quantities occur in mathematical physics. Du Bois, in his book on magnetic circuits, has given a table of six cases. Prof. Nipher's discovery was effusively welcomed by Prof. Silvanus Thomson, but it was amusing to find one of the English technical journals editorially refusing to admit its truth, on the ground that the current from an electrode in the form of a spherical bowl in an infinite conductor would probably not be distributed in like manner to the lines of force from an electrified bowl in air.

After the chapter on electrostatics, of the large number of examples worked out, nearly all are of practical interest. In fact, the principal complaint that we have to make of the book is that it seems written for engineering students. Practically, of course, this is the reverse of a disadvantage. There is a large amount of arithmetic in the book, which again, although repulsive to some in an 'advanced' book, will be very welcome to many. There are a number of excellent figures, some of them quite original, an interesting one being of a surface showing the doubtless dependence of the strength of an alternating current on self-induction and capacity. Although the dynamo and transformer, including the tri-phase system, receive ample treatment, there is, for those who do not find examples enough in the body of the book, a chapter of well selected problems at the end. There is also a chapter on units, in which both systems are treated, although nothing is said about keeping κ and μ in the formulas. The names given the practical units by the American Institute of Electrical Engineers are mentioned. We notice the curious spelling 'culomb,' which seems neither fish, flesh nor fowl. Each of the above books has a good index. In conclusion we may be permitted to express the wish that every student of electrical engineering might learn at least as much theory as is contained in one or the other of these books. We hope that their appearance will not cause anyone to suppose that Maxwell may now be laid on the shelf.

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WINGE ON BRAZILIAN APES.

MR. HERLUF WINGE has recently published his fourth paper on the mammals of the province of Minas Geraes, Brazil.* In this quarto of 45 pages the author deals with the Primates as he has already treated the rodents, bats and marsupials. The material on which the present study is based was brought to the Zoölogical Museum in Copenhagen by Lund and Reinhardt.

As in the earlier numbers of the series, this paper consists of three parts: (1) nominal lists of the species; (2) a detailed enumeration of the species, with critical notes on the relationships of the forms whose remains are found in the cave deposits ('Jordfundne'), and those now living ('Nulevende') in the immediate vicinity of the caves; (3) a review of the mutual relationships of the members of the group.

The paper is illustrated by two plates reproduced from photographs of actual specimens. While the results attained by this process are not as uniform as could be desired, the figures on the whole are satisfactory, especially those of the skull of *Callithrix*.

Five species of apes are represented in the collections, *Callithrix personata*, *Mycetes seniculus*, *Hapale penicillata*, *Cebus fatuellus* and *Eriodes brasiliensis* (*Eriodes* '*propithecus*' Winge). Four of these are found both in the cave deposits and living in the vicinity of the caves. Except in the case of *Callithrix personata* the cave bones agree perfectly with those of recent specimens. The single femur of *Callithrix* found in the Lapa da Serra das Abelhas is slightly larger than that of living examples and has the ridges for muscular attachment rather more sharply defined, but is not specifically distinct from *C. personata*. The only extinct species is *Eriodes brasiliensis* (Lund), the living representatives of which occur in extreme southern Brazil.

Mr. Winge applies the new specific name *propithecus* to *Eriodes brasiliensis* because the other species of the genus are also Brazilian, and because the term *propithecus* originally proposed by Lund as the generic name for a group now considered congeneric with *Eriodes* should

* *Jordfundne og nulevende Aber* (*Primates*) *fra Lagoa Santa, Minas Geraes, Brasilien.* Med Udsigt over Abernes indbyrdes Slægtskab. Af HERLUF WINGE. Aftryk af 'E Museo Lundii,' en Samling af Afhandlinger om de i Brasiliens Knoglehuler af Professor Dr. P. W. Lund udgravede Dyre- og Menneskeknogler. Paa Carlsbergfondets Bekostning udgivet ved Professor Dr. C. F. Lütken. Kjöbenhavn, 1895.

not be allowed to disappear from nomenclature.* Fortunately very few systematic zoölogists thus disregard the law of priority.

