, and palatine bones are movable on the skull in birds, but more or less fixed in lizards.

3. In birds the hinder end of the palatine and front end of the pterygoid are brought into close relation with the rostrum of the sphenoid. This is not the case with lizards.

4. The orbit is rarely completed by bone in birds, and never by the jugal ; in lizards the orbit is surrounded by bone, and the jugal forms part of it.

5. In birds there is no prefrontal bone, while it is always present in lizards.

6. No bird has a supra-temporal bar of bone, but it is always developed in lizards.

7. In lizards the paroccipital process is large and formed by the opisthotic ; in birds the paroccipital is small and formed by the exoccipital.

8. In birds the bones of the cranium are early anchylosed ; in lizards they nearly always remain separate.

9. Birds have the premaxillæ large and united into one bone ; in lizards they are usually small.

10. The ant-orbital fossa which is present in birds is only occasionally present in lizards.

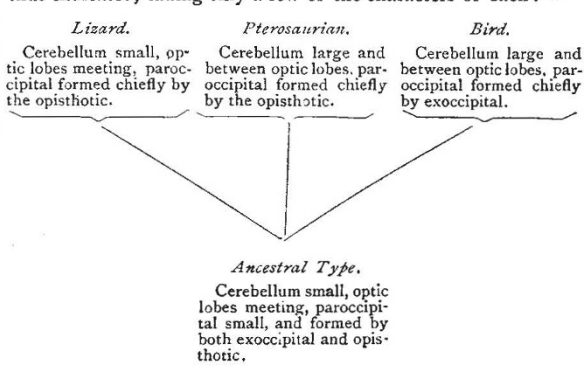
11. In birds there is always a lower temporal bar of bone extending from the maxilla to the quadrate. This bar is incomplete in all lizards except *Sphenodon*, although well developed in other reptiles.

The skull of *Scaphognathus Purdoni* agrees with lizards in the first seven of the above characters ; and with birds in those numbered 8, 9, 10. Number 11 need not be considered, as it can scarcely be regarded as distinctive. The greater importance of the first seven characters makes it clear that in the structure of the skull *S. Purdoni* most nearly resembles the Lacertilia.

The brain of *Scaphognathus Purdoni* agrees with that of reptiles in its relatively small size ; while the separation of the optic lobes by the cerebellum and the meeting of the latter with the cerebrum, as well as the possession of a distinct flocculus, are important points in which it resembles the brain of the bird. On the other hand, the form of the optic lobes is unlike that of any living bird.

The brain of the American fossil-bird, *Hesperornis*, shows a striking resemblance to that of *Scaphognathus Purdoni*, for not only is it proportionally smaller than in recent birds, but the relation of the cerebellum and cerebrum to the optic lobes is very similar.

The facts above stated seem to show that the Pterosauria are related to the birds in the form of the brain, and to the lizards in the structure of the skull. This, however, does not constitute the Pterosaurian a transitional form between birds and reptiles, in the sense of the Pterosauria having been derived from reptiles, or of the birds having been derived from Pterosauria ; but rather points to *Aves*, *Pterosauria*, and *Reptilia* having been derived from some common ancestral type. These relationships may be thus indicated, taking only a few of the characters of each :—



Mathematical Society, April 12.—Sir J. Cockle, F.R.S. President, in the chair.—The following communications were

made:—Continuation of a former paper on simplicissima, by W. J. C. Sharp —Synthetical solutions in the conduction of heat, by E. W. Hobson.—Symmetric functions, part ii., by R. Lachlan.—On a law of attraction which might include both gravitation and cohesion, by G. S. Carr.—Messrs. Buchheim, Larmor, and Greenhill spoke upon the various papers.

PARIS.

