THURSDAY, MAY 30, 1907.

ALCOHOLISM.

The Psychology of Alcoholism. By George B. Cutten. Pp. xvi+357. (London and Felling-on-Tyne: The Walter Scott Publishing Co., Ltd., 1907.) Price 5*s*.

The Drink Problem in its Medico-Sociological Aspects. By Fourteen Medical Authorities. Edited by Dr. T. N. Kelynack. Pp. viii+300. (London: Methuen and Co., n.d.) Price 7*s*. 6*d*. net.

MR. CUTTEN writes lucidly and well. He has delved deeply in a somewhat dreary field of literature. All men know that alcohol when taken in excess is very injurious, and may be lethal. It has contributed much to the gaiety, but more to the gloom, of nations. In the present work many of the physical and apparently all the mental ill-effects ever alleged by anyone as due to alcoholism are set forth in detail. A large part of the book consists of quotations, some of which (*e.g.* footnotes, pp. 210 and 211) obviously controvert, and were intended by the original writers to controvert, the opinions in favour of which they are quoted. There are some errors. It is stated (p. 1) that

"The use of alcohol is universal. . . . Some form of intoxication has always been found by the investigators of the most primitive people."

Doubtless all peoples who have been in a position to obtain alcohol have abused it, but until recently it has been beyond the reach of various savages, for example, the Esquimaux and Tierra-del-Fuegians.

"Moderate drinking has rarely been carried out successfully, for it almost invariably develops into excess; but to-day there appears to be less and less control, the moderate drinker passing very quickly into the impulsive, violent consumer" (p. 2).

As a fact, all races (*e.g.* Red Indians) when first introduced to drink are "furious drinkers, furious in their drink." But during the lapse of many generations they grow more moderate, as witness the Jews and south Europeans, who were drunken anciently, but to whom alcohol is now "like the taste of sweetness whereof a little more than a little is by much too much." The statement that in England "the women drunkards equal or exceed the men in number" is an exaggeration.

The author gives a very full account of the mental effects of acute and chronic alcoholism, but passes lightly over that vital matter, the psychology of the *potential* drunkard. Why do men drink? Presumably because the act promotes pleasure or surcease of pain or discomfort. Why do some men drink in moderation and others in excess? Formerly it was believed that moderation depended entirely on self-control. But almost any moderate drinker may satisfy himself by introspection that he exercises little restraint. He drinks, as a rule, as much or nearly as much as he desires. At least he has not to struggle against that dire longing that drives the dipsomaniac to destruction as with the force of a tempest. A headache or two, and a little experience of "hot-coppers," suffice to secure his sobriety. A drunkard faces them every day, and ruin, ill-health, and death as well. Men differ, therefore, in their susceptibility to the charm of alcohol. Those who are most tempted tend on the average to drink most, and so to perish. In the course of ages the survival of the fittest results in a race of moderate drinkers, such as the inhabitants of the vine belt in Europe and of the palm-toddy region in Africa. Neither climate, strength of beverages, civilisation, nor race has any influence. Drunken races are found in all zones of the earth; peoples (*e.g.* some savages) who have experience of only very dilute solutions in scanty quantities are very drunken when opportunity serves; some civilised and some savage races are drunken and some are temperate; and all races which now are temperate were anciently drunken. The invariable rule is that every race that commands a sufficient supply of alcohol is temperate (*i.e.* resistant) precisely in proportion to the duration and severity of its past experience of alcohol. The same is true of opium and every lethal disease. Thus, of all peoples that are in the habit of indulging in opium, the natives of India, who have used it longest, are most temperate, and of all peoples exposed to malaria, the natives of tropical Asia, Africa, and America are the most resistant to the disease.

By way of demonstrating that parental drunkenness is a cause of filial degeneration, Mr. Cutten quotes the opinions of various physicians who have proved that it is not uncommon amongst the ancestors of asylum patients. Unfortunately, the extent to which it has prevailed amongst the ancestors of people in the same class of life who are not insane has not been ascertained. No race that has long used and abused drink shows any signs of degeneracy. Thus Italians, south Frenchmen, and Germans are not more degenerate than Tierra-del-Fuegians or Australian Blacks. The protective evolution of races which have been exposed to narcotics or disease is not seriously disputed nowadays. It is difficult to understand, therefore, how races can grow stronger in each generation through the survival of the fittest, and yet, as implied by the authorities quoted by Mr. Cutten, weaker through the inherited effects of parental drunkenness. Obviously, natural selection has no scope if every child is inferior to the parent.

