THURSDAY, MAY 29, 1913.

OLD HERBALS.

Herbals: their Origin and Evolution. A Chapter in the History of Botany, 1470–1670. By Dr. Agnes Arber. Pp. xviii + 253 + xxi plates. (Cambridge University Press, 1912.) Price 10*s.* 6*d.* net.

IN this age of literary activity it is difficult to find a sphere of knowledge that has not been hitherto exploited by the makers of books. It is therefore a refreshing experience to find that the work before us is the first attempt to present to the public a popular survey of this fascinating old literature of herbals. The active life-period of this literature extends over a course of two hundred years, beginning in the latter part of the fifteenth and ending during the second half of the seventeenth century.

These curious old books treat of the medicinal virtues of plants and herbs, and were written chiefly by physicians for their own convenience and the use of the public at a time when botany was still a branch of medicine. But, in addition to the medical, they possess an artistic interest, being illustrated from the earliest times with woodcut figures of plants. This is exemplified in the profuse collection of choice and beautiful illustrations in Mrs. Arber's work.

The mediæval encyclopædia of Bartholomæus Anglicus has a section dealing with herbs and trees and their medicinal properties, and although this is perhaps the first printed book containing information of a strictly botanical nature, the earliest work to which the term "herbal" is generally applied is the Latin Herbarium of Apuleius Platonicus, first printed at Rome about 1484 by the physician to Pope Sixtus IV. This little book, based on classical writings, and illustrated with figures coming down from late Roman art, was, in its manuscript form, the chief text-book of medicine of our Anglo-Saxon forefathers.

But we must turn to Germany for the *doyens* amongst printed herbals. These are the Latin "Herbarius" (1484), the German "Herbarius" (1485), and the "Hortus Sanitatis" (1491), all three representing a tradition of great antiquity and printed at Mainz. It is also to the German "fathers of botany," Brunfels and Fuchs, that we owe the handsome herbals which, for the beauty and faithfulness of their illustrations, remain not only unsurpassed by any other herbal, but perhaps unequalled. In the Netherlands, Italy, Switzerland, and France the herbal attained great popularity, and for an account of its origin and growth in these countries Mrs. Arber's work must be read.

The first work printed in our own country, dealing exclusively with the medicinal virtues of herbs, was a small quarto volume without illustrations published anonymously by Richard Banckes in 1525. During the next four decades this book was in great demand, no fewer than about fourteen editions appearing, some with the names of Macer, Linacre, and Askham on the title-pages, and others attributed erroneously to the physician Walter Cary and to the printer William Copland. But a year after the appearance of Banckes's book there appeared the fine folio, with woodcut illustrations, called the "Grete Herball." This was a translation of the French work "Le Grant Herbier." Nevertheless, it may be looked upon as the *doyen* of the English herbals, and no lover of books would wish to dispute this claim after reading the delightful old phraseology in the quaint black letter fount of our early printers. The herbals of the great English botanists, William Turner, John Gerard, Henry Lyte, and John Parkinson, are all described in the work before us.

We wish we had space enough to deal adequately with other interesting parts of Mrs. Arber's work. The chapter on the evolution of botanical illustration, and the well-chosen illustrations numbering upwards of one hundred and twenty, show clearly the important position this old herbal literature occupies in the history of wood-engraving. But our concluding remarks must be confined to the chapter on signatures and astrological botany. Absurd and preposterous as these doctrines are, they nevertheless make delightful reading. According to the former, many medicinal plants were stamped, as it were, with some indication of their uses. In this extraordinary superstition of the mystics, described by Dr. Paris as the most absurd hypothesis that ever disgraced the annals of medicine, the best botanists of the period had little belief; and in astrological botany they perhaps had less. Nevertheless, as Mrs. Arber rightly explains,

"a number of books dealing with such topics appeared during the period we have considered, but their writers form a class apart, and must not be confused with the herbalists proper, whose attitude was, on the whole, marked by a healthy scepticism, which was in advance of their time. It would, naturally, be far from true to say that they were all quite free from superstition, but, considering the intellectual atmosphere of the period, their enlightenment was quite remarkable."

The few inconsistencies we have noticed are chiefly bibliographical in their nature, and do not detract from the merits of the book. We confidently recommend it to all lovers of antiquarian lore.

THE BELIEF IN IMMORTALITY.

The Belief in Immortality and the Worship of the Dead. By Prof. J. G. Frazer. Vol. i.: The Belief among the Aborigines of Australia, the Torres Straits Islands, New Guinea, and Melanesia. Pp. xxi+495. (London: Macmillan and Co., Ltd., 1913.) Price 10*s.* net.

THE publication of Prof. Frazer's Gifford lectures has been awaited with interest by students of anthropology and religion. Their subject was one of the first to occupy the author's attention; his paper on primitive burial customs placed the study of the belief in immortality and the worship of the dead in a new light. He has now given us the first instalment of a comprehensive survey of the whole institution. Psychical and ceremonial though it is, the doctrine and cult form an institution as deserving of the name as political government. The belief in some degree of immortality has been practically universal, and is still a "last infirmity of noble mind"; some form of "worship," fear of the ghost or actual veneration of the deified ancestor, has accompanied the belief in the case of the majority of peoples. The author acutely points out, for the consideration of "historians and economists, as well as of moralists and theologians," that the direct consequences of this moral institution have been grave and far-reaching, such as no mere sentiment could have produced, not only in primitive but in civilised history. It has, he says,

"not merely coloured the outlook of the individual upon the world; it has deeply affected the social and political relations of humanity in all ages; for the religious wars and persecutions, which distracted and devastated Europe for ages, were only the civilised equivalents of the battles and murders which the fear of ghosts has instigated amongst almost all races of savages of whom we possess a record. . . . And when we consider further the gratuitous and wasteful destruction of property, as well as of life, which is involved in sacrifices to the dead, we must admit that with all its advantages the belief in immortality has entailed heavy economical losses upon the races—and they are practically all the races of the world—who have indulged in this expensive luxury."

The treatment of the subject is, so far, merely descriptive; it is not even comparative. But the analysis of belief and practice among the aborigines of Australia, the Torres Straits, New Guinea, and Melanesia, which occupies nearly 400 pages of this volume, is a masterly performance. The intention of the author is to pursue this method from the lower to the higher planes of culture. The savage conception of death as unnatural, and due, first to sorcery, and secondly to the operation of ghosts or spirits, is further studied, and shown in its development towards a recognition of disease and accident as causes. The interesting view of Weismann and Wallace that death in higher organisms may actually be an acquired adaptation is cited in comparison.

There is an extraordinary likeness between the varieties of belief and ceremony, which never degenerates into mechanical sameness. In one case their connection with tabu results in a very sensitive regard for the rights of property; in another, the fear of sorcery leads to a punctilious system of sanitation and scavenging; in several cases the dramatic art finds its beginnings in the ghost-dance and similar propitiatory ceremonial. Incidentally, the author quotes interesting varieties of the belief in the soul, which he assumes, though he does not go further than Tylor's dream-theory, to be the cause of the general belief in survival after death. It is to be hoped that in future volumes the author will treat the cause with the same fullness as he has treated the effect.

A. E. CRAWLEY.

RECENT PSYCHOLOGY AND LOGIC.

(1) *Elements of Physiological Psychology.* A Treatise of the Activities and Nature of the Mind from the Physical and Experimental Points of View. By Prof. G. T. Ladd and Prof. R. S. Woodworth. (Thoroughly revised and re-written.) Pp. xix+704. (New York: Charles Scribner's Sons, 1911.) Price 4 dollars net.

(2) *Formal Logic: a Scientific and Social Problem.* By Dr. F. C. S. Schiller. Pp. xviii+423. (London: Macmillan and Co., Ltd., 1912.) Price 10*s.* net.

(3) *Der Mechanismus des menschlichen Denkens.* By Erich Ruckhaber. (Humboldt-Bibliothek, Heft 2.) Pp. 126. (Brackwede i. W.: Dr. W. Breitenbach, 1911.) Price 2 marks.

(4) *Religion and Modern Psychology.* By J. Arthur Hill. Pp. vii+200. (London: Wm. Rider and Son, Ltd., 1911.)

(5) *Is the Mind a Coherer?* By L. G. Sarjant. Pp. 304. (London: George Allen and Co., Ltd., 1912.) Price 6*s.* net.

THE first two books of those mentioned above are by far the most important of the group. The new, largely re-written edition of (1) Ladd's "Physiological Psychology" will be welcomed by students of psychology. Nearly twenty-five years have passed since the first edition of the book, a period within which the then new branch of experimental psychology has forced its way to the front. Very considerable additions have been made to this book in the section on the physiology of the nervous system. It may be questioned whether such a full study of physiological processes is not better obtained, even by the student of psychology, directly from standard works on physiology. It

has the advantage, however, of forming a selected introduction to the later parts of the work, in which the psychology of the senses obtains the fullest treatment.

In his book (2) on formal logic, Dr. Schiller attacks the fundamental assumption of that science, viz., that one *can* consider the purely formal aspect of truth alone. The book is written in a style quite characteristic of the most prominent upholder of Pragmatism in this country. We have not space to give the book the full discussion which it deserves. We may observe, however, that the fact that all the problems of logic shade off into those of metaphysics or psychology, even if true, does not imply that it cannot do useful and essential work in its own sphere.

(3) In "Der Mechanismus des menschlichen Denkens" the author has sought to present in handier form some of his ideas upon the mechanical interpretation of thought expounded in his larger work, "Des Daseins und Denkens Mechanik und Metamechanik." In the first section he discusses the "feeling of contradiction" as a fundamental factor of all thought. This is followed by a critical consideration of the association theory and the logical, psychological, and physiological objections to it. Memory and thought are dealt with in a third section, in which the unity of brain-function in memory is emphasised.

(4) "Religion and Modern Psychology" would have more aptly been called "Mysticism and Psychical Research." A discussion of mysticism occupies a large portion of the book, and psychical research is of central importance to the author's position, which is that little else can afford satisfactory reasons for belief in a future life. The book is written in a readable style, and contains very numerous quotations—for those who are fond of them. Theism is dismissed in a couple of pages, though the author "distrusts those who arrive at a conclusion too speedily." "Metaphysics," he says on p. 35, "is obsolete in the ontological sense," yet in the concluding chapter he describes, with qualified approval, a crude metaphysic which gives a sort of world soul to each of the heavenly bodies.

(5) The last-named book is a metaphysical essay which will probably prove highly amusing to the trained philosopher, but highly confusing to the novice. The book begins with the question, "Do you ever go out of your mind, reader?" and we must confess that in reading the book we have several times felt that we did. We regret that space forbids us to quote one of the many passages which rival anything we have met for obscurity of thought and confusion of language.

ANATOMY, NORMAL AND MORBID.

(1) *The Essentials of Morbid Histology.* For the use of students. By Prof. A. S. Grünbaum. Pp. xvi + 219. (London: Longmans, Green and Co., 1912.) Price 7*s.* 6*d.* net.

(2) *Die Muskeln des Stammes.* By Prof. P. Eisler. (Handbuch der Anatomie des Menschen. Herausgegeben von Prof. K. von Bardeleben. Zweiter Band. Zweite Abt. Erster Teil.) Pp. xii + 705. (Jena: Gustav Fischer, 1912.) Price 38 marks; subscription price, 35 marks.

(3) *Neue Lehre vom zentralen Nervensystem.* By Dr. Em. Rádl. Pp. vii + 496. (Leipzig: W. Engelmann, 1912.) Price 12 marks.

(1) THE aim of Prof. Grünbaum's book is to provide the student of pathology with a manual that will serve the same purpose as Prof. Schäfer's well-known book on histology does for the student of normal anatomy. The author has succeeded in compressing into a small compass a great deal of information (and an excellent series of well-chosen figures) without any sacrifice of lucidity of treatment. To select from the enormous amount of material now available the subject-matter for a small manual upon morbid histology for students is a task of great difficulty, and perhaps no two pathologists would make precisely the same choice. It would be easy to criticise any such selection as this book contains; but, on the whole, Prof. Grünbaum has succeeded in producing a work that will be welcomed by all medical students, and we think by most teachers of pathology and medicine. The publishers are to be heartily congratulated on the excellence of their work, and especially on the clearness of the illustrations.

(2) Everyone who has had occasion to refer to that great anatomical library known as Bardeleben's "Handbuch," of which Prof. Eisler's volume constitutes the twenty-first "Lieferung," must have been impressed with the extraordinary inequality of the different volumes, both as regards the material and the manner in which the information is presented. This large treatise on the muscles of the trunk is one of the best volumes that have yet appeared. Needless to say, a book of 705 pages dealing solely with the trunk muscles of man is a storehouse of detailed information; but its great merit is that most of it is the result of the author's original observations. He freely refers to the work of other investigators, and gives copious illustrative facts from comparative anatomy, but the reader is made to feel that he is getting first-hand information throughout. The illustrations are excellent, both artistically and

anatomically, for they have that kind of accuracy which no artist who is not the investigator and author ever can portray.

As a work of reference and a storehouse of accurate information, Prof. Eisler's monograph will be invaluable.

(3) In the notes upon the other two volumes we have been dealing with facts, normal and pathological; but in Dr. Rádl's excursion into transcendental philosophy we are invited into the realms of ultra-Bergsonian casuistry, which is certainly not the normal environment of the biologist. The major part of his book is devoted to a discussion of the comparative anatomy of the visual organs and related nervous structures, chiefly of invertebrate animals; and the author uses these facts, or rather his speculative interpretation of them, as the ammunition for an attack upon the usual methods of biological argument, and especially upon theories of phylogenesis. It is easy to see why he chose the visual organs for this purpose: the data relating to the other sensory mechanisms, if employed as he uses his materials, would all have pointed in the direction opposite to that desired by Dr. Rádl. But the retina grows out from the central nervous system: therefore it is not formed by the influence of environment; it is the material expression of the "neue Lehre" that the mind makes its own instruments! This is the kind of argument, if such speculations can be called argument, that Dr. Rádl indulges in. It seems to the reviewer that Dr. Rádl has not sufficiently acknowledged his indebtedness to Bergson; but, on the other hand, his statement lacks even the superficial plausibility of Bergson's writings.

OUR BOOKSHELF.

Tracks of the Sun and Stars, A.D. 1900 *to* A.D. 37900. Photographs from Stereoscopic Perspective Drawings made at Tenby, A.D. 1912–13. By Thomas Edward Heath. Pp. 17 + photographs. (London: W. Wesley and Son; Manchester: Flatters and Garnett, Ltd., n.d.) Price 5*s.* net.

IT has probably occurred to many who are interested in the study of stellar motions that it would be instructive to have a model of those star-tracks which are known, so that the phenomena in the three-dimensional aspect might be more easily grasped. By means of Mr. Heath's stereoscopic drawings it is now possible to have such a model before our eyes, and to see in a vivid manner the complex system of motions of a portion of the stellar universe. We have been delighted with the clearness with which the varying inclinations and directions of the interlacing movements are shown. Perhaps the most striking impression is the very considerable change of relative position which takes place in the selected interval of 36,000 years—a period by no means long from the astronomical point of view. The great range of difference in the speeds of the stars is also brought out prominently.

In order to ascertain the complete motion of a star, the proper motion, radial motion, and parallax must be known, the parallax being generally much the most uncertain of these quantities. In some cases where the value is small, Mr. Heath's tracks are rather hypothetical; but recent researches have increased considerably the number of trustworthy parallaxes, and the data used for these drawings appear to be well selected on the whole. Two views are given, in one of which the observer is supposed to be removed 100 light-years, and in the other 200 light-years, from the present position of the sun. The letterpress contains useful instructions for the reader who wishes to make for himself other drawings of this character.

A. S. E.

Die europaeischen Schlangen. Kupferdrucktafeln nach Photographien der lebenden Tiere. By Dr. Fritz Steinheil. Erstes Heft. (Jena: Gustav Fischer, 1913.) Price 3 marks.

ALTHOUGH there is no lack of good figures of most of the snakes of Europe, yet these are mostly executed from preserved specimens. We therefore welcome the publication, of which the first fascicle has just appeared, undertaken by the enterprising firm of Gustav Fischer, in which Dr. Steinheil intends to represent, by means of photographs taken from living examples, the different species of snakes inhabiting Europe, as well as their principal varieties. The five copper-plates now issued could scarcely be surpassed.

The letterpress accompanying each plate is short, and deals merely with the geographical distribution and the habits in captivity; no information is given concerning the mode of reproduction, a subject of particular interest not only to the herpetologist, but also to the amateur who keeps snakes in the terrarium. No systematic order is followed, but a brief introduction explains the classification followed, which, as well as the nomenclature, is in accordance with the British Museum catalogue of snakes, also adopted in Schreiber's recently issued second edition of the "Herpetologia Europæa." In fact, as the author tells us in the preface, this work is intended to serve as an atlas to the "Herpetologia Europæa," and as such will prove of great service.

G. A. B.

Die Methoden der exakten, quantitativen Bestimmung der Alkaloide. By Prof. Anton Ritter von Korczynski. Pp. iv+82. (Berlin: Gebrüder Borntraeger, 1913.) Price 3.50 marks.

