THURSDAY, NOVEMBER 21, 1912.

THE MECHANISTIC CONCEPTION OF LIFE.

The Mechanistic Conception of Life. Biological Essays by Dr. Jacques Loeb. Pp. vi+232. (Chicago, Illinois: University of Chicago Press; London: Cambridge University Press, n.d.) Price 6*s.* net.

THIS book deals for the most part with facts derived from the author's own experimental work. The facts are set forth in a manner easily to be understood, in a series of essays, most of which have already appeared in print, and the general nature of which can be inferred from their titles, viz., the significance of tropisms for psychology; the comparative physiology of the central nervous system; pattern adaptation of fishes; physiological morphology; the nature of fertilisation; the nature of formative stimulation; the prevention of death by fertilisation; the rôle of salts in the preservation of life; the influence of environment on animals. That these diverse subjects are closely interwoven and that the facts which are cited point to a definite conclusion regarding the nature of life is demonstrated in the first essay, which gives the title to the work, and it will be best to confine attention mainly to that one, since it would require more space than the Editor could fairly be expected to place at my disposal to deal at any length, and in the manner it deserves, with each individual paper of the series.

The results at which Prof. Loeb has arrived are best expressed, wherever possible, in his own words—they are, indeed, stated so clearly and concisely that it would be superfluous to attempt to set them forth in other language than that which he has himself employed.

In connection with phenomena characteristic of life, he begins by pointing out that the first attempt to reduce such a phenomenon—that of the production of animal heat—to physico-chemical terms was made as long ago as 1780 by Lavoisier and Laplace, an attempt which has now been successfully converted into accomplishment. As the author remarks, this work touches the core of the problem of life, since "oxidations form a part, if not the basis, of all life phenomena in higher organisms."

With regard to the so-called "riddle of life," Prof. Loeb of necessity admits that we are not yet able to give an answer to the question as to how life originated on the earth. Whilst leaning towards the idea of Arrhenius that life germs may be driven through space by radiation-pressure, he emphasises the necessity of attempting the "other problem"—that, namely, of producing living matter artificially. The kind of living matter that he expects to be thus produced is that which constitutes nuclear substance. For the nucleins have the peculiarity of acting on ferments for their own synthesis, and thus reproducing themselves. Whoever claims to have succeeded in making living matter from inanimate will have to prove that he has succeeded in producing nuclear material which acts in this way. "Nobody has thus far succeeded in this, although nothing warrants us in taking it for granted that the task is beyond the power of science."

Regarding fertilisation of the egg, it is shown that only a short while ago this was still "shrouded in that mystery which to-day surrounds the origin of life in general," but the problem is to-day reduced to physico-chemical terms, since activation is determined by chemical or even by mere physical agencies.

Discussing the question of the nature of life and death, "which occupies the interest of the layman perhaps more than any other problem," the author remarks that "we can well understand that humanity did not wait for experimental biology to furnish an answer. The answer assumed the anthropomorphic form characteristic of all explanations of nature in the prescientific period. Life was assumed to begin with the entrance of a "life-principle into the body. . . . Death was assumed to be due to the departure of this 'life-principle.'" Scientifically, however, individual life "begins with the acceleration of oxidation in the egg," and "ends with the cessation of oxidation in the body." The problem of the beginning and end of individual life is thus physico-chemically clear, and the doctrine of a "life-principle" must be abandoned.

Dealing with the subject of heredity, an interesting account is given of the discovery of the sex chromosomes and their relation to the Mendelian theory. Whilst admitting that science has yet to determine the chemical substances in the chromosomes which are responsible for hereditary transmission of qualities and the mechanism by which they act, the author shows that a commencement has already been made, since it is known that for the formation of a certain black pigment transmitted through the male element, the cooperation of tyrosin and tyrosinase are required, and the chromosome must carry substances which determine the formation of these. "While until twelve years ago the field of heredity was the stamping ground for the rhetorician and metaphysician, it is to-day perhaps the most exact and rationalistic part of biology." Thus the phenomena of fertilisation and heredity, which "are

specific for living organisms and without analogues in inanimate nature," are both shown to be susceptible of a physico-chemical analysis.

The question of adaptation is next dealt with. "In the answer to this question, the metaphysician finds an opportunity to put above purely chemical and physical processes something specific which is characteristic of life only." But the phenomena of adaptation only cause apparent difficulties because "we rarely or never become aware of the numerous faultily constructed organisms which appear in nature." "The number of species existing to-day is only an infinitely small fraction of those which can, and possibly do, originate," but which "cannot live and reproduce." "Disharmonies and faulty attempts in nature are the rule, the harmonically developed systems the rare exception. But, since we only perceive the latter, we gain the erroneous impression that the "adaptation of the parts to the plan of the whole" is a general and specific characteristic of animate nature." "Nobody doubts that the durable chemical elements are only the product of blind forces. There is no reason for considering otherwise the durable systems in living nature."

Lastly, the author discusses the question whether what he terms the "contents of life" or "inner life" (psychical life)—"our wishes and hopes, disappointments and sufferings"—are also amenable to a physico-chemical analysis. In spite of the gulf which separates us to-day from such an aim, he believes that it is attainable. "As long as a life-phenomenon has not yet found a physico-chemical explanation, it usually appears inexplicable." But that in the case of one's inner life such an explanation is possible is shown by the fact that we are able to explain the phenomena of animal tropisms, which are cases of simple manifestations of animal instinct and will, on a physico-chemical basis. Thus, to take as an example the tendency of certain animals—some of them by no means low in the scale of organisation—to be attracted to a source of light. This appears to be explicable by the law of Bunsen and Roscoe for photochemical effects in inanimate nature, which states that within wide limits the effect equals the product of the intensity of light into the duration of illumination; although the direct measurements in regard to the applicability of the law to animal heliotropism have still to be made. "But we may already safely state that the apparent 'will' or instinct of these animals resolves itself into a modification of the action of the muscles under the action of light; and for the metaphysical term 'will' we may in these instances safely substitute the chemical term 'photochemical action of light.'"

But the point will naturally be raised: "If we are only chemical mechanisms, how can there be an ethics for us?" The answer is that our instincts are the root of our ethics, and that these instincts are hereditary. The mother loves and cares for her children, not because metaphysicians had the idea that this was desirable, but because the instinct of taking care of the young is inherited. We seek and enjoy the fellowship of human beings because we have a hereditary impulse so to do. "Not only is the mechanistic conception of life compatible with ethics: it seems the only conception of life which can lead to an understanding of the source of ethics."

The above quotations will suffice to show that, with regard to the nature of living processes, Prof. Loeb speaks with no uncertain sound, and it would be well for biologists of the arm-chair and rostrum variety to bear in mind that he also speaks with the authority of personal experimentation and first-hand observation. E. A. SCHÄFER.

THE FRENCH ARTHURIAN ROMANCES.

The Vulgate Version of the Arthurian Romances. Edited from manuscripts in the British Museum by H. Oskar Sommer. Vol. i., "Lestoire del Saint Graal." Pp. xxxii+296. (1909.) Vol. ii., "Lestoire de Merlin." Pp. 446. (1908.) Vol. iii., "Le Livre de Lancelot del Lac." Part i. Pp. ii+430. (1910.) Vol. iv., ditto. Part ii. Pp. 399. (1911.) Vol. v., ditto. Part iii. Pp. 474. (1912.) (Washington: Carnegie Institution.)

THESE sumptuous volumes are priceless gifts to the world of scholarship by the Carnegie Institution of Washington. No one knows better than the erudite editor, whose studies of the sources available are well known, "both from a physical and from a pecuniary point of view, that no single scholar was equal to the task of producing a critical text of the vulgate cycle, even if he devoted the better part of his life to the work, and that it could be achieved, within a measurable space of time, only by the united efforts of many, all working on a common basis."

What the editor has accomplished, single-handed as he tells us, is the erection of a "fundamental structure" in the form of a "reliable printed edition of a manuscript which contained the whole cycle, and was provided with all the essentials for comparison and reference" (vol. i., pref. iii., iv.). That the transcript he presents us with may be depended on is well assured by the *modus operandi* used. The preparation of the transcript for press fully occupied the author's time for three years and seven months. "I have

read every line of the printed text five times, three times with the original manuscript, once with my transcript, and finally without either" (*ib.*). For checking his reading of the original manuscript, he "constructed a sliding indicator with a cardboard ruler covered with soft leather, a strong ribbon of silk attached to a small leather-bag for the reception of a lead-weight, and a clip to be attached to the stand on which the manuscript was placed; this was easily moveable from line to line, and just as easily transferable from column to column and from leaf to leaf" (pref. xxviii.).

In his introduction (vol. i.) the editor gives an outline of his studies of the vulgate cycle, as the French version of the Arthurian prose-romances is called. That version "represents the ultimate stage in a process of welding heterogeneous elements into a not very harmonious whole" (pref. vii.). In other words, the version is the furthest removed, barring still later modifications, from the original sources. Even between that version and the older strata of the Welsh Mabinogion and their Irish analogues is a great gulf fixed, and the latter again are now well proven to be late Celtic versions of pre-Celtic traditions. The French romances throw very little light on the ultimate sources. On the other hand, the evidence of deliberate adaptation to mediæval conditions is in these volumes most apparent. The Welsh and Irish extant sources are downright pagan productions, with very little to show that we are indebted for them to Christian ecclesiastics.

The French version is, or once was, popular Christian theological literature. The core of the typical tale of the conception and birth of an illustrious child of an unknown father and a king's wife or daughter appears in the Welsh and Irish versions as something separate from any moral considerations, and while it may reflect a state of society far removed from ours, it seems fairly clear that such tales were not originally intended to represent actual human relationships and conditions, but were rather symbolical representations of phenomena. We must come down to the vulgate cycle to find in such legends the element of sin. The editor has clearly discerned the essential change which ensued in the character of the legends when he remarks: "Syr Lancelot, the title-hero of the huge romance of that name, has no prototype in Celtic literature" (pref. viii.). He is simply a Frenchman of the twelfth century. One cannot compare the groups of legends referred to without being deeply impressed with the comparative worthlessness of the French romances as guides to prehistoric cults, customs, and manners.

As French literature, the materials must, of course, be seriously treated. The editor, in justly claiming recognition for the noble work he has done, expresses himself here and there rather unfortunately.

"I shall be glad if I have succeeded in pointing out the path on which others after me may advance to success, for then I shall have done more than any scholar has achieved before me in these studies" (pref. v.). "Scholars of various nationalities have devoted much time and effort during the last seventy years to the study of the origin and growth of the Arthurian romances, but the results of their labours are comparatively insignificant, and have done little to open up this vast tract of romantic literature" (pref. iii.).

In penning such sentences, the editor must have discarded his "sliding indicator." Conscious of the soundness of his weapon—his excellent transcript—and his intimate knowledge of the subject, he appears rather eager for a free all-round fight. He announces that his study of the manuscripts concerned has led him to "results considerably at variance with what has hitherto been accepted as probable and correct" (pref. vii.). He asserts that the *matière de Bretaigne*, although undoubtedly the fountain-head of many episodes and adventures in Arthurian romance, has exercised an infinitesimal, if any *direct*, influence on the several branches of the vulgate cycle (*ib.*). He does not believe that Walter Map had anything to do with the French prose-romances (pref. xi., note). As transcribers form an absolutely indispensable class, we have learnt to tolerate almost anything they are pleased to say. To supply others with excellent texts, with never a chance to preach a sermon from them, would have been very hard lines indeed.

JOHN GRIFFITH.

GEOGRAPHICAL TEXT-BOOKS AND GUIDES.

(1) *A First Book of General Geography.* By B. C. Wallis. Pp. viii+151. (London: Macmillan and Co., Ltd., 1912.) Price 1*s.* 6*d.* (First Books of Science.)

(2) *Maps: How they are made; how to read them.* By Prof. H. N. Dickson. Pp. 66. (London: G. W. Bacon and Co., Ltd, 1912.) Price 6*d.*

(3) *Black's Modern Guide to Harrogate.* Edited by Gordon Home. Pp. 128+12 coloured plates. (London: A. and C. Black, 1912.) Price 1*s.*

(4) *Les Alpes de Provence: Guide du Touriste, du Naturaliste et de l'Archéologue.* By G. Tardieu. Pp. vi+310. (Paris: Masson et Cie., 1912.) Price 4.50 francs.

(5) *Regional Geography: the World.* By J. B. Reynolds. Pp. vii + 360. (London: A. and C. Black, 1912.) Price 3*s.* 6*d.*

(6) *Libya Italica: Terreni ed Acque, Vita e Colture della Nuova Colonia.* By P. Vinassa de Regny. Pp. xv + 214. (Milano: Ulrico Hoepli, 1913.) Price 7.50 lire.

(1) MR. WALLIS rightly begins his elementary general geography with a note about pictures, plans and maps, and establishes a connection between them so as to show the pupil how certain features appear (for instance) on a photograph and on a map respectively, and how a map is for some purposes a clearer representation than a picture if rightly interpreted. The book generally is on a regional basis, and the usual connection is established between climatic and other phy' cal conditions, economic and natural products, and the life of man. The whole is clear and simple, and not overloaded with detail. There are some good maps among the illustrations.

(2) There can no longer exist any excuse for ignorance in the matter of map-reading and map-construction when so convenient and cheap a book on the subject as Prof. Dickson's is accessible. It is so well produced, and, above all, so fully illustrated, that its cheapness is especially a matter for remark, while the simple explanation of scales and conventional signs of the various methods of representing relief and so forth are admirable. Incidentally we find a few useful explanations of certain terms in physical geography which are not infrequently misused, and there is also some indication as to the general inferences which can be drawn from a good map as to the nature of a country. Thus, there are some interesting paragraphs on lines of communication, with illustrations of typical routes for various types of conveyance across a given piece of country.

(3) The feature of Messrs. Black's new guide to Harrogate and its neighbourhood is that of an alphabetical arrangement under names of places, so far as concerns the environment of Harrogate, and to some extent under subjects as regards the place itself. This undoubtedly adds to ease of reference. The volume is of convenient size and light; it is also well mapped. The appreciation, or otherwise, of the three-colour illustrations may be a matter of taste.

(4) The guide under notice to the Alps of Provence is chiefly to be commended for the prominence and greater space than usual which are given to a general dissertation on the physical, geological and other natural features of the region. Apart from this, both the printing and illustrations reach a standard in advance of many guide-books printed abroad which have come under our notice.

(5) Miss Reynolds's "Regional Geography of the World" will probably be of greatest service as a topographical introduction to the regional system of geographical teaching which is now so widely applied. The general regional conclusions are deferred to the end and are disposed of briefly, though Miss Reynolds points out that it is optional to the teacher to take them at the beginning, and probably many will do so. Topography and economic products receive specially careful attention throughout the book. The maps are not always carefully printed and occasionally are difficult to read, while those given to illustrate political features of the European countries and elsewhere are old-fashioned and scarcely worth their space in the volume.

(6) The production of a volume dealing with Tripoli under the name of "Italian Libya," and bearing the date of next year, is an example of publishing enterprise not untinged with humour; but the book itself is a thorough geographical study of the region. The morphology and topography are first dealt with, and later the climate, hydrography, vegetation and other natural features are successively outlined, with appropriate bibliographies, tables and illustrations, the last in ample numbers. There is a particularly clear geological map in colour, worked out by the author.

OUR BOOKSHELF.

Customs of the World. A Popular Account of the Customs, Rites, and Ceremonies of Men and Women of all Countries. Edited by W. Hutchinson. Part i. (London: Hutchinson and Co., 1912.)

THIS is the third division of the valuable series of works on popular anthropology which we owe to the enterprise of Messrs. Hutchinson. Part i., which is now before us, sufficiently indicates the scope of the publication.

Dr. Haddon supplies a useful general introduction, in which he illustrates the importance of the subject. Custom he defines to be unwritten law. It depends primarily on the environment, that is, the conditions under which each group, the customs of which are being examined, secures its livelihood. The geographical control, while it is more marked among races the culture of which is of the primitive type, tends, with advance in civilisation, to become more or less negligible, but is never entirely lost. Generally speaking, some of the most primitive customs are those of a magical nature, intended to secure the most elementary needs of humanity, such as the periodical growth of plants or animals used for food, the causation of rain or sunshine, and so on. With the more complete organisation of the group we reach those customs which represent the influence of the collective emotion of its members, such as rites of initiation, birth, marriage, and death, all of

which are social, not individual. Combined with these comes the growth of totemism and the recognition of emotions which we class indiscriminately as religious.

The first part of the work is devoted to an account of the customs in Melanesia, contributed by Mr. R. W. Williamson. Needless to say, this instalment is illustrated by a fine series of photographs.

The work, as a whole, if it does not make all its readers anthropologists, is admirably designed to excite popular interest in a most fascinating science.

Grundriss der Biochemie für Studierende und Aerzte. By Prof. Carl Oppenheimer. Pp. vii + 399. (Leipzig: Georg Thieme, 1912.) Price 9 marks.

THE title of Prof. Oppenheimer's book is somewhat misleading. One expects to learn something fundamental about the chemistry of living organisms, but the subject matter is mainly concerned with the chemistry of mammalian functions.