'The Drink Problem," though shorter, is more comprehensive than Mr. Cutten's book, and is altogether a valuable, practical, and readable volume, refreshingly free from fanaticism. Dr. Harry Campbell discusses very interestingly drinking amongst ancient peoples and primitive races, and traces the natural evolution of sobriety. Prof. Sims Woodhead deals with the pathology of alcoholism, and Dr. Claye Shaw with its psychology. Dr. Hyslop discusses alcoholism and mental disease. Other interesting essays are "Alcohol and Public Health," "Alcohol and Life Assurance," and "Alcohol and Pauperism."

Naturally amid much agreement is some conflict of opinion, a fact which has its humorous aspect. Thus, at the close of his essay on "The Criminology of Alcoholism," Dr. Sullivan, who believes that parental alcoholism "has a very high degree of importance . . . in the genesis of those conditions of arrested or perverted development which characterise the moral imbecile and instinctive criminal," refers the reader to the essay on heredity. When, however, we turn to that essay, we find no reference to the alleged effects of parental intemperance on the morals of offspring, but a statement that "we should expect those communities which for the greatest number of consecutive generations have had opportunities for chronic drunkenness—or what comes to the same thing, those possessing the most ancient civilisations—to be the most disposed to temperance."

BERNTHSEN'S ORGANIC CHEMISTRY.

A Text-book of Organic Chemistry. By A. Bernthsen. Edited and revised up to date by Dr. J. J. Sudborough. Pp. xvi+658. (London: Blackie and Son, Ltd., 1906.)

THE new issue of Bernthsen's text-book, which has been edited and revised by Prof. Sudborough, is a great advance on former editions. Although the general arrangement of the contents has been preserved, the amount of additional material has so much extended the scope of the original work that, in its present form, it is practically a new book. Some of the more prominent alterations and additions may be briefly noticed. In the first place, there are frequent references to physical chemistry and its application to problems of organic chemistry which are interesting and suggestive. Secondly, more than 100 additional pages at the end of the book are devoted to topics which have undergone recent development, such as the alkaloids, the terpenes, resins, glucosides, and proteins; there is a section on reagents, a section on stereochemistry, and one on physical constants in relation to structure. Though highly condensed, they are clear and explicit, and are furnished with full and useful references (which, by the way, would be more convenient and less disturbing to the reader at the foot of the page than embodied in the text). Finally, the system of nomenclature has been modernised The term "atomic," applied to alcohols, phenols, &c., has been replaced by "hydric"; "ether," used in connection with organic salts, becomes "ester"; "alcohol radical" is changed to "alkyl," and the word "radical" is properly spelt. The editor seems to have been in doubt about *isomer* and *isomeride*, and *oxy* and *hydroxy*, which are used indiscriminately. The writer entirely sympathises with this uncertainty in the use of certain terms, for the chemist often finds himself awkwardly placed. Not only does he feel obliged to respect the nomenclature adopted by foreign chemists, which is not always happily chosen, but he must conform in some measure to the system laid down by the Chemical Society. The purine derivatives offer a case in point. E. Fischer derives uric acid from purine and calls it a "trioxy" purine, though the usual formula is innocent of hydroxyl groups. The English equivalent, "trihydroxypurine," is consequently misleading. He is therefore confronted with the alternative of either using German nomenclature which is not official or confusing the reader with its English equivalent.

Another example is that of the carbohydrates, to which the term "saccharide" is applied in Germany by analogy with "glucoside." This analogy is lost in the case of the hexose group of sugars, which are not anhydrides in the ordinary sense. The editor in this case has wisely employed the termination "-ose," and divided the group into mono-, di-, tri-, and polysaccharoses. Incidentally, it should be pointed out that the terms monose, biose, triose, &c., which he employs as synonymous with the above are also used to distinguish the sugars by the number of their carbon atoms, with the result that triose is applied equally to raffinose, with eighteen carbon atoms, and glycerose, with three. It is a little unfortunate that the Chemical Society does not tackle these questions of terminology as soon as they arise, and, by a sensible and authoritative revision, remove a real difficulty in the way of writers on organic chemistry. One cannot but think that a generic terminal syllable denoting a particular class of compounds has much to recommend it, and had this been recognised such a word as "proteose" could not have crept into the new *protein* nomenclature.

The defects of the volume before us seem to be few in comparison with its many excellences, and where so much information has been collected and arranged it may appear hypercritical to find any fault.