THIS little work deals with the methods by which alkaloids may be accurately determined quantitatively, but not with the methods by which the total alkaloids may be extracted from crude drugs or their preparations, although an appendix of fifteen pages contains the details of the alkaloidal drug-assays of the German Pharmacopœia. One-third of the book is devoted to the determination

of quinine; morphine and the opium alkaloids, and strychnine and brucine, occupy the next places of importance, whilst the remaining alkaloids are very briefly discussed. It is essentially a compilation, and, like all compilations, has a distinct value. In this case the value is somewhat adversely affected by the scanty treatment that some of the alkaloids have received. Thus the separation of emetine from cephaëline is simply mentioned, although Paul and Cownley showed long ago how it could be effected, and Farr and Wright have published a method for the accurate determination of colchicine, to which no reference is made; indeed, the results obtained by English workers in this field have been sadly neglected. The utility of the work would be much enhanced by a more thorough examination of the literature.

Manual of Wireless Telegraphy and Telephony. By A. F. Collins. Third edition. Pp. xv+300. (New York: John Wiley and Sons; London: Chapman and Hall, 1913.) Price 6*s.* 6*d.* net.

THIS edition differs from the first, which was reviewed in the issue of NATURE for February 14, 1907 (vol. lxxv., p. 366), in several respects. The improvements in apparatus, and the advances made in wireless telegraphy in other directions, have led Mr. Collins to extend his treatment of the apparatus of a commercial station, and to describe the transmitting and the receiving instruments in separate chapters. The suggestions to operators relating to the management of stations are more exhaustive, and other useful additions have been made.

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.*]

Artificial Hiss.

CAN any of your readers tell me how to make an artificial hiss? I have heard something like one from steam blowing off at a safety-valve. There the pressure was very high, but in the mouth a hiss is made with a moderate pressure behind. The problem must have been faced by inventors of speaking machines, but I do not know with what success. The best that I have been able to do myself is by blowing through a rubber tube nipped at about half an inch from the end with a screw clamp, but the sound is perhaps more like an *f* than an *s*.

There is reason to think that the ear, at any rate of elderly people, tires rapidly to a maintained hiss. The pitch is of the order of 10,000 per second.

RAYLEIGH.

Terling Place, Witham, Essex.

An Application of Mathematics to Law.

I WOULD not have troubled you with further correspondence on this subject but for the fact that Mr. Potts's letter (April 24, p. 187) illustrates in a remarkable way the value of a knowledge of the fundamental principles of mathematics when possessed by persons occupied in work often apparently of a very unmathematical nature.

Mr. Cripps (May 15, p. 270) appears to belong to the unfortunately too prevalent class of individual who mistakes algebra for mathematics, and he bases his objection entirely on the purely algebraic equation $I=M+i$. He completely overlooks the fact that Mr. Potts's method is based entirely on the great and powerful conception of *functionality*. But if I understand Mr. Potts correctly, the problem in which he is an expert consists in determining the forms and characteristics of certain functions, and not in the mere numerical solution of equations. G. H. BRYAN.

Overheated Water.

THE experiment of Dufour, in which drops of water were suspended in a mixture of linseed oil and oil of cloves, and heated to 120° C. without boiling, is seldom repeated for class demonstration, presumably owing to the difficulty of preparing a mixture of the oils exactly equal in density to water at the temperature named. The phenomenon may be shown with ease and certainty, however, by employing a mixture of four volumes of ethyl benzoate and one volume of aniline instead of the mixture of oils, the procedure being as follows:—Place 80 c.c. of ethyl benzoate and 20 c.c. of aniline in a beaker, and surround by a bath of glycerine or strong sulphuric acid. Heat the bath until the temperature of the mixture is 125° C., and then add 2 to 5 c.c. of freshly boiled water by means of a pipette. The water will sink at first, and rest on the bottom of the beaker; but on attaining the temperature of the mixed liquids it will break up with some violence into spheres of various sizes, which remain floating in the liquid so long as the equi-density temperature of 125° C. is maintained. It is advisable to place a cover over the beaker to prevent the fuming of the mixture.

For lantern projection, a copper vessel, square in section, and having two opposite sides of patent plate-glass, will be found satisfactory, glycerine being used to surround the beaker and the temperature raised gradually. CHAS. R. DARLING.

City and Guilds Technical College, Finsbury, E.C.

"Coal, and the Prevention of Explosions and Fires in Mines."

I MUST point out that some of the statements in your review of the above book in NATURE of April 24 are inaccurate.

"Great explosions do not, as Dr. Harger imagines, travel either exclusively or generally against the direction of the ventilating currents." What I say in the book (p. 78) which your reviewer is presumably criticising is this:—"All big dust explosions are similar to the one at Altofts. Ignition is followed by quiet combustion for 50–100 yards, then the wave of progressive combustion gathers speed, and finally attains a velocity approaching that of detonation, and races through the dust and air at a speed of 50–100 miles per minute. Such dust explosions always proceed *against* the current of air; sometimes they go the other way also, but seldom reach the working faces. As a rule the branch of an ignition which travels with the air current fails to develop violence," &c.

Every dust explosion in a mine on record *has* travelled against the air current, and the *reason* for this is clearly put in my paper on gob fires and the prevention of gob fires in mines, which your reviewer quotes, and also on pp. 98–100 in the book.

Your reviewer quotes Proc. Roy. Soc., vol. xxviii.,

p. 416, to show that a mixture of Ferndale dust and air is probably explosive, but the Ferndale dust mentioned in my papers and book is from the anthracite seams, and it is generally admitted now that anthracite dusts and air are *not* explosive *when unmixed with firedamp*.

I think readers of NATURE will agree that it is not permissible to quote half a paragraph when the rest of it amplifies. JOHN HARGER.

Chemical Laboratory, Liverpool University.

WE take exception to Dr. Harger's statements, in the quotation which he gives from p. 78 of his book, that "dust explosions" such as Altofts "always proceed *against* the current of air," and that, "as a rule, the branch of an ignition which travels with the air-current fails to develop violence."

The explosion at Altofts travelled to a distance of more than a mile in No. 1 chain road in the same direction as the air current had been previously travelling, and produced a greater amount of wreckage in that heading than in any other part of the mine. It did not reach the faces at any point, nor did it enter the return airways, for the reasons plainly set forth in Proc. Roy. Soc., vol. xlii., p. 174.

In our experience explosions are invariably found to have penetrated into the faces wherever there has been an uninterrupted train of coal-dust leading to them; and they have, as a rule, failed to pass through the return airways where the latter have not been recently used as haulage roads, and where, consequently, the coal-dust has become mixed with a large proportion of shale dust. For instance, the composition of a sample of dust taken from the return airways at Altofts Colliery after the explosion was as follows:—

	Per cent
Moisture	4·40
Volatile matter other than moisture ...	10·37
Carbon (estimated)	15·64
Ash	69·59

The experiments since made, both at Altofts and Liévin, have shown that dust of this quality is incapable of propagating an explosion.

The reference to Proc. Roy. Soc., vol. xxviii., p. 416, in the review, was not intended to show that a mixture of Ferndale dust and air "*is probably explosive*," as Dr. Harger suggests, but that return air does not contain too little oxygen or too much carbon dioxide to prevent its ignition when mixed with coal-dust even of the same quality as that of Ferndale. There are no anthracite seams in Ferndale Colliery; all the seams consist of steam coal of high-class quality. THE REVIEWER.

Error in the Smithsonian Physical Tables.

I HAVE just discovered a very awkward error in Table 47, p. 35, of this valuable publication. The table is headed "Least Squares," and gives the values of the probability integral. To illustrate the error, an example will be best.

For argument 0·53, the table gives 0·55494, but this is really the value for the argument 0·54, and the same error runs throughout the table. An easy way to correct it is to increase by 0·01 each of the figures in the horizontal line heading the table.

My copy is dated 1896, and I do not know if the mistake has been set right since.

I am reminded that some years ago I wrote to NATURE to suggest that all discovered errors in tables should be sent to some official scientific body, which should annually publish corrections of them.

C. T. WHITMELL.

Hyde Park, Leeds, May 22.

ANTHROPOLOGY IN WEST AFRICA.[1]

WE welcome a report by Mr. N. W. Thomas on the people of the Awka district, Ibo country, Southern Nigeria. Mr. Thomas is the Government anthropologist and has already given us an interesting report on the Edo-speaking people.

The present report is divided into three parts; the first treats of the law and customs of the people, the second is a dictionary, and the third contains proverbs, narratives, and vocabularies.

The most interesting to the general reader is undoubtedly part i. In chapter ii. Mr. Thomas gives some most interesting demographic facts and figures. Referring to infanticide, he says:—

> In addition to this legal infanticide (the exposure of twins) . . . I have more than once heard that the first-born of every woman is killed; my informants were Roman Catholic missionaries, who certainly know the native and his ways, and my own statistics seem to bear out the statement.

This is very interesting, and bears out the principle common, evidently, to most West Africans, that the first-born belongs to the owner of the family (*i.e.* the dead father). He, as head of the family, is worshipped by his son, grandson, great-grandson, and great-great-grandson. He (the dead one) has need of followers in dead man's land, and claims this toll in exactly the same way as the owner of a goat will claim its first-born from the farmer who is looking after it for him.

The genealogical tables are of great interest, and, in spite of the fact that the number of wives to one husband varies from four to eight, "the proportion of boys to girls in the births was fifteen to eleven." But there are more grown-up females than males. Taking the statistics for living males and females among the Ibo (1218 males to 1340 females), we can only conclude that the mortality among boys is greater than among girls or that this majority is largely composed of widows. That husbands in such a country should have four to eight wives must deprive a great number of men of the luxury of a wife. Many chiefs tacitly acknowledge this want and have appointed females in each town or village to supply the need. But in spite of this precaution young bachelors are constantly committing adultery. Men with one wife in this district account for 760 male and 787 female children, men with four wives for 137 male and 113 females. This chapter is most instructive to those who are interested in the question of polygamy *versus* monogamy.

Chapter iii. is entitled "Religion," and, written by such a master of anthropology as Mr. Thomas, is a lesson to all students of religion in Africa. Those of our readers who have followed the development of this great colony will not have forgotten the suppression of the so-called juju at

[1] "Anthropological Report on the Ibo-speaking Peoples of Nigeria." By N. W. Thomas. Part i., Law and Customs of the Ibo of the Awka Neighbourhood, S. Nigeria. Pp. 161+xx plates. Part ii., English-Ibo and Ibo-English Dictionary. Pp. vii+391. Part iii., Proverbs, Narratives, Vocabularies, and Grammar. Pp. vi+199. (London: Harrison and Sons, 1913.)

Aro Chuku and the recent recrudescence of the horrible rites nipped in the bud by the District Commissioner. Mr. Thomas writes: "We have, it is true, at the head of the pantheon a supreme god known as Cuku," who "seldom appears to figure in creation myths." The old men say that they knew nothing of Cuku before the coming of the white man. This may be quite correct, for our experience is that the idea of a supreme god is seldom reached by people living in the clan stage. To have a god like the Yoruba Olorun, or the Bini Osalubwa, people must have reached the kingdom stage of development. If the Aro Chuku juju had not been suppressed it is possible that the Ibos would be well on their way in their development of a great Ibo kingdom under the supreme god Chuku. It is rather remarkable that a trained anthropologist like Mr. Thomas should call the chief of Uri king in his chapter on priestly kings. The father of the family prays for his people, the head of the house does the same, the elected judge or head of a number of clans, or a tribe, does the same. The priestly office is there, but surely not kingship. At any rate, if the chief of Uri is not yet a king, it would appear that he, as a great spiritual leader, is on his way to kingship if his progress is not interfered with.

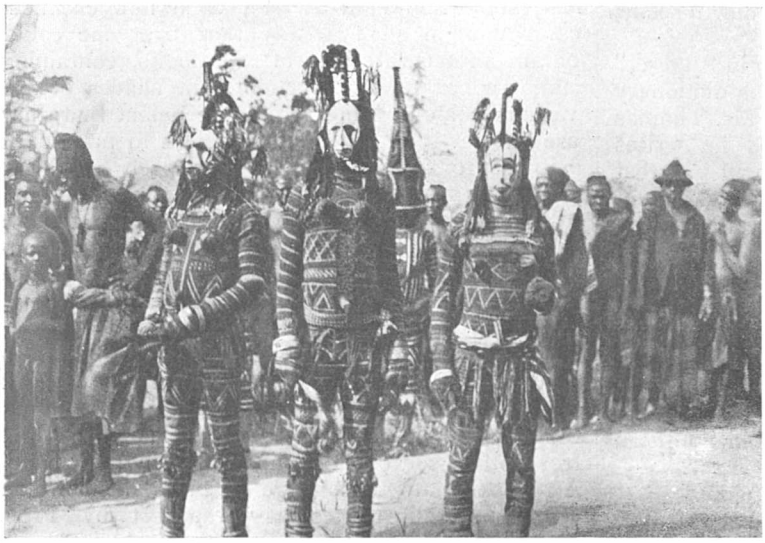


FIG. 1.—Mauri. From "Anthropological Report on the Ibo-speaking Peoples of Nigeria."

It is impossible to do justice to this part of Mr. Thomas's report in the space available. All his chapters are intensely interesting.

Part ii. is the dictionary, the material for which was, Mr. Thomas says, collected in 1911 from natives of Awka and Onitsha. It seems a pity that the vast and interesting material collected by the various missionary societies has not been taken into account. They must have dictionaries, at any rate in manuscript, and they have made translations in the Ibo language. We notice that Onitsha is spelt Oniča, and that Mr. Thomas, instead of adopting the geographical system of spelling as officially gazetted, has given us a system of his own—a good one, no doubt, but a new one. There are thus three systems of writing in Nigeria—the system adopted by the missionaries, the system enforced on officials by the Government, and Mr. Thomas's system.

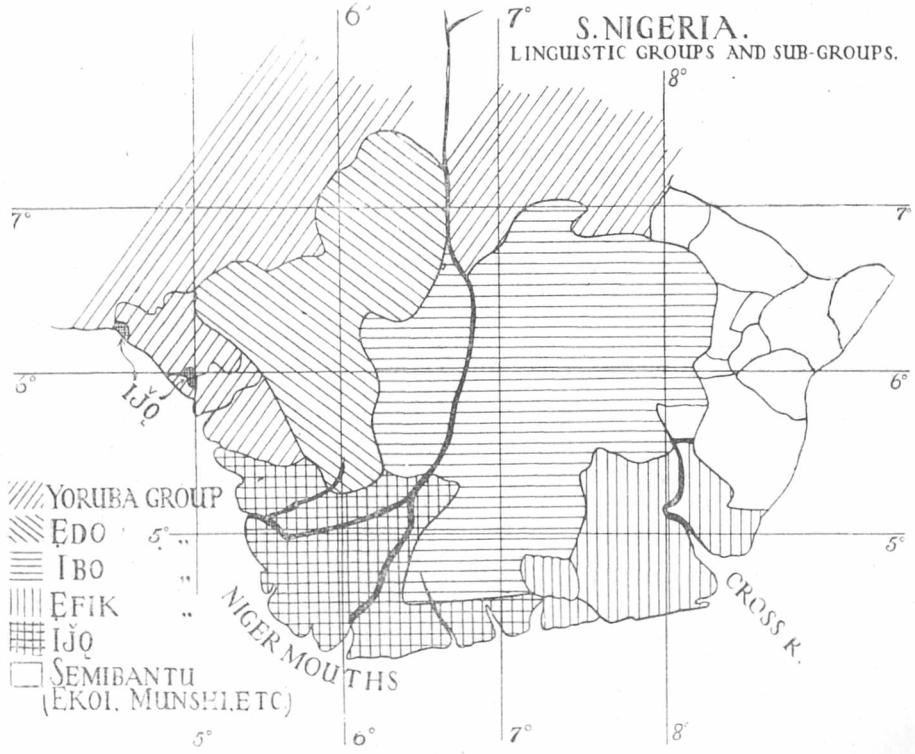


FIG. 2.—From "Anthropological Report on the Ibo-speaking Peoples of Nigeria."

Mr. Thomas has shown his caution by omitting the words "God" and "Čuku" from his dictionary.

There are no words beginning with the English *c* sound in the dictionary, and all the words under *č* in the dictionary are to be pronounced *tch*, or as the *c* in "church." Why, then, should not the simple *c* stand for this sound? The new *č* seems unnecessary.

The letter *j* is to be pronounced as *j* in "judge," but it is to be written *ǰ*. In the Yoruba dictionary the sound *sh* is written *ṣ*. This sign, Mr. Thomas says, stands for the cerebral *s*, and he writes the *sh* sound *š* instead of *ṣ*. There will be great gnashing of teeth in Nigeria until the Government takes the matter up and appoints a commission to settle which system is to be maintained.

Part iii.—Needless to say, Mr. Thomas has treated the proverbs, narratives, and grammar scientifically. The folklorist will revel in them. The student of the Ibo language will be greatly helped by the literal translations of the stories and by the vocabularies.

Mr. Thomas divides the languages in Southern Nigeria into four groups.

(*a*) Yoruba with Igara and Ṣekri (Jekri).

(*b*) Edo (Ado), including Sobo, Bini, Kukuruku, and Esa (Ishan).

(*c*) Ibo with Ika and numerous other languages.

(*d*) Efik and Ibibio.