The book is divided into two sections. The first consists of a description of chemical substances. As such it comprises a synopsis of organic chemistry with references to the biological source and significance of the substances described. The second section contains a brief outline of the chemical processes concerned in mammalian physiology.

The scope of this book indicates that it is intended for medical students preparing for their examination in physiology. The compressed descriptions render the reading dull, and at the same time the amount of information is not sufficient to make the book useful for reference purposes. Bearing these points in mind there is no doubt that the author has accomplished his purpose. There is a clear, short statement concerning the chemical properties of the different compounds found in the body, a description of enzyme action, and an outline of the chemical processes concerned in the activity of the body. A knowledge of the facts described would enable a student to pass any ordinary examination in physiological chemistry. H. E. R.

Legends of our Little Brothers: Fairy Lore of Bird and Beast. By Lilian Gask. Pp. 268. (London: G. Harrap and Co., n.d.) Price 3*s.* 6*d.* net.

THESE stories, retold from the folk-lore of many lands, will inspire sympathetic interest in animal life in the young readers for whom they are written. From every point of view they are far better than the grotesque tales often supposed to be suitable for children. They tell of self-sacrifice, right relations of man to the creatures around him, the blessing of pity, the wrong of wanton killing, the suffering caused by thoughtlessness, the origin of the totem as the bond of union between men, and many like matters. We have read the stories with interest, and congratulate the author upon her rendering of them. As a gift-book the collection merits wide distribution.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

The Investigation of Flint.

THE remarkable body which we know as "flint" was, in the early history of mankind in this part of the world, as important, relatively to the general conditions of life, as the metal "iron" is at the present day. In order to interpret correctly the significance of fractured flints—whether as due to man's agency or to other causes—and also in order to infer from the glaze, polish, colour, opacity, or other features of a humanly worked flint what are the geological and other physical conditions to which it has been subjected, very definite and accurate knowledge of flint, only to be arrived at by careful quantitative investigation, such as the skilled physicist and chemist can bring to bear, is necessary. Yet the entire scientific world is in a remarkable state of ignorance with regard to flint.

Flint has been neglected by the geologist, mineralogist, chemist, and physicist for reasons which are not very obvious. At the present moment there is great need for a thorough study of flint, a study which no one man can undertake and carry through. At the same time, it is possible for an individual to indicate what are the lines of investigation which seem to be those which should be followed, and I venture to make the attempt.

(1) First, as to the *history* and *nature* of "flint." By the word "flint" we understand the black-looking siliceous nodules which occur in the upper chalk of this country, and have been broken up and variously altered and re-deposited in the Tertiary and Quaternary strata. Any investigation of "flint" as thus understood must include an inquiry into the history and nature of "chert," and of those flint-like concretions which occur in both Tertiary and Mesozoic strata. The history and the structure of agate must also be compared with those of flint, since geodes of agate are not only also composed of silex, but have many properties in common with flints.

It will be further necessary to distinguish and account for the varieties of flint which are known to occur in the chalk. Thus we have in the chalk of the south of England not only nodular flints disposed in distinct beds or horizons of stratification, but we have also tabular flint formed in fissures which traverse obliquely or vertically many feet of thickness of chalk strata. We have also local varieties of chalk-flints, some darker and greener when thin splinters are examined, others yellower, and others of a bluish tendency. Others, again, are somewhat grey and opaque. Some Lincolnshire flint appears to differ in this way from Brandon flint. Such differences are also to be observed in the flints of different horizons in one and the same chalk-pit.

Some observers call those flints which, after fracture, tend to develop a bluish glaze "chalcedonic"; but there are nodules which superficially look like "flints" to be found in association with ordinary black flints in the chalk of the south of England, which are apparently true chalcedony throughout, nearly transparent and colourless, with a bluish cloud in the depths. These almost invariably are oblong nodules embedding a sponge, and form beautiful objects when cut and polished. Often they contain (even when in the chalk) small quantities of iron, which produce in the transparent chalcedonic substance striking patches of red and brown colour.

Cavities occur in chalk flints as in the agate of the geodes of igneous rock, and rock crystal, as well as botryoidal chalcedony, is often found lining the cavities of the flints as of the agate geodes. Occasionally crystals of iron sulphide occur in chalk flints. We require some definite classification and recognition of the varieties of chalk flint and their probable significance. The hardness, fracture, density, and especially the elasticity of each *kind* of flint must be measured and stated.

(2) As to the *origin* and *formation* of flint, our knowledge seems to be very little further advanced than it was fifty years ago. The microscopic examination of thin sections of flint has not been applied to many varieties of flint, and, so far as I can ascertain, possible methods of staining thin sections and of applying light, heat, and chemical agents to the detection of structure and differentiation in the substance of thin sections of flint, examined with the microscope, have not been thoroughly and extensively used.

It appears to be held that the normal chalk-flint consists of extremely minute crystals of silica, cemented by opaline silica, and that the white cortex which every chalk-flint possesses is due to the removal of the opaline cementing colloid silica from the cortical region by solution. One would like to know more about this as the outcome of experiment. What is the solvent? Re-deposited flints in Pleistocene gravels are often opaque ("decomposed," it has been called) right through, and in some cases are pulverulent. How has this been brought about? Broken flints (flint implements) in Pleistocene gravels sometimes show a curious basket-work of white bands crossing and interlaced on a black ground. Is this white pattern a pre-existent structure developed by the action of a solvent? Can such a change be produced experimentally?

There is no general agreement as to the mode of origin of the flints in the chalk. It is clear from the existence of tabular flint in vertical and oblique fissures traversing great thicknesses of chalk that the flint was deposited in cavities formed after the solidification of the chalk. It is also probable that the silica deposited is the opaline or colloid silica of the spicules and shells of marine organisms mixed up with calcareous particles in the original chalk ooze, and dissolved out of it by percolating water containing some solvent—but what? What are the circumstances which have determined (1) the solution of the colloid silica of spicules, and (2) its deposition in the form of cavity-filling masses consisting of minute crystals cemented by colloid silica?

The cavities in which the nodular flints were formed were probably once filled by organic lumps and débris, but it is questionable whether the organic matter attracted the silica and determined its deposition (although we know this occurs in the silicification of tree-trunks in the sea), since flint is deposited freely in the tabular form in the upper chalk, in vertical fissures containing no organic residues. In what respects (one would like to inquire) is the mode of deposition of chalk-flint similar to, and different from, that of chert on the one hand and of geode-agate on the other? The solubility of the colloid silica of organic skeletons requires investigation. The silica deposited as agate in trap-rocks had probably a different origin from that of flint.

(3) Apart from these questions as to the intimate structure of flint, its varieties, and its origin in the chalk, there are certain more direct and simple physical investigations of flint which are necessary, and would help us in distinguishing varieties of flint, and perhaps throw light on other questions. They certainly would render it possible for archæologists to speak of facts and not merely make guesses as to the causes of the fracturing of flints found in Pleistocene, Pliocene, and other Tertiary deposits.

The most important of these inquiries are (1) as to the *porosity* of flint, and (2) as to the *fracture* of flint by blows, by pressure, by heat, and by cold. The two inquiries are closely related. It is well known that an agate geode is porous, and will absorb a large quantity of water containing colouring matters in solution. Our chalk flints are also highly porous and absorbent of water. But, so far as I can ascertain, this property has never been investigated quantitatively. It should be determined experimentally in the case of normal black flint from the chalk (and in varieties of it and in allied bodies). We require to know—

(1) What is the difference in the specific gravity of flint fresh from the chalk, and of carefully dried flint, from which all free water has been removed by non-destructive methods of desiccation?

(2) What is the maximum amount of water which such a specimen of dried flint can be made to absorb? We could thus get the coefficient of absorption of water by flint at various pressures and temperatures, also of flint lying naturally in the chalk, as compared with flint when lying on the surface and under various other conditions.

(3) Other facts as to this porosity could be accurately determined, as, for instance, in what way it is related to structure. Coloured substances might be forced into the pores, as also chemical solvents, and microscopic examination of thin sections made with very high powers.

The investigation of *fracture* is closely related to the foregoing. The most familiar and certain cause of the fracture of flint is a blow with a hammer wielded by a man. Many archæologists are (I have found) not aware that according to the character of the blow given flint may be broken with a practically flat surface of fracture, or, on the other hand, with what is called "a conchoidal fracture." The flint-knappers of Brandon break the large masses of flint removed from the chalk into blocks of convenient size by heavy blows given with what they call "a quartering hammer." The surfaces of fracture so obtained are not "conchoidal." A heavy blow in a direction perpendicular to the surface gives this plane fracture. The lighter knapping hammer gives the kind of blow which produces a conchoidal fracture, and the flint workers can produce complete cones of flint at pleasure by giving the needful kind of blow.

The exact quantitative features of the weight, velocity, and direction of this blow must be determined experimentally, as also must those of the "quartering" or plane-fracture blow. Apparatus to determine these features could be devised. It would then be possible to investigate the exact measurable characters of the conchoidal fracture or "cone" or "dome" of percussion, and to compare it in different varieties of flint. It would be very important to determine whether "saturated wet flint" has the same fractural indices as "dry" flint—whether the one fractures with conchoidal form as easily as the other, &c., &c. Then we could arrive at an answer to the question, "What weight and velocity of blow were necessary to produce the fracture (whether conchoidal or plane) exhibited by a given piece of flint?" And so it would be possible to arrive at a certainty as to whether the fractures which give shape to some supposed human flint implements could have been produced by the inter-concussion of flint nodules driven by the waves of the sea.

But in this investigation the very important fact would be exactly and quantitatively determined that

the vibration tending to set up a conchoidal fracture may produce a "flaw" when the blow causing it was not of sufficient power to cause an actual fracture, and the subsequent history of such "flaws" would be experimentally studied. I have found that one of the most certain ways of obtaining a fine "dome of percussion" in black chalk-flint is to strike a "*staccato*" blow with a light hammer. No fracture results, but subsequent "tapping" with a heavier hammer causes the flint to yield along the dome-like plane of "flaw" set up by the first blow.

The fracture of flint by blows due to other agents than man has been rarely observed. At a few points on the sea-coast large flint pebbles may be picked up with one, or even six or seven, irregularly placed conchoidal fractures of the size of a haricot bean at most. Observations of the fracture of flint by torrents or by heavy wave-action are not forthcoming. The delicate pitting and granulation of the surface of flint-pebbles on the seashore is due to the action of the sea-waves causing the pebbles to knock against one another, and is a very different thing from large and uniformly "directed" fracture.

Leaving for a moment the question of the fracture of flint under graduated pressure, we must cite the action of cold and of heat in fracturing flint as demanding careful and quantitative investigation. There is no doubt that in this country the greatest "breaker of flint" is frost. In the Egyptian desert a chert-like substance allied to flint is constantly fractured by the heat of the sun. It is most important to determine whether "wet" and "dry" flint are equally subject to fracture by cold and also by heat. Has the water absorbed by porous flint any important part in its thermal fracture? The artificial fracturing of flint by the heat of camp-fires is well known as a mere fact. But the very curious structure of flint revealed by it has never been investigated.

I do not know whether anyone else has ever determined the simple fact experimentally that sudden exposure to cold will cause flint to fracture—to "fly," as the expression is in the case of glass. But last July Sir James Dewar kindly placed some large flakes of Brandon flint (prepared by the flint-knappers for breaking into gun-flints), which I brought to his laboratory, into liquid air in my presence. An extensive fracture of peculiar form, its edge having a deeply undulated margin like that of an oak-leaf, was the result. Obviously the whole subject of the fracture of flint by cold and by heat requires experimental investigation, and must yield results of great importance. I am not in a position to carry out this investigation myself, nor have I the necessary training in such determinations. My hope is that some physicist may be attracted by the subject.

An important point which I should wish to determine as bearing on the appearances presented by broken flints in Tertiary strata and gravels is whether frost can, in any circumstances, produce a *conchoidal* fracture in flint. It seems to me not improbable that a flint may by natural (*i.e.* non-human) blows, or a single blow—insufficient to break it—have acquired conchoidal "flaws," or a single conchoidal flaw, which would be developed as a conchoidal "fracture" when the flint was caused to break by sudden frost. We do not even know whether "suddenness" is an element in the causation by lowered temperature of the fracture of flint. The flints on the surface of chalk downs and in many of our later gravels are one and all broken into irregular angular fragments. This is probably correctly attributed to frost, but it would be possible to gain more precise information as to the conditions and determining causes of that fracture. The exact temperature at which, under varying conditions, fracture occurs and the possible extent and form of frost-fractures could be determined. The same is true with regard to the fracture of flint by heat.

The investigation of pressure as causing fracture of flint can be accurately investigated. What kind of fractures can be produced by pressure? And what kind of pressure can produce fracture? We have been asked to accept the statement that the pressure of sandy strata overlying flints can fracture them. By many this is considered an impossibility. We are then told of some mysterious kind of rolling or sliding pressure as producing such effects. Its action should be experimentally demonstrated.

Lastly, in regard to fracture, there seems to be a possibility that vibrations produced by very slight blows may, in special circumstances (such as great cold or heat or dryness), start large fractures in an elastic body like flint. The possibility requires experimental investigation.

There remain yet to be mentioned some other matters for experimental investigation in regard to flints. The acquirement of green, of yellow, brown, and rich red, as well as of black *coloration*, both deeply and superficially, by flint nodules and pebbles when deposited in Tertiary strata is one of these. This subject is part of the general subject of the porosity of flint. It has an important bearing on the study of the flint implements found in gravels. Of more peculiar importance is the classification of the different states of polish which broken flints, whether implements or not, present in different gravels. And with this has to be associated the study of the chemical and molecular changes of the surface of broken flints, and their curious laminar and vermicular sculpturing. Further, the deposition upon those broken surfaces of chemical material requires precise investigation. The "glaze" of the fragments of bone and teeth in the bone-bed at the base of the Red Crag is usually attributed to the deposition on them of phosphate of lime.

It is not certain that this is a correct conclusion. Is the peculiar glaze of most of the broken flints from that deposit due to chemical action, or are all the glazes supposed to be present on broken flints really only different degrees of sand polish effected by wind or by water?

The wonderful flints found in small number in the Savernake gravel, which look as though they had just received a wet coat of spirit varnish, have never yet been satisfactorily dealt with. Some geologists have supposed that they owe their appearance to a chemical glaze deposited on them. But microscopical sections are absolutely contradictory of that view. Their wonderfully brilliant surface is almost certainly a water-made sand-polish. But one would like to see such polishing of an irregular surface of flint produced experimentally. And it would be important to know what were the conditions at work at Savernake to produce this polish on small Acheullian flint implements, as well as on unbroken flint pebbles of large size, and upon one and not all the surfaces of irregular fragments.

A detailed knowledge of the causes of colour and colour patterns, and of the glazing and polishing of flint implements, would enable prehistorians to give a more complete account of the historical vicissitudes of this and that implement than is at present possible. The most urgently needed of the investigations above suggested appears to me to be the experimental and quantitative determination of the causes and conditions of the different kinds of fracture of which flint is susceptible.

E. RAY LANKESTER.

November 9.

The Making of a Rostro-carinate Flint Implement.

By the courtesy of Sir Hercules Read, K.C.B., I have now been able to exhibit in the case at the British Museum containing the sub-Red Crag rostro-carinate implements a specimen which I have myself flaked, using an ordinary flint pebble as a hammer-stone, into this definite and peculiar form.

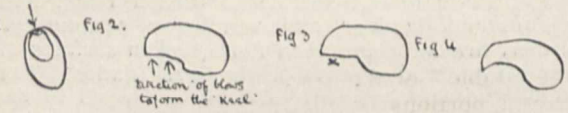
It was only after a very careful and prolonged study of one of the sub-Crag implements that I was able to recognise the plan upon which the ancient men had worked, and, after many failures, to produce a true rostro-carinate type.

I found it to be necessary to select a potato-shaped nodule of flint, and to detach a flake from one end of it, and in such a manner as to produce the ventral plane (Fig. 1). Then, having by this means got a flaking surface, I was able to remove flakes on either side of this surface and to produce the typical "keel" or carina (Fig. 2).

I may say that unless the nodule of flint is held in a particular manner when being struck the flakes detached will not be taken off at the required angle, and no "keel" will be formed.

When this "keel" is produced the flint must be undercut or cleared at the point X (Fig. 3) to form the actual overhanging "beak."

This is a very difficult task, as if a careless blow is given the end of the implement is broken off, and it is useless, a fact continually impressed upon one when making these rostro-carinate specimens. The only means of avoiding the necessity for undercutting is to detach the primary flake of such a concave shape that the necessary overhang is produced (Fig. 4).



Careful flaking will then give the "keel," and the rostro-carinate implement be complete.

I find it is sometimes necessary to detach flakes from the dorsal as well as the ventral surface to get the required form, and an examination of the sub-Crag specimens shows that their makers were occasionally compelled to adopt this method.

It was also noticed that some of the sub-Crag pieces when held with the "beak" towards one exhibited a curious one-sided appearance, which puzzled me greatly for some time.

I was also very surprised to find the specimens of my own manufacture also showed this same peculiarity. I have now found that this is due to the fact that flakes of unequal size and thickness are taken off from the two sides respectively when forming the "keel," which causes one side to get more hollowed out than the other, and the asymmetrical appearance to be produced.