The following omissions and corrections, however, seem important, and may perhaps be rectified in a future edition. The modern methods used in the manufacture of potassium cyanide, potassium ferrocyanide, and cyanamide are omitted; so are Piloty's synthesis of glycerin, Lawrence's synthesis of citric acid, Bertrand's method for obtaining dihydroxyacetone and other ketonic alcohols, and the citric acid fermentation of glucose. The following errors should also be corrected. The product obtained by Fischer from glycerin by oxidation is mainly dihydroxyacetone, and not glyceric aldehyde (p. 306); in the conversion of pseudouric acid into uric acid, hydrochloric acid, and not oxalic acid, is now used (p. 291); it is not true that all the chlorinated products of benzene up to C_6Cl_6 can be obtained by chlorinating benzene (p. 253), for some of the isomers are not formed in this way; in preparing the esters of the amino acids from the hydrolytic products of protein substances Fischer and Speier's method is not employed, but the alcoholic liquid is saturated with hydrogen chloride (p. 576).

It only remains to add that, in the writer's opinion the new edition of Bernthsen may claim to be one of the best, if not the best, text-books of organic chemistry for advanced students in the English language. J. B. C.

PRACTICAL PHYSICS.

A Text-book of Practical Physics. By Dr. William Watson, F.R.S. Pp. xvi+626. (London: Longmans, Green and Co., 1906.) Price 9*s*.

SMALL books on practical physics have been very plentiful of recent years since the subject has taken a place in schools, but the number of large and complete treatises in English embracing all branches is still few. Looking back, the present writer can recall to mind as the earliest an English translation of Kohlrausch's "Leitfaden" by Waller and Procter, published in 1873, and the book, in two volumes, by E. C. and W. H. Pickering, on "Physical Measurements," published in 1873 and 1876. The latter was founded on the course of practical physics conducted at the Boston School of Technology by the authors, who have since become two of the foremost astronomers of the United States. After these two books we have to pass to 1884, when Glazebrook and Shaw's "Practical Physics" was published. It was founded on the elementary practical course conducted in the Cavendish Laboratory, Cambridge, and is still in use, and is perhaps the one book on practical physics which has had the widest influence on English laboratory methods. All these books placed the side of accurate measurement before the student, and omitted demonstrations and showy lecture experiments from their contents. They were written for the student's use in the laboratory, and formed a great advance on the descriptive books in which physics and chemistry were mixed, and which constituted the science of the popular lecturer of the early and middle Victorian period.

Later came a treatise by Balfour Stewart and Gee, which contained very detailed descriptions of experiments in properties of matter and in magnetism and electricity. The book came from the Owens College Laboratory at Manchester, and was, we believe, the first in which precise descriptions of magnetic methods appeared. Then from the same laboratory, published in 1901, we received a course of experiments by Schuster and Lees. This book contained only selected exercises from different branches, as the authors considered it sufficient to put before the students a short course of typical experiments.

Now we have before us the latest book on the subject, a complete treatise by Prof. W. Watson, of the Royal College of Science, South Kensington, and it is framed on a plan different from those we have mentioned. Prof. Watson calls it a book of reference for the student when working in the laboratory. It is not intended that any one class shall work through all the experiments, but that the teacher shall select from it according to the requirements of the pupil and the resources of the laboratory. The descriptions and hints apply to almost any form of apparatus suitable for the particular experiment.

As to the contents of the book, the first chapter contains a general discussion of the theory of the treatment of experimental data, the use of logarithmically divided papers, the consequent determination of exponential laws, and the description of calculating machines, including arithmometers and planimeters. It would take too long to go in detail through the entire contents of the book, but to illustrate its scope we may mention that thirty-four chapters are required to cover the whole field of physics. At chapters xxxii. and xxxiii. we are brought to magnetic induction and permeability. The comparisons and absolute measures of the induction coefficients are treated very fully indeed, and in chapter xxxiv. the use of the Dolezalek form of quadrant electrometer and the measure of the saturation current through air in the presence of uranium oxide are described. It will be evident that the author has made the field covered by the book very wide, and has brought into prominence the methods of recent research. We cannot omit to mention the excellent chapters which occur earlier on magnetic measurements and on the constants of terrestrial magnetism, subjects in which the author is a well-known authority.

At the end an appendix, probably one of the most useful parts of the book, contains an account of laboratory arts, glass-blowing, working in quartz, silvering, and other necessary processes. To these descriptions we feel very confident in referring the student, for the great excellence of the Royal College of Science in the branch of laboratory arts is well known. There is also a collection of useful tables.

The book is printed in very clear type, and the diagrams are excellently drawn. The whole setting of the book is of the same high standard as that of Prof. Watson's large work on physics.

Judging from the short experience which we have had of the use of the book in the laboratory, we may conclude by saying that it has proved most acceptable to the students, and we have been able to recommend it to those studying for university degrees. Schoolmasters should have a copy for reference and for their higher work. S. S.