The Government of Southern Nigeria is to be congratulated on the production of these valuable reports by its Government anthropologist, and we hope that Mr. Thomas will soon give us equally interesting books about the Ibibios and Efiks.

THE INTERNATIONAL ASSOCIATION OF ACADEMIES.

THE fifth meeting of the International Association of Academies was held at St. Petersburg during Whit-week. Of the twenty-two academies which constitute the association, twenty-one took part in the proceedings, the British Academy being the only society which was not represented. The delegates of the Royal Society were: Sir David Prain, Prof. Arthur Schuster, Prof. Sherrington, and Prof. Turner.

Among the new proposals the most important was that submitted by the Berlin Academy for an international investigation of the problems connected with volcanoes. It is not intended to form an international institute similar to that for geodesy or seismology, but rather to encourage each country to take its share in the investigation by establishing, if desirable, a separate institute of its own. An autonomous commission of the International Association of Academies could then act as connecting link between the different institutions. A small committee was nominated to make more definite proposals to the next assembly, and was authorised to enter into communication with the separate academies, each being asked to nominate a representative, and thus form a larger body to assist the committee in formulating a scheme of joint investigation.

An interesting proposal came from the Imperial Academy of St. Petersburg. The want is apparently felt in several branches of science to have a more scientific scale and definition of compound colours than exists at present. It ought to be possible to define the colour, *e.g.*, of a particular leaf, the skin of an animal, or a new chemical compound in such a way that everyone could obtain an accurate idea of it. Books, containing numbered samples of the different shades of the various colours, suffer from the defect that they are subject to change; and though in practice it may be found necessary to use such books as secondary standards, some means should be found to compare them from time to time with a more scientific scale of colours. The committee appointed to discuss this question consists of: Prince Galitzin, Sir Wm. Abney, and Messrs. Nasonow, Saccardo, Schuster, and Walden.

It has become the habit of the association to give its moral support to undertakings which it considers valuable; such support often enabling those more directly interested in them to obtain from other sources the financial help they need. A proposal to encourage in this fashion an organisation instituted at Frankfort by Prof. Brendel for calculating the orbits of small planets was adopted on the motion of the Académie des Sciences of Paris.

An enterprise to publish annually a table of physico-chemical constants had already been supported at the meeting at Rome; and though the utility of the work was subjected to some criticisms, it appeared that there was a real demand for it, and it received renewed support at the present assembly.

A report was presented by Prof. Turner on the progress of the work connected with the nomenclature of features on the surface of the moon. Although the committee has suffered much through the deaths of Prof. Franz and Mr. Saunders, there is good hope that the work will soon be completed and prove a most useful help to students of lunar phenomena.

A question of wider interest was raised by the French proposal to discuss the possibility of a reform of the calendar. This includes not only the question of fixing the date of Easter, but also more sweeping changes intended to divide the year into four equal quarters (at present the first six months consist of 181 and the second six months of 184 days) and the intercalation of an occasional extra day in the week, introduced to secure that the same day in each year should always be associated with the same day of the week. A committee was appointed to consider this matter.

The above, referring entirely to the work of the section of science, does not exhaust the questions which were raised and discussed before that section. The section of letters also had a successful meeting.

The association is still young, and consequently has to devote some attention to the statutes and regulations for its procedure, which have not yet become crystallised. A proposal to appoint a permanent secretary was strongly supported by some and opposed by other academies. It will

come up for decision at the next meeting, which will be held three years hence in Berlin, after discussion by a standing committee charged with the general revision of the statutes.

Proposals to elect the Royal Society of Edinburgh and the Finnish Academy of Helsingfors as members of the association were presented by the Royal Society of London and the Imperial Academy of St. Petersburg respectively. As several of the delegates were without definite instructions from their academies, the proposals will have to be submitted to the constituent bodies and voted upon by correspondence.

It is needless to say that the social functions of the meeting were carried out admirably and with lavish hospitality. Dinners and evening parties followed each other almost too continuously, and the ladies accompanying the delegates will not forget the manner in which they were hospitably entertained throughout their stay in St. Petersburg. But this account is only intended to deal with the scientific aspect of the meeting, and a brief reference only can therefore be made to the visit to the Tsar's palace at Tsarkoé Sélo, during which the delegates were individually presented to the Emperor of Russia and afterwards entertained at luncheon. ARTHUR SCHUSTER.

PROF. JAMES GORDON MACGREGOR, F.R.S.

PROF. J. G. MACGREGOR, of Edinburgh University, died suddenly and unexpectedly on the morning of Wednesday, May 21, shortly after he had risen, apparently in his usual health. It was known, of course, both to himself and his friends that his heart was not in the healthiest condition, but up to the moment of his death no really grave symptoms had declared themselves.

Prof. MacGregor was born on March 31, 1852, at Halifax, Nova Scotia, where his father had been a well-known clergyman. He early showed mental abilities of a high order; and in 1871 he graduated M.A. at Dalhousie College, Halifax, with the highest distinctions in all departments. He was awarded the Canadian Gilchrist scholarship, the condition of which required him to continue his studies and take a degree in London University. He decided to follow out physical and chemical science, and in 1871 entered himself as a student of science in the University of Edinburgh. He began what promised to be a most distinguished career; but unfortunately he broke down in health and was forbidden to work for competitive honours in the classes. During his second winter he spent much of his time in Prof. Tait's laboratory, and in conjunction with Ewing (now Sir Alfred) he measured the electrical resistance of certain saline solutions. The paper was soon afterwards published in the Transactions of the Royal Society of Edinburgh, and it may be regarded as giving the impulse which led MacGregor to follow up the line in which his best original work was done.

He spent the better part of two years in Leipzig in the laboratory of Gustav Wiedemann, and carried out some investigations in the electrical resistance of stretched silver wires. He gained his doctorate of science in 1876, and was immediately thereafter recalled to his native town as lecturer in physics in Dalhousie College. This he held for only one year, and from 1877 to 1879 he filled the important post of physical science master in Clifton College. The tragic death, as the result of a shooting accident, of one of the Clifton College masters, beside whom MacGregor was sitting at the moment of the accident, seriously affected his health at the time, compelling him to stop work entirely for several months. Meanwhile the Dalhousie College lectureship had developed into the Munro chair of physics, and MacGregor, undoubtedly their most promising alumnus, was invited to become professor. For twenty-two years he filled this post to the educational advantage of his native town. He took an active share in the founding of the Royal Society of Canada, in the Transactions of which some of his most important papers are published. He also keenly interested himself in the welfare of the Nova Scotian Institute of Science.

In 1887 MacGregor brought out a text-book on kinematics and dynamics (Macmillan and Co.). At the time of its publication it occupied an intermediate position between the elementary text-books and the treatise of Thomson and Tait, whose methods, indeed, MacGregor largely followed. The book had outstanding merits, and covered not only what is ordinarily understood by dynamics, but much also of hydrodynamics and elasticity. In 1909 appeared a third edition, considerably altered and improved.

The writing of this book turned MacGregor's mind to the difficult question of the foundations of dynamical science; and his conclusions were given in several papers, some of which appeared in the Transactions of the Royal Society of Canada and others in the *Philosophical Magazine*. These are characterised by clearness of apprehension of the questions at stake and by a logical statement of his own views.

On the retirement of Prof. Tait in 1901 from the chair which he had filled with such conspicuous success for forty years, Prof. MacGregor was elected his successor. During the twelve years of his tenure of this post MacGregor's chief work outside the ordinary duties of his chair was to develop the natural philosophy department and bring it into line with modern requirements. The transformation of the old infirmary building into a well-equipped laboratory demanded a vast amount of detailed consideration; and after two years of careful planning the new department was opened in 1907, not in the completed state designed by MacGregor, but sufficiently developed for a start to be made. With later additions and developments the whole combined departments of natural philosophy and applied mathematics remain as a lasting monument to Prof. MacGregor's energy, zeal, and forethought.

During the last few years Prof. MacGregor had been actively engaged in appealing to Prof. Tait's

old students for subscriptions towards a new chair on the mathematical side of natural philosophy, to be called the "Tait Chair."

Prof. MacGregor's original contributions to scientific literature other than those already indicated are mainly concerned with electrical conduction, ionisation, densities, and freezing-point depressions of solutions. These are published chiefly in the Transactions and Proceedings of the Royal Society of Canada, the Royal Society of Edinburgh, and in the *Philosophical Magazine*. He also wrote interesting addresses on educational subjects of a more general nature, and a few years ago published for the use of the students a pamphlet on physical laws and observations.

Prof. MacGregor was an enthusiastic teacher, and spared neither time nor trouble for the sake of his students. His accessibility endeared him to all. Busy though he was at all times, he was ever ready to lay aside his personal work, however pressing, so as to discuss any difficulties his students might have. His was a sunny, genial nature, finding pleasure in ministering to the needs of others; and there was no trouble too great which he would not take on behalf of his friends.

C. G. KNOTT.

NOTES.

WE regret deeply to announce that Lord Avebury died on May 28, at seventy-nine years of age.

THE annual visitation of the Royal Observatory, Greenwich, will be held on Saturday, June 7.

THE Croonian lecture of the Royal Society will be delivered by Dr. Robert Broom on Thursday, June 5; the subject will be "The Origin of Mammals."

WE learn from the *Revue Scientifique* that the mathematical works of the late Henri Poincaré are to be published by the firm of Gauthier-Villars, under the auspices of the Minister of Public Instruction and the Paris Academy of Sciences.

AT the meeting of the Royal Meteorological Society on Wednesday, May 21, Dr. V. F. K. Bjerknes, professor of geophysics in the University of Leipzig, and Dr. Hugo Hergesell, president of the International Commission for Scientific Aëronautics, Strassburg, were elected honorary members of the society.

THE American Association for the Advancement of Research by Women has awarded the Ellen Richards prize of 1000 dollars to Dr. Ida Smedley (Mrs. MacLean) for her work on the biochemical synthesis of fatty acids. The prize is offered biennially, and was last awarded in 1909, when the successful candidate was also an Englishwoman, Dr. Florence Buchanan.

THE fourth International Congress for the Hygiene and Salubrity of Dwellings is to be held at Antwerp on August 31–September 7. The congress will be divided into four sections: the hygiene of emigrants, colonial hygiene, hygiene of ports and ships, and the development of towns from the hygienic point of view. Persons desiring to take part in the congress should communicate with the treasurer, Mr. A. Cols, notary, Willem Tell Street, 3, Antwerp.

THE president of the Royal Society has received from the Portuguese Legation subscriptions amounting to 21*l.* 5*s.* forwarded by the Society of Medical Science of Lisbon as a donation to the Lister Memorial Fund. A sum of 867 dollars has been collected by Dr. W. W. Keen, of Philadelphia. Further donations intimated from foreign countries include:—University of Paris, 500 francs; University of Lyons, 100 francs; Société de Chirurgie of Lyons, 100 francs; faculty of medicine of the University of Munich, 100 marks; faculty of medicine of the University of Breslau, 110 marks; and Stockholm Medico-Chirurgical Society, 5*l.* A donation of 10*l.* has been received from the University of Calcutta.

WE are glad to be assured by Prof. Sampson, Astronomer Royal for Scotland, that the damage to instruments due to the explosion of a Suffragette bomb at the Royal Observatory, Edinburgh, on May 21, was happily insignificant. The bomb was placed on the floor below that of the west dome. The floor of the west dome is a heavy one, and thoroughly protected the 24-in. reflector and Cooke photovisual above it. The driving clock for these telescopes was near the bomb, but appears uninjured except in respect to its glass case. On the floor below falling plaster smashed the glass case of the Cooke drum chronograph, which is at present out of use. The disturbance was recorded by the Milne seismograph at 0h. 57·2m. as a small, sharp oscillation of approximately 0·1″ semi-amplitude.

SINCE 1908 the Somersetshire Archæological and Natural History Society has engaged in excavation work at Glastonbury Abbey, and year by year results of great historical and archæological importance have been secured. Last year, the society, at the request of the Abbey trustees, appointed a special committee to undertake the supervision of the future excavation work, and the researches will proceed systematically. An income of 250*l.* a year is needed to carry out the work efficiently, and the funds hitherto raised by subscriptions and donations are exhausted. The committee now makes a further appeal for money. Subscriptions or donations may be sent to the treasurer of the Glastonbury Abbey Excavation Fund, The Castle, Taunton, Somerset.

AT the annual meeting of the Royal Geographical Society on Monday last, in addition to the presentations made to Lady Scott and Mrs. Wilson of the awards voted to their husbands, who died in the Antarctic, and that made to Lieut. Campbell, which are referred to elsewhere, the following awards were made:—The Victoria medal to Col. S. Burrard, Surveyor-General of India; the Murchison award to Major H. D. Pearson, for his work in the Sudan; the Gill memorial to Miss Lowthian Bell (Mesopotamia, &c.); the Cuthbert Peek grant to Dr. Felix Oswald (Armenia); and the Back bequest to Mr. W. S. Barclay (South America). In his anniversary address, Earl Curzon, as president, referred to the momentous events of the past year in polar exploration, and made the interesting announcement that the society expects presently to receive into its charge

Scott's diary and some of Dr. Wilson's beautiful water-colours. He mentioned the important work projected in the Arctic by Amundsen, Stefánsson, and Macmillan, and briefly reviewed geographical work elsewhere. He had naturally a good deal to say on the new establishment of the society at Kensington Gore, viewed with optimism the important bearing which the better conditions under which the society will now work should have on the progress of geographical study in this country, and discussed the new meeting-hall which he clearly expects to see built. At the annual banquet in the evening, Sir E. Grey and Lord Milner, among the speakers, both testified emphatically to the importance of geographical teaching and study, in relation to the maintenance of empire, on their now broadened basis of the bearing of physical conditions upon human activities.

THE annual congress of the Royal Institute of Public Health was held in Paris, May 14–19, Prof. W. R. Smith, the principal of the institute, presiding. Important papers on tuberculosis were contributed by Prof. Delépine ("Milk-borne Tuberculosis") and Dr. Lister ("The Future of State Campaigns against Tuberculosis"), who considered that the future of campaigns against the disease was a matter more for the social reformer than for the public health officer. Mr. L. Gaster lectured on artificial illumination, making many useful suggestions on the nature of the illuminant to be employed and its methods of use. Dr. Bertillon arranged an exhibit showing the mortality in a number of trades and employments, contrasting those of Great Britain with those of France and one or two other countries. The members of the congress were most cordially received, and visits were arranged to all the important institutions, municipal and public, factories, and so on. The Harben gold medal of the institute for 1912 was presented to Dr. Roux, of the Pasteur Institute.

THIS year the Société Helvétique des Sciences Naturelles will hold its meeting at Frauenfeld on September 7–10. Among the lectures announced already the following may be mentioned:—Prof. Grubenmann, of Zurich, "Ueber die Entwicklung der neuern Gesteinslehre"; Prof. Fuhrmann, of Neuchâtel, "Voyage d'études scientifiques dans les Cordillères de Colombie"; Dr. de Quervain, of Zurich, "Die Durchquerung Grönlands durch die schweizerische Expedition und deren Ergebnisse"; Prof. Keller, of Zurich, "Die Tiergeographie des Kaukasus"; Prof. Maillefer, of Lausanne, "Les lois du géotropisme"; Prof. Rikli, of Zurich, "Pflanzengeographische Studien über die Kaukasusländer"; and Prof. Dutoit, of Lausanne, on a subject of physical chemistry. On September 9 the Swiss mathematical, physical, chemical, geological, botanical, and zoological societies will also hold their annual meetings at Frauenfeld. A number of attractive excursions have been arranged for visitors. Persons desiring to attend the meeting of the Swiss Association should communicate with M. A. Schmid, president of the committee, at Frauenfeld.

THE Board of Agriculture and Fisheries has issued a circular intimating that numbers of salmon smolts and kelts have been "marked" in various rivers, by means of a wire, or a wire and label, attached to the dorsal fin. Rewards will be paid for the return of these marks, accompanied by the particulars of sex, length, weight, and condition of the fish to which it was attached, and by a few scales taken from the body of the fish behind the gill-cover. The object of these experiments is to trace the migrations of the fish, mainly the length of the period spent in the sea. The object of the removal of the scales is to determine, from a microscopical examination of the latter, the age of the fish and its history as regards sexual maturity and previous spawning acts. Anglers and others interested in the study of the salmon will welcome the instigation of these experiments by the Board. Investigations of a similar kind have been made so far mainly by private persons in this country, but with the resources at the command of the Board very valuable results should be obtained. The investigation is, of course, one which depends for its success upon the cooperation of sportsmen and fishermen, and we cordially recommend that this assistance be rendered.

ON May 23 a communication was made to the Hon. Society of Cymmrodorion, by Mr. T. A. Acton and Mr. W. Burton, descriptive of the excavations that have been conducted during the last three years at Holt, near Wrexham. Mr. Acton has discovered the site of a tile and pottery works of the twentieth Roman Legion, and he gave a review of the discoveries of the foundations of buildings for housing the workers and probably the garrison of what must have been practically a frontier post, and also of the excavations of a series of potters' kilns. Thousands of fragments of Roman tiles and pottery have been excavated from the site, and are now in process of classification. Mr. William Burton explained the construction of the kilns, which are fortunately so well preserved that the leading features of the construction of both the circular and rectangular kilns used by the Romans in various parts of the empire are now clearly established; they foreshadow in a remarkable way the main principles of modern kiln construction. Mr. Burton exhibited three models of different types of kilns made from careful measurements of the remains, and these will be deposited ultimately in the British Museum.