The last and most general part (pages 9 to 32) begins with a detailed enumeration of the changes that take place in the body during the evolution of the apes from ancestors with bodies in the normal, horizontal position, and in which progression took place by ordinary running and jumping. Mr. Winge's account of the development of the limbs is substantially as follows: The *Primates* were originally raised above the level of the *Insectivora* through special improvement in climbing. Even in the most arboreal of the *Insectivora* (the *Cladobatidæ*) progression is rather by running and jumping among the branches than by true climbing. The apes, however, climb very differently. The hands and feet seize and hold fast to the branches, and the limbs, especially the arms, lift the body and draw it forward. The fingers and toes clutch the branches and in this way take upon themselves the work formerly done by the claws. Since the claws serve no longer as hooks for clinging, they degenerate and become more like nails fitting the shape of the terminal phalanges which on their part are squeezed flat by the pressure of the fingers and toes upon the branches. To improve the grasping power of the hand and foot, the thumb and great toe stand out from the other digits and become opposable to them. At the same time the thumb and great toe increase in size and strength, while the positions of their articulations, as well as the form of the bones to which they are attached, are necessarily altered. As a result of efforts to accomplish a variety of movements in all directions, the limbs become more independent. The thigh and upper arm are held less closely to the sides and are no longer bound by a covering of the body skin. As the limbs become more free the muscles which work them undergo modifications. In the arms the *supraspinatus*, *infraspinatus* and *subscapularis* increase in strength and produce great changes in the form of the shoulder blade. The *deltoideus* shows its increased power by causing the clavicle to grow heavier. Of the muscles which work the legs the *glutæi* and *iliacus internus* produce the most noticeable changes in the bones to which they are attached. Since the fore limbs are little used as supports for the body, the shoulder blades lose the nearly perpendicular position which they occupy as a mechanical necessity in most terrestrial mammals. To permit freer motion of the limbs the joints either retain the structure characteristic of the Insectivora or become even more loose, especially in the arm, hand, fingers and toes. At the same time the radius and ulna become mutually more free, while the latter loses its connection with the wrist. The metacarpals degenerate somewhat, becoming at length small and flat, their articulations with the proximal phalanges taking on a form which approaches the ball and socket joint. The two small sesamoid bones under each metacarpal degenerate, and the ridges on the latter on each side of which the sesamoids play disappear. The more varied the motions of a limb, the less strength exerted in each movement. The muscles of the limb become, therefore, more evenly developed, none of them increase at the expense of the others, and the bones do not give off strongly projecting ridges. Two of the movements which in most animals are performed oftenest and with most strength, the simple flexion of the elbow and ankle, are now less frequent. Hence the *triceps* and *gastrocnemius* have less influence over the other muscles, while the *processus anconeus* and the *calcaneum* have a tendency to become weaker. In the primates, entirely contrary to what occurs in ordinary running and springing animals, the arms become of more importance than the legs, because in true climbing the former are used most. The lengthening arms force the body to take on a more and more upright position during progression, so that when the arms have become very long, walking on all four feet is so difficult that it is entirely abandoned, and the body is at length held in equilibrium over the hind limbs.

*"*Propithecus* kan ikke opretholdes som egen Slægt; den falder sammen med *Eriodes*. Strengt taget skulde Arten fra Lagoa Santa derefter kaldes *Eriodes brasiliensis*, et Navn, der dog vilde være for intetsigende; ogsaa Slægtens andre Former kjendes fra Brasilien. Det er foretrukket at give Arten et 'nyt' Navn, *Eriodes propithecus;* Ordet *Propithecus* fortjener ikke at forsvinde." No. 2, p. 24.

After enumerating in a similar manner the changes that occur in other parts of the body, especially in the vertebræ, brain and mouth, the author gives a detailed study of the inter-relationships of the different groups of monkeys and lemurs. Space will not permit an analysis of this part of the work, but the following table of supergeneric groups (p. 12), arranged according to their greater or less resemblance to the *Insectivora*, gives a concise synopsis of the conclusions reached by Mr. Winge.

- Lemuroidei.
  - Tarsiidæ.
    - Adapini.
    - Tarsiini.
  - Lemuridæ.
    - Nycticebini.
      - Otolicini.
      - Nycticebi.
    - Lemurini.
      - Lemures.
      - Propitheci.
- Ceboidei.
  - Cebidæ.
    - Mycetini.
      - Callitriches.
      - Pitheciæ.
      - Mycetæ.
    - Hapalini.
    - Cebini.
      - Cebi.
      - Ateles.
  - Simiidæ.
    - Simiini.
      - Hylobatæ.
      - Homines.
      - Simiæ.
    - Cercopithecini.
      - Cercopitheci.
      - Cynocephali.

GERRIT S. MILLER, JR.