I hope this description of the rostro-carinate flints will convince archæologists that we are dealing with a very complex type of implement, and that such a highly specialised tool cannot very well have been produced by unguided, haphazard natural forces.

J. Reid Moir.

12 St. Edmund's Road, Ipswich, November 8.

On an Apparent Fallacy in the Statistical Treatment of "Antedating" in the Inheritance of Pathological Conditions.

The problem of the "antedating" of family diseases is one of very great interest, and is likely to be more studied in the near future than ever it has been in the past. The idea of antedating, *i.e.* the appearance of an hereditary disease at an earlier age in the offspring than in the parent has been referred to by Darwin, and has no doubt been considered by others before him. Quite recently, studying the subject on insanity, Dr. F. W. Mott speaks of antedating or anticipation as "nature's method of eliminating unsound elements in a stock" ("Problems in Eugenics," papers communicated to the First International Eugenics Congress, 1912, p. 426).

I am unable to follow Dr. Mott's proof of the case for antedating in insanity. It *appears* to me to depend upon a statistical fallacy, but this apparent fallacy may not be real, and I should like more light on the matter. This is peculiarly desirable, because I understand further evidence in favour of antedating is soon forthcoming for other diseases, and will follow much the same lines of reasoning. Let us consider the whole of one generation of affected persons at any time in the community, and let n_s represent the number who develop the disease at age s, then the generation is represented by—

$$n_0, n_1, n_2 \ldots n_s \ldots n_{100}, \text{ say.}$$

Possibly some of these groups will not appear at all, but that is of little importance for our present purpose.

Let us make the assumptions (1) that there is no antedating at all; (2) that there is no inheritance of age of onset; thus each individual reproduces the population of the affected reduced in the ratio of p to 1. Then the family of any affected person, whatever the age at which he developed the disease, would represent on the average the distribution—

$$pn_0, pn_1, pn_2 \ldots pn_s \ldots pn_{100}.$$

The sum of such families would give precisely the age distribution at onset of the preceding generation.

Now let us suppose that for any reason certain of the groups of the first generation do not produce offspring at all, or only in reduced numbers. Say that q_s only of the n_s are able to reproduce their kind; then of the older generation, *limited to parents*, the distribution will be—

$$q_0n_0+q_1n_1+q_2n_2+ \ldots +q_sn_s+ \ldots +q_{100}n_{100},$$

but the younger generation will be—

$$p(q_0+q_1+ \ldots +q_s+ \ldots +q_{100})(n_0+n_1+ \ldots +n_s+ \ldots +n_{100}),$$

i.e. the relative proportions will remain absolutely the same.

The average age at onset and the frequency distribution of the older generation, that of the *parents*, will be entirely different from that of the offspring, and will depend wholly on what values we give to the q's. If frequency curves be formed of the two generations they will differ substantially from each other. This difference is not a result or a demonstration of any physiological principle of antedating, but is solely due to the fact that those who develop the disease at different ages are not equally likely to marry and become parents.

A quite striking instance of the fallacy, if it be such, would be to consider the antedating of "violent deaths." Fully a quarter such deaths in males, nearly a half in females, occur before the age of twenty years. Consider now the parents and offspring who die from violent deaths; clearly there would be no representative of death from violence under twenty in the parent generation, and we should have a most marked case of antedating, because the offspring generation would contain all the infantile deaths from violence.

In the case of insanity, is the man or woman who develops insanity at an early age as likely to become

a parent as one who develops it at a later age? I think there is not a doubt as to the answer to be given; those who become insane before twenty-five, even if they recover, are far less likely to become parents than those who become insane at late ages—many, indeed, of them, considering the high death-rate of the insane, will die before they could become parents of large families. Now Dr. Mott took 508 pairs of parents and offspring, "collected from the records of 464 insane parents whose 500 insane offspring had also been resident in the County Council Asylums," and ascertained the age of first attack. As at present advised, it seems to me that his data must indicate a most marked antedating of disease in the offspring, but an antedating which is wholly spurious. There is, I think, a further grievous fallacy involved in this method of considering the problem; but before discussing that I should like to see if my criticism of this method of approaching the problem of antedating can be met. KARL PEARSON.

Biometric Laboratory, University College, London, November 11.

Is the Earth Shrinking?

I HAVE carefully looked at this question from every point of view which presented itself to me, and doubt very much whether any direct evidence will ever be forthcoming on this subject, unless it should one day be established that the changes of magnetic declination are associated with a slight difference of rotation between the core of the earth and its crust, for such a movement would have to be explained by a difference of rate of contraction between the two.

The foldings and crackings of the earth's surface have been attributed to variations in the rate of cooling of the earth. Thus whenever this rate is accelerated, the surface cools faster than the core, and should crack like a drying ball of clay; whenever the cooling rate is diminishing, as assumed by Lord Kelvin, the core should shrink faster than the skin, like a drying apple, and folding should occur. But to my mind, as recently explained in "Unity in Nature," such effects would be entirely masked by such foldings and crackings as are slowly progressing even to-day, for the sediment which is being constantly deposited on the floors of the oceans must cause the underlying strata to grow warmer and to expand in every direction, resulting in slight local risings, which are most marked near the mouths of large rivers, and in distant bulgings and foldings of the weakest lines of the earth's crust, which are the mountain ranges. On the other hand, the gradual wearing away of the surfaces of the continents and mountain ranges must cause the underlying strata to cool, to shrink, and to crack. This suggestion would certainly more than account for all the foldings, faults, and cracks to be found in the earth's crust, even if a considerable allowance be made for those cases in which the expansions and contractions occur in the same direction, and partly balance each other.

C. E. STROMEYER.

"Lancefield," West Didsbury, November 7.

THE HARDNESS OF COINS.

HARDNESS is a word which is used in various senses. In dealing with metals, it sometimes means the cutting or scratching hardness, but is more often defined briefly as the *resistance to permanent deformation*, a property which is of great importance to all users of metals. It is this kind of hardness with which those engaged in minting are chiefly concerned. When a blank is struck in a coining press, the metal is compressed and at the same time forced to flow into the recesses of the dies, and the ease with which this can be done depends on the amount of resistance offered by the metal to a force momentarily applied and tending to deform it. The hardness should therefore be measured by the effects of a sudden blow, and falling-weight machines, such as Shore's scleroscope, offer a ready means of doing this.

The hardness numbers given below are scleroscope readings, about which it may be said that a piece of metal giving a higher reading is certainly harder than a piece of similar metal giving a lower reading, but that the readings cannot be taken as proportional to the hardness, except as a rough approximation. It cannot be admitted, for example, that a specimen with a hardness number of 40 is exactly twice as hard as one with a hardness number of 20.

The application of hardness tests to the coins of the realm has resulted in some curious and interesting data being obtained.[1] It is found, naturally enough, that the blow of a coining press does not raise soft metal to a state of maximum hardness. A sovereign blank after annealing has a surface hardness of 25·5, and this is raised to 50–53 on being struck in an ordinary press, the maximum hardness of standard gold being about 76. Silver coins of similar size are hardened to much the same extent; but while sixpences, for example, have a hardness number of about 50, florins are only 37. These are the hardnesses of the "table" or flat portions of the coins, but the raised portions of the designs are much softer, especially the highest parts of large thick coins in high relief. Thus in George V. florins the centre of the effigy has a hardness of only 31, that of the annealed blank from which the coin is struck being 27·5. Such coins will evidently wear very differently from coins made in low relief, such as the modern French coins, in which the surface hardness is higher and more uniform.

The hardness of the surface of coins, however, differs widely from that of the interior. The force of the blow seems to be expended chiefly on the surface layers. When these are carefully removed, the hardness of the underlying metal is found to be considerably less. The hardness rapidly falls off with depth, and near the centre even sixpences are almost as soft as annealed silver. Old worn coins are similarly soft.

It is clear, therefore, that a freshly-minted coin has a hard skin and a soft core, and that after the removal of the skin by wear, the loss of weight in circulation will proceed very much as though the coin had been annealed before it was issued. That this is a matter of some importance is illustrated by the fact that the loss by wear of the coinage, which falls on the State, amounts to 30,000*l.* per annum for gold, and somewhat more for silver.

Annealing, one of the oldest processes prac-

[1] Memorandum on "The Hardness of Coins," 42nd Annual Report of the Deputy Master of the Mint, 1911, pp. 107–112.

tised in the arts, has had a surprisingly small share of the attention which has been paid to metals by numerous observers in recent times. Experiments made at the Mint[2] with coins and coinage alloys gave such remarkable results that the experiments were extended to pure metals, and have enabled a fairly complete account of the

FIG. 1.—Structure of pure gold after being rolled. ×11.

course of events in annealing to be clearly stated for the first time. It appears, from a large number of observations, that at comparatively low temperatures metals and alloys, hardened by rolling or hammering, are in an unstable condition, and undergo a gradual change to the soft state. The old standard silver and gold trial plates, for

FIG. 2.—The same rapidly heated to 200° and quenched at once. ×15.

example, have in the course of centuries, at the ordinary temperature, become almost completely softened, while lead appears to soften below the ordinary temperature. As the temperature rises the change is hastened, and a *critical range* is passed through, varying in extent for different metals, below which annealing is too slow for practical purposes, while above it metals and alloys revert from the hard to the soft state almost instantaneously. During the critical range, the time required for annealing undergoes a significant reduction with each slight increment in the temperature, while above and below the critical range, the change in the time is small even with great differences of temperature.

Pari passu with softening, recrystallisation takes place, not by diffusion, but by a change in the orientation of molecules *in situ*, as predicted by Dr. Beilby. When the softening is instantaneous, recrystallisation is almost, if not equally, instantaneous. Thus, for example, pure gold, which can be annealed in a few days in boiling water, softens at once at 200°, and the large primary distorted crystals (Fig. 1) break up simultaneously into smaller irregular ones (Fig. 2). The gradual growth of crystals, which has been studied by Ewing and Rosenhain and by others, takes place subsequently without much further softening.

T. K. ROSE.

2 "The Annealing of Coinage Alloys," Journal of the Institute of Metals, September, 1912.

INTERNATIONAL CONGRESS FOR GENERAL AND MEDICAL RADIOLOGY.

THE sixth meeting of the above congress was held this year at Prague, and was attended by a large number of scientific workers. This society has now a membership of 600, and embraces workers of many nationalities. The opening meeting took place in the Landes-Museum on October 3, and was attended by more than 2000 people. At this meeting addresses were given by Prof. Stoklasa, of Prague, who is president this year, and by Prof. Becquerel, of Paris. At the subsequent meetings of the congress, no fewer than 130 papers were read on physical, biological, and medical subjects. Among the excursions made by the members was one to the uranium mines of St. Joachimstal, from which most of the radium in use has been obtained.

The president chose for the subject of his address the action of the rays from radioactive bodies, and of ultraviolet light, on animal and plant organisms. In the first part of his speech he gave a short account of the development of our knowledge of the connection between electricity and life processes during the last two hundred years. He gave next a summary of the results of the last few years of the action of radium rays, and of ultraviolet light, on living organisms. The germination of seeds, and the development of fungi, flowers, and leaves, may be accelerated under certain conditions by these radiations, whilst, under other conditions, these processes may be entirely arrested. An intense source of α-rays from radium, for instance, has a destructive action on plant and animal organisms, while a weak source has a stimulating effect. The action of the more penetrating β-rays is similar to that of the ultraviolet rays of short wave length. These latter rays have a chemical action on the

mycoplasms of bacteria and the protoplasms of plant and animal cells.

The president then gave an account of experiments of his own, in which he has shown that, under the action of the rays from radium emanation dissolved in water, seeds may germinate from two to three times as rapidly as they do in ordinary water. In other experiments he has shown also that, by acting on carbon dioxide and nascent hydrogen in the presence of ultraviolet light, a photosynthesis is effected resulting in the formation of formaldehyde, and this body itself, in the presence of potash, condenses to form a sugar. Further results indicate that photosynthesis in chlorophyll cells, and in nature generally, is due entirely to the action of ultraviolet light, or of the radiations from radioactive bodies. Chorophyll, indeed, owes its properties to the fact that it is the medium through which these radiations act on the cells. Carbohydrates are produced in nature by the action of ultraviolet light on carbon dioxide and water, and, without this synthesis, all life in any form would be impossible.

Throughout his address Prof. Stoklasa emphasised the need of biologists and of physiologists for a better understanding of the newer developments in experimental physics. A. S. R.

SLEEPING SICKNESS IN THE KATANGA.[1]

THE brochure referred to below contains the results of an investigation undertaken by the author into the distribution and other problems of sleeping sickness in the Katanga. His object is to consider the question from a general point of view and to collate the results of two years of work in the northern part of the province. He wishes to prove that "methodical work on the spot is the sole means of combating the evil in each district." If the differences presented by the districts "are lost sight of in attempting to put in practice measures prescribed in ignorance of the actual conditions, only negative, though costly, results can be obtained." With these objects in view, the author sets forth his observations upon the Katanga, its geography, commerce, and people, and upon the special problems of sleeping sickness in that country, such as the origin and progress of the disease, its diagnosis, treatment, and natural course, the distribution and occurrence of the transmitting fly, *Glossina palpalis*, and the results of administrative efforts to cope with the evil. His descriptions are supplemented by nine maps and a number of excellent photographs.

The author's attitude is mainly that of an independent observer offering gratuitous advice to the Belgian administration of the Congo; hence, doubtless, his choice of the French language for publishing his results. His foremost conclusion is that "the first thing to do is to publish the truth in Belgium"; the next, that as a necessary preliminary to efficacious measures, the zones of *Glossina palpalis* and sleeping sickness should be delimited accurately; and his third, that when the country has been carefully surveyed from this point of view the problem becomes administrative rather than medical. "For medical men the most simple and radical system of conquering the disease is to remove the people from the proximity of *G. palpalis*; it is for the administration to decide how far this is practicable." He is strongly against the treatment of the infected natives in isolation-camps, which he considers to be of little use, while difficult and costly.

[1] "La Maladie du Sommeil au Katanga." By F. O. Stohr (Oxon.) Pp. 83, with maps and illustrations. (London: Constable and Co., Ltd., 1912.) Price 4*s*. net

NOTES.

THE King has approved of the awards this year, by the president and council of the Royal Society, of a Royal medal to Prof. W. M. Hicks, F.R.S., for his researches in mathematical physics and investigations on the theory of spectroscopy, and a Royal medal to Prof. G. Elliot Smith, F.R.S., for his researches on the comparative anatomy of the brain. The following awards have also been made by the president and council:—The Copley medal to Prof. Felix Klein, For.Mem.R.S., of Göttingen, for his researches in mathematics; the Rumford medal to Prof. H. Kamerlingh Onnes, of Leyden, for his researches at low temperatures; the Davy medal to Prof. Otto Wallach, of Göttingen, for his researches on the chemistry of the essential oils and the cycloolefines; the Darwin medal to Dr. Francis Darwin, F.R.S., for his work in conjunction with Charles Darwin, and for his researches in vegetable physiology; the Buchanan medal to Colonel William C. Gorgas, of the United States Army, for his sanitary administration of the works of the Panama Canal; the Hughes medal to Mr. William Duddell, F.R.S., for his investigations into technical electricity.

AT the annual general meeting of the London Mathematical Society, held on November 14, the following were elected officers and council for the ensuing session:—*President*, A. E. H. Love, F.R.S.; *Vice-Presidents*, H. F. Baker, F.R.S., and J. E. Campbell, F.R.S.; *Treasurer*, Sir Joseph Larmor, M.P., F.R.S.; *Secretaries*, J. H. Grace, F.R.S., and T. J. I'A. Bromwich, F.R.S.; *Other Members of the Council*, W. Burnside, F.R.S., A. L. Dixon, F.R.S., L. N. G. Filon, F.R.S., J. H. Jeans, F.R.S., E. W. Hobson, F.R.S., J. E. Littlewood, H. M. Macdonald, F.R.S., P. A. MacMahon, F.R.S., H. W. Richmond, F.R.S., and A. E. Western.

AT the anniversary meeting of the Mineralogical Society, held on November 12, the following officers and members of council were elected:—*President*, Dr. A. E. H. Tutton, F.R.S.; *Vice-Presidents*, Prof. H. L. Bowman, Dr. A. Hutchinson; *Treasurer*, Sir William P. Beale, Bart., K.C., M.P.; *General Secretary*, Dr. G. T. Prior, F.R.S.; *Foreign Secretary*, Prof. W. W. Watts, F.R.S.; *Editor of the Journal*, Mr. L. J. Spencer; *Members of Council*, Mr. T. V. Barker, Mr. W. Barlow, F.R.S., Mr. F. H. Butler, Mr. T. Crook, Mr. J. P. De Castro, Rev. J. M. Gordon, Sir Thomas H. Holland, K.C.I.E., F.R.S., Mr.