THE census report of the Nicobar Islands for 1911, just published, gives a good example of the custom of Couvade or "hatching." For some days or even weeks before the wife's confinement, the people in the hut, as a form of sympathetic magic, unloose all the cane and fibre lashings of their spears or vessels. During the first month after the birth of his first child the father is treated as an invalid. On subsequent occasions this lasts only one or two days. He is looked after and fed by his wife, and may not bathe or chew betel. These rules, which are enforced by the Menluanas, or medicine-men, are so irksome that it is believed their observance accounts for a widespread avoidance of maternity among the women.

THE classical account of the pagan tribes of the Malay Peninsula by Messrs. Skeat and Blagden is being gradually supplemented by later inquiries among this interesting people; but these investigations only serve to prove the correctness of the earlier record. Mr. L. H. N. Evans now publishes in the Journal of the Federated Malay States Museum, which takes the place of the Perak Museum Notes, an account of the Besisi of Tamboh, Kuala Langat, Selangor. Their advance in culture is illustrated by the fact that they are now able to ride bicycles, which they borrow from the Chinese. Mr. Evans made a considerable ethnographical collection, including specimens of two methods of fire-making—by the saw and drill—which are being replaced by the use of matches and the flint and steel. As an example of culture contact, two ingenious forms of animal traps are now found in use from Nepal and Assam eastward through Indo-China and the Malay Peninsula, and all over the Greater Sunda Islands.

THE researches that are being carried out at the present time, with so much patience and minuteness, upon disease-producing parasites, though undertaken primarily with practical aims in view, are helping to accumulate in many cases data of great value from a purely scientific and theoretical point of view. It is becoming, for example, increasingly evident that the pathogenic trypanosomes represent a group of incipient species in process of coming into being, in many cases differentiated physiologically, but not morphologically. From this point of view the human trypanosome generally known as *Trypanosoma rhodesiense* is very interesting. It is possible that it is an old-established species lately discovered; but it is far more probable that it has become but recently differentiated, and that it represents either a race of *T. brucii* that has acquired the power of living in human blood, or a race of *T. gambiense* adapted to transmission by *Glossina morsitans*. The former view has been advocated by Bruce and his colleagues, of the Royal Society's commission working in Nyasaland; but Stephens and Fantham, in a paper in the Annals of Tropical Medicine and Parasitology (vol. vii., No. 1), find it difficult to distinguish between *T. rhodesiense* and *T. gambiense* by means of measurements. The chief distinctive character of *T. rhodesiense* is the presence of the so-called posterior nuclear forms, which are studied by Blacklock in a memoir in the same journal; these forms have been found, however, in other species of trypanosomes, including *T. brucii*.

WE have received a report by Prof. E. C. Starks, issued in the Leland Stanford Junior University Publications, on the fishes collected by the second Stanford expedition to Brazil, in which several species are described as new. A report has also reached us on the fishes of certain tanks in Bengal, drawn up by Mr. T. Southwell and Capt. R. B. S. Sewell, and published at Ranchi by the Bihar and Orissa Department of Agriculture.

THE March issue of the Proceedings of the Philadelphia Academy contains a report on parasitic worms infesting the animals in the local zoological gardens. The average number of infestations is about forty-five per annum, but in 1910 there was a rise, due to the prevalence of cestodes in birds, while a second rise, owing to nematodes in parrots and perching birds, occurred in the following year. Among mammals Carnivora are much more heavily infested than any other order, monkeys, ungulates, and marsupials making nearly a dead-heat for second place. The new observations confirm previous statements that nematodes are the most common parasites, these being followed by cestodes, flukes, and Acanthocephali, in the order named.

IN *The American Museum Journal* for March Mr. Barnum Brown describes, with a good series of photographs, the discovery at Red Deer River, Alberta, of a new crested dinosaur, now named Saurolophus, "the crested saurian." In life this animal was about 32 ft. in length, and stood about 15 ft. in height when erected. Like Tracodon, it was a herb-eater, and unable to defend itself from the contemporary flesh-eating Albertosaurus, except by its power of escaping danger by swimming. Great numbers of these creatures lived in the prehistoric coastal marshes, and in a single quarry on the Red Deer River bones of several hundred individuals, mostly of this kind, have been washed out of the bank. Another set of bones discovered in the same district represents the skeleton of another new dinosaur coming from an older formation, and probably an ancestor of Saurolophus.

THE first of a series of studies on the evolution of the teeth of primates, by Dr. L. Bolk, professor of anatomy in the University of Amsterdam, has been published (G. Fischer, Jena, 1913, price 5 marks). A completely new interpretation is given of the relationship between milk and permanent teeth. We have hitherto regarded them as belonging to different epochs of evolution—the milk teeth representing a primary dental outfit, the permanent a secondary acquisition. Prof. Bolk, from a prolonged inquiry into the developmental stages of the teeth of reptiles and mammals, has accumulated evidence to show that both reptiles and mammals have arisen from a stock which was furnished with three rows of teeth, all of which came into use at the same time. In both reptiles and mammals the outer row is represented by vestiges—the so-called pre-lacteal dentition. In reptiles the middle and inner rows persist and come into use together. In the higher or diphyodont mammals the middle rows come into use first, forming the milk dentition, while the inner is delayed in its appearance, and forms the permanent set of teeth. In lower or monophyodont mammals both middle and inner rows of teeth—that is to say, milk and permanent teeth—come into place and use together, forming an apparently linear series. Prof. Bolk's hypothesis promises to simplify our conception of the evolution of mammalian teeth, and explains many facts which were formerly obscure.

MR. W. ENGELMANN, Leipzig, has lately issued parts 55, 56, 57, and 58 of "Das Pflanzenreich." This magnificent *regni vegetabilis conspectus* is making rapid progress, though up to the present time only one group (Sphagnaceæ) of cryptogamous plants has

been dealt with. Heft 55, by Prof. Engler, begins the account of the Philodendroideæ section of the large family Araceæ by Engler and Krause, and is unusually well and fully illustrated with new figures. Heft 56, by Dr. F. Kranzlin, forms a self-contained monograph of the "Indian shot" family, Cannaceæ, and concludes the treatment of the interesting order Scitaminales, the remaining three families of which (Musaceæ, Zingiberaceæ, Marantaceæ) have already been described by Schumann; in his introduction the author gives an account of the various interpretations which have been put forward of the structure of the outer floral organs in Canna, the sole genus in the family. In Heft 57, Dr. Pax, assisted by Käthe Hoffmann, continues the monograph of the large and difficult family Euphorbiaceæ; in addition to figures of many of the species, there is given a useful table showing the geographical distribution of the genera belonging to the section (Chrozophorinæ) dealt with in this part. Heft 58, by G. Grüning, gives the Stenolobeæ section of the same family.

WE have received a copy of vol. xlviii., No. 8, of the Proceedings of the American Academy of Arts and Sciences, consisting of an extensive memoir by Mr. J. W. Hotson on culture studies of fungi producing bulbils and similar propagative bodies. In this paper the author brings together the scattered references in mycological literature to the occurrence in various fungi of these propagative bodies, which are cell-masses ranging from spore-like structures to large sclerotium-like forms, and indeed shading gradually into these two definite and distinct types (spore and sclerotium) of reproductive body. After describing in detail, with numerous excellent figures on twelve plates, the structure and development of bulbils in the various species examined during his long-continued culture experiments, the author discusses the morphological significance, distribution, and occurrence of bulbils in fungi. He concludes that in most cases, if not in all, these bodies are not to be regarded as abortive spore-fruits (ascocarps), but rather as an auxiliary method of reproduction that has been interpolated in the life-history of certain fungi without definite relation to other methods of reproduction they may possess, or that if they have in reality been derived from some other reproductive body, this was more probably some form of non-sexual spore rather than the primordium of an ascocarp.

THE Memoirs of the Indian Meteorological Department, vol. xxi., part 7, contain an interesting inquiry into the cold weather storms of northern India by Dr. G. T. Walker and Rai Bahadur Hem Raj. It is pointed out that the storms in question, which occur between December and April, are of considerable agricultural importance, and that it is extremely desirable that their origin should be ascertained, the view that these rain-bearing disturbances are generated over the arid districts of Persia and Baluchistan being by no means free from difficulty. An examination of charts recently prepared by the Meteorological Service of Egypt for the years 1906–12 shows that about seven-tenths of the disturbances which affect north-west India in those months are continuations of depressions from southern Europe, but the paths of the depressions vary considerably from year to year. In order to confirm the origin of most of the storms without a large expenditure of labour in preparing charts, Dr. Walker had recourse to statistical methods. He says that if these storms pass over Syria or Asia Minor it is to be expected that severe winters with much precipitation in these areas will tend also to be severe winters in north-west India. "A calculation was accordingly made of the correlation coefficients of the seasonal rainfall in north-west India with those of rainfall in places to the west for which records were available." The evidence shows that the winter seasons in the west of Asia Minor, in Syria, and in Malta have a closer resemblance to those of north-west India than do the winter seasons of Persia and Mesopotamia.

IN his presidential address to the Institution of Mining and Metallurgy, delivered on March 13, a copy of which has just reached us, Mr. Bedford McNeill devoted his attention more particularly to the statistics of production of the more important metals, laying especial stress upon the precious metals. He showed that the production of metals was increasing at a rate quite unexampled in the history of the world, the percentages of increase during the decade ending in 1911 ranging from 29 in the case of lead up to no less than 513 for aluminium, whilst it was 58 for iron and 68 for copper. The metal miner is therefore supplying the world with the metals used in the arts upon an enormously greater scale than ever before. As regards the precious metals, it is shown that within the above-named decade the production of gold has increased by 79 per cent., and that the world's annual output of gold is now more than equal to the total production for the sixty years preceding the year 1700. Mr. McNeill shows that this increase of production is to some small extent counteracted by the remarkable absorption of gold that has been taking place for some years past in India, and to a smaller extent also in Egypt. The production of silver has also undergone an increase, though less than gold, the increase during the decade 1901–11 being 41 per cent.; the actual production of silver during that period was ten times as great as that of gold, though this proportion is one that appears to fluctuate considerably from time to time.

WHEN our knowledge of the mean depth of the oceans was less extensive than it is now, it was supposed that a close approximation along certain lines was given by the velocity of seismic sea-waves. The formula (Lagrange's) used for the purpose was $v=\sqrt{(gh)}$, where v is the mean velocity of the waves and h the mean depth along the line of ocean traversed by them. It was shown, however, by Dr. Davison (*Phil. Mag.*, vol. xliii., 1897, pp. 33–36) that, when the depth is variable, the formula gives too great a depth, and that it should be $v=s\Big/\int\frac{ds}{\sqrt{(gh)}}$, s being the distance from the epicentre. Prof. Rudski ("Physik der Erde," 1911, p. 340) suggested the formula $v=\frac{1}{s}\int\sqrt{(gh)}ds$. Prof. G. Platania has recently made a comparison of the results given by the three

formulæ in the case of the Calabrian earthquake of October 23, 1897, the sea-waves of which were registered by the mareographs at Messina and Catania (*Boll. Soc. Sism. Ital.*, vol. xvi., 1912, pp. 166–174). The actual mean velocity was 102 metres per second, while the values given by Davison's, Rudski's, and Lagrange's formulæ were respectively 109, 114, and 120 metres per second.

VOL. xiii., part 2, of the Proceedings of the Nova Scotian Institute of Science contains an account, by Mr. J. H. L. Johnstone, of measurements of the specific resistance of ice at temperatures between 0° and −19° C., made by a new method, in which the effects of electrolytic polarisation were eliminated. The values obtained agree fairly well with those obtained by Profs. Ayrton and Perry, using a different method, and show that the value of the temperature coefficient is very much higher than that of ordinary electrolytes and decreases in value as the temperature departs from 0°. The same number of the Proceedings also includes an interesting account of the sacred trees of India, by Capt. J. H. Barbour.

WE have received a copy of the reprint of the Carnegie Institution of Washington paper on the magnetic survey work in southern and central Africa carried out in 1908 and 1909 by Prof. Beattie, of the South African College, Cape Town, and Prof. Morrison, of Victoria College, Stellenbosch, who for the time necessary were made officials of the Carnegie Institution. The cost of the work was defrayed by the Carnegie Institution, 2000*l.*, the Royal Society, 250*l.*, and Sir L. S. Jameson and Sir L. Mitchell, 100*l.* The survey covers the regions between the Zambezi and the Nile, including parts of north-eastern Rhodesia, the Congo, German East Africa, Uganda, Nyasaland, and British East Africa, with further observations in Cape Colony and German South-West Africa. Throughout most of the journey the only means of conveyance was by native carriers, and the history of the expedition reads like a chapter of Livingstone's travels. We offer our congratulations to Profs. Beattie and Morrison on the successful accomplishment of an important and much-needed piece of magnetic survey work.

SEPARATE copies have reached us of a considerable number of papers which have been published by the staff of the Reichsanstalt during the present year. Dr. F. Henning has compared the platinum resistance with the hydrogen thermometer at temperatures between 0° C. and −193° C. He finds that Callendar's formula connecting the two holds only down to −40° C., and proposes another formula, which holds over the whole range. Drs. K. Scheel and W. Heuse have determined by the continuous-flow method the specific heats at constant pressure of helium, hydrogen, nitrogen, oxygen, air, and carbonic oxide, at temperatures down to that of liquid air. The specific heats of helium and hydrogen increase with increase of temperature, the others decrease. In connection with these researches a thermostat suitable for low temperatures has been devised by Dr. Henning. It depends on the passage of a stream of liquid air through a suitable liquid, as, for example, petroleum ether. The air evaporates in the liquid, and the rate of evaporation determines the temperature to which the liquid is cooled. The former papers will be found in the March and April numbers of the *Annalen der Physik*, and the last in the February number of the *Zeitschrift für Instrumentenkunde*.

IT has long been known that the photometry of sources of light widely differing in colour is rendered difficult by the peculiarities of the eye, especially at low illuminations. Until recently this was not of much practical importance, since most of our commercial illuminants yielded continuous spectra and light of substantially the same tint. Now, however, things are changed. A recent communication by Messrs. Broca, Jouast, De la Gorce, and Laporte (*Bull. Soc. Int. des Electriciens*, February, 1913) shows the perplexities likely to be met with in comparing such sources as the mercury-vapour lamp and the new neon tube. The former contains only yellow, blue, and green light, the latter only red and orange rays between 0·585 μ and 0·640 μ. The authors meet with differences of 100 per cent. or more, according to the illumination of the photometer screen. Similar discrepancies are caused by the personal errors of different observers. To these difficulties, due to the colour of the light, must be added those arising from the fact that the light is not a point, but a tube of considerable dimensions, so that the ordinary inverse square law of photometry does not apply. Another interesting observation is that objects illuminated by the neon light appear more sharply defined than in the case of ordinary illuminants. The reason would appear to be that the monochromatic nature of the light avoids the results of chromatic aberration in the eye.

SOME new experiments on the preparation and properties of pure alcohol are described in the Chemical Society's Journal by Mr. R. W. Merriman. The density of the pure alcohol was established for about forty samples as 0·80628 at 0°/4°. It was shown that freshly burnt quicklime prepared from marble is a better drying agent than metallic calcium, which produces no improvement in alcohol dried by lime. In distilling the alcohol from the lime it is necessary to reject the first and last fractions; the latter have a high density, which is attributed to partial dehydration of calcium hydroxide as the temperature of distillation rises from 80° to 100° on the water-bath.

A "NEW Iron Bacterium" is described by Mr. E. M. Mumford in the Transactions of the Chemical Society. It was discovered in the Bridgewater Canal tunnels at Wasley, Lancashire, where the water contains much iron derived from colliery pump water. The new bacterium appears to have a twofold action, an aërobic action whereby it precipitates ferric hydroxide from iron solutions, and an anaërobic action which transforms the ferric hydroxide into bog iron ore with partial reduction of the iron to a ferrous state. It is probable that the deposits of bog ore are due to this organism rather than to the higher bacteria, since the latter have not the facultative power

necessary to dehydrate and reduce the ferric hydroxide to bog ore.

THE English Ceramic Society has recently issued the twelfth volume of its Transactions, and is to be congratulated on the good work which it continues to do in furthering the application of scientific methods to so important an industry. Attention may be directed specially to a paper by Mr. A. J. Campbell in which the application of "surface combustion" to pottery practice is suggested, and to a description by Dr. W. R. Ormandy of an "Electrical Process for the Purification of Clays." This consists in partially coagulating the emulsified clay by the addition of electrolytes, and then further purifying the emulsion by passing it through a vessel containing electrodes differing in potential by 60 to 100 volts. The chief impurities are electropositive, and can thus be removed, even when present in very fine particles. The clay-substance is electronegative, and is laid down in the form of a continuous blanket $1\frac{1}{2}$ yards wide and $\frac{1}{4}$ in. thick. It is deposited in a remarkably dry state with only 18 to 20 per cent. of water, and may contain as much as 99·5 per cent. of china-clay substance.