Palæozoic Fossils (Vol. 3, Part II.). By J. E. WHITEAVES. Geological Survey of Canada. Ottawa. 1895.

This publication contains two papers: (1) Revision of the fauna of the Guelph formation of Ontario, with descriptions of a few new species, and (2) Systematic list, with references, of the fossils of the Hudson River or Cincinnati formation at Stony Mountain, Manitoba. In the first paper 130 species and varieties are enumerated, and it may be considered as a complete list of the fossils so far known from the Guelph of Canada. The new species described are *Monomerella durhamensis*, *Pleurotomaria velaris*, *P. halei* var., *P. townsendii*, *Loxonema magnum* var., *Polytropis durhamensis*, *P. parvulus* and *Illænus aboynensis*.

The second paper dealing with fossils from Stony Mountain is interesting as a systematic list of all the fossils from this lonely outlier of the Cincinnati group of the Lower Silurian. The rocks are said to be 'identical, both in their lithological and paleontological characters, with the well-known rocks of the Hudson River or Cincinnati group of southern Ohio and elsewhere.' If this be the case it is interesting to note the presence here of a species of *Favasites* (*F. prolificus*, perhaps only a variety of *F. gothlandicus*) well known as a Niagara fossil in Ohio, but not yet found in the true Cincinnati rocks. Most of the others are well-known fossils occurring in Ohio, although appearing under names not given in the older volumes on Paleontology of New York or Ohio. The plates in the pamphlet, seven in all, are beautifully lithographed. J. F. J.

Contributions to a Biography of Linnæus. By TH. M. FRIES.

Prof. Th. M. Fries, of Upsala, Sweden, has for a number of years been engaged in a critical study of the life of Linnæus, and the first instalment of his forthcoming work was some time ago published in the University Annual. The paper treats of the early life of the great naturalist up to the time of his entering the University of Upsala at the age of twenty-one.

The author is clearing away some of the fictions with which the earlier biographers have sometimes adorned their accounts of the career of the 'Flower King.'

While it is true that Linnæus did not come of a distinguished line of ancestors, the author shows that he was no exception to the laws of descent and of inheritance of mental traits, as some have made it out. His male ancestors on his mother's side belonged to the clergy and had for three generations been rectors in the same parish, and his lineage on his father's side extends into the best peasantry of Småland. It is also noted that both of his parents took much interest in gardening and in the culture of flowers. With the relatives of his father, the author says, this seems to have been an often recurring trait. An uncle of Linnæus' father, while in the employ of the Count von Horn, of Germany, as private chaplain, devoted himself with great zeal to the study of horticulture, and laid out a garden for his master according to the requirements of the art of gardening at that time. Later on when this gentleman had returned to Sweden he planted a garden, in which were grown a number of species not previously cultivated in his native country. It was among these plants that Carl's father, Nils Linnæus, acquired a lasting interest in gardening, and several years afterwards, while a student at the University of Lund, he busied himself learning the Latin names of various kinds of plants, and 'put up with his own hand' an *herbarium vivum* of fifty plants. This was somewhat unusual for a student at that time. While rector at Stenbrohult Nils Linnæus in his turn had a garden, which surpassed everything before seen in that part of the country, and in which were found several hundred exotic, mostly ornamental, plants.

All of Linnæus' biographers tell of his early fascination for the beauties of flowers. We have heard the story of his own little plantation, maintained in a corner by itself and duplicating most things grown about the parsonage. We are informed that at the age of four his curiosity prompted him to make inquiries of his parents for the names and properties of different plants and to go out into the fields and meadows to look for flowers. It is well known that the predilections of the child early matured into the earnest inquiries of the student and the investigator. On this point there have been no opportunities for fiction or exaggeration. Not so with some other features of his earlier life. He has by some been represented as a stupid scholar in everything not pertaining to natural history. On this point Prof. Fries brings forth evidence that such was not the case.

The records of the gymnasium show that Carl Linnæus was regularly promoted, from year to year, through the several classes of the preparatory school and that he was in due time promoted to the Wexio gymnasium at the age of seventeen, ranking eleventh in a class of eighteen members. The author admits that Linnæus neglected the studies of theology, Hebrew, composition and philosophy (logic), which subjects were then regarded as the most important ones, as nearly all of the students were supposed to prepare for the clerical profession or to take up, later on, an administrative career. In mathematics and in physics Linnæus was always among the best students in the class. In the Latin language he was quite proficient, even for the times he lived in, as is evident from the ease with which he used this language in his writings.