B. Kitto, Prof. A. Liversidge, F.R.S., Dr. R. Pearce, Dr. G. F. H. Smith, and Mr. H. H. Thomas.

WE offer our congratulations to *The Electrical Review* upon the celebration of its fortieth anniversary. The first number of our contemporary was issued on November 15, 1872, and the current issue bears the date exactly forty years later. From the first number *The Electrical Review* has represented the best interests of the electrical profession, and has adapted itself to the great changes which have taken place during the period of its existence. How remarkable have been the developments of electrical science and engineering may be judged from a complimentary message which Sir William Preece sends to our contemporary. The prominent electrical industries in 1872 were electroplating and the electric telegraph. The Society of Telegraph Engineers (later to become the Institution of Electrical Engineers) was founded in that year, which was also the year of birth of Mr. W. Duddell, F.R.S., who now occupies the presidential chair of the institution. "The life of *The Electrical Review*," says Sir William, "is a history of the life of the electrical industry." The journal has established an important position as the organ of the practical electrician and manufacturer, and we have no doubt it will continue on its successful career for many years to come.

WE notice with regret the anouncement of the death on November 19, in his ninety-seventh year, of Mr. W. B. Tegetmeier, formerly a frequent contributor to NATURE, and whose name is well known to many naturalists. We print the following particulars of his career from an obituary notice in Wednesday's *Times*:—Mr. Tegetmeier was destined for the medical profession, and studied at University College, and though he did not qualify, the knowledge of anatomy and physiology which he acquired was of great service to him as a practical breeder and writer on poultry, pigeons, and general natural history subjects. He was a recognised authority in all that concerned pigeon racing, and his article on "Utilisation of Homing Pigeons" in NATURE of February 4, 1892, is of permanent value. In 1855 he was introduced by Yarrell to Darwin, whom he supplied with a good deal of material in the shape of skulls and skeletons, and for whom he carried out many experiments in breeding. Mr. Tegetmeier's reputation as a breeder and fancier caused him to be chosen as judge at principal shows and secured his appointment as poultry editor of *The Field*, a position which he held for more than forty years, retiring only in 1907. During this period he also contributed largely to the natural history columns of the paper, and for many years supplied the leading articles for *The Queen*. He became a Fellow of the Zoological Society in 1866, and was made an honorary Fellow in 1905; his membership of the British Ornithologists' Union dates from 1873, and he was a frequent exhibitor at the meetings of the society and of the British Ornithologists' Club. In 1854 he published "Profitable Poultry," and in 1856 edited a serial issue of Wingfield and Johnson's "Poultry Book," which seems to have formed the basis for his own "Poultry Book" in 1867; this was a great advance on any previous work on the subject, and a second edition was called for in 1873. Besides some smaller books on poultry, pigeons, and economics, Mr. Tegetmeier published "Pheasants" in 1873, and, with Colonel Sutherland, a book on horses and mule-breeding in 1895; he also edited and enlarged Blyth's articles on the cranes, and revised R. B. Morris's "British Game Birds" and F. O. Morris's "Nests and Eggs of British Birds"; and contributed the article on poultry to the ninth edition of the "Encyclopædia Britannica." The funeral will be at the Marylebone Cemetery, Finchley, on Saturday, at 2 o'clock.

DURING the session of the International Congress of Prehistoric Anthropology and Archæology, held at Monaco in 1906, a committee was appointed to secure uniformity of craniometric and cephalometric measurements. This aspect of the subject having been finally settled, the congress at a subsequent meeting at Geneva in 1912 adopted similar measures for the unification of anthropological measurements of the living subject. A translation of the rules thus adopted has been issued by one of its members, Dr. W. H. Duckworth, from the Anthropological Laboratory at Cambridge. The rules now authoritatively adopted define the position of the subject under examination and the classification of the measurements now approved. To these are added a general caution that no person should undertake work of this kind without undergoing a preliminary course of instruction, and a recommendation that anthropologists should append complete lists of measurements to their publications. The committee is to be congratulated on a scheme which will promote uniformity of measurement both of the living subject and of prehistoric remains discovered in the course of excavations.

THE Research Defence Society has issued (through Messrs. Macmillan and Co., Ltd.), at the modest price of 4*d*., an excellent pamphlet of fifty-six pages on sleeping sickness, by Dr. F. M. Sandwith. The author, after giving a brief historical account of the disease, describes fully the progress and present position of our knowledge with regard to the trypanosomiases of animals and human beings in Africa, both in their clinical aspect and from the point of view of their etiology and causation. The problems that still require solution, and their practical bearing on administrative measures having as their object the prevention and control of these diseases, are set forth concisely and clearly. This little work should be extremely useful to those, especially who, without an expert knowledge of these matters, are confronted with them in the performance of their official duties. At the same time, it furnishes a most striking example of the all-importance of experiments on living animals in order to obtain the knowledge necessary to combat effectually the most terrible of all plagues afflicting both men and animals in our African dependencies.

IN addition to interesting matter in the text, a recent number of *Country Life* contains an exquisite coloured plate of a dew-spangled web of the garden spider (*Epeira diadema*) and its owner.

ACCORDING to the fifth annual report of the American Bison Society, the herds of bison in the United States and Canada continue to show a gratifying increase, the total number of animals known to exist in the country at the date of the report being 2760, against 1310 four years previously.

IN the report of the Horniman Museum and Library for 1911 it is stated that considerable progress has been made in the arrangement of the collections. A large decrease in attendance is attributed to the hot summer of the year under review. In a footnote reference is made to the opening of the new building in January last.

The Field of November 9 contains a photograph of a "nest," or sleeping-platform, built high up in a tree adjacent to the ape-house by an orang-utan which escaped from captivity in the Zoological Gardens on the evening of Sunday, November 3. The ape probably intended to pass the night on the platform, but, either from fear of the keepers, or on account of the situation being too cold, changed his mind, and returned to the building.

WE have to acknowledge the receipt of a copy of a new and revised edition of Dr. Egid Schreiber's well-known "Herpetologia Europæa," which includes descriptions of all the species of amphibians and reptiles hitherto recorded from Europe. The present edition, published, like its predecessor, by G. Fischer, of Jena, forms a bulky volume of 960 pages, and is illustrated by a large number of text-figures, the price being 30*s*. It is of special importance on account of containing full notices of the varieties which have been described in the case of certain species. Another valuable feature is formed by the tables of the geographical ranges of all the species given near the end of the volume.

THE economic importance—either beneficial or injurious—of the various species forms the keynote in Prof. W. B. Barrows's "Michigan Bird-life," a fully illustrated volume of 822 pages, published by the Agricultural College of the State to which it refers. The volume is the outcome of ten years' labour, and appears thoroughly exhaustive, so far as the present state of knowledge goes. The seventy full plates have been prepared from specially selected photographs taken by a former student of the college. The author confirms previous statements with regard to the apparent extermination of the passenger pigeon, remarking that the last wild specimen known in the United States, so far as ascertained, was killed in September, 1898, in Mayne County, Michigan. The author is of opinion that the clearing of forests and the general opening-up of the country are largely responsible for the extinction of the species, the result of this being that "the birds were driven from one place to another, and gradually compelled to nest further and further to the north, and under conditions successively less and less favourable, so that eventually the larger part of the great flocks consisted of old birds, which, through stress of weather and persecution, abandoned their nesting-places and failed to rear any considerable number of young."

THE Glacial flora and fauna of the Grand Duchy of Baden have been investigated by Dr. P. Stark (*Berichte d. Naturforsch. Ges.*, Freiburg, Band xix., Heft 2), who has made a most painstaking study of the Glacial deposits in this area. The botanical portion of the work includes not only the flowering plants, but also the mosses, and not merely the relatively large remains such as stems and leaves, but such minutiæ as pollen, spores, and fragments of epidermis. This careful study is of special interest from the ecological point of view, since it contains numerous contributions to the knowledge of moorland, alpine, and arctic vegetation during Glacial and post-Glacial times. The author shows commendable caution in the matter of inferring marked changes of climate from the succession of plant remains in the "Glacial" and "inter-Glacial" peat deposits, and lays stress on the need for taking into account ecological conditions other than variations in temperature in an attempt to explain the differences in the vegetation of the superposed beds.

THE Mexican cotton-boll weevil (*Anthonomus grandis*) has spread so rapidly in the southern States of America during recent years as to become the most serious pest with which cotton-growers have to contend. A detailed report on this insect and its ravages has been published by the Bureau of Entomology, U.S. Department of Agriculture (Bulletin 114), with twenty-two plates and thirty-four text-figures. An exhaustive account is given of the investigations carried on since 1895, the chief contents of previous publications on the boll-weevil being incorporated in this important memoir. The area infested by this pest has increased from 1400 square miles in 1892 to no fewer than 271,000 square miles in 1911, the average rate of spread during the last six years having been 27,000 square miles a year. At present 400,000 square miles of cotton-producing area remain unaffected, but the alarming rate of spread has led to the adoption of energetic measures for the repression of the weevil. The report is largely devoted to elaborate descriptions of the life-history, dissemination, and hibernation of the insect. Under the heading "natural control," the compilers describe the effects of temperature and other climatic conditions upon the weevil, the fungus and bacterial diseases (unfortunately very few and sporadic) to which it is subject, and the extent to which it is kept down by parasitic and predatory insect enemies and by birds. Finally, they enumerate the various methods of repression which have been tried; the most successful is that of destroying the weevils in autumn by uprooting and either ploughing-in or burning the cotton-plants.

THE first sheets of *The Geophysical Journal* for 1912 (second year) have reached us. This journal forms part of "The British Meteorological and Magnetical Year Book," issued by the Meteorological Office. It gives, as before, daily values for the meteorological and geophysical elements observed at three observatories—Kew, Valencia, and Eskdalemuir—and includes, *inter alia*, solar radiation, seismology, atmospheric electricity, and terrestrial magnetism (see NATURE, April 25). The new issue contains additional tables giving the results of the exploration of the free atmo-

sphere over the British Isles by means of kites and balloons. All the units employed are based on the C.G.S. system.

PROF. H. F. REID has suggested that the initial steps in the movement which gives rise to a great earthquake might be detected by the gradual displacement of a series of pillars erected along a line at right angles to a growing fault. Another method of foreseeing the occurrence of an earthquake has been suggested by Dr. C. Davison in a recent paper (Gerland's *Beiträge zur Geophysik*, vol. xii., 1912, pp. 9–15). The method depends on the distribution of the preliminary shocks in time and space. In the case of the Mino-Owari (Japan) earthquake of 1891, it is shown that there was a marked increase in frequency of these shocks along and near the line of the fault-scarp during the four years before the earthquake. During the two years before it, the centres of the earthquakes embraced the whole region of the fault-system, clinging closely to the principal fault-lines. Before the great displacement which causes an earthquake can take place, the small obstacles to slipping must first be removed. The slips by which these obstacles are removed give rise to the preliminary shocks. The effective resistance to displacement thus becomes equalised throughout the whole fault, so that the main displacement occurs with great rapidity throughout its entire extent. It follows, therefore, that when a fault is being outlined by the epicentres of a number of slight shocks, it is probable that a great displacement throughout the region so outlined will occur after an interval which, as in the case of the Mino-Owari earthquake, may amount to a couple of years.

FOR the detection of minor fluctuations of atmospheric pressure, differentiated from the general barometric changes, a microbarograph was designed some time ago by Dr. W. N. Shaw and Mr. W. H. Dines, and was referred to in these columns (NATURE, vol. lxxi., December 29, 1904, p. 216). Dr. Yoshida, of Tokyo, claims to have made some improvements in this instrument, and Prof. Fujiwhara, of the Central Meteorological Observatory, Tokyo, has developed a dynamical and adiabatic theory in connection therewith. The apparatus consists essentially of an air chamber, connected by tubes with a cylindrical vessel containing oil, in which floats a bell-jar. The latter rises and falls with the variations of atmospheric pressure, and an attached pen records the results on a revolving cylinder. A capillary tube serves to damp the effect of the larger and slower movements, only the smaller and more rapid variations being noted. Prof. Fujiwhara gives a series of equations based on his theory in the Journal of the Meteorological Society of Japan (xxxi., No. 9, 1912). He concludes that the dimensions and mass of the apparatus itself constitute an unavoidable source of error when the barometric variations are extremely rapid. To secure the best results he recommends that the apparatus be small, and the bell-jar and its attachments of the lightest material, *e.g.* aluminium.

WHEN a liquid jet breaks into drops in the air it is well known that the drops become positively, the air negatively, charged. This effect is utilised in Kelvin's water-dropper as a means of generating electric charges, and in electrical measurements in the atmosphere to bring the instrument used to the same potential as the air at a point. The exact nature of the process by which the charges are produced is, however, unknown. The recent work of Dr. von Bernolák, of the University of Heidelberg, which appears in the *Annalen der Physik* for October, indicates that the production of the charge is intimately connected with the formation of very small secondary drops which accompany the primary drops. If the number of secondary drops formed is increased by producing large primary drops rapidly from a tube the lower end of which is widened, the total amount of charge produced is considerably increased.

THE *Electrical Review* for November 8 devotes three articles to the openings which China offers to engineers generally and to engineering manufacturers in particular. The latter are strongly urged to send out at once capable engineers as agents in order to grasp an opportunity which will pass rapidly away. One of the articles is by Prof. C. A. M. Smith, of the University of Hong Kong, and deals with the foundation and the aims of that University. From the statement of Sir F. D. Lugard, the Governor of Hong Kong, it appears that in the first instance engineering and medicine are to be the principal applied sciences taught there, while an arts course will afford an opportunity to Chinese students of making themselves well acquainted with English. A dispatch from the Viceroy of Canton to the chief officials of the Chinese Government under him is quoted by Prof. Smith, and from it we gather that considerable anxiety has been caused in China by the evil results which in some cases have followed the residence in Europe or America of Chinese students under conditions of freedom, to which they are quite unaccustomed in their own country. The new University will in all probability intercept this stream of students to foreign countries within the next few years. The drawing and plan in Prof. Smith's article indicate that the University buildings cover an area of 50,000 square feet, and occupy a fine site on a hill overlooking the harbour.

A SECOND edition of Mr. J. P. Johnson's "Prehistoric Period in South Africa" has been published by Messrs. Longmans, Green and Co. The first edition was reviewed in the issue of NATURE for August 10, 1911 (vol. lxxxvii., p. 183). The most important addition to the new edition is an appendix by Mr. Kennard, entitled "The Sequence of the Stone Implements in the Lower Thames Valley." In addition, Mr. Johnson has been able, as a consequence of the publication by Dr. Peringuey of the material in the Capetown Museum, to extend the scope of the book to the Coast Middens.

IN the 1912 volume of the Transactions of the Leicester Literary and Philosophical Society, which also contains the report of the council and annual

reports of the sections, the only two papers are concerned with literary subjects. The report of the council contains an announcement that the society has decided to publish a book on the Trias by Mr. T. O. Bosworth, a member of the geological section of the society, which should be of great assistance to students of the geology of the county.

A WELL-ARRANGED and excellently illustrated catalogue of their electrical specialities has been received from Messrs. F. Darton and Co., 142 St. John Street, Clerkenwell, E.C. Special attention may be directed to the large number of designs of small electric motors and dynamos this firm is able to supply. In addition, the catalogue gives particulars of a great variety of electrical appliances and accessories.

OUR ASTRONOMICAL COLUMN.

THE IDENTITY OF SCHAUMASSE'S AND TUTTLE'S COMETS (1912*b*).—Using new observations made by M. Schaumasse, and extending over the period October 18 to November 1, MM. Fayet and Schaumasse have derived a set of elements for comet 1912*b* which, when compared with the elements for Tuttle's comet, taking into account the approximate perturbations of Jupiter during the period 1900–01, show that the comets are undoubtedly identical. The comet is now too low to be observed in these latitudes, its positions for November 21 and 23 being $\alpha = 11$h. 43m., $\delta = -37° 14'7$, and $\alpha = 11$h. 50 m., $\delta = -39° 6'8$, respectively. (*Astronomische Nachrichten*, No. 4612.)

BORRELLY'S COMET 1912*c*.—A number of observations of comet 1912*c* are published in No. 4612 of the *Astronomische Nachrichten*, where elements and an ephemeris, extending to December 9, are also given. An observation made at the Bergedorf Observatory on November 3 gave the magnitude as 7·5, and showed that the comet was a round nebulous body with a nucleus but no tail; other observations made between November 3 and 6 gave the magnitude as 9·5, while the calculated magnitude for November 7 was 8·3. Dr. Kobold's ephemeris gives the following positions:—

Ephemeris 12h. Berlin M.T.

1912	α	δ	1912	α	δ
	h. m.	° ′		h. m.	° ′
Nov. 21...19	30·2...+11	50·1	Nov. 29...19	53·1...+4	40·2
23...19	36·5...+9	49·9	Dec. 1...19	57·9...+3	11·6
25...19	42·4...+7	58·7	3...20	2·5...+1	49·4
27...19	47·9...+6	15·7	5...20	6·9...+0	33·1

It will be seen that between November 22 and 27 the comet apparently travels along a line nearly parallel to, and about 3m. west of, that joining γ, α, and β Aquilæ; its calculated magnitude is now 9·0, and sinks to 9·5 by December 1.