MESSRS. J. AND A. CHURCHILL have nearly ready an English translation of the Italian work, "A Treatise on General and Industrial Organic Chemistry," by Dr. Ettore Molinari. The work of translation has been carried out by Mr. T. H. Pope, of the School of Malting and Brewing of the University of Birmingham.

AN examination of "The Social Guide, 1913," which has now been issued by Messrs. A. and C. Black, at the price of 2*s.* 6*d.* net, shows that the editors regard some scientific meetings at least as social events. Attention is directed, for instance, to the meetings of the Royal Society, the Royal Institution, the Royal Geographical Society, and the British Association. The University Extension meetings arranged in the summer by the Universities of Oxford and Cambridge are also referred to, but, speaking generally, the matters of prominence relate to sports and amusements. The subjects are arranged alphabetically, but an index would assist reference greatly.

ERRATUM.—The term $\frac{\Sigma P - P.N}{\frac{N}{2}}$ on p. 279 of NATURE of May 15 should have been $\frac{\Sigma P - P.M}{\frac{N}{2}}$.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES FOR JUNE :—

June 1. 4h. 4m. Venus in conjunction with the Moon (Venus 4° 38′ S.).
,, 12h. 0. Mercury in superior conjunction with the Sun.
4. 0h. 25m. Saturn in conjunction with the Moon (Saturn 6° 22′ S.).
,, 16h. 4m. Mercury in conjunction with the Moon (Mercury 3° 48′ S.).
7. 4h. 40m. Neptune in conjunction with the Moon (Neptune 5° 9′ S.).
19. 14h. 26m. Jupiter in conjunction with the Moon (Jupiter 4° 47′ N.).
June 21. 8h. 8m. Uranus in conjunction with the Moon (Uranus 3° 27′ N.).
,, 13h. 9m. Sun enters Sign of Cancer—summer commences.
22. 6h. 0m. Vesta in conjunction with the Moon (Vesta 0° 31′ N.).
23. 22h. 35m. Mercury in conjunction with Neptune (Mercury 2° 11′ N.).
24. 2h. 0m. Venus at greatest distance from the Sun.
29. 5h. 5m. Mars in conjunction with the Moon (Mars 4° 51′ S.).
30. 7h. 4m. Venus in conjunction with the Moon (Venus 7° 44′ S.).

COMET 1913*a* (SCHAUMASSE).—*Astronomische Nachrichten* No. 4652 contains not only numerous observations of the comet which Mr. Schaumasse discovered, but three sets of elements and ephemerides computed by Kiess and Nicolson, Ebell, and Fayet and Schaumasse. The observations made between May 7 and 11 give the magnitude between 9·5 and 11.

The following parabolic elements are those calculated by the last two observers mentioned above, and they are based on Schaumasse's observations at Nice on May 6, 7, and 8 :—

$T = 1913$ May $15{\cdot}4222$ M.T. Paris.
$\omega = 53^\circ\ 32'\ 8''$
$\Omega = 315\ 21\ 7$ } 1913·0
$i = 152\ 31\ 26$
$\log q = 0{\cdot}162920$

Ephemeris for 12h. M.T. Paris.

		α	δ
		h. m. s.	° ′
May 30	...	17 45 55	... +38 31
June 1	...	17 15 56	... +40 6
,, 3	...	16 45 33	... +41 9
,, 5	...	16 15 50	... +41 35

EFFECTIVE TEMPERATURES OF STARS.—An important communication is published in the *Comptes rendus* of May 5 (vol. clvi., No. 18, p. 1355), by Dr. Charles Nordmann, relative to the effective temperatures of stars. It will be remembered that Dr. Rosenberg published recently (*Astronomische Nachrichten*, No. 4628, p. 360) the results of measures of the effective temperatures of seventy stars based on the determinations of the intensity of the photographic spectra. It will be remembered also that Dr. Nordmann made a like series of measures based, on the other hand, on visual observations. As the two series of measures deal with different regions of the spectrum they may be considered as independent determinations, and Dr. Nordmann here compares the results obtained in cases where the same star has been measured. The following table shows the resulting comparison :—

	Effective temperatures (in absolute degrees)		
	Nordmann λλ 460–630	Rosenberg λλ 400–500	Spectral types (Lockyer)
δ Persei	... 18500	... 15500	... Algolian
ε ,, ...	... 15200	... 23000	... Crucian
β ,, (Algol) ...	... 13300	... 12000	... Algolian
α Lyræ (Vega) ...	... 12200	... 22000	... Sirian
α Persei	... 8300	... 6500	... Polarian
α Ursæ Minoris (Polaris) ...	8200	... 5200	... ,,
α Canis Minoris (Procyon) ...	6800	... 7000	... Procyonian
γ Cygni	... 5620	... 5100	... Polarian
Sun	5320	... 4950	... Arcturian
α Aurigæ (Capella)	4720	... 4500	... ,,
β Andromedæ	3700	.. 2650	... Antarian
α Tauri (Aldebaran)... ...	3500	.. 2150	... Aldebarian

Dr. Nordmann directs attention to the good agreement of the two series, with one or two exceptions, which he discusses, and points out that if the stars be arranged in the order of ascending temperatures they become hotter and hotter as one passes from the

Aldebarian and Antarian types to helium stars. This, he states, conforms to the thermal classification which Sir Norman Lockyer deduced from his qualitative study of the stellar spectra.

THE WORK OF SIR WILLIAM HUGGINS.—Under this heading, in *The Astrophysical Journal* for April (vol. xxxvii., No. 3) Prof. G. E. Hale takes the opportunity of again cheering up those astronomical observers who possess only a small and limited instrumental equipment, and may conceive the idea that the multiplication of large instruments renders any attempt at research on their part useless. Being the director of an observatory which may be considered the best equipped, contains the largest instruments, and is situated on a nearly ideal mountain site, it may appear that he is only trying to console workers with modest means. But this is not so. Prof. Hale knows the value of both large and small instruments, and there is abundant work for both classes. The reader should look through this article and he will find depicted there the magnificent work of amateurs, in spite of the fact that large instruments were in active employment at the time the work was done. Sir William Huggins he takes as an example of one of "that great English group of amateurs," and he directs attention to the fact that while in 1856 he acquired his first telescope, a 5-in. refractor, in 1858 an 8-in., and in 1870 an 18-in. reflector, such powerful instruments as 15-in. refractors at Pulkowa and Harvard, Lord Rosse's 6-ft. reflector, Lassell's 4-ft. reflector, the Melbourne 4-ft. reflector, &c., did not deter him from securing results of the highest importance.

Prof. Hale concludes in the following terms:—"Every investigator may find useful and inspiring suggestions in the life and example of Sir William Huggins. Their surest message and strongest appeal will be to the amateur with limited instrumental means, and to the man, however situated, who would break new ground."

THE SCOTT EXPEDITION TO THE ANTARCTIC.

THE huge audience which filled the Albert Hall on Wednesday evening, May 21, on the occasion of the Royal Geographical Society's meeting to hear Commander Evans's account of the Scott expedition to the Antarctic, showed no less by its eager plaudits than by its suppression of them at the fitting moments that the public sense of the tragedy of the expedition is not dulled by familiarity. Yet throughout the proceedings there was no false note of sentiment; the president, Lord Curzon, stated, without risk of misunderstanding, that the tribute of the society to the dead had been paid already, and begged any (and there were some) who felt that "this great reception is inconsistent with the feelings of sorrow which affect us all" to "abandon such a reflection," for that he was sure that Scott himself would not have had his companions forgo the reward of their labour. And the story of the expedition was told by Commander Evans very simply; he exhibited the sense of loss which all his collaborators share in a few words only, and by implication rather than by direct statement. Finally, the tribute paid by both president and lecturer to the generosity of the public and to the Government for the provisions made for the dependants of those who are lost showed that any criticism which has been directed against the allowances made from the public funds is without official concurrence.

It was satisfactory to learn that the funds subscribed will admit of the proper publication of the scientific results of the expedition. As regards these results, not a great deal emerged from the lecture which was not already realised by those who have taken interest in this aspect of the work accomplished. Nor was it to be expected that any detail should be given within the compass of a single lecture, though long; for it was long, and a tribute is due to Commander Evans, who so ably sustained the strain of delivering it, and never for a moment allowed the intense interest of the audience to wane. And here a word, though perhaps scarcely appropriate in this place, may be permitted in commendation of the singularly well-chosen organ music which was given before the opening of the proceedings.

But if it is scarcely possible, after hearing the lecture, to add materially to what is already known as to the scientific results of the expedition, it is right at the outset to record the full measure in which the value of those results has clearly been enhanced by photography. Obviously no photographer to any expedition has laboured with a more thorough sense of his duty, or more successfully, than Mr. Ponting. The lecture was delivered with lowered lights and with an accompaniment of lantern slides throughout, and was followed by a few kinematograph films of extraordinary interest. It is impossible to over-praise the beauty of the photographs, nor is it easy to select those of chief scientific interest, though an exquisite series showing new ice at successive stages of formation may be specially mentioned. Of the moving pictures, those of the killer whales were singularly clear, though the motion of creatures of their kind is familiar to many; those which showed seals leaving and entering the water through ice-holes were of even greater interest and value.

Some wonder has been expressed, with the vast area unexplored in the Antarctic region and the many problems awaiting solution in mind, that Scott elected to follow Shackleton's route, or even (and this criticism dates from early Arctic days) that he or anyone else should desire to reach the geographical pole at all. Against this there should be recalled the desire once expressed by a high Antarctic authority, that the south pole should be reached as quickly as possible since, until it should be, explorers would not rest content with work in other directions merely. On this count criticism is scarcely to be directed against Scott's expedition, for it included the largest scientific staff ever taken to the Antarctic, and scientific research certainly played no subordinate part in relation to the journey to the pole. We know already of the devotion with which Scott himself and his lost companions carried their geological specimens to the end of those last dreadful marches. Commander Evans showed how the three weeks during which the ship was held in the pack on the outward voyage were "not wasted," for magnetic observations, soundings, and serial sea temperatures were obtained, while marine biological work of importance was also done. Only the impossibility of finding a suitable base at Cape Crozier prevented the expedition from landing there in order that the embryology of the emperor penguins during winter might be studied. Wilson afterwards made his famous winter expedition thither, and one heard how he recorded the unimaginable temperature of 109° of frost.

Mr. Griffith-Taylor's party, which traversed the Ferrar Glacier, broke new ground, reaching a valley free of snow, containing a fresh-water lake only surface-frozen and full of algæ. Gravels in this limestone region, rich in garnets, "were washed for gold, but only magnetite was found." Commander Evans also paid tribute to Dr. Simpson's work as physicist and meteorologist, which was carried on after his departure by Mr. Wright, who also "made a special

study of ice structure and glaciation." Lieut. Campbell's party, in spite of extraordinary hardships, which included wintering away from its base, for which it was not prepared, was very successful in meteorological, magnetic, geological, and surveying work, while the penguins were the object of further study. Commander Evans had time to commend the work of Mr. Griffith-Taylor on the coast of Victoria Land (in geology and surveying), as well as that carried out on the ship, not only in the open ocean, but on the less-known coasts of New Zealand, no more fully than to intimate that each of these departments of the whole great undertaking is worthy of a lecture to itself, which it is to be hoped may be devoted to it.

Finally, reference is due to the results of the determination of the position of the south pole itself, as obtained by Amundsen and by Scott. The latter fixed the exact spot by means of a 4-in. theodolite, "at a point which only differed from Amundsen's reckoning by half a mile," that is to say, "by one scale division on the theodolite, which was graduated to half a minute of arc. Experts in navigation and surveying will always look on this splendidly accurate determination as a fine piece of work, by our own people as well as by the Norwegian explorers."

At the annual meeting of the society on Monday last, in the Theatre, Burlington Gardens, Lady Scott was presented by Earl Curzon with the patron's medal and the special Antarctic medal awarded to her husband in 1904, inclosed in an inscribed silver casket. Mrs. Wilson also received a patron's medal awarded to Dr. E. A. Wilson. To Lieut. Campbell was presented a gold watch as a special award.

THE BRITISH SCIENCE GUILD.

THE seventh annual meeting of the British Science Guild was held at the Mansion House on May 21, the Lord Mayor in the chair. In his opening remarks, the Lord Mayor made sympathetic reference to the aims and work of the guild, which, he said, seeks to further the application of scientific methods to all human endeavour and advocates the adoption of measures for the conservation of natural resources; in other words, its desire is to foster national efficiency. The Right Hon. Sir William Mather was elected president of the guild in succession to Lord Haldane, who has been president since its foundation. The new vice-presidents elected were Lord Sydenham, the Right Hon. the Lord Mayor of London, the Right Hon. Sir John Brunner, Bart., Sir Patrick Manson, and Sir Philip Watts; and other new members added to the executive committee are Mr. Charles Bathurst, M.P., Mr. R. Kaye Gray, Sir Philip Magnus, M.P., and Mr. Robert Mond.

The annual report, which was adopted at the meeting, surveys the activities of the guild in many directions. Reference is made in it to the new Post Office service for the synchronising of clocks—a subject which the guild has done much to promote. Other matters referred to are the final report of the Royal Commission on Tuberculosis, the new horticultural branch of the Board of Agriculture and Fisheries, the conversion of the Sleeping Sickness Bureau into the Tropical Diseases Bureau, the Society for the Promotion of Nature Reserves, and the Royal Commissions and Departmental Committees appointed during the year to deal with subjects with which science has some relationship. All these Commissions and Committees have been announced already in NATURE, but the report of the guild brings them together in a convenient form as a record of official action.

The various committees of the guild continue to do valuable work. The medical and agricultural committees have drawn up a report on the Government's Milk and Dairies Bill. While recognising that the Bill is a very decided advance in the direction of obtaining pure milk, the committees feel that in certain respects stronger and more drastic action should be taken. A note upon the report of the committees appeared in NATURE of May 1 (p. 222).

A report on tide and wave energy, and on the possibility of utilising this form of energy for power purposes, is being drawn up by the committee on the conservation of natural sources of energy; also a report on the utilisation of peat, which occurs in such enormous quantities in some districts in the British Isles and British possessions.

Owing to the declaration of the Government of the intention to bring in a comprehensive scheme to reorganise the educational system of the country, a joint committee of the education committee and the technical education committee, with Sir William Mather as chairman, was appointed to consider the subject. A valuable report has been drafted, which urges that a scientific system of national education demands:—

(1) The duty of local authorities to make such provisions as will promote healthy growth during infancy and throughout school life.

(2) The absolute necessity of manual work and related practical exercises throughout the whole course of school instruction, and also in the training of teachers.

(3) Efficient public elementary schools within the reach of all children, and attendance at school compulsory until the age of fourteen years is reached.

(4) Attendance at continuation schools for at least six hours per week obligatory up to seventeen years of age for all young persons not otherwise receiving suitable education.

(5) Suitable secondary schools available for all who can profit by them and will undertake to complete the full course of instruction.

(6) The institution of school certificates to serve as passports to higher schools or universities, or as testamurs of satisfactory completion of a school course.

(7) Examinations to occupy a secondary place in comparison with school records for the award of certificates, or to qualify for promotion to higher courses of study.

(8) Coordination of technical institutions and faculties of technology in universities in order to prevent overlapping and render specialised types of technological training available to students who have the capacity to profit by them.

(9) Increased grants to universities and other places of higher education for the purposes of ensuring the reduction of fees for all courses and promoting post-graduate research.

(10) The position and condition of service of teachers of every grade to be greatly improved in order to encourage men and women of the highest aptitude and qualifications to devote their lives to the work of teaching and the advancement of knowledge.

(11) Readjustment of the shares of the cost of education borne by the National Exchequer and by local authorities, so that educational progress may be made primarily a national responsibility.

The synchronisation of clocks committee refers to the Government action in connection with the subject, already mentioned. Since the guild took the matter up the Post Office has always viewed the matter sympathetically, and this new departure will, if it be taken up by those exposing public clocks, be

of the utmost value. It is hoped that the railway companies, at least in the metropolis, will take advantage of this enterprise on the part of the Postmaster-General. The borough councils have in the past not been very sympathetic, but perhaps, now that the matter will be arranged for them by the Post Office at such a trifling cost, they will adopt a more progressive attitude.

The explosives committee has considered the question of the available sources of nitrates, and the possibility of obtaining them during war; also the feasibility of manufacturing nitrates on a large commercial scale in this country. The committee considers that it is of the utmost importance that nitrates should be manufactured in Great Britain, even if the manufacture is not profitable; it is, however, of opinion that a commercially successful scheme is possible.

In the report of the Canadian committee reference is made to the conservation of natural resources of Canada. A source of great loss to the country is the prevalence of forest fires, and last year the Government spent the sum of 312,500*l.* in protection against this source of loss. The protection of native birds is also referred to. Much useful work has recently been done by the Canadian Waterways Commission, and in connection with this Dr. H. T. Barnes, the hon. secretary of the Canadian committee of the guild, has continued his valuable researches on ice formation in the St. Lawrence. Other subjects dealt with are radium standards, university settlement, prevention of tuberculosis, and free ice for the poor.