Academy of Sciences, April 9.—M. Janssen, President, in the chair.—Observations of the minor planets made with the great meridian instrument of the Paris Observatory during the third and fourth quarters of the year 1887, by M. Mouchez. The right ascension, polar distance, and correction of ephemerides are tabulated for thirteen of the minor planets.—On Gompertz and Makeham's laws of mortality, by M. J. Bertrand. Some arguments are advanced to show that, although he does not mention them, Thomas Simpson must have been acquainted with one or both of these laws.—Observations on the fixation of nitrogen by certain vegetable soils, by M. Berthelot. Some remarks are made in connection with the author's previous communications and M. Schlœsing's recent notes on this subject. It is pointed out that M. Schlœsing has not taken sufficient account of the experimental conditions which M. Berthelot has shown to be necessary in dealing with the question of nitrification.—On a new gas-thermometer, by M. L. Cailletet. This instrument, which has been for some time employed by the author, especially in connection with his researches, jointly made with M. Bouty, on the measurement of electric resistances at low temperatures, is described as of an extremely sensitive character, indicating differences of height of 2·36 millimetres for 1° of temperature. Being intended for measuring extremely low temperatures, it is charged with hydrogen as the expanding body.—Report on M. Delauney's astronomical communications, by the Commissioners, MM. Daubrée, Tisserand, and Faye. These communications, which were addressed to the Academy during M. Delauney's residence in Cochin-China, are now resumed in one volume, and are of an extremely varied character. They deal with the distances of the planets from the sun; the distances of the satellites from their respective planets; the distances of certain stellar groups from the central orbs of their systems; the distance of aërolites from the sun, their action on the solar spots, on our volcanoes, on the meteorological phenomena of our atmosphere, and on terrestrial magnetism; formation of the stellar systems, and especially that of Sirius, of which the sun itself, with Procyon, α Centauri, Vega, Arcturus, and others, would appear to be members. These, and other even bolder speculations, seem based on the three laws of distances here formulated by the author.—Observations of Sawerthal's Comet 1888 *a* made at the Paris Observatory (equatorial of the West Tower), by M. G. Bigourdan, and at the Bordeaux Observatory (0·38 m. equatorial), by MM. G. Rayet and Courty. The Paris observations cover the period from March 25 to April 6; those of Bordeaux from April 4–6.—Observations of Palisa's new planet, discovered April 3, 1888, made at the Observatory of Algiers with the 0·50 m. telescope, by MM. Trépied and Sy. These observations, made on April 4, give an estimated magnitude of 12·5 for this planet.—On M. Bertrand's geometrical curves, by M. G. Demartres. These curves are here considered as geodetic lines of ringed surfaces, and the following problem is proposed and discussed: To find the surfaces whose circular generator is inclined at the same angle, *i*, on the same family of geodetic lines, this angle, however, being capable of varying from one generator to the next.—Action of the tetrachloride of carbon on oxygenated mineral compounds free of hydrogen, by M. H. Quantin. It was long ago shown by Geuther that potassa and baryta raised to a red heat in the vapour of the tetrachloride of carbon are transformed to chlorides and carbonates. More recently the experiments of Demarçay and Quantin, since confirmed by Lothar Meyer, have shown that oxides which cannot be attacked by chlorine alone are under the same conditions also transformed to chlorides. In the present paper the author deals more fully with these phenomena, and generalizes the results already obtained.—On the sesquichloride of rhodium, by M. E. Leidié. After examining the processes hitherto employed in the preparation of the anhydrous sesquichloride, the author describes a new method in which the chlorine acts on the alloy of rhodium and tin, $RhSn_2$, described by Debray. He then gives the processes of preparation of some double chlorides formed by the hydrated sesquichloride.—On the passive property of nickel, by M. Ernest Saint-Edme. Having already described the results of his researches on the passivity of steel and iron, the author here deals with some of the conclusions he has obtained from the analogous study of nickel.—Action of the cyanide of zinc on some chlorides, by M. Raoul Varet. The results are described of experiments with the chlorides of mercury and copper, as well as with the alkaline chlorides. The general conclusion is arrived at that the cyanide of zinc does not enter into molecular combination with the chlorides.—Syntheses by means of cyanacetic ether (continued), by M. Alb. Haller. In the present paper the author deals with the higher homologues of acetylcyanacetic ether.—Heat of formation of aniline, by M. P. Petit. The heat of formation of aniline is here determined, both by the wet and dry processes, with fairly uniform results.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

A Key to the Mysteries of Water, Electricity, and Heat: W. Boggett (Trübner).—Die Catastrophe von Zug, 5 Juli, 1887 (Hofer and Burger, Zürich).—Zrání Oplození a Rýhování Vajíčka: Fr. Vejdovský (Prag).—Zeitschrift für wissenschaftliche Zoologie, 46 Band, 2 Heft (Leipzig).—Proceedings of the Academy of Natural Sciences of Philadelphia, Part 3, 1887 (Philadelphia).—Journal of Physiology, vol. ix. No. 1 (Cambridge).—Bulletin de la Société Impériale des Naturalistes de Moscou, 1888, No. 1 (Moscou).—Proceedings of the Geologists' Association, No. 87 (Stanford).—Botanische Jahrbücher für Systematik, Pflanzengeschichte, und Pflanzengeographie, Neunter Band, 4 Heft (Williams and Norgate).—Annalen des k. k. Naturhistorischen Hofmuseums, 1887 (Wien).—Journal of Comparative Pathology and Therapeutics, Part 1 (Johnston).—Journal of the Society of Telegraph-Engineers and Electricians, No. 71 (Spon).—Journal of the Asiatic Society of Bengal, vol. xvi. Part 2, Nos. 2 and 3 (Calcutta).—Journal of Anatomy and Physiology, April (Williams and Norgate).—Sitzungsberichte der k. b. Gesellschaft der Wissenschaften. Math. Naturw. Classe, 1886 (Prag.)—Bericht über die Math. und Naturw. Pubn. ii. Heft (Prag).—Geschichte der k. b. Gesellschaft der Wissenschaften, Zweites Heft (Prag).—A Higher Arithmetic and Elementary Mensuration: P. Goyen (Macmillan)—Next of Kin Marriages in Old Irân: D. P. Sunjana (Trübner).—Mechanics and Experimental Science: *Chemistry*, C. Aveling (Chapman and Hall).—The Minerals of New South Wales, &c.: A. Liversidge (Trübner).—Dissolution and Evolution and the Science of Medicine: C. P. Mitchell (Longmans).—Notes from the Leyden Museum, vol. 9, Nos. 1 and 2 (Leyden).—Journal of the Royal Statistical Society, March (Stanford).—Journal of the Chemical Society, April (Gurney and Jackson).—Bulletin de l'Académie Royale des Sciences de Belgique, No. 2 (Bruxelles).—Journal of the Royal Microscopical Society, April (Williams and Norgate.—The Auk, April (New York).—Mittheilungen der Naturforschenden Gesellschaft in Bern, 1887 (Bern).—Verhandlungen der Schweizerischen Naturforschenden Gesellschaft in Frauenfeld, 1886–87 (Frauenfeld).—Quarterly Journal of the Royal Meteorological Society, January (Stanford).

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