OBSERVATIONS OF GALE'S COMET 1912*a*.—A number of observations, and some excellent photographs, taken by M. Quénisset at Juvisy, of comet 1912*a* are published in the November number of *L'Astronomie*. On October 16 the principal tail (p.a. = 65°) extended beyond the edge of the plate, and was at least 6° in length. The secondary tail (p.a. = 138°) was strongly curved towards the south, having the appearance of a cock's spur, and was 1° long; the successive photographs, October 6 to 16, showed that the angle between these two tails was increasing by nearly 1° per day. A third tail, near to and north of the principal, was photographed on October 14, and showed a marked dislocation at a distance of 33′ from the head. Several good spectra were secured with the Baume-Pluvinel prismatic camera, and will be reduced at M. de la Baume-Pluvinel's laboratory. They show a strong continuous spectrum, in which the usual cometary bands are shown as well-marked condensations, and the spectrum somewhat resembles that of Brooks's comet (1911*c*) at the end of October, 1911.

On November 1 the comet was still just visible to the naked eye, and photographs showed the principal tail to be 6° long with extremely undulating borders; the angle (86°) between the two tails had still further increased to the extent of 13° since October 16. Other observations of this comet are published in No. 4612 of the *Astronomische Nachrichten*.

NEBULÆ AND CLUSTERS PHOTOGRAPHED WITH THE CROSSLEY REFLECTOR.—Lick Observatory Bulletin No. 219 contains descriptions of 132 nebulæ and star clusters that have been photographed with the Crossley reflector. The descriptions in many cases are extremely interesting, and are written by Dr. H. D. Curtis, who states that the modern photographic studies of nebular structure show that the visual observations made in the past are almost valueless, in comparison, even when made with powerful instruments by skilful observers. For example, in the case of N.G.C. 83, the catalogue gives thirteen nebulæ in this region, while in reality there are at least fifty small nebulæ and nebulous stars.

One or two examples must serve to illustrate the importance of the present publication. N.G.C. 1300 shows a two-branched spiral, 6′ long, where the whorls start from the extremities of straight extensions on each side of the nucleus. Nova Aurigæ on November 16, 1901, Nova Geminorum on April 23, 1903, and Nova Lacertæ on September 13, 1912, showed no traces of nebulosity, although long exposures were given in each case. With two hours' exposure the stars of Præsepe show no signs of being nebulous. N.G.C. 5921 is a very interesting spiral, with a strong oval nucleus 1·8′ long, crossed by a straight lane of matter. N.G.C. 6960 is a wonderful object, more than 1° in length, made up of bright filaments like the "Network" nebula. N.G.C. 6914 is a very irregular diffuse nebulosity about 4′ across. The neighbouring stars, BD. +41°3731 and 3737, are surrounded by bright nebulosity not noted in the N.G.C., although that around the second star is brighter than N.G.C. 6914.

CAPTAIN AMUNDSEN'S JOURNEY TO THE SOUTH POLE.

CAPTAIN ROALD AMUNDSEN communicated the results of his journey to the south pole at a meeting of the Royal Geographical Society on November 15, in the Queen's Hall. His expedition "landed" on the ice-barrier in the Bay of Whales, which, he observes, was charted by Ross in 1841; it is therefore to be considered, not as a casual formation of the ice, but as a permanent feature, owing its existence to shallow banks or to land beneath the ice but above sea-level. This view was confirmed by the discovery, on landing, of a surface broken by steep hills and ridges, instead of one approximately level and unbroken. The work of the expedition in laying depôts for the march to the south pole was completed in April, 1911, and it may be said at once that it was thoroughly successful, for when we follow Captain Amundsen on the journey itself it would appear (however thickly he glosses its dangers) to have been carried through with less difficulty than any of a similar character preceding it, so far as concerned food supply, the health of the party, and the condition of the sledge-dogs; there is here no tale of suffering from hunger or exhaustion, and on the return march from 86° S., the party had not even to go on fixed

rations. One remarks, among other wise provisions, the practice of setting up lines of signs across the line of march for some distance on either side of some of the depôts, so that if, on the return, a deviation had been made, the depôts could still have been found. During the depôt-laying journeys a minimum temperature of −50° F. was observed.

The expedition was extraordinarily favoured by the weather conditions. During the year of the sojourn in the south only two moderate storms were encountered; otherwise the wind was mostly light and easterly. During five months temperatures below −56° F. were observed, and on August 13 −74·2° F. was recorded. These low temperatures delayed the start for the pole, and even occasioned a false start and an enforced return early in September. It was not until October 20 that settled weather justified the journey being finally undertaken.

In 83° S. high mountains—10,000 to 15,000 ft.—were observed to the south-west (the travellers' course lying due south). These probably belong to the South Victoria land range, and were found to be met, about 86° S., 163° W., by a much lower range trending east and north-east. The junction of the ice-barrier and the land was reached on November 17 in 85° S., 165° W. No very grave difficulties were encountered in ascending to the polar plateau between the great peaks of the above range. The greatest height, attained on December 6, was 10,750 ft., from which the plateau was found to continue flat to 88° 25′ S., and thence to slope slightly down. Progress was easy, and even leisurely. Beautiful weather was experienced; the region seemed to be one of constant calm, and even the absolutely plain surface of snow strengthened this impression. At the latitude last mentioned the last good azimuth observation was obtained. On December 14 and 15 close observations gave the latitude as 89° 55′. On December 16 the camp was removed the remaining distance to the pole, and observations were taken hourly by four men through twenty-four hours. The plateau was given the name of King Haakon VII.

So far as concerns the Antarctic land-mass, the main geographical importance of the expedition seems to lie in the observations of the great mountain-range mentioned above, which, with clear weather on the return journey, was observed from 88° S., where it was lost on the horizon, to the junction-point in 86° S., and has been given the name of Queen Maud. But three of the party, including Lieut. Prestrud, who did not accompany the southward expedition, carried out topographical work in the vicinity of the Bay of Whales, and east of it as far as Scott's King Edward Land, while Captain Nilsen, in the course of cruising which extended from Buenos Aires on one hand to Africa on the other, made oceanographical observations at sixty stations, and by navigating the *Fram* to a point further south than any known vessel had reached before, set the crown on the fame of that ship in polar exploration.

ANTHROPOLOGY AT THE BRITISH ASSOCIATION.

NOTWITHSTANDING the unfortunate overlapping in the dates of the meetings of the Association and the International Congress of Prehistoric Archæology at Geneva, which seemed likely at one time to affect seriously the attendance of anthropologists at Dundee, the proceedings of Section H (Anthropology), which met this year under the presidency of Prof. G. Elliot Smith, F.R.S., were, if anything, of even greater interest than usual, and included several communications of considerable importance. The attendances throughout were good, and if, in the first half of the meeting, the discussions were a little below the customary standard, this was due to lack of time rather than to lack of interest, and was more than counterbalanced in the second part of the meeting, when the problems of Mediterranean archæology and the President's views on the origin and distribution of megalithic monuments gave rise to animated interchanges of opinion.

In any detailed review of the papers presented to the section it would be necessary, on more grounds than one, to give a prominent place to the two communications by Prof. Anthony, of Paris, who attended the meeting as the distinguished guest of the section. These dealt respectively with the suprasylvian operculum in primates with especial reference to man, and the brain of La Quina man, one of the earliest and the finest of the brains of Palæolithic man yet known, and now described for the first time. With these two papers must be included Prof. Keith's exhibit of the brain of Gibraltar man, the three forming a group pendant to the President's address, and affording further evidence in support of his conclusions as to the evolution of the human brain, and in particular of the association areas.

Other communications also dealt with early types of man. Dr. Duckworth's description of the fragment of a human jaw of Palæolithic age found in Kent's Cavern, Torquay, in 1867, but previously undescribed, in the absence of the author was appropriately presented to the section by Prof. Boyd Dawkins, who was a member of the committee appointed to explore Kent's Cavern which recorded the discovery in a report presented to the Association at the Dundee meeting in 1867. On anatomical grounds, Dr. Duckworth considers the jaw to belong to the Neanderthal type. Dr. Ewart gave an account of an important find of human remains in a raised beach at Gullane, the skeletons being described by Prof. Keith. When the results of this discovery are published in full, they will be found to have an important bearing upon the prehistory of the Scottish area. In the discussion which followed the reading of the paper, Prof. Bryce stated that, in his opinion, the skeletons found in association with the very early types of Neolithic implements represented the earliest type of man yet discovered in Scotland, antedating the men whose remains have been found in the cairns of Tiree.

Other papers dealing with the physical side of the study of man were Dr. Duckworth's contributions to Sudanese anthropometry based upon measurements made in the south-eastern Sudan by Dr. Atkey; Dr. Wood Jones's papers on the lesions caused by judicial hanging, in which injuries received by criminals executed in Egypt in Roman times were contrasted with those received in modern instances, and on the ancient and modern Nubas, in which he suggested an origin for the foreign immigrants into Nubia in the early Christian era whose remains have been discovered by the Archæological Survey of Nubia; Mr. D. E. Derry's description of a macrocephalous skull from Egypt; and a highly interesting paper by Mr. L. Taylor on the Bontoc Igorots now exhibited at Earl's Court, based upon measurements which suggest that these people may not be of such unmixed Indonesian stock as has usually been supposed.

Two organised discussions were largely attended and aroused much interest. The discussion on the ethnological aspects of Scottish folklore was opened by Mr. Crooke with a paper on customs connected with the Scottish calendar, followed by Mr. Hartland with a paper on folklore as an element in history. Canon J. A. McCulloch, after a reference to features in

Scottish folklore common to other countries, contrasted the form taken by the fairy belief in the Highlands and the Lowlands, and Mr. Brodie-Innes, in a paper covering a wide range of fact and theory, adduced data for distinguishing Celtic, Saxon, and Scandinavian elements in Scottish beliefs and practices. Miss Burne urged the importance of the collection of evidence, especially in border counties, before it should be too late.

It would be unfair to attempt to summarise in a few words the arguments put forward by Prof. Elliot Smith in opening the discussion on megalithic monuments and their builders in support of his views that this form of sepulchral monument originated in Egypt at about the time of the first utilisation of copper implements, and spread thence as a religious idea to the remaining parts of the world in which megalithic monuments are found. Mr. Peet, in a paper which, in the absence of the author, was presented to the section by the President, while assigning a single origin at some one centre to these monuments, ascribed their distribution to a racial migration. These views were sharply criticised in the discussion which followed, strong exception being taken to a theory which derived the round form of megalithic monument from the square Egyptian tomb. Among the speakers were Prof. Boyd Dawkins, Prof. Ridgeway, Prof. Myres, and Prof. Bryce.

Communications dealing with the archæology of Egypt and the Sudan were numerous. Prof. Petrie described his excavations during the last season on an early dynastic cemetery near the village of Tarkharn, thirty-five miles south of Cairo, which in his opinion is the earliest site as yet discovered so far north. Mr. Quibell described the excavation of second and third dynasty tombs at Sakkara, which led to the rediscovery of the tomb of Hesy and revealed a style of mural decoration previously unknown. Prof. Elliot Smith gave the results of his examination of the bodies found in these excavations, carrying back the evidence for an alien population in Egypt to the second dynasty. One of the bodies examined showed an attempt at mummification. This is the earliest evidence for this method of preserving the body which has yet been discovered. He also described the work of the Boston Museum and Harvard University expedition in Egypt from material provided by Prof. Reisner, who is in charge. Mr. Ogilvie gave an account of Prof. Reisner's work under the Archæological Survey of Nubia, and showed slides of his own sketches, recently made, of the ruins of the temples at Philae, which are shortly to be submerged by the irrigation works. It would be difficult to praise too highly Mr. R. Mond's coloured slides of the Theban tombs excavated by Mr. Alan Gardner, which were greatly admired, both for their exquisite beauty and their value as accurate records of the objects discovered.

An important communication by Mr. H. S. Wellcome described for the first time the result of two years' work on a site containing remains of primitive Ethiopian races in the southern Sudan, from which he has obtained a large quantity of implements, pottery, ornaments, and other Ethiopian and Egyptian objects, ranging in date from the neolithic age to the Ptolemaic period. Dr. Derry discussed the phenomenon of the red pigment found on ancient bones, and came to the conclusion that in the Nubian and Egyptian examples it was due to a red pigment applied to the grave wrappings and afforded no evidence of mutilation after death.

The interest in the problems of Mediterranean archæology shown by the members of the Association who attend this section has been so marked in the past that it was gratifying to find this subject again becoming prominent in the proceedings. Mr. Wace gave an account of the excavations carried out by himself and Mr. Thompson in tombs and a tumulus belonging to the early Iron age at Halos in Achaia Phthiotis, which contained "geometric" pottery, bronze fibulæ, and swords, knives, and long spears of iron. Prof. Ridgeway described a group of bronze and iron javelins found together in Caria, and now in his possession, which illustrate the overlapping of the use of bronze and iron. Prof. J. L. Myres presented the report of the Committee on Archæological and Ethnological Investigations in Crete, which contained a further instalment of Dr. Duckworth's report on the measurements made when he visited the island some years ago on behalf of the committee. Dr. Ashby gave an account of recent excavations of the prehistoric monuments of Malta, Gozo, and Sardinia, which was in part a supplement to the discussion on megalithic monuments from the point of view of the evidence furnished by these islands.

The papers dealing with the archæology of Britain were few in number, but of considerable interest. Mr. Willoughby Gardner described the excavation of an interesting hill fort in Parch-y-Meirch Wood, near Abergele. The fort was evidently British in origin, but showed signs of three occupations, one being by the Romans. Miss Leslie-Paterson exhibited a series of pigmy flints from the Dee Valley, the first examples of the actual implements to be found north of the Forth, and the Rev. Father Blundell presented the report of the Committee on the Artificial Islands in the Lochs of the Highlands of Scotland. The committee, which was appointed at the Sheffield meeting, has now completed two years' work; a considerable number of these islands has been recorded, and much interest in them has been aroused locally. Papers by Mr. Marett on a Neolithic cemetery on the islet of La Motte, in Jersey, and by Dr. Irving on further investigations on a prehistoric site in the Valley of the Stort were presented to the section, but, in the absence of the authors, were not discussed.

Two important technological points were raised by Dr. Rivers, the first being the disappearance of useful arts, and the second "conventionalisation" in art. In regard to the former, he entered a caution against over-hasty conclusions as to the character and extent of a primitive culture, by pointing out that it was possible, as he had found in Melanesia, for a useful art to die out of everyday life and leave no trace of its existence in the technology of the people by whom it had been practised. In the second of his papers, to explain the problem which is not completely solved on any of the current theories of the development of decorative art, namely how it comes about that a realistic representation should become a geometrical figure, he offered the hypothesis that in the clash of cultures of two races with different art motives and forms there may result the retention of the motive from one side and of the form from the other. In another branch of the study of primitive art, Dr. C. S. Myers's phonograph records of Sarawak music were greatly appreciated by a large audience.

Among other ethnographical papers, mention must be made of Mr. Amaury Talbot's description of tribes of the West and Central Sudan with numerous illustrations of racial types, implements, and ornaments, Mr. MacRitchie's paper on the magic drum of the northern races, and Miss E. B. Lindsay's paper on an undescribed totem post of stone from British Columbia.

In conclusion, two statements made to the section may be placed on record. Dr. George Bryce sent a

report on the first eighteen months' work of the ethnographical department of the Geological Survey of Canada, which, it will be remembered, was a direct outcome of the visit of this Association to Winnipeg in 1909, and Dr. Hrdlička, in a letter from Siberia addressed to the President, announced that he had discovered in north-eastern Asia living representatives of the ancient race which gave North America its Indians.

BIRD NOTES.

IN an article on the food of nestling birds published in the Journal of the Board of Agriculture for September, 1912, Mr. W. E. Collinge commences by referring to the fact that in the early stages of life birds daily consume more than their own weight of food. It is also mentioned that since nearly all birds except pigeons feed their young upon an animal diet, and that the nesting season occurs when insects are most abundant, the value of birds as insect-destroyers is self-apparent.

In *Witherby's British Birds* for October an instance of one cuckoo laying in the nest of a marsh-warbler and of a second in that of a rock-pipit are recorded. Only about five instances of a similar event have been previously recorded in the case of each species.

To *The Zoologist* for October Mr. Harvie Brown contributes the first part of an article on the past and present distribution of the fulmar petrel on both sides of the Atlantic, and its recent spread in northern Britain.

For about a century naturalists were content with the name *Strix flammea* for the barn-owl. The late Prof. Newton proposed to replace the generic name by Aluco, but this usage was recently stated by Mr. G. M. Mathews to be invalid. In No. 4 of *The Austral Avian Record*, after referring to a couple of alternative generic designations, the same writer brings forward the name *Flammea vulgaris* as one to which no objection can be taken. It seems a pity to try to displace a name which has become almost a household word. This replacement of long-accepted names of British birds by others of earlier date forms the subject of an editorial article in the September number of *The Scottish Naturalist*, where it is remarked that "though our sympathies are strongly in favour of the British Association's rules, yet we are willing to view the present situation in a liberal spirit. There must, however, be concessions, and we regard it as essential that a number of time-honoured names must be conserved."

In the above-mentioned issue of *The Scottish Naturalist*, Mr. Eagle Clarke describes, with an illustration, a male hybrid between an eider drake and a wild duck, which was shot early in 1912 in the Orkneys. What appears to have been a fellow-hybrid was seen on the Pentland Skerries in the following May. No other instance of a similar hybrid appears to be on record.