Appended to the report are the reports of committees dealing with the Milk and Dairies Bill, the work of the Canadian branch, and on a national system of education. Prof. R. A. Gregory contributes an appendix in which benefactions exceeding 10,000*l.* for the purposes of science and higher education are recorded, and a comparison is made between the incomes of universities and colleges in the United States and that of State-aided universities in Great Britain. From this article it appears that the total receipts of universities in the United States in the year 1910–11 amounted to nearly nineteen million pounds, and the benefactions to four and a half millions. In the same year, the total receipts of those universities and university colleges in Great Britain which participate in the Treasury grant were little more than 600,000*l.* The receipts from fees in England amounted to rather less than 32 per cent. of the total income. The amount received from endowment was about 15 per cent.; the receipts from local authorities 15·6 per cent. The total receipts of all kinds from the Exchequer amounted to 28·5 per cent. of the income.

As regards numbers of students in universities and technological institutions of university standard, comparison is made with Germany. There are twenty-one universities in the German Empire and eleven technical high schools or technical universities having the power to grant degrees. Taking the universities and technical high schools together, the statistics show that in the year 1910–11 they had about 71,000 matriculated students. The total number of full-time day students in the universities and university colleges of England and Wales (including those of Oxford and Cambridge) in 1910–11 was about 17,000, and in Scotland about 7600, in comparison with 55,000 in German universities. In the technical institutions of the United Kingdom, the number of day students in attendance was about 2000, in comparison with 16,000 in the technical high schools of Germany. From other tables given in the article it appears that more than 90 per cent. of the pupils in the State-aided secondary schools of England and Wales are under sixteen years of age, and one-quarter of the pupils are under twelve years of age. More than four-fifths of the pupils have not passed an examination of university matriculation standard when they leave school. Two per cent. of the pupils proceed to universities, and 7 per cent. to technical schools and institutions, medical schools, training colleges for secondary-school teachers, and like places providing special training for professions, trades, or commercial occupations.

RECENT WORK IN ECONOMIC ENTOMOLOGY.

VALUABLE memoirs published by the Entomological Division of the United States Department of Agriculture are constantly reaching us. Of these, Bulletin 110, on "The Spring Grain-Aphis, or Green-bug," by F. M. Webster and W. J. Phillips, is of more than passing interest. The species described—*Toxoptera graminum*, Rondani—has been noticed as seriously destructive to wheat and other cereals in North America—especially in the Middle Western States—during several seasons from 1890. In the eastern hemisphere it has been recorded only from a few localities—Italy, Hungary, Belgium, India, South and East Africa. The bulletin, extended to 150 pages, gives a full account of the insect, its embryology, post-natal development, habits, and natural enemies. An interesting bionomical observation is that south of the 35th parallel the species reproduces itself only by successive generations of virgin females, and even further to the north the sexual generation may be omitted from the life-cycle in mild winters.

Another bulletin which contains welcome original contributions to our knowledge of the life-history of Hemiptera is No. 108, on "Leafhoppers affecting Cereals, Grasses, and Forage Crops," by Prof. Herbert Osborn. H. M. Russell's contribution (No. 118) on the bean thrips (*Heliothrips fasciatus*) is also noteworthy. It is needless to add that these bulletins all deal with practical means for the extermination or control of the pests.

As a contribution to animal parasitology, Bulletin 106, "The Life-history and Bionomics of some North American Ticks," by W. A. Hooker, F. C. Bishopp, and H. P. Wood, is worthy of mention. It forms an excellent introduction to the ticks of pathological importance, giving diagnostic characters of genera and species, and furnishing in each case details of the early stages in the life-history.

From the Canadian Department of Agriculture we have received Dr. C. Gordon Hewitt's Bulletin, No. 10, on the large larch sawfly (*Nematus Erichsonii*). This paper gives, in a handy form, particulars of the prevalence of the insect as a larch-destroyer in Europe and North America. British entomologists are familiar with Dr. Hewitt's work in connection with this insect in the Cumbrian lake district. He finds it still more injurious across the Atlantic, where, he believes, it must be regarded as an introduced species. Naturally he is endeavouring to acclimatise in Canada the ichneumon-fly (*Mesoleius tenthredinis*), which reduced so considerably the sawfly population on the shores of Thirlmere.

Dr. Hewitt has found time also to contribute to *Parasitology* (vol. v., No. 3, 1912), a short account of the larvæ and bionomics of *Fannia canicularis* and *F. scalaris* (better known to most naturalists under the generic name of Homalomyia). These curious spinose maggots have an unpleasant interest as occasional inhabitants of the human intestinal and urinary tracts.

From the Imperial Indian Government's Agricultural Research Station at Pusa has been issued Bulletin No. 28 on "The Cultivation of Lac in the Plains of India," by C. S. Misra, a well-illustrated account of the insect (*Tachardia lacca*), the trees on which it thrives, their culture, the collection of the product, the manufacture of shellac, and its economic uses. The most dangerous enemies of the lac insect appear to be the predaceous caterpillars of four species of moth.

FORESTS AND CLIMATE.

THE very general belief in the influence of forests upon climate, and especially upon rainfall, is discussed by Prof. R. de Courcy Ward in an interesting article in the April number of *The Popular Science Monthly*. The subject is very complicated, and the author points out that we must be careful not to put the cart before the horse; in other words, the forests are the result of the rainfall, and not *vice versâ*.

The various questions involved are discussed in detail, the following being among the points dealt with:—(1) The historical method; (2) why forests should influence climate; (3) influence upon (*a*) temperature, (*b*) humidity and evaporation; (4) the cases frequently cited as showing an influence upon rainfall; (5) recent European studies. Among the authorities quoted, Hellmann has shown that the increase in the rainfall over a forest is accompanied by a lessened fall to leeward—simply a slight difference in distribution. Both Voeikof (Russia) and Hann (the leading authority on climate) believe that the vast tropical forests may increase the amount of rainfall. But as regards our own latitudes the author considers that there is at present no conclusive evidence that forests have a significant effect upon the amount of rain*fall*, as distinguished from the amount of the rain*catch* in the gauge.

There is comparatively little popular interest in the possible influence of forests upon temperature; the forest is a little cooler than the open in summer, and possibly very slightly warmer in winter. Supan sums up the case as follows:—"No one will care to maintain that the system of isotherms would be radically altered if Europe and Asia were one great forest from ocean to ocean." With regard to moisture, the author thinks that the local supply from forests cannot play any considerable part in the great rain-producing processes.

SYSTEMS OF LONG-DISTANCE WIRELESS TELEGRAPHY.

THE Advisory Committee appointed by the Postmaster-General to consider and report on the merits of existing systems of long-distance wireless telegraphy has made its report. The Committee heard evidence in private from representatives of the Marconi, the Telefunken, the Poulsen, the Goldschmidt, and the Galetti interests, and of the Admiralty, and the members visited a number of stations.

The report is strictly limited to practical considerations, and deals with matters of engineering rather than of scientific interest. From the point of view of the building of stations for immediate operation in the Imperial wireless chain, the report is overwhelmingly in favour of the Marconi Company, not only on account of its plant, but also on account of its experience; though the Committee points out that it would be possible for the Government to get together a highly trained staff and erect the stations, using any desirable patents under the provisions of section 29 of the Patents and Designs Act, 1907. The Marconi spark plant was tested by the Committee as to duplex working, and as to automatic transmission at the rate of sixty words per minute, across the Atlantic, a distance of 2300 miles. The Committee found Transatlantic communication practically continuous, though there are periods when the signals become very weak; and there are occasional periods when no signals at all can get through. These weak periods are due to natural causes, and can probably only be overcome by the use of high powers.

The Committee received no evidence supporting the reported transmission from San Francisco to Honolulu (2100 miles) by the Poulsen arc, but witnessed transmission over a relatively short distance at seventy words per minute. The members also saw the Goldschmidt alternator transmit at the rate of sixty words per minute. It is interesting to note that the Marconi Company and the Telefunken Company are both experimenting with generators of continuous waves. The Marconi machine consists essentially of a rapidly rotating contact-maker in a direct-current circuit with special dispositions of other circuits to give continuous oscillations in the antenna. The Telefunken machine is an alternator constructed to give as high a fundamental frequency as may be convenient in the first instance, the frequency being doubled or quadrupled by a polarised transformer method. The Marconi machine was witnessed working across the Atlantic.

SOME FURTHER APPLICATIONS OF THE METHOD OF POSITIVE RAYS.[1]

THE method to which I shall refer this evening is the one I described in a lecture I gave here two years ago. The nature of the method may be understood from the diagram given in Fig. 1. A is a vessel containing the gases at a very low pressure; an electric discharge is sent through these gases, passing from the anode to the kathode C. The positively electrified particles move with great velocity towards the kathode; some of them pass through a small hole in the centre, and emerge on the other side as a fine pencil of positively electrified particles.

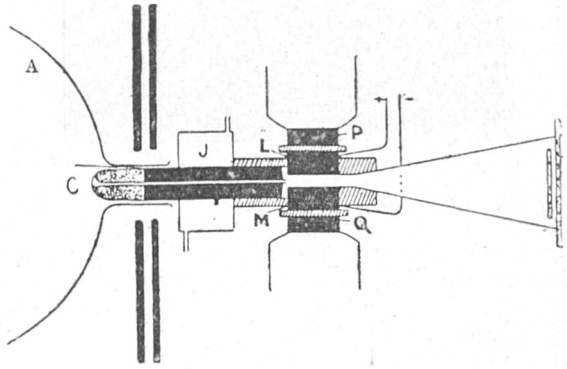


FIG. 1.

This pencil is acted on by electric forces when it passes between the plates L and M, which are connected with the terminals of a battery of storage cells, and by a magnetic force when it passes between P and Q, which are the poles of an electromagnet. In the pencil before it passed under the influence of these forces there might be many kinds of atoms or molecules, some heavy, others light, some moving quickly, others comparatively slowly, but these would all be mixed up together. When they are acted on by the electric and magnetic forces, however, they get sorted out, and instead of travelling along the

[1] Discourse delivered at the Royal Institution on Friday, January 17, by Sir J. J. Thomson, O.M., F.R.S.

same path they branch off into different directions. No two particles will travel along the same path unless they have the same mass as well as the same velocity; so that if we know the path of the particle we can determine both its mass and its velocity. In chemical analyses we are concerned more with the mass than with the velocity, and we naturally ask what is the connection between the paths of particles which have the same mass but move with different velocities. The answer is that all such paths lie on the surface of a cone, and that each kind of particle has its own cone; there is one cone for hydrogen, another for oxygen, and so on. Thus one cone is sacred to hydrogen, and if it exists there must be hydrogen in the vessel; so that if we can detect the different cones produced from the original pencil, we know at once the gases that are in the tube. Now, there are several ways of identifying these cones, but I shall only refer to the one I have used in the experiments I wish to bring before you this evening. These moving electrified particles, when they strike against a photographic plate, make an impression on the plate, and a record of the place where they struck

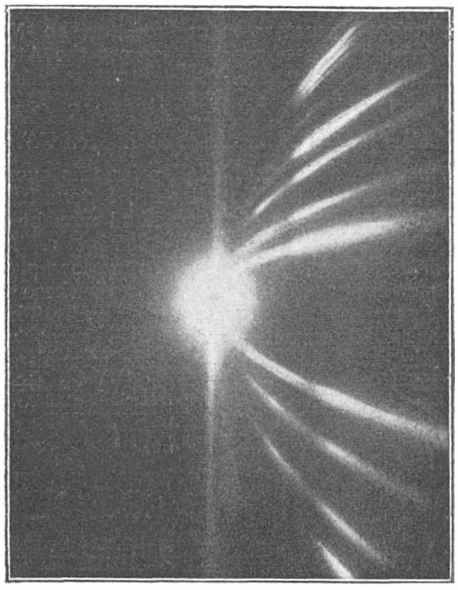


FIG. 2.

the plate can be obtained. Thus, when a plate is placed in the way of the particles streaming along these cones, the sections of these cones by the plate (parabolas) are recorded on the photograph, hence we can identify these cones by the parabolic curves recorded on the photograph, and these parabolas will tell us what gases are in the vessel.

The first application of the method which I shall bring before you this evening is to detect the rare gases in the atmosphere. Sir James Dewar kindly supplied me with two samples of gases obtained from the residues of liquid air; the samples had been treated so that one might be expected to contain the heavier gases, the other the lighter ones. I will take the heavier gases first. The photograph of these is shown in Fig. 2. When the plate is measured up it shows a faint line corresponding to the atomic weight 128 (xenon), a very strong line corresponding to the atomic weight 82 (krypton), a strong argon line 40 (argon), and the neon line 20. There are no lines unaccounted for, and hence we may conclude that in the atmosphere there are no unknown gases of large atomic weight occurring in quantities comparable with those of xenon or krypton. This result gives an example of the convenience of the method, for a single photograph of the positive rays reveals at a glance the gases in the tube. I now turn to the photograph of the lighter constituents shown in Fig. 3; here we find the lines of helium, of neon (very strong), of argon, and, in addition, there is a line corresponding to an atomic weight 22, which cannot be identified with the line due to any known gas. I thought at first that this line, since its atomic weight is one-half that of CO_2, must be due to a carbonic acid molecule with a double charge of electricity, and on some of the plates a faint line at 44 could be detected. On passing the gas slowly through tubes immersed in liquid air the line at 44 completely disappeared, while the brightness of the one at 22 was not affected.

The origin of this line presents many points of interest; there are no known gaseous compounds of any of the recognised elements which have this molecular weight. Again, if we accept Mendeléef's periodic law, there is no room for a new element

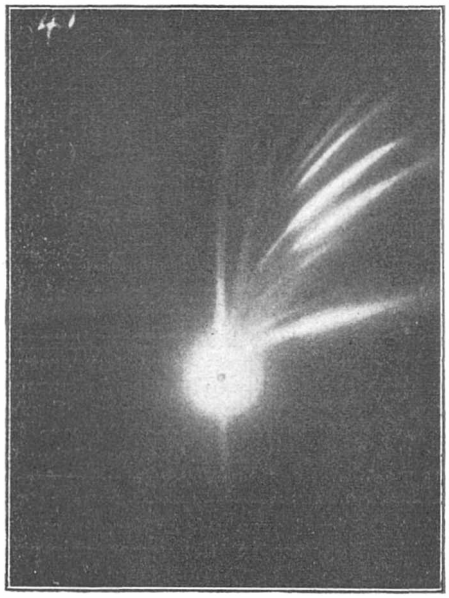


FIG. 3.

with this atomic weight. The fact that this line is bright in the sample when the neon line is extraordinarily bright, and invisible in the other when the neon is comparatively feeble, suggests that it may possibly be a compound of neon and hydrogen, NeH_2, though no direct evidence of the combination of these inert gases has hitherto been found. I have two photographs of the discharge through helium in which there is a strong line, 6, which could be explained by the compound HeH_2, but, as I have never again been able to get these lines, I do not wish to lay much stress on this point. There is, however, the possibility that we may be interpreting Mendeléef's law too rigidly, and that in the neighbourhood of the atomic weight of neon there may be a group of two or more elements with similar properties, just as in another part of the table we have the group iron, nickel, and cobalt. From the relative intensities of the 22 line and the neon line we may conclude that the quantity of the gas giving the 22 line is only a small fraction of the quantity of neon.

Let me direct your attention again to the photo-

graph of the heavier gases in the atmosphere. You will notice that the parabolas corresponding to many of the elements start from points which are all in the same vertical line; this indicates that the atoms or molecules which form these parabolas all carry the same charge. Several of these lines, however, do not follow this rule; you will notice, for example, that the neon line has a prolongation which comes nearer than the normal line to the vertical line drawn through the undeflected spot. Measurement of the photograph shows that the neon line begins at a distance from this vertical line which is only half the normal distance; this shows that some of the neon atoms in the positive rings possess two charges of electricity; the majority of them, however, only possess one. If you examine the argon line you will find that it comes even nearer to the vertical than the neon line; in fact, it begins at a distance from the vertical only one-third of the normal distance; this proves that the argon atom can have as many as three charges of electricity. If now you examine the krypton line you will find that it comes nearer to the vertical line than even the argon; its least distance is one-fourth of the normal distance, showing that the krypton atom may have as many as four charges. The mercury line comes so close to the vertical line that it is only on large photographs that it can be seen that there is in reality an interval; this interval is only one-eighth of the normal interval, showing that mercury may acquire eight positive charges, *i.e.* that it may lose eight corpuscles. The mercury atom when it is on this line must have only the normal charge, *i.e.* it must have regained all but one of the corpuscles it previously lost; if it had retained two positive charges it would have been on the line corresponding to the atomic weight 200/2 or 100; if it had retained 3, or 4, 5, 6, 7, 8 on the lines corresponding to the atomic weights, 200/3, 200/4, 200/5, 200/6, 200/7, 200/8 respectively. All these except the last have been detected on the plate. The lines corresponding to the multiple charges on krypton, argon, and neon have also been detected. It appears, then, that in a vacuum tube a mercury atom, for example, may be ionised in two ways; in the one way the atom loses one corpuscle, in the other it loses eight.