Prof. Fries throws some new light on one circumstance which has been quite generally misunderstood. The teachers at Wexio have been made the objects of much unjust censure from Linnæus' biographers for having advised his father to take the young man out of school and have him learn some trade. Even Linnæus himself in his older days of failing memory refers to the advice of these men in a piquant manner. But it is quite probable that this advice was given in the way of emphasizing their disapproval of the young man's neglect of some of his studies. Considered from this point of view, it was quite natural and proper for the teachers to give such advice to the parent of a son, who had slighted several of the subjects regarded as of the greatest importance for his future. The same course would no doubt be taken by the teachers in our own schools of to-day. The ridicule and the criticisms of these men have evidently been prompted by a desire to give a brighter lustre to a great name.

In a similar way it has been represented that on his departure for the University of Lund Linnæus was not properly recommended by the rector of Wexio gymnasium in this gentleman's letter of dismissal. But it is pointed out that this letter itself must silence such representations. The rector wrote: "As nature in the vegetable kingdom offers pleasant spectacles when she hastens and favors the growth of the plants as they are removed to a new place, so the muses pleasantly exercise their power when bidding young men with great talents take up their studies at another place. * * With this purpose the muses now call * * Carl Linnæus, a particularly excellent young man, of a good family, etc., from our gymnasium to the University." Then follow the usual good wishes for the future welfare of the scholar. The rector in this letter evidently betrays an appreciation of Linnæus' character and ability and his words indicate that he had some expectations as to the future career of his pupil.

The further treatment of the later life and work of the great naturalist will be awaited with interest. The author remarks that no biography of Linnæus can do him justice, unless it be written on the basis of a thorough knowledge of all the sciences to the development of which he gave his attention. It is only by comparison of these sciences, in the condition in which they were before his time and in the state to which they were brought by his efforts as an investigator and by the powerful impetus of his teaching, that we can truly appreciate the greatness of his work and see its influences extending into our own time. In this age of specialization there is perhaps no one man who has such a wide knowledge of these branches as would be required; and a full account of Linnæus as a man of science would require the coöperation of several men interested in the different departments of natural history.

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PHYSICAL REVIEW, VOL. III, NO. 3, NOVEMBER-DECEMBER, '95.

Variation in Electrical Conductivity of Metallic Wires in Different Dielectrics. By FERNANDO SANFORD.

In a paper published in 1892 Prof. Sanford presented the results of observations on the resistance of copper wires when immersed in different dielectrics, and reached the conclusion that the conductivity was to some extent dependent upon the nature of the dielectric, quite apart from incidental temperature changes, leakage, etc. The change observed in the resistance was small, amounting to not more than 0.2%. Since that time similar measurements have been undertaken by at least one other observer in the hope of verifying Prof. Sanford's conclusions, but without success. The original papers have in fact been quite generally and severely criticised.

In the present paper Prof. Sanford discusses the sources of error which have been suggested as accounting for his results, and calls attention to the fact that his conclusions have recently been qualitatively verified by Grimaldi and Catania with more accurate apparatus than he had himself used. The paper also contains the results of further observations on copper and silver wires. The amount of the resistance change was found to differ greatly with different samples of wire; but the direction of the change was always the same for a given material. Thus the resistance of copper was less in petroleum than in air, while with silver the resistance was found to be less in air. Strangely enough the behavior of a silver wire which had been copper-plated was almost identical with that of pure silver. The results obtained are certainly difficult of explanation, but are the more interesting on that account.

A Study of the Polarization of the Light Emitted by Incandescent Solid and Liquid Surfaces. II. By R. A. MILLIKAN.

The first half of this paper, dealing with the qualitative study of polarization by emission, has already been noticed in SCIENCE. In the present article the subject is treated quantitatively. The substances investigated were platinum, silver, gold and iron, the first two mentioned proving most satisfactory.

By means of a simple but accurate polarimeter the amount of polarization was measured at different angles of emergence. The results were then compared with the values given by Cauchy's theory of metallic reflection, upon the assumption that the polarization is due to the refraction of the rays from the interior on emerging from the surface. The agreement between the computed and observed values is quite striking, and makes it appear that refraction at emergence offers a satisfactory explanation of the phenomena in all the cases investigated. The agreement is especially good in the case of molten silver.

Observations upon the light developed by fluorescence at the surface of Uranium glass show that the light is polarized much in the same way as the rays from an incandescent surface. Here, too, the effect may be explained as a result