We are indebted to Mr. W. Junk, of Berlin, for a copy of a sale catalogue of ornithological literature.

R. L.

REPORT OF THE METEOROLOGICAL COMMITTEE.

THE report of the Meteorological Committee for the year ended March 31, 1912, shows that several important matters were dealt with during that period, *e.g.* the reconsideration of the relations with the Post Office as regards weather telegraphy, the incorporation in the official network of stations which had previously sent their observations to the Royal Meteorological Society, the publication of results of various classes of observations, and the revision of rules under which the increasing number of telegraphic reports from health resorts can be accepted for communication to the Press.

The present capabilities of international and wireless weather telegraphy are well illustrated by the frontispiece synoptic chart for April 1 of the distribution of weather phenomena over a large part of the northern hemisphere compiled from data received within ten days of the date of the chart. One great advantage has been conceded by the Post Office at the request of H.M. Treasury in allowing priority of transmission to certain classes of meteorological telegrams and to storm warnings; but very much still remains to be effected in the way of facilitating the telegraphic distribution of forecasts to all parts of the United Kingdom by some financial arrangement by which the Meteorological Office would be placed on a better footing in carrying out its important public work than that accorded to a "private person."

The percentage of complete success and the sum of successes (complete and partial) of the 8h. 30m. p.m. forecasts for the year 1911 were both higher than in any year since 1879, when the present service of daily forecasts was inaugurated. The "further outlook" frequently appended to the forecasts for twenty-four hours has also been remarkably successful. Want of space precludes special mention here of the useful work carried on in other departments of the office.

THE METALS IN ANTIQUITY.

THE Huxley memorial lecture was given by Prof. W. Gowland, F.R.S., on Tuesday, November 19, at the Royal Anthropological Institute, the subject being "The Metals in Antiquity." After pointing out the sources whence our knowledge of the use of metals by man in prehistoric and protohistoric times was derived, the lecturer gave an account of the primitive metallurgy of copper, tin, gold, lead, silver, and iron, the conditions under which they were extracted from their ores, and the localities in which they were first obtained.

The origin of the smelting furnace was traced to the camp fire, in which, if by chance a lump of ore either of copper carbonate, tin-stone, or brown iron ore or hæmatite, had been one of the ring of stones surrounding the camp or domestic fire and had accidentally become embedded in its embers, it would undoubtedly be reduced to metal.

The metals which occur—native copper, gold, and iron—were undoubtedly the first to be known to man in the localities in which they occurred, but until the art of smelting metals had been invented, the discovery and use of the native metals was insufficient to affect to any great extent the old Stone age culture.

Gold, although doubtless the first metal to be known in many localities owing to its wide distribution in the sands of rivers, was useless for any practical purpose.

Copper, however, or an alloy of the metal with tin, antimony, or arsenic, was extracted from ores at a very remote period, and it or its alloys was the first to be applied to practical use. In fact, the first metal to be obtained by primitive man by smelting copper ores depended on their composition, and in the localities where tin did not occur it was a more or less impure copper.

The extraction of gold from its ores on a large scale in the earliest times was attributed to the Sudan

district of Egypt, and the primitive tools and methods employed at the mines were described.

Egypt was also noted for having produced the first mining map in the world, a map showing a gold mining region of the time of Seti I. or Rameses II. (1350 to 1330 B.C.).

The influence of silver and lead on the development of primitive culture was shown to be insignificant, the latter metal only becoming of importance during the supremacy of the Romans, in connection with their elaborate systems for the supply and distribution of water and in the construction of baths.

As regards iron, the belief that the first iron generally known to man was either of meteoric origin or telluric native iron was not supported by any substantial evidence. Nor was such origin necessary, as iron ores are so easily reducible that they can be converted into metallic iron in an ordinary charcoal fire. They are, in fact, reduced to metal at a considerably lower temperature than the ores of copper.

The earliest iron smelting in Europe was traced to the upper waters of the Danubian tributaries, the ancient Noricum, but in still earlier times iron was extracted from its ores in the region on the south-east of the Euxine, in Ferghana and other localities in Asia. In Africa, so far as metallurgical evidence may be depended on, the extraction of iron from its ores was carried on at a remote date. That this early African iron smelting was known in Egypt is well shown by a bas-relief on a stone now in the Egyptian collection in Florence.

THE BORDERLAND BETWEEN ELECTRICITY AND OTHER SCIENCES.[1]

THERE are applications of electricity that give work to many men, applications which employ much plant and apparatus, and on which large sums of money are spent, about which we have heard very little or nothing in the institution. Again, we hear little, if anything, about what is occurring on what I may term the borderland between electricity and the other sciences. In this borderland or fringe a large number of scientific workers are quietly at work, and what is to-day a laboratory experiment may to-morrow form the basis of a large industry. Finally, we should have an opportunity of discussing the many details in the design and operation of electrical plant and apparatus, the importance of which cannot be overestimated.

Wireless Telegraphy and Telephony.—Corresponding to each spark at the transmitter of a wireless telegraphy plant, a train of oscillations is received, and these trains of oscillations are rectified by the detector, and in general are passed through a telephone as an indicator. At each spark a click is heard in the telephone, so that with 600 sparks a second the diaphragm is attracted 600 times, producing a somewhat musical note.

Herein lies one of the great advantages of high-spark frequency.

There seems no doubt that the combination of the human ear and a telephone is much more sensitive for high-frequency notes than for low. In some tests I have made, using an alternating current to determine the minimum power required to produce an audible signal in a telephone receiver at different frequencies, I found in one case that the power was reduced from 430 micro-microwatts at 300 frequency to 7·7 micro-microwatts at 900 frequency. At higher frequencies it increased again.

[1] From the presidential address delivered to the Institution of Electrical Engineers on November 14 by Mr. W. Duddell, F.R.S.

Due to atmospheric causes, there is generally audible in the telephone receiver clicks and noises commonly spoken of as atmospherics or strays. With high-spark frequencies the human ear easily distinguishes the musical note from these atmospherics; this enables the operators to read through a large amount of extraneous interference. The elimination or compensation of these atmospherics is one of the most important outstanding problems in wireless telegraphy.

When operating with continuous waves practically no note is heard in the receiver telephone unless the currents are chopped up into rapidly recurring groups of waves either at the transmitter (tone sender) or at the receiving end (ticker).

In order to make a permanent record of the signals, and to allow of high-speed working, the rectified current from the detector may be passed through a galvanometer or a relay, and here we come to one of the difficult problems which requires solution, namely the construction of a relay or recording instrument which will make a record of the very small received currents at high speeds. The Einthoven or string galvanometer, which is at present used for this purpose, is delicate and gives a photographic record.

Although the difficulties may be minimised, I do not feel at this moment that the photographic method of recording, with the attendant chemicals, and the necessity of handling moist slip, can be looked upon as the final solution from the point of view of commercial telegraphy.

The problem of constructing a relay for this purpose is a very difficult one. The mean current strength of the signals, after rectification by a high-resistance detector, is of the order of $\frac{1}{10}$ to $\frac{1}{100}$ of a microampere, and the amount of power available to work the instrument is only of the order of a few micro-microwatts. For high-speed reception the number of contacts to be made and broken per second may be anything up to fifty. The problem before our instrument-makers is to construct a relay or recorder which will operate with a power not exceeding a few micro-microwatts at the rate of fifty signals per second.

Of the sister science, namely wireless telephony, there is not so much to relate. A certain amount of progress has been made, but the details of the methods used have not been made public. The principle is simple. Given continuous oscillations or a spark frequency above the limits of audibility, you may vary the antenna current, and hence the radiation by means of a microphone, in the same way as a continuous current is varied by the microphone in ordinary telephony. As the radiation varies according to the modulation of the current by the voice the received current will be varied in the same manner and the voice will be reproduced. The difficulties are mainly in the transmitter. First, we require a perfectly steady source of continuous oscillations, and secondly a microphone capable of modulating the large powers required to transmit any distance. Over short distances of a few miles there are no difficulties. It is only when we come to distances of fifty to 100 miles that the engineering problems become troublesome. In view of the progress that is being made in the high-frequency alternator, and of how much more easy it is to modify the power given out by an alternator, it will not be surprising if, as soon as high-frequency alternators are in use, wireless telephony over comparatively long distance becomes a working possibility.

Electrochemistry and Electrometallurgy. — The amount of power installed for chemical and metallurgical purposes is very large indeed. Exact data are wanting, but it seems probable that the power employed in these processes in Norway and at Niagara may already reach 1,000,000 kw. One of the neces-

sities of our industry, namely copper, is largely purified by electrical means. Aluminium, calcium carbide, carborundum, sodium, and potassium are wholly prepared electrically. The only hydroelectric stations of any size that have been built in this country are used for electrochemical purposes. The production of aluminium alone at Loch Leven absorbs some 30,000 kw.

The production of disinfectants electrolytically is being worked on a small scale. In Poplar the formation of a solution of chlorine in water by means of electrolysis is in practical use. Although one cannot anticipate very large powers being required for this purpose, yet if the demand for electrolytic disinfectants all over the country was the same as in Poplar, it would require about 2,000,000 units per annum, all of which could be supplied at such times as would help to level up the load curve.

Electromedical apparatus.—The design of induction coils for the production of X-rays has advanced a long way of late years, and some of the latest pieces of apparatus for the production of the discharge through the X-ray tube involve considerable ingenuity and engineering design. The discharge must be unidirectional and at a high pressure, say, 50,000 volts or more. One method to obtain this is to step up by means of an E.H.T. transformer and to rectify the secondary current. Another method of working to obtain practically instantaneous photographs consists in switching the primary of the transformer straight on to the direct-current mains, when the current rush instantly blows the fuses. This interruption of the current produces one powerful discharge on the secondary, which, passing through the X-ray tube, suffices for the photograph. I do not know how the supply companies view this method of operation, because the rush of current must be pretty considerable, as the apparatus is not constructed on a particularly small scale. The transformer weighs about half a ton.

Electricity and Chemistry.—We are all of us acquainted with the brush discharge, yet how much do we know of its mechanism? In our high-tension machinery we are mainly occupied with trying to get rid of it and its injurious effects. Yet it has its uses. Nearly all the information in our proceedings deals with the negative question, namely how to avoid it.

Now the brush discharge has a peculiar property of producing that modification of oxygen known as ozone, which is without doubt a strong sterilising agent, and which may in the future have considerable applications. A modification of the conditions of the production of the discharge will cause the formation of oxides of nitrogen instead of oxides of oxygen. Oxides of nitrogen are of great commercial importance, and their production by electrical means will probably be one of the most important industrial applications of electricity.

Already in Norway between 100,000 and 120,000 kw. are employed working day and night for this purpose, and it is stated that this power will shortly be increased to nearly 250,000 kw. The main object of fixing the atmospheric nitrogen is to form a substance to replace Chile saltpetre. The demand for this is yearly growing at an increasing rate.

Last year about 125,000 tons of nitrate were imported into this country. To produce the equivalent amount of fixed nitrogen per annum would, on the basis of Norwegian plants, require about 150,000 kw.

At the moment I believe that the cost of electrical power is the chief stumbling-block to the introduction of the manufacture on a large scale in this country.

Electricity and Sound.—I do not know of many researches on the efficiency of the telephone receiver, yet the question is really a practical one and of considerable importance. The telephone receiver may be looked upon as an alternating-current motor. It receives electrical energy, which it converts into the mechanical form in the motion of its diaphragm, which energy is transmitted to the air as sound waves. There is no special difficulty in measuring the electrical energy supplied to the telephone receiver to a moderate degree of accuracy. The amount of this energy that is transmitted to the diaphragm is much more difficult to estimate. The real difficulty is the determination of the amount of energy of the sound waves. If we possessed any apparatus by means of which we could measure energy of sound waves we could not only determine the efficiency of the telephone receiver, but the apparatus would have many other useful applications. It is curious to think that up to the present we have no unit or standard of sound. We cannot specify its strength or intensity. Even the comparison of two sounds by the ear is very inaccurate; nowhere near as accurate as the comparison of two lights by means of the eye. This want of standards and methods of measurement is, I believe, one of the causes that has retarded progress in the science of sound. Can electricity, the handmaid of all the other sciences, help in this direction?

Electricity and Radiation.—Much work is quietly going on, of which we in the institution hear nothing, to try to unravel completely the mechanism of the transfer of electricity through gases. There is much to be hoped for along these lines. The elaborate glass apparatus, the vacuum tubes, the mercury, the liquid air, &c., which are being used in the research make the experiments look most unpromising from the practical engineer's point of view. Yet some progress is being made in electric lighting by means of the passage of electricity through gases. Many members will remember the vacuum tube, 176 ft. long, which was used to light the courtyard of the Savoy Hotel. That tube, I believe, contained nitrogen, and according to the tests of Prof. Fleming, gave an efficiency of 0·56 candle per watt. About a year ago I saw a tube, not such a long tube, filled with the rare gas neon, obtained from the residues in the manufacture of liquid air. This tube gave a most beautiful rose-coloured light. If this rare gas were obtainable in sufficient quantities we might have a rival to the flame arc. I may mention in passing that tubes containing neon are now commercially obtainable, and are claimed, in the larger sizes, to have an efficiency as high as two candle-power per watt. Further researches on the borderland between electricity and radiation will no doubt provide us with still more efficient sources of light.

We are at present very far from any practical means of converting the energy of radiation directly into electrical energy, although on a small scale this conversion really takes place in many photoelectric arrangements. For instance, the action of the light on the liquid potassium sodium alloy has been shown by Prof. Fleming to produce a voltage as high as 0·6 volt when the liquid alloy and a platinum plate are enclosed in a highly exhausted tube, and the liquid alloy is illuminated strongly. There seems little doubt that the current that is generated in this case is produced from the energy of the light that is absorbed.

The effects so far obtained are extremely small. At the most only a few microamperes are obtainable with very strong illumination. Nevertheless, this property of sensitiveness to light, though at the moment it has no practical applications, may at any time be found to fill some useful purpose and make another case illustrating how observations that are one day on the borderland of science may shortly afterwards be of practical use in engineering.

When it is remembered that the water-power in Norway alone is estimated to produce several million kilowatts, it is evidently better, for the present at any rate, for engineers to utilise the solar radiation by harnessing the waterfalls rather than by attempting to build radiation traps in the Sahara.

UNIVERSITY STUDENTS IN STATE-AIDED INSTITUTIONS OF ENGLAND AND WALES.

AN article on the budgets of certain universities and university colleges, based on the reports for the year 1910–11 from universities and university colleges in Great Britain in receipt of grants from the Board of Education, was published in the issue of NATURE for August 15 last. These reports also contain a great deal of information concerning the number of students in the various colleges, their ages, the subjects they are studying, and so on; and we have abstracted the subjoined facts from them and the introductory statement signed by the President of the Board of Education.

Before summarising the statistics under these headings, it is well to point out that the numbers which follow concern the following English universities:—Birmingham, Bristol, Durham (Armstrong College), Leeds, Liverpool, Manchester, Sheffield, London (including University College, King's College, Bedford College, School of Economics, and East London College), and also the University Colleges at Nottingham, Reading, and Southampton. The University of Wales includes the University Colleges of Aberystwyth, Bangor, and Cardiff.

Certain other constituent colleges of universities are in receipt of aid under "The Statement of Grants available from the Board of Education in Aid of Technological and Professional Work in Universities in England and Wales." These institutions are twelve in number, nine being medical schools attached to hospitals in London. They are all schools of the University of London. One, the Newcastle College of Medicine, is a constituent college of the University of Durham, while the two remaining, namely, Manchester Municipal School of Technology and the Bristol Merchant Venturers' College, make provision for the faculties of technology and engineering respectively in the universities to which they are attached.

NUMBER OF FULL-TIME STUDENTS, 1910–11.

	England	Wales
Degree students:—		
Training college	1459 ...	451
Others	3512 ...	702
Total	4971 ...	1153
Non-graduate (diploma) students:—		
Training college	729 ...	—
Others	1100 ...	105
Total	1829 ...	105
Post-graduate students	477 ...	75
Others	628 ...	58
Total	7905 ...	1391

NUMBER OF PART-TIME STUDENTS, 1910–11.

	England	Wales
Day.		
Degree	254 ...	11
Non-graduate (diploma)	112 ...	4
Post-graduate	809 ...	15
Others	2987 ...	286
Evening.		
Degree	494 ...	—
Non-graduate (diploma)	810 ...	—
Post-graduate	173 ...	—
Others	7298 ...	—
Total	12937 ...	316

In addition, there were in England 277 evening students studying for matriculation and nine such students in Wales.