I would suggest that these two types of ionisation may result from the two different types of collision which the atom must experience. The first type is collision with a corpuscle; since the corpuscle is an exceedingly small body moving with a very great velocity, it can pass freely through the atom, and the collision it makes with the atom is really a collision with a corpuscle inside the atom; this may result in the corpuscle it strikes acquiring such a great velocity that it is able to escape from the atom; this type of collision will result in the detachment of a single corpuscle. The second type of collision is when the atom collides with another atom and not with another corpuscle; the result of this collision may be that the atom suffers a sudden change in its velocity. This change is not at first shared by the corpuscles, so that these just after the collision may have a very considerable velocity relative to the atom. If there are several corpuscles which are comparatively loosely attached to the atom, these may all be detached from it and leave it with a positive charge corresponding to the number shaken out. It is this type of collision which we regard as giving the multiply-charged ions, and we see that the magnitude of the charge is a measure of the number of corpuscles in an atom which are readily detachable from it. We have seen that the greater the atomic weight the greater the charge it can acquire, the maximum charge being roughly proportioned to the square root of the atomic weight, hence the heavy elements have a larger number of detachable corpuscles than the lighter ones.

Another application of the method I should like to bring before you is the use of it for the discovery and investigation of a new substance. I have in previous lectures said that sometimes there appeared on the plates a line corresponding to a particle with an atomic weight 3; this must either be a new element or a polymeric modification of hydrogen, represented by H_3. The other possibility that it is a carbon atom with four charges is put out of court by the fact that it frequently occurs when the carbon line is exceedingly faint, and when there is not a trace of a carbon atom with even two charges, though the doubly-charged carbon atom occurs readily under certain conditions. In addition to this, the carbon atom parabola never approaches the vertical near enough to allow of its having four charges. I thought the study of the substance producing this line would be of interest, and I have for some time been working at it, and although the research is by no means completed, I have obtained some results which I should like to bring before you.

At first I was greatly hindered by not knowing the conditions under which the line occurred; although it appeared from time to time on the plates, its appearance was always fortuitous and sometimes for weeks together the plates would not show a trace of the line. The line sometimes appeared, but why it did so was a mystery, and I could not get it when I wanted it. I began an investigation, which proved long and tedious, to find the conditions under which the line appeared. I tried filling the discharge-vessel with all the gases and vapours described in the books on chemistry without success. At last I tried bombarding various substances with kathode rays. Under this treatment the substances give off considerable quanties of gas the greater part of which is hydrogen, carbonic acid, or carbon monoxide. When I came to analyse by the positive rays the gases given off in this way, I found that with a large number of substances these gases contained the substances giving the three lines, so that I was now in a position to get this line whenever I wanted it, and investigate the properties of the gas to which it owes its origin. The question of the gases absorbed and given off by solids is an extremely interesting one, and a considerable number of investigations have been made on it. In all these, so far as I know, the method has been to heat the solid to a high temperature, and then measure and analyse the very considerable amount of gas which is driven off by the heating. So far as I know, no experiments have been made in which the gases were driven off by bombardment with kathode rays. This treatment, however, will cause the emission of gas even when ordinary heating fails to do so.

Belloc, who has recently published [2] some interesting experiments on this subject, after spending about six months in a fruitless attempt to get a piece of iron in a state in which it would no longer give off gas when heated, came to the conclusion that, for practical purposes, a piece of iron must be regarded as an inexhaustible reservoir of gas. There are some interesting features about the emission of gas from a heated solid. If the body is kept for a long time in a vacuum at a high temperature, the emission of gas becomes too small to be detected; if after this treatment the temperature is raised considerably, there will be a further copious emission of gas, which again diminishes as the heating continues. After it has fallen to zero, all that is necessary is to raise the temperature again and you will get a fresh supply of gas; and so far as my experience goes, after you

[2] *Ann. de Chimie et de Physique* [8], xviii., p. 569.

have got all the gas you can out of the solid by heating it, you have only to expose it to kathode rays to get a fresh outburst. This effect of increased temperature in renewing the stream of gas from the solid seems to me to be too large to be accounted for merely by an increase in the rate of diffusion of the absorbed gas from the interior to the surface; it seems to be more analogous to the case of the emission of the water of crystallisation from some salts. There are some salts, for example, copper sulphate, which when heated lose their water of crystallisation in stages; thus, if the temperature is raised to a certain value, some of the water of crystallisation comes off, but the rest remains fixed, and you may keep the salt at this temperature for ever without getting rid of all the water of crystallisation; on raising the temperature, however, fresh water of crystallisation is given off. Something of this kind seems to take place in the case of gases absorbed in metals, and there seem to be indications that there is some kind of chemical combination between the gas and the metal. This absorbed gas may influence the behaviour of the substance. For example, an ordinary carbon filament gives off, when raised to a white heat, large quantities

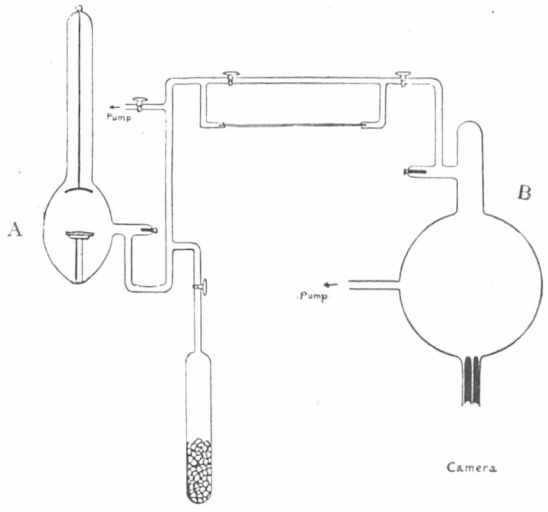
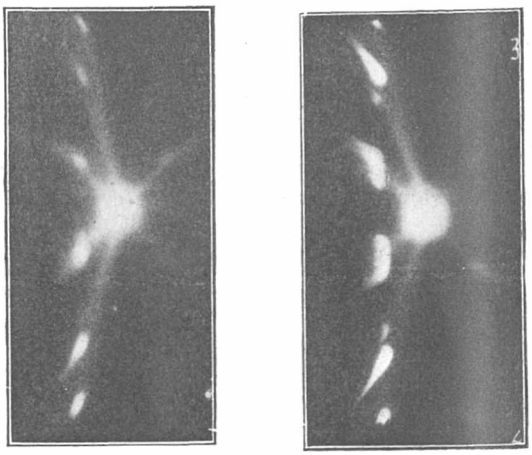


FIG. 4.

of negatively electrified corpuscles; but Pring and Parker [3] have shown that when great precautions are taken to get rid of the absorbed gas, the emission of these corpuscles falls to less than one-millionth of their previous value. It is in the gases given off by certain metals when they are bombarded by kathode rays that I have found an unfailing source of the substance, which I shall denote by X_3, giving the line corresponding to the atomic weight 3. The arrangement I have used for investigating the presence of this gas is shown in Fig. 4. A is a vessel communicating with the bulb B in which the positive rays are produced by two tubes, one of which is a very fine capillary tube, while the other one is five or six millimetres in diameter; taps are inserted so that one or both of these vessels can be closed, and the vessels A and B isolated from each other. A is provided with a curved kathode such as are used for Röntgen ray focus tubes, and the kathode rays focus on the platform on which the substance to be bombarded is placed. (It is not absolutely necessary to focus the kathode rays in this way, but it makes the supply of the gas X_3 more copious.) After the metal or other solid to be examined has been placed on the platform, the taps between A and B being turned so as to cut off the connection between them, A is exhausted until the vacuum is low enough to give the kathode rays; the discharge is then sent through A, and the kathode rays bombard the solid. The result of this is that in a few seconds so much gas, mainly CO_2 and hydrogen, is driven out of it that the pressure gets too high for the kathode rays to be formed, and unless some precautions to lower the pressure were taken the bombardment would stop. To avoid this, a tube containing charcoal cooled by liquid air is connected with A, and this absorbs the CO_2 and enough of the hydrogen to keep the vacuum in the kathode ray state. To see what new gases are given off in consequence of the bombardment, a photograph is taken while the connection between A and B is cut off. After this is finished, and when the bombardment has gone on for about four hours, the tap is turned and a little of the gas from A is allowed to go into B; another photograph is taken, and those lines in the second photograph which are not in the first represent those gases which are liberated by the bombardment, and have escaped being absorbed by the charcoal. I have here a slide (Fig. 5) representing the result of bombarding nickel. There are two photographs, one



α FIG. 5. β

(α) before turning the tap, and the other (β) after; in the second you see the 3 line very distinctly, while it is absent from the first, showing that the gas giving the 3 line has been liberated by the bombardment. I have got similar results to these when, instead of nickel, iron, copper, lead, and zinc have been bombarded. I have tried two specimens of meteorites kindly lent to me from the Mineralogical Museum, Cambridge, and found there the 3 line. Nearly every substance I have tried gives, the first time it is bombarded, the helium line as well as this line due to X_3; if, however, the same substance is bombarded a second time, the helium line is in general absent (occasionally it is still to be detected, though exceedingly faint); and on the third bombardment is invisible in all the substances I have tried except monazite sand, where it is given off in exceedingly large quantities so long as the bombardment continues. It is remarkable that monazite sand, which contains so many elements, gives no trace of the 3 line when bombarded.

I have also obtained the X_3 line and also the helium line when the tube A was replaced by one containing a Wehnelt kathode; with this the current of kathode rays through the tube was much larger than with the other kathode, though the velocity of the rays was

[3] *Phil. Mag.*, xxiii., p. 192.

smaller. The Wehnelt kathode gives the line without placing pieces of metal in the tube, so that in this case nothing is bombarded by the kathode rays but the glass walls of the tube; the strip of metal forming the kathode is, however, bombarded by the positive rays.

The 3 line when present at all continues even though the bombardment is very prolonged. In some cases the bombardment has been prolonged for twenty hours, and at the end of that time the line seemed almost as bright as at the beginning; indeed, I could not feel certain that there was any difference. This might lead one to suspect that X_3 was manufactured from the lead or other metal by the bombardment rather than stored up in it, and this view might be regarded as receiving some support from the fact that very little of the X_3 is liberated by heating. The following experiment is an illustration of this. I took a piece of lead, and instead of bombarding it with kathode rays I placed it in a quartz tube connected with vessel A, and heated the tube to a bright red-heat for several hours. Large quantities of CO_2 and hydrogen were driven off by this process; this was absorbed by charcoal, and the residual gases, which had accumulated in A, were admitted into the vessel B; the X_3 line and helium line could just be detected, and that was all. I then gave the lead a second heating, raising this time the temperature until the quartz was on the point of softening. The lead was boiling vigorously; the heating was kept up for about three hours. In this time about three-quarters of the lead had boiled away. I then let the gases which had been given off at the second heating into the vessel B, and took another photograph; no trace of the line due to X_3 or helium could be detected. The fraction of the lead which had not been boiled away was now placed in A and bombarded by kathode rays. It now gave the 3 line quite distinctly; the helium line was visible, but faint. By the bombardment with the kathode rays the lead was only just melted, so that the average temperature was much less than when it was heated in the quartz tube. This rather suggests that the X_3 might be due to a kind of dissociation of the metal by the kathode rays, and not to a liberation of a store of that substance. Another experiment shows, however, that for lead, at any rate, this view is not tenable. I took some lead which had just been deposited from a solution of lead acetate by putting a piece of zinc into the solution, and forming the well-known lead-tree. When I bombarded this freshly precipitated lead, I could get no trace of the X_3 line; the helium line, too, was absent. I then tried another experiment. I took a piece of lead and divided it into two parts. The first of these I bombarded by the kathode rays: it gave the X_3 line quite distinctly. The other part I dissolved in boiling nitric acid, getting lead nitrate. The nitrate was heated and converted into oxide, and this was bombarded by the kathode rays: it did not give the X_3 line, showing that the X_3 is not produced by the bombardment, but is something stored up in the lead, which can be detached from it when the lead is dissolved. I have tried several samples of lead; the one which gave the X_3 line most distinctly was a piece of lead from the roof of Trinity College Chapel, several hundred years old. A sample of Kahlbaum's chemically pure lead, which must, I suppose, at no distant date have been subjected to severe ordeals by fire and water, showed the line quite distinctly, though not so well as the older lead. I have tried similar experiments with iron, and found that iron which gave the 3 line very distinctly ceased to do so after it had been dissolved in acid.

As the most obvious explanation of X_3 is that it is H_3, bearing the same relation to hydrogen that ozone does to oxygen, and produced in some way from the hydrogen dissolved in the metal, I tried if I could produce it by charging metals with large quantities of hydrogen, and then seeing if the hydrogen coming from the metal gave any traces of H_3. Thus, for example, I tested the hydrogen given off from hot palladium, but found no trace of X_3. I then charged nickel at a temperature of about 355° C. with hydrogen in the way recommended by Sabatier, but found no increase in the brightness of the X_3 over nickel that had not been deliberately exposed to hydrogen. I tried if the brightness of the line would be increased by adding hydrogen to the bulb A, in which the bombardment took place, but found no effect. I also tried adding oxygen to this bulb, thinking that if it was H_3 it would combine with the oxygen, and thus be eliminated, but no great diminution in the intensity was produced by this treatment. The gas seems quite stable, at least it can be kept for several days without suffering any diminution that can be detected; indeed, when once it has got into a bulb, there is considerable difficulty in getting the bulb free from it. It must be remembered, too, that by the method by which it is produced the gas is subjected all the time to electric discharges which would break it up unless it possesses very great stability. Thus if X_3 is a polymeric modification of hydrogen, it must possess the following properties:—

(1) It must be very stable.

(2) it must resist the action of oxygen.

(3) It must not be decomposed by long-continued exposure to the electric discharge.

These are properties which *a priori* we should scarcely have expected an allotropic modification of hydrogen to possess.

Mendeléef predicted the existence of an element with an atomic weight 3. According to him this element should be intensely electro-negative and possess the properties of fluorine to an exaggerated extent. The gas X_3 can, however, be kept in glass vessels, which we should not expect to be possible if it possessed more than fluorine's power of combining with glass. I prefer to defer expressing any opinion as to the actual nature of the gas until I have had the opportunity of making further experiments upon it. It is only about two months ago that I found how to get the gas with any certainty, and, as the method involves long bombardments, each experiment takes a considerable time. This has prevented me from making several experiments which suggest themselves, and which ought to be made before coming to a final decision. I thought, however, that the investigation, though incomplete, might not be unsuitable for a Friday evening discourse, as the gas, whatever its nature, is certainly one of considerable interest, and its detection illustrates the delicacy of this new method.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The Sudbury-Hardyman prize offered for an original dissertation by a graduate member of Emmanuel College under the standing of M.A. has been increased to 40*l.*, and divided between G. E. K. Braunholtz, formerly scholar and research student, and R. D. Vernon, research student. Mr. Braunholtz's dissertation was "The Nomina of Italy, peculiar to Gallia Transpadana," and Mr. Vernon's "The Geology and Palæontology of the Warwickshire Coalfield."

THE electors to the Michael Foster research studentship in physiology give notice that there will be an

election to the studentship in the year 1913. Candidates are required to send in their applications to the professor of physiology before the end of June, with a statement of the course of research which they propose to undertake.

The Board of Agricultural Studies, in consultation with the president of the Royal Agricultural Society, has nominated C. R. Fay to be the Gilbey lecturer on the history and economics of agriculture.

The General Board of Studies is authorised to appoint a University lecturer in agricultural physiology for a further period of five years from midsummer, 1913. The lecturer will receive an annual stipend of 200*l*., payable out of the agricultural education fund.

LEEDS.—Mr. W. A. Millard, formerly assistant lecturer in botany, has been appointed lecturer in agricultural botany.

A series of week-end lectures on modern Germany will commence on May 31, and will be continued on June 6, 7, and 14. Among the lecturers will be Dr. Hiby, managing director of the Otto Coke Oven Co., on industrial and social conditions; Prof. Smithells, on the story of German science; and Mr. J. L. Paton, on modern German education.

MANCHESTER.—The council has made a number of appointments and rearrangements in the department of chemistry consequent on the resignation of Prof. W. H. Perkin on his acceptance of the chair of chemistry at Oxford. Dr. A. Lapworth, F.R.S., has been appointed professor of organic chemistry and Dr. Charles Weizmann has been appointed reader in biochemistry and lecturer in colouring matters. Dr. E. C. Edgar and Dr. F. B. Burt have been made senior lecturers in chemistry. Prof. H. B. Dixon has been reappointed director of the chemical laboratories, to supervise the department as a whole.

Mr. Edward Sandeman has been appointed associate professor of engineering in the University. He will lecture on water supply and irrigation, and will be responsible for the studies of all students specialising in this branch of engineering.

OXFORD.—The fourth Halley lecture was delivered in the schools on May 22 by Dr. Louis A. Bauer, director of the department of research in terrestrial magnetism in the Carnegie Institution of Washington, U.S.A. The subject of the lecture was "The Earth's Magnetism." Dr. Bauer paid a tribute to Halley as one of the greatest among early investigators of the variations of the compass. He described the two years' cruise undertaken by Halley in the years 1698–1700, at the cost of William III., for the purpose of making magnetic observations. The expedition which left New York four years ago in the *Carnegie* had followed the same track, but found a great alteration in the magnetic conditions. The magnetic poles were gradually shifting. Though Halley's theory of terrestrial magnetism was not strictly correct, it seems to have been the first definite recognition of the complexity of the problem. This would not be completely solved until the physicists were able to answer the question, What is magnetism?

A valuable lecture on wireless telegraphy has been given before the Ashmolean Society by Mr. W. G. Gill, of the Officers Training Corps and fellow of Merton College.

Entries for the Final Honour School in Natural Science number eighty-nine, distributed as follows:—Physics, ten; chemistry, thirty-two; zoology, two; physiology, eighteen; botany, five; geology, ten; engineering science, twelve.

On May 27 Congregation passed the preambles of two statutes relating to the holders of professorships at present tenable for life, and to which no canonry is annexed. The statutes provide that every such professor shall vacate office within one year of attaining the age of seventy years, and that a scheme of pensions shall be established to apply to professors vacating office under the above conditions. If these statutes are finally adopted in their present form, they will not apply to any of the present holders of professorships, nor, in all probability, to any of their successors for some years to come. It has, however, been widely felt that some steps should now be taken to provide for the eventual establishment of a satisfactory system of retirement and pension, nothing of the kind being at present in existence.

THE University of Glasgow has received, under the will of Miss Jeanie Pollock, of Glasgow, the sum of 10,000*l*. for providing a materia medica research lectureship.

DR. GEORGE BARGER has been appointed by the Senate of the University of London to the University chair of chemistry tenable at the Royal Holloway College, with the status of appointed teacher.

DR. S. B. SCHRYVER, biochemist at the Research Institute of the Cancer Hospital, Brompton Road, S.W., has been appointed assistant professor of biochemistry at the Imperial College of Science and Technology.

THE board of regents of the University of Nebraska recently voted a general increase in the salaries of deans and professors in the University. *Science* states that the necessary 70000*l*. was obtained from the additional maintenance grant voted by the last legislature.

DR. L. F. GUTTMANN, formerly of London University and the College of the City of New York, and for the last four years assistant professor of physical and industrial chemistry at Queen's University, Kingston, Canada, has been appointed associate professor of chemical engineering in this University.

IT is now announced that the executors of the late Sir J. Wernher, Bart., have completed the allocation of the 100,000*l*. bequeathed to them to be devoted to charitable and educational purposes. 35,000*l*. has been allotted to charitable and educational purposes in South Africa, and the balance of 65,000*l*. has been distributed over nearly 150 different institutions in this country. Among the grants for scientific and educational purposes may be mentioned: to the Institute of Mining and Metallurgy, 5000*l*.; the Imperial Service College, Windsor (to found a scholarship for Bedfordshire), 2500*l*.; the London School of Tropical Medicine, 1500*l*.; and lesser amounts to the London School of Economics, the Bedford College for Women, and the Working Men's College.

SOCIETIES AND ACADEMIES.

LONDON.

Geological Society, May 7.—Dr. Aubrey Strahan, president, and afterwards Mr. W. Whitaker, in the chair.—M. **Odling**: The Bathonian rocks of the Oxford district. The lithology, palæontology, and stratigraphy of the Bathonian rocks north of Oxford are described, from the evidence afforded by numerous quarries and well-borings and by the Ardley Cutting. The general sequence is given. After a general account of the series, the points of interest in the sections and their relations are described; and it is pointed out that, although no definite zones can be formulated, the different horizons are recognisable by their assemblage of fossils. The chemical and micro-

scopic structures of the rocks are dealt with, and the conditions of deposition and stratigraphical relationship of the different members of the series discussed. Some structures from the Chipping-Norton Limestone are described, and the reasons given for considering them to be annelid-tubes. A list of fossils is appended. —Dr. J. A. **Thomson**: The petrology of the Kalgoorlie Goldfield (Western Australia). The district comprises an area about four miles long by one mile in breadth. Towards the south the auriferous lodes are rich (The Golden Mile), but in the north they are less productive. Most of the junctions are faulted. In "The Golden Mile" the central feature is a broad dyke of quartz-dolerite, forming a prominent ridge flanked by amphibolites and greenstones. The quartz-dolerite is cut by dykes of albite-porphyry. Gold is found in shear-zones, impregnated with sulphides and tellurides, and is most abundant in the lodes in the quartz-dolerite. The sequence of the rocks of Kalgoorlie is discussed. The greenstones, fine amphibolites, and calc-schists are regarded as the old "country-rocks," into which the others are intrusive. The quartz-dolerites, hornblende-dolerites, and pyroxenites are closely related one to the other. Probably the peridotite group is the early basic facies of the quartz-dolerite series, and the porphyries and porphyrites are regarded as being derived from the same magma. The characteristic of this goldfield is the prevalence of albitisation in the auriferous districts. A consideration of the rock-facies developed from the magma suggests that there is in Kalgoorlie an instance of the production of auriferous lodes by rocks belonging to the same class as the pillow-lavas and their diabases and soda-granite-porphyries.

PARIS.

Academy of Sciences, May 19.—M. F. Guyon in the chair.—A. **Haller** and Edouard **Bauer**: Monomethylcamphoroxime, methylcampholenic nitrile, and methylcampholenic acid. By the action of sodium amide and methyl iodide upon camphor, a mixture of monomethylcamphor and dimethylcamphor is obtained. These can be separated by treatment with Crismer's salt (hydroxylamine chlorozincate); dimethylcamphor remains unchanged, and can be separated from monomethylcamphoroxime by fractional distillation.—M. de **Forcrand**: The condition of water in hydrated salts. The determination of the heat of solution of hydrated salts is suggested as the best means of attacking the problem of the condition of the attached water molecules.—M. André **Blondel** was elected a member of the section of free academicians in the place of the late Louis Cailletet.—H. **Godard**: Observations of the comet 1913*a* (Schaumasse) made with the 38-cm. equatorial at the Observatory of Bordeaux. Two positions are given for May 16. The comet appeared as a diffuse nebulosity, without nucleus, of 10·5 magnitude.—J. **Guillaume**: Observations of the Schaumasse comet (1913*a*) made with the equatorial of the Observatory of Lyons. Two positions are given for May 10 and one for May 11. The comet is described as circular, bluish, condensed at the centre; magnitude about 10·5.—Rodolphe **Soreau**: A new approximate formula for the length of the ellipse.—Paul **Lévy**: The integration of functional partial differential equations.—M. **Moulin**: The law of deformation of the flat spiral spring of chronometers.—M. de **Sparre**: Hammering of the water in pipes formed of sections of different diameter.—C. **Tissot**: The influence of electrical oscillations on the conductivity of certain fused metallic salts. A layer of certain fused salts (lead and thallium chlorides, cadmium bromide, silver nitrate, chloride, and bromide) in contact with two metallic plates as electrodes becomes conducting when the E.M.F. exceeds a certain limiting value. If the system is now submitted to electrical oscillations of sufficient intensity, the conductivity immediately disappears.—Carl **Benedicks**: The deduction of Planck's law of distribution of energy by the hypothesis of agglomeration. Planck's law can be deduced without the use of the *quanta* hypothesis.—J. **Chaudier**: The variations of magnetic rotatory power in changes of state.—André **Léauté**: The precautions to be taken in the use of resonance in tests of electric cables intended for use with high voltages.—R. V. **Picou**: Internally excited dynamos.—Camille **Matignon**: The law of volatility in chemical reactions. The law of Berthollet is given in a generalised form. Any system of solids or non-volatile liquids susceptible of giving rise by a new grouping of atoms to a system containing volatile bodies ought to enter into reaction at a suitable temperature. Thus it has been shown that at a very high temperature aluminium will react with magnesia, the magnesium formed being gaseous. The reduction of barium oxide by silicon is another example.—G. **Arrivaut**: Study of the system manganese-silver. Manganese and silver are capable of forming the combination $MnAg_2$; experimental evidence on this is given dealing with the melting-point curves, microscopical structure, electromotive forces, and chemical behaviour of various alloys of the two metals. This conclusion is opposed to that previously arrived at by G. Hindrichs.—Marcel **Gompel** and Victor **Henri**: The quantitative study of the absorption of the ultra-violet rays by the alkaloids of the atropine group. Absorption data are given for atropine, apoatropine, and cocaine.—MM. **Taffanel** and Le **Floch**: The combustion of gaseous mixtures. An examination of the causes of the lag in the inflammation of combustible mixtures of methane. Moisture was found to be without effect in reducing this lag.—J. **Aloy** and Ch. **Rabaut**: Benzoyl cyanhydrins of ketones, amides, and the alcohol acids from which they are derived.—E. E. **Blaise**: The characterisation of the chloro-ketones. The use of the semicarbazones was found to be advantageous for the identification of the chloro-ketones.—Alfred **Guillemard**: Nature of the optimum osmotic pressure in biological processes.—Jean **Daniel**: The relations existing between the age of the dicotyledons and the number of successive layers of their secondary woods. Under certain conditions of growth the number of concentric layers of secondary wood cannot be distinguished, and the number of years of growth cannot be determined by this means.—C. J. **Pitard**: The vegetation of Chouïa, Morocco.—M. **Hirtz**: Intensive galvanotherapy with feeble current density.—Louis **Roule**: Contribution to the study of the biology of the salmon.—L. **Bordas**: A case of lateral budding in *Lumbricus herculeus*.—J. **Bounhiol**: The reproduction of the Algerian sardine. —Albert **Berthelot**: Researches on the intestinal flora. The pathogenic action of a microbial association of *Proteus vulgaris* and *Bacillus aminophilus*. A study of the symbiosis of these two organisms *in vitro* leads to the conclusion that the *B. aminophilus* prevented to some extent the growth of Proteus, but experiments *in vivo* with white rats at once showed that the opposite was the case. Proteus alone, even in large doses, is without apparent influence on rats, but in association with the bacillus above-mentioned, enteritis is rapidly produced.—G. **Béchamp**: Concerning *microzyma cretae*. Remarks on a recent communication by Raphaël Dubois.—J. **Lesage**: Epizootic myocarditis of the sheep.—C. **Gerber**: Comparison of the hydrolysing diastases of the latex of *Maclura aurantiaca* with those of *Ficus carica* and of *Broussonetia papyrifera*.—J. **Vallot**: The value and variation of the temperature of the lower portion of the glacier of Mont Blanc.

BOOKS RECEIVED.

Fortschritte der naturwissenschaftlichen Forschung. Edited by Prof. E. Abderhalden. Achter Band. Pp. 308. (Berlin and Vienna: Urban and Schwarzenberg.) 15 marks.

Behaviour Monographs. Vol. ii., No. 1, Serial No. 6. The Delayed Reaction in Animals and Children. By W. S. Hunter. Pp. 86. (Cambridge, Mass.: H. Holt and Co.)

Cape of Good Hope. Department of Mines. Sixteenth Annual Report of the Geological Commission. 1911. Pp. 136+v. (Cape Town: *Cape Times*, Ltd.)

A Naturalist in Cannibal Land. By A. S. Meek. Edited by F. Fox. Pp. xviii+238+plates. (London: T. Fisher Unwin.) 10*s*. 6*d*. net.

The Living Plant. By Prof. W. F. Ganong. Pp. xii+478+plates. (New York: H. Holt and Co.) 3.50 dollars net.

The Child: its Care, Diet, and Common Ills. By Dr. E. M. Sill. Pp. viii+207. (New York: H. Holt and Co.) 1 dollar net.

The Fringe of the East. By H. C. Lukach. Pp. xiii+273. (London: Macmillan and Co., Ltd.) 12*s*. net.

Trans-Himalaya. By Sven Hedin. Vol. iii. Pp. xv+426+plates+maps. (London: Macmillan and Co., Ltd.) 15*s*. net.

A Dictionary of Applied Chemistry. By Sir E. Thorpe, assisted by eminent contributors. Revised and enlarged edition in five vols. Vol. iv. Pp. viii+727. (London: Longmans and Co.) 45*s*. net.

Ueber kausale und konditionale Weltanschauung und deren Stellung zur Entwicklungsmechanik. By W. Roux. Pp. 66. (Leipzig: W. Engelmann.) 1.50 marks.

Handbuch der vergleichenden Physiologie. Edited by H. Winterstein. Lief. 34. (Jena: G. Fischer.) 5 marks.

DIARY OF SOCIETIES.

THURSDAY, MAY 29.

ROYAL SOCIETY, at 4.30.—*Acineta tuberosa*: a Study on the Action of Surface Tension in Determining the Distribution of Salts in Living Matter: Prof. A. B. Macallum.—Morphology of Various Strains of the Trypanosome causing Disease in Man in Nyasaland. IV. The Mzimba Strain: Surg.-General Sir David Bruce, Major D. Harvey, Major A. E. Hamerton, and Lady Bruce.—Notes on *Toxoplasma gondii*: Helen L. M. Pixell.—An Investigation by Pedigree Breeding into the Polymorphism of *Papilio polytes*, Linn.: J. C. F. Fryer.—The Action of Radium Rays upon the Cells of Jensen's Rat Sarcoma: Dr. S. Russ and Dr. Helen Chambers.

ROYAL INSTITUTION, at 3.—Recent Chemical Advances. II. Chemistry in Space: Prof. W. J. Pope.

ROYAL SOCIETY OF ARTS, at 4.30.—Indian Section.—Irrigation Works in India: Sir John Benton, K.C.I.E.

SOCIETY OF DYERS AND COLOURISTS, at 8.—The Action of Ozone on Some Textile Fibres: Dr. C. Dorée.—Some Defects in Silk Dyeing: Dr. L. L. Lloyd.

FRIDAY, MAY 30.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Annual General Meeting. At 8.30.—Practical Application of Telephone Transmission Calculations: A. J. Aldridge

PHYSICAL SOCIETY, at 5.—The Origin of New Stars: Prof. A. W. Bickerton.—Electro-thermal Phenomena at the Contract of Two Conductors with a Theory of a Class of Radio-telegraph Detectors: Dr. W. H. Eccles.—The Evaluation of Certain Combinations of the Ber, Bei, and Allied Functions: S. Butterworth.—The Extraordinary Ray Resulting from the Internal Reflection of an Extraordinary Ray at the Surface of an Uniaxal Crystal: J. Walker.

SATURDAY, MAY 31.

ROYAL INSTITUTION, at 3.—Radioactivity. II. The Origin of the Beta and Gamma Rays and the Connection between them: Prof. E. Rutherford.

MONDAY, JUNE 2.

ROYAL INSTITUTION, at 3.—The Heredity of Sex and Some Cognate Problems: Prof. W. Bateson.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—Precipitation in Aqueous and Colloidal Systems: W. P. Dreaper.—Some Experiments on the Theory of Electro Tanning: E. K. Rideal and U. R. Evans.—An Illustration of the Partial Pyrite Process: W. R. Schoeller.—The Estimation of Alcohol in Beer by Means of Malligand's Ebullioscope: J. C. Cain.—The Joint Action of Catalysing Agents. Dehydration of Ethyl Alcohol and Ethyl Ether: General W. Spatiew.

INSTITUTE OF ACTUARIES, at 5.

TUESDAY, JUNE 3.

ROYAL INSTITUTION, at 3.—Recent Advances in the Production and Utilisation of Wheat in England: Prof. T. B. Wood.

ZOOLOGICAL SOCIETY, at 8.30.—Notes on Turacin and Turacin-bearers: Sir A. H. Church.—Observations on the Anatomy of the Shoe-bill (*Balaeniceps rex*): Dr. P. Chalmers Mitchell.—Some Miocene Cirripedes of the Genera Hexelasma and Scalpellum from New Zealand: T. H. Withers.—The Classification and Phylogeny of the Calcareous Sponges, with a Reference List of all the Described Species, systematically arranged: Prof. A. Dendy and R. W. H. Row.—Contributions to the Anatomy of the Ophidia: Surg. J. C. Thompson.—Observations on Osteomalacia in the Zoological Collections of Manchester and Cleveland: Prof. T. Wingate Todd.

RÖNTGEN SOCIETY, at 8.15.—Reflection of X-rays: Prof. C. G. Barkla.—Experiments on the Reflection of X-rays: Dr. R. W. A. Salmond.

WEDNESDAY, JUNE 4.

SOCIETY OF PUBLIC ANALYSTS, at 8.—An Electrochemical Indicator for Oxidisers: E. K. Rideal and U. R. Evans.—The Estimation of Tannin in Tea: H. L. Smith.—The Detection and Estimation of Nickel by means of *a*-Benzildioxime: F. W. Atack.—The Analysis of Various East Indian Tanned Hides: M. C. Lamb.—Note on the Sterilisation of Rag Flock Samples: L. Reed.—A General Method for the Detection of Caramel: P. F. Thompson.

ROYAL INSTITUTION, at 3.—The Heredity of Sex and Some Cognate Problems. II.: Prof. W. Bateson.

THURSDAY, JUNE 5.

ROYAL SOCIETY, at 4.30.—Croonian Lecture: The Origin of Mammals: Dr R. Broom.

ROYAL INSTITUTION, at 3.—Recent Chemical Advances. III. The Structure of Crystals: Prof. W. J. Pope.

FRIDAY, JUNE 6.

ROYAL INSTITUTION, at 9.—Reflection and Refraction of Light as Concealing and Revealing Factors in Sub-aquatic Life: F. Ward.

SATURDAY, JUNE 7.

ROYAL INSTITUTION, at 3.—Radio-activity. III. The Radio-active State of the Earth and Atmosphere: Prof. E. Rutherford. (The Tyndall Lectures.)

CONTENTS.

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