The number of full-time students in England during the year 1910–11 was 7905, as compared with 8174 in the previous year. This apparent drop of 269 is, however, more than accounted for by the stricter classification adopted. A number of students taking post-graduate and special courses have this year been clsssified as part-time students. The number of full-time degree and diploma students, on the other hand, increased by 150, and the real increase was larger since the figures for the earlier year included 78 engineering students at the Bristol Merchant Venturers' College who were included in the returns for Bristol University, but have this year been shown separately. The establishment of a somewhat higher criterion and the consequent exclusion of a certain number of students who simply attend a certain number of lectures render it somewhat difficult to make any detailed comparison of the figures for part-time students with those for the previous year, but it seems safe to say that the apparent reduction in the total number of part-time students is more than accounted for by the reduction in the number of "Other" students, many of whom could scarcely be regarded as serious students, and have consequently been excluded altogether. On the other hand, the number of part-time students taking degree, diploma, or post-graduate courses showed marked increase. It follows that the reduction in the total number of all kinds of students is not to be taken as implying any diminution in the number of genuine students; on the contrary, there is good reason to think that the number of such students is on the increase. In support of this view it may be pointed out that the total number of post-graduate students has increased since the previous year by more than 200.

In Wales there has been a small increase in the total number of full-time students; on the other hand, there has been a drop in the number of part-time day students.

AGE AT ADMISSION OF FULL-TIME STUDENTS.

	England	Wales
Number admitted during 1910–11	3587 ...	465
Percentage under 17	3·8 ...	3·9
Percentage 17–18	12·0 ...	14·4
Percentage 18–19	23·9 ...	31·2
Percentage above 19	60·3 ...	50·5

The number given above under England include 277 students at the nine medical schools of the University of London and 29 students at the Newcastle College of Medicine, which is a constituent college of the University of Durham.

NUMBER OF FULL-TIME STUDENTS IN THE VARIOUS FACULTIES, 1910–11.

	England	Wales
Arts	3410 ...	936
Pure science	1723 ...	254
Medicine	2586 ...	62
Engineering	1015 ...	43
Technology	735 ...	22
Agriculture	162 ...	63
Other departments	203 ...	11

To make the above summary more explicit, it should be pointed out that under "Arts," fine art, music, law, commerce, teachers' diploma, and economics are included; "Engineering" covers naval architecture; "Technology" comprises also mining, metallurgy, and architecture; and "Agriculture" embraces horticulture and dairy-work.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Mr. N. Cunliffe, of Trinity College, has been appointed to the office of assistant to the superintendent of the museum of zoology for one year as from October 1.

The Board of Agricultural Studies reports that the number of students receiving instruction in the School of Agriculture continues to increase. This term 117 names are on the books, as compared with 106, 100, and 81 in the corresponding terms of the last three years. It is hoped that the new building will be ready for occupation in October, 1913. The rooms lately vacated by the Forestry Department are now used for the advisory work subsidised by the Development Commissioners. In addition to the University farm, possession of How House Farm for the purposes of the Plant Breeding Institute was taken on September 30. The farm belongs to Trinity College, and consists of 146 acres of arable land and 67 of pasture. The soil survey of the eastern counties is in active progress. The analytical work on the soils of Norfolk, Cambridgeshire, Isle of Ely, and Huntingdonshire is completed, and that of Bedfordshire, Suffolk, and Northamptonshire is well in hand.

OXFORD.—On November 19 the decree assigning a plot of land on the south side of the University park for an extension of the chemical department was proposed by the president of Magdalen, opposed by Prof. Oman, and carried in Convocation by 175 to 106. In the same Convocation, a decree assigning a plot at the north-west corner of the park for the erection of an engineering laboratory, also proposed by the president of Magdalen, was supported by Prof. Jenkin, opposed by the rector of Exeter, and rejected by 234 to 81. The vote may be taken, not as showing any ill-will on the part of the University to the subject of engineering, but as the expression of a pretty general opinion that a more suitable site than that suggested could be found for the proposed laboratory.

THE Right Hon. Sir Albert Spicer, Bart., M.P., will distribute the prizes and certificates at the Borough Polytechnic Institute, Borough Road, London, S.E., on Monday, December 2, at 8 p.m.

IT is proposed to establish at the Huddersfield Technical College a library relating to the woollen and worsted industries, to include (1) pamphlets, books, and printed matter of all kinds, and (2) pictures and other illustrations dealing with the rise and growth of the industries, their present position and possible further developments. An appeal is made, therefore, for gifts of books, &c., and for donations of money with which to purchase necessary additions to the library not otherwise obtainable. Any contributions may be sent to the secretary, Technical College, Huddersfield.

IN her lecture on November 15 to the London Child Study Society on Maria Montessori's method and self-education, Madame Pujol-Ségalas urged that from different points of view Froebel and Montessori perceive the same necessity for taking "nature as a guide" in the endeavour to create conditions favourable to the child's development. Attempts, she said, have been made in Europe and America to apply natural and rational methods in practical teaching, but the teachers experience difficulties from a deformation of the child's mind which has previously taken place. Such deformation does not take place in the houses administered under the Montessori system, because the training is as a rule individual instead of being constantly collective, and because it leaves room for the free expansion of the growing life. The aim of the system is to show how it is possible to stop making slaves of our pupils, intellectually and morally. Montessori schools are laboratories of experimental psychology in the truest sense. Practical difficulties in the application of the method vary together with qualities of races, classes, persons, and age. In order to serve the children we must have faith in human nature, and give it an opportunity of rising up to its highest present ideal, so that realising it, it may conceive new ones, higher still, ever progressing, and thus fulfilling its destiny.

AN interesting point made in the preface to the recently published calendar of the University College of North Wales for the session 1912–13 is that to the establishment of the college all classes of the community contributed their aid with remarkable unanimity. Never before, in so short a period, had so many persons, either in England or in Wales, subscribed towards a movement for the promotion of higher education. The subscription list was opened at a meeting held in Chester on January 23, 1883, when seven gentlemen subscribed 1000*l.* each. In twelve months the list had risen to upwards of 30,000*l.*, the total number of subscribers being nearly 8000. A large proportion of this amount was given in small sums, much of it as the result of a house-to-house canvass in the rural parts of North Wales. More than 1250*l.* was contributed by the quarrymen of the Penrhyn and Dinorwic Quarries, who undertook the entire work of collection, appointing collectors for each "gallery" in the quarry and contributing each monthly pay-day a fixed sum out of their earnings. In view of this local enthusiasm for higher education, it is not surprising that there should have been a progressive increase in the number of students year by year. At the beginning of the session 1884–5, the total number of students was fifty-eight, while the session 1911–12 opened with 338 students, three-quarters of whom were from North Wales.

IN the issue of *Science* for October 25 last, Prof. Rudolf Tombo, Junior, of Columbia University, contributes an article on the geographical distribution of the student body of a number of American universities and colleges. Among other matters of interest, Prof. Tombo deals with the number of foreign students at American institutions of higher learning. Thirty-seven American universities and colleges together attracted no fewer than 1782 foreigners during the academic year 1910–11, exclusive of the attendance at summer courses. Of these students from other countries, Canada sent 344, China 330, Japan 197, Mexico 193, Turkey (in Europe and Asia) 84, India 73, British Isles 72, Cuba 62, Germany 48, Russia 48, and Australia 47. When the foreign *clientèle* of twenty-one of the leading American universities is compared with that of the twenty-one German universities, America is seen to be far behind Germany in attracting foreign students to its institutions of higher learning. During the winter session of 1910–11 the German universities were attended by no fewer than 4672 foreign students, as against 1576 foreigners at the American universities mentioned. The German universities draw 4046 students from other European countries, 398 from North and South America, 203 from Asia, 20 from Africa, and 5 from Australasia, while the American universities attract 478 students from North American countries outside of the United States, 112 from South America, 318 from Europe, 587 from Asia, 32 from Africa, and 49 from Australasia; in other words, the American universities lead in every continent with the exception of Europe.

THE Imperial Education Conference, at its meeting last year, recommended that there should be appointed in connection with that conference an advisory committee consisting of the accredited agents in London of the several Governments concerned, together with representatives of the Colonial Office, the India Office, the Board of Education, the Scotch Education Department, and the Irish Office. The functions of the committee as recommended by the conference were to be to keep itself acquainted with the progress of any courses of action that the conference had recommended, to facilitate that progress when necessary by communicating with the Governments concerned, and to consider such proposals as might be submitted for the agenda of any future meetings of the conference. The following representatives have been nominated by the various Governments and departments concerned to serve on the committee:—Mr. L. A. Selby-Bigge, C.B., Board of Education; Dr. H. Frank Heath, C.B., Board of Education; Sir John Struthers, K.C.B., Scotch Education Department; Dr. W. J. M. Starkie, Irish Government; Sir H. W. Just, K.C.M.G., Colonial Office (Dominions Division); Mr. J. F. N. Green, Colonial Office (Crown Colonies); Sir Theodore Morison, K.C.I.E., India Office; the Right Hon. Lord Strathcona and Mount Royal, G.C.M.G., G.C.V.O., Dominion of Canada; the Right Hon. Sir G. H. Reid, P.C., G.C.M.G., Commonwealth of Australia; the Hon. Thomas Mackenzie, Dominion of New Zealand; Mr. T. Slingsby Nightingale, Union of South Africa; Mr. T. A. Coghlan, New South Wales; the Hon. Sir John Taverner, Victoria; Major Sir Thomas Robinson, Queensland; the Hon. A. A. Kirkpatrick, South Australia; Mr. Cyril Jackson, Western Australia; the Hon. Sir John McCall, Tasmania. The Board of Education has placed at the disposal of the committee the services of Mr. W. W. Hornell, Assistant Director of Special Inquiries and Reports, to act as honorary secretary.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, November 7.—Sir Archibald Geikie, K.C.B., president, in the chair.—Louis V. **King**: The scattering and absorption of light in gaseous media, with applications to the intensity of sky radiation. The analysis of the present investigations seems to support the view that, at levels above Mount Wilson, molecular scattering is sufficient to account completely both for attenuation of solar radiation and for the intensity and quality of sky radiation. Even at sea-level the effect of "atmospheric dust" can be taken into account in a simple manner in formulæ for absorption and scattering.—Dr. P. E. **Shaw**: A standard measuring machine.—E. M. **Stubbs** and Dr. E. B. R. **Prideaux**: A spectro-photometric comparison of the emissivity of solid and liquid gold at high temperatures with that of a full radiator. (1) The emissivity of solid and liquid gold at high temperatures, relative to the emissivity of a full radiator at the same temperatures, has been measured throughout the visible spectrum. (2) A sharp discontinuity in the emissivity takes place at the melting point, the liquid gold emitting more strongly than the solid in the red and yellow, and less in the extreme blue. The shape of the "relative emissivity" curves is quite different in the two cases. (3) The curve of "relative emissivity" of solid gold at high temperatures is similar to that of absorptivity at low temperatures as determined from reflectivity measurements; whether it is identical, in which case the temperature coefficient of the absorptivity would be *nil*, could not be absolutely determined, owing to the change of structure which a polished surface undergoes on heating. (4) No temperature coefficient of "relative emissivity" could be detected for the liquid metal through a range of more than 100°. (5) "Black body" temperatures of solid and liquid gold at the melting point have been calculated. (6) It has been shown that the general equation expressing the radiation of a selective radiator is of the form

$$E_{\lambda'} = f(\lambda, T) c_1 \lambda^{-5} e^{-c_2/\lambda T},$$

which in the case of gold and other metals cannot be reduced to the form of Wien's equation for a full radiator with changed values of the constants.—C. **Smith**: Optical properties of substances at the critical point.—Hon. R. J. **Strutt**: Absorption of helium and other gases under the electric discharge. Attempts to repeat Berthelot's absorption of helium by carbon disulphide under the influence of the silent discharge have given absolutely negative results. Helium is slightly absorbed by phosphorus under electric discharge, though in much less quantity than nitrogen or hydrogen. The absorption in the former case is regarded as mechanical, in the latter as chemical.—F. W. **Aston**: The discharge between concentric cylinders in gases at low pressures. (1) The relations between pressure, voltage, and the length of the Crookes dark space in the discharge between concentric cylinders take much the same form as those in the discharge between parallel planes. (2) Curvature of the surface of the kathode appears to have no influence upon the rate of alteration of the length of the dark space with change of current density, *so long as the latter is measured at the surface of the kathode.* (3) *Ceteris paribus*, the length of the dark space is greater for a convex cylindrical surface than a plane, and for a plane than a concave one.—F. W. **Aston**: The influence of the nature of the kathode on the length of the Crookes dark space. (1) The relations between the values of pressure, voltage, current, and the length of the dark space are determined for plane kathodes of many different materials, and found to satisfy the same form of equations as those previously given for aluminium, the constants varying considerably. (2) Roughness of the kathode surface does not appear to affect the discharge, if the dimensions of the irregularities are small compared with the length of the dark space. (3) The length of the dark space is shown, in the cases examined, to be greatest for silver and least for magnesium, the metals following the same order as in the case of the kathode fall. (4) The rate of change of length of the dark space with change of current density at the surface of the kathode seems much the same for all kathodes. (5) Difficulties in the way of arriving at a satisfactory explanation of these and other data connected with the dark space are indicated and shortly discussed.—A. **Campbell**: The determination of the absolute unit of resistance by alternating-current methods.—A. **Mallock**: Some unclassified properties of solids and liquids. This paper suggests that many qualities of solids and liquids, which, although well known and commonly recognised, are not classified (qualities, for instance, such as ductility and malleability), may be explained by reference to the relations of the limits of the principal elasticities of the substances. A real homogeneous isotropic substance, whether solid or liquid, offers two distinct kinds of resistance to deformation, viz., resistance to alteration of volume and resistance to shear. There are also two distinct and different limits to each of these kinds of deformation—limits which cannot be exceeded without causing rupture or permanent alteration of the substance. When a strain involves both shear and alteration of volume, the behaviour and properties of the strained material depend to a great extent on whether the limit of shear or the limit of

volume alteration is the first to be overcome.—Sir W. de W. **Abney**: Trichromatic theory of colour vision. The measurement of fatigue of the retina.

November 14.—Sir Archibald Geikie, K.C.B., president, in the chair.—J. W. **Cropper**: The development of a parasite of earthworms. A description of "bodies" found within some of the epithelial cells of the vesiculæ seminales of the earthworm. They closely resemble "Kurloff's bodies" found within the lymphocytes of guinea-pigs. By means of the jelly method of examination, the development of these bodies into free spirochætes is demonstrated in the same way that it has recently been shown that "Kurloff's bodies" also become spirochætes. The author suggests that these new parasites be called *Spirochaeta lumbrici*.—Edith R. **Saunders**: Further contribution to the study of the inheritance of hoariness in stocks (Matthiola).—Prof. A. J. **Brown** and F. P. **Worley**: The influence of temperature on the absorption of water by seeds of *Hordeum vulgare* in relation to the temperature coefficient of chemical change.—R. **Kirkpatrick**: Note on *Merlia normani* and the "Monticuliporas."—James **Thompson**: The chemical action of *Bacillus cloacae* (Jordan) on citric and malic acids in the presence and absence of oxygen.—G. W. **Ellis** and J. A. **Gardner**: The origin and destiny of cholesterol in the animal organism. Part x., The excretion of cholesterol by man, when fed on various diets.—Prof. R. Boyd **Thomson**: The comparative anatomy and affinities of the Araucarineæ.—Muriel **Robertson**: Notes on the polymorphism of *Trypanosoma gambiense* in the blood and its relation to the exogenous cycle in *Glossina palpalis*.—H. L. **Duke**: Further observations on the recovery of *Trypanosoma gambiense* from *Tragelaphus spekei* on the islands of Lake Victoria Nyanza.—Colonel Sir David **Bruce**, Majors **Harvey** and **Hamerton**, Dr. J. B. **Davey**, and Lady **Bruce**: The morphology of *Trypanosoma simiae*, sp. nov.—H. L. **Duke**: (1) Some observations on *T. pecorum* (Bruce) and *T. uniforme* (Bruce). (2) A camel Trypanosome; with some remarks on the biometric method of diagnosing Trypanosomes. (3) Some experiments with arsenphenylglycin and *Trypanosoma gambiense* in *Glossina palpalis*.—Dr. H. **Bayon**: The cultivation of *Trypanosoma rhodesiense* (Stephens and Fantham).

Zoological Society, October 29.—Prof. E. A. Minchin, F.R.S., vice-president, in the chair.—Mrs. Rose Haig **Thomas**: Eggs of *Phasianus versicolor*, *P. formosus*, and of the F_1 and F_2 offspring of an experimental cross between a male *P. versicolor* and a female *P. formosus*. Attention was directed to the resemblance in size of the eggs of the offspring and of the male parent species, whereas the expectation was a likeness to those of *P. formosus*, thus showing the descent through the male to his female offspring of the small egg of his species.—E. G. **Boulenger**: The breeding-habits of the "Millions" fish (*Girardinus poeciloides*). Cases were recorded of the male of this species breeding before assuming the livery of its sex. The author directed attention to parallel cases among fishes, in which, however, except in one case, the question was one of degree only.—Rev. T. R. R. **Stebbing** read a paper on the crustacea Isopoda of the *Porcupine* expedition.—Dr. F. E. **Beddard**: The anatomy and sytematic arrangement of the Cestoidea.—E. Dukinfield **Jones**: Thirteen new species of butterflies of the genus Thecla, collected at various localities in south-east Brazil.

Challenger Society, October 30.—Prof. E. W. MacBride in the chair.—D. J. **Matthews**: (1) A bacteriological water-bottle. This bottle consists essentially of a glass-lined brass cylinder, closed at each end by rubber washers. It is lowered closed and full of alcohol, sterility being thus ensured and external pressure counteracted; it is then opened (when sea-water replaces the alcohol) and closed by messengers. (2) The observations of Mr. G. H. Drew in the Tongue of the Ocean. The Tongue is an inlet of deep water (700 to 1000 fathoms) running southward into the Great Bahama Bank. The salinity and temperature in the depths agreed with those of nearest stations of *Challenger* and *Michael Sars*; surface temperatures were higher. A layer of water of high salinity was found near the surface near the coast, but not farther out, and as it was not accompanied by irregularities of the temperature curve, a strong current was probable.—E. **Heron-Allen** and A. **Earland**: *Saccammina sphaerica* (M. Sars) and *Psammosphaera fusca* (Schulze). The views of Dr. Ludwig Rhümbler as to the life-history of these forms were combated, and the stages of the life-cycle he described referred to different species, namely *Crithionina mammilla* (Goes) and the above. The three species were found to differ widely in distribution, though they sometimes occur together.

Geological Society, November 6.—Dr. Aubrey Strahan, F.R.S., president, in the chair.—Prof. A. C. **Seward**: A contribution to our knowledge of Wealden floras, with special reference to a collection of plants from Sussex. In this paper an account is given of specimens of Wealden plants from the Sussex coast, for the most part from the neighbourhood of Fairlight, acquired by the British Museum since 1895, the date of publication of the second part of the Wealden Flora (British Museum catalogue).—E. **Proctor**: Notes on the discovery of fossiliferous Old Red Sandstone in a boring at Southall, near Ealing. With a note on the fish-remains, by Dr. A. Smith **Woodward**. The boring described in this paper is situated at Southall, and was made for the purpose of obtaining water from the Lower Greensand. For this purpose, however, the boring was a complete failure, as it passed directly from the Gault into Palæozoic rocks. The older rocks were met with at a depth of 1130 ft., and continued with slight variation to a depth of 1261 ft., the lower limit of the borehole. The fossils were yielded by definite bands, which varied from 1 in. to an eighth of an inch in thickness; they consisted mainly of scales and teeth of Holoptychius and plates of Bothriolepis, both characteristic genera of the Old Red Sandstone.

Linnean Society, November 7.—Prof. E. B. Poulton, president, in the chair.—Dr. R. R. **Gates**: Mutating Oenotheras. The following facts and views regarding mutation as an evolutionary factor were referred to:—(1) *Oenothera Lamarckiana* has probably undergone crossing in the wild state to the same extent that other open pollinated species intercross. (2) The mutation phenomena are an evidence of germinal instability resulting from crossing, change of climate, or cultivation. (3) Hybrid splitting is inadequate to account for the forms which suddenly appear. (4) Some of the mutants differ from the parent in their physiological adjustments, and this may account for cases of "climatic adaptation," but mutations will not suffice to explain the more complex adaptations which involve inter-relationships between several organisms. (5) *O. rubricalyx* has originated as a heterozygous mutant, but there are obvious difficulties in applying the same explanation to the other mutants of Oenothera. (6) The origin of certain of the mutations, at least (*e.g. O. lata*, *O. gigas*), is intimately concerned with chromosome mechanisms; that of certain others may be concerned with the action of releasing stimuli. (7) Darwinian natural selection always assumed an original environmental change for the organism, either (*a*) a change of climate in a given area, or (*b*) the introduction of new organisms, lead-

ing to the gradual modification of the species. (8) But neither chance-wise mutations in all directions nor the vicissitudes of changing climates and distributions can account for the orderly phylogenies which larger groups of organisms frequently show. (9) There is no single evolutionary factor, but the process is a multifarious one.—H. N. **Ridley**: A collection of plants from Mount Menuang Gasing, Selangor. In February, 1912, Mr. C. B. Kloss made an expedition to Mt. Menuang Gasing in Selangor to collect the fauna and flora of this mountain. In this paper is an account of the expedition and of the plants collected by him in four or five days spent at an altitude of 4900 ft. there. Menuang Gasing is the most southern high point of the great chain of the granite mountains which form the backbone of the peninsula, and the object of the expedition was to discover whether the high mountain fauna and flora descended so far south as this point. The mountain is 4900 ft. high, and though there are other hills a little south of this, this is the highest and most likely to bear the high hill flora. The fauna was found to belong to that of high northern ranges, and the flora shows clearly that it corresponds. Among the characteristic plants found were the golden balsam, *Impatiens oncidioides*, Ridl., *Bucklandia populnea*, R. Br., the rare *Polyosma parviflora*, King, *Pratia begonifolia*, Lindl., *Dilochia Cantleyi*, Ridl., and *Goodyera gracilis*, Hook. fil. The only mountain south of this one of approximate altitude is Mt. Ophir in Malacca; the flora of this is well known, and is very different from that of the main range. Indeed, there is every evidence that Mt. Ophir was never connected with the main chain, at least during the period of the evolution of the flora. One hundred and forty-three species were collected by Mr. Kloss, of which fourteen were undescribed; of these the most noteworthy were what is probably the biggest species of the large genus Oberonia, a remarkable species of Blastus, and a new species of Balanophora.

Mathematical Society, November 14.—Annual meeting.—Dr. H. F. Baker (president, 1910–11), and afterwards Prof. A. E. H. Love (the newly elected president), in the chair. After the election of council and officers for the coming session, the following papers were communicated:—A. B. **Grieve**: Some properties of cubic surfaces.—Prof. W. H. **Young**: The determination of the summability of a function by means of its Fourier constants.—Prof. W. **Burnside**: Groups of linear substitutions which possess quadratic invariants.—J. B. **Holt**: The irreducibility of Legendre's polynomials.—Prof. E. W. **Hobson**: The representation of a summable function by means of a series of finite polynomials.—E. **Cunningham**: Theory of functions of a real vector.—G. N. **Watson**: Some solutions of Laplace's equation.

PARIS.

Academy of Sciences, November 11.—M. Lippmann in the chair.—Édouard **Branly**: The intermittent conductivity of thin dielectric layers. An experimental study of the electrical conductivity of thin sheets of dielectrics (gutta-percha, collodion, mica, celluloid, varnish) under varying conditions of pressure and electromotive force, and submitted to the effects of shock or induced oscillatory currents set up at a distance by the spark discharge of a condenser. The results are applied to explain the action of radio-conductors utilised in wireless telegraphy.—M. **Borrelly**: Observations of the Borrelly comet (1912*c*) made at the Observatory of Marseilles with the comet-finder. Positions are given for November 3, 6, and 8.—M. **Coggia**: Observations of the Borrelly comet (*c*, November 2, 1912) made at the Observatory of Marseilles with the 26 cm. Eichens equatorial. Positions given for November 4 and 8.—M. **Giacobini**: Observations of the new Borrelly comet (1912*c*) made at the Paris Observatory with the 40 cm. equatorial. Positions given for November 6 and 7.—J. **Guillaume**: Observations of the Schaumasse comet (1912*b*) made at the Observatory of Lyons. Positions given for October 2, 3, 6, and 7.—MM. **Luizet** and **Guillaume**: Observations of the Borrelly comet (1912*c*) made at the Observatory of Lyons. Six positions given for November 7, 8, and 9.—P. **Chofardet**: Observations of the Borrelly comet made at the Besançon Observatory. Five positions given for November 4, 6, and 7.—P. **Brück**: Observations and elements of the Borrelly comet (1912*c*) obtained at the Observatory of Besançon.—Louis **Fabry**: The identification of the small planets.—Jean **Chazy**: A differential system formed by M. Schlesinger.—Ch. J. de la Vallée **Poussin**: The development of trigonometrical series.—M. **Hisely**: A new theorem on the effects of moments.—M. **Poincet**: The wake and suction at the back of ships. A discussion of the results of experiments carried out by Creusot on the torpedo-destroyer *ST*, and their bearing on the propulsion of turbine vessels.—M. **Duchêne**: The use of the carrying planes in the construction of an aëroplane.—Alphonse **Berget**: A velocity formula applicable to aëroplanes. An empirical formula, $V = A\left(\frac{F}{S}\right)^{\frac{1}{3}}$, is given, in which V is the velocity, S the supporting surface of the planes, F the h.p. of the motor, and A a numerical coefficient. In eleven types of aëroplane actually in use the coefficient A varies between 7 and 8.—C. **Raveau**: The fringes of holohedral crystalline plates with parallel faces.—Georges **Claude**: The phenomena of electrical pseudo-resonance.—M. **Hanriot**: Drawing down metals.—L. **Grimbert** and M. **Laudat**: The estimation of lipoids in blood serum. A description of a rapid and moderately accurate method of determining cholesterol, lipoids containing phosphorus, fatty acids, and neutral fats in a small quantity of blood serum. Analytical figures are given for normal and pathogenic serum.—H. **Vincent**: The diagnosis of typhoid fever by the spleen reaction. The injection of a preparation made from typhoid bacilli determines a characteristic hypertrophy of the spleen in cases of typhoid fever, and this reaction appears to be specific. It has given positive results in cases where the blood culture remained sterile.—Léon **Bernard**, A. Le **Play**, and Ch. **Mantoux**: The minimum pulmonary capacity compatible with life.—C. **Schlegel**: The influence of temperature on the course of development of *Maïa squinado*.—Henri **Martin**: The distribution of the human deposits in the Mousterian layer of La Quina (Charente).—Léon **Bertrand** and Louis **Mengaud**: The structure of the Cantabrian Pyrenees, and their probable relations with the western Pyrenees.—G. **Vasseur**: The discovery of a layer of vertebrates in the upper Agenais Aquitanian. The geological age of the fauna of Saint-Gérand-le-Puy.

BOOKS RECEIVED.

Der Kautschuk: Eine kolloid-chemische Monographie. By Dr. R. Ditmar. Pp. viii + 140 + plate. (Berlin: J. Springer.) 6 marks.

Elektrobiologie: die Lehre von den elektrischen Vorgängen im Organismus auf moderner Grundlage dargestellt. By Prof. J. Bernstein. Pp. ix + 215. (Braunschweig: F. Vieweg und Sohn.) 6 marks.

The Electrical Conductivity, Dissociation, and Temperature Coefficients of Conductivity from Zero to Sixty-five Degrees of Aqueous Solutions of a Number of Salts and Organic Acids. By Prof. H. C. Jones and others. Pp. iv + 148. (Washington: Carnegie Institution.)

Easter Island. The Rapanui Speech and the Peopling of South-east Polynesia. By W. Churchill. Pp. iv+340. (Washington: Carnegie Institution.)

The Mineralogy of the Rarer Metals. By E. Cahen and W. O. Wootton. Pp. xxviii+211. (London: C. Griffin and Co., Ltd.) 6s. net.

The Gas Turbine. Theory, Construction, and Records of the Results obtained from two actual Machines. By A. Holzwarth, translated by A. P. Chalkley. Pp. viii+140. (London: C. Griffin and Co., Ltd.) 7s. 6d. net.

Electrical Photometry and Illumination. By Prof. H. Bohle. Pp. xi+222. (London: C. Griffin and Co., Ltd.) 10s. 6d. net.

Science and the Human Mind. By W. C. D. and C. D. Whetham. Pp. xi+304. (London: Longmans and Co.) 5s. net.

Aeronautics. Technical Report of the Advisory Committee for the Year 1911–12. Pp. 323+plates. (London: H.M. Stationery Office; Wyman and Sons, Ltd.) 11s.

Collected Papers in Physics and Engineering. By Prof. J. Thomson. Selected and arranged with unpublished material and brief annotations by Sir J. Larmor and J. Thomson. Pp. civ+484. (Cambridge University Press.) 15s. net.

Papers on Psycho-Analysis. By Prof. E. Jones. Pp. xv+432. (London: Baillière, Tindall and Cox.) 10s. 6d. net.

The Lost Towns of the Yorkshire Coast, and other Chapters bearing upon the Geography of the District. By T. Sheppard. Pp. xviii+329. (London: A. Brown and Sons, Ltd.) 7s. 6d. net.

Notes and Queries on Anthropology. Edited by B. Freire-Marreco and Prof. J. L. Myres. Fourth edition. Pp. xii+288. (London: Royal Anthropological Institute.) 5s.

Zum Problem der Vererbungsträger. By Dr. F. Vejdovský. Pp. iii+184+12 plates. (Prag: Königl. Böhm. Gesellschaft der Wissenschaften.)

DIARY OF SOCIETIES.

THURSDAY, NOVEMBER 21.

ROYAL SOCIETY, at 4.30.—An Investigation of the Spectrum of Ionium: A. S. Russell and R. Rossi.—(1) A Note on the Absorption of β Rays; (2) The Similarity in Nature of X and Primary γ Rays: J. A. Gray.—The Spectra of Fluorescent Röntgen Radiations: J. C. Chapman.—Optical Investigation of Solidified Gases. II. The Crystallographic Properties of Hydrogen and Oxygen: Dr. W. Wahl.—An Electric Furnace for Experiments *in vacuo* at Temperatures up to 1500° C.: R. E. Slade.—An Investigation of the Dissociation-Pressures and Melting Points of the System Copper, Cuprous Oxide: R. E. Slade and F. D. Farrow.—Note on the Capacity Coefficient of Spheres: Dr. A. Russell.—The Motion of Viscous Liquid due to Uniform and Periodic Motion maintained over a Segment of an Infinite Plane Boundary: W. J. Harrison.—The Elastic Hysteresis of Steel: Prof. B. Hopkinson and G. T. Williams.—Ionic Size in Relation to Molecular Physics, together with a New Law relating to the Heats of Formation of Solid, Liquid and Ionic Molecules: W. R. Bousfield.—The Synthesis of a Silicalcyanide and of a Felspar: Dr. J. E. Reynolds.—A Method of Finding the Conductivity for Heat: Prof. C. Niven and A. E. M Geddes.

INSTITUTION OF MINING AND METALLURGY, at 8.

LINNEAN SOCIETY, at 8.—Mr. P. A. Talbot's Collection of Plants from Southern Nigeria, illustrated by Lantern Slides: Dr. A. B. Rendle.—Impressions of the Feeding Tracks of *Limax maximus* and *Helix aspersa*: Mrs. Longstaff.—Vegetable Mechanics: Rev. George Henslow.—Some Indian Jurassic Gymnosperms: Miss Nellie Bancroft.

FRIDAY, NOVEMBER 22.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Vapour-Compression Refrigerating Machines: J. Wemyss Anderson.—A Contribution to the Theory of Refrigerating Machines: Dr. J. H. Grindley.

PHYSICAL SOCIETY, at 5.—(1) The Law of Plastic Flow of a Ductile Material; (2) Kinematograph Illustrations of the Torsion and Breaking of Large Specimens: C. E. Larard.—A Column Testing Machine: Prof. E. G. Coker.

MONDAY, NOVEMBER 25.

INSTITUTE OF ACTUARIES, at 5.—Inaugural Address by the President (Fredk. Schooling).

TUESDAY, NOVEMBER 26.

ROYAL SOCIETY OF ARTS, at 4.30.—The Hardwood Timbers of New South Wales: W. H. Warren.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.30.—Some Bronze Age and British Bones from Broadstairs, with Type Contours of all the Bronze Age Skulls in the Royal College of Surgeons' Museum: F. G. Parsons.

ZOOLOGICAL SOCIETY, at 8.30.—The Genus Engæus, or the Land Crayfishes of Australia: G. W. Smith and Dr. E. H. J. Schuster.—The Structure of Bone in Fishes: a Contribution to Palæohistology: E. S. Goodrich.—Report on the Myzostomida collected by Mr. Cyril Crossland in the Red Sea in 1905: Dr. C. L. Boulenger.—Description of an Amphipod belonging to the Family Talitridæ, from the Woodbush, Transvaal: Hon. Paul A. Methuen.—Some Points in the Anatomy of the Mouth-parts of the Mallophaga: Bruce F. Cummings.

INSTITUTION OF CIVIL ENGINEERS, at 8 p.m.—Mechanical Handling of Coal for British Locomotives: C. J. B. Cooke.

FARADAY SOCIETY, at 8.—The Billiter Alkali-Chlorine Cells: Dr. A. J. Allmand.—A Neutral Oil Emulsion as a Model of a Suspension Colloid: R. Ellis.—Note on the Electrolysis of Nitric Acid Solutions of Copper: J. H. Stansbie.

WEDNESDAY, NOVEMBER 27.

ROYAL SOCIETY OF ARTS, at 8.—Political Economy as a Code of Life: H. Cox.

BRITISH ASTRONOMICAL ASSOCIATION, at 5.—The Astronomical Significance of the Prehistoric Monuments in the Outer Hebrides: Capt. Bayle Somerville, R.N. *And other Papers.*

THURSDAY, NOVEMBER 28.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.

CONCRETE INSTITUTE, at 7.30.—Bills of Quantities for Reinforced Concrete Work: John M. Theobald.

SATURDAY, NOVEMBER 30.

ESSEX FIELD CLUB (at the Essex Museum, Stratford), at 6.—Some Letters from the Rev. Wm. Derham, Rector of Upminster, Essex, to Dacre Barrett, of Belhus, Essex (1704–1710). Communicated, with Remarks, by T. Barrett-Lennard.—The Mycetozoa: Miss Gulielma Lister.

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