CLASSIFICATION OF SOUTH AFRICAN STONE IMPLEMENTS.

The Stone Implements of South Africa. By J. P. Johnson. Pp. 53. (London: Longmans, Green and Co., 1907.) Price 7*s*. 6*d*.

THIS is a useful addition to our acquaintance with the Stone age of South Africa. Mr. Johnson has exceptional qualifications for the task he has undertaken, being a trained geologist and surveyor, and a competent observer in the field, whilst his travels have given him the opportunity of examining large sections of South Africa, the collections of implements described having been obtained by himself from localities so widely separated as the valley of the Zambezi, the Transvaal, Prieska, in the north-

west of Cape Colony, the Orange River Colony, Algoa Bay, and various intermediary stations.

In this volume, which contains 258 illustrations, Mr. Johnson has confined himself to coordinating the various discoveries of stone implements he has made during the past four years in South Africa, with descriptions of the deposits from whence they were derived; he, however, makes no attempt to review the abundant literature on the same subject already published. The exceptional value of the author's work rests in the fact that he makes little or no direct reference to surface finds or to specimens of man's handiwork which, in the shape of flakes, cores, and implements, are scattered over the surface of South Africa, in extraordinary profusion in some localities; but in every instance in which he describes his "finds" he takes us to the actual deposits from which he extracted the implements, whether it be the high plateau gravels in the neighbourhood of Johannesburg, the river gravels of the Zambezi, Vaal, and Orange rivers, the more recent alluvial deposits of the country, or the middens on the coast of Algoa Bay.

The author divides the stone implements of South Africa into three groups, which he considers well defined, namely, Primitive, Palæolithic, and Advanced; these are, in his opinion, the South African equivalents of Eolithic, Palæolithic, and Neolithic. The artificial character of the implements of the primitive group is, the author admits, still a matter in dispute, but when we come to the Palæolithic group we reach sure ground. If the old level gravels of the Zambezi, below the Victoria Falls, from which undoubted Palæolithic implements have been derived, were deposited prior to the retrocession of the present falls, and there is strong evidence in favour of such being the case, then the presence of man in South Africa is relegated to a past, bewildering in its antiquity. Similar conclusions are arrived at from the presence of Palæolithic implements in the old river gravels of the Vaal and Orange rivers. When we compare the more carefully fashioned implements (which, however, are not represented in Mr. Johnson's illustrations), notably from the Cape Flats, the laterite beds of Natal and Zululand, from rock shelters and the caves and middens of the coast-line of Table Bay and Algoa Bay, with the rude weapons of the old river gravels, we unquestionably find a progressive element in their making, though they are not comparable in artistic merit with those found so abundantly in Egypt, for instance. This perhaps may be due to the stone-implement makers of South Africa not having had at their disposal equally suitable material to work on.

Though Mr. Johnson's division of the stone implements of South Africa into three definite groups may be considered by some as perhaps premature in our present state of knowledge, yet it is a step in the right direction, and this volume with its useful illustrations will certainly be welcomed by students of South African prehistoric archæology.

OUR BOOK SHELF.

Pocket-Book of Aëronautics. By Hermann W. L. Moedebeck, in collaboration with O. Chanute and others. Authorised English edition, translated by W. Mansergh Varley. Pp. xiii+496. (London: Whitaker and Co., 1907.) Price 10*s.* 6*d.* net.

In this handy little volume we have an excellent comprehensive summary of the whole subject of aëronautics, and the English reading public have to thank Major Moedebeck for producing such a work which has been so capably translated by Mr. Varley.

Although called a pocket-book, the book might really be described as a treatise on the subject, so ably and so well arranged is the mass of material dealt with. In fact, the book takes a very broad view of aëronautics, and leads off with chapters on the physical properties and technology of gases, the physics of the atmosphere, meteorological observations in balloon ascents, and the computation of results. Such a beginning is an indication of the very scientific and complete way in which the author set about bringing the matter pertaining to aëronautics to a focus, and his various collaborators, ten in all, have succeeded notably in their task.

Further, the historical survey of previous attempts to gain the supremacy of the air is by no means omitted, and admirable summaries are included which give the reader a comprehensive and intelligent view of the steps taken in each mode of attempted flight.

To give some idea of the contents and authors who have contributed to the book, it may be mentioned that the subjects referred to above are from the pens of Dr. R. Emden, Lieutenant J. Stauber, and Prof. V. Kremser. The articles on the technique of ballooning, on ballooning, on military ballooning, historical account of artificial flight, and on air-ships, are treated by the author. Prof. W. Köppen deals with kites and parachutes. Dr. Miethe deals with balloon photography, while Prof. W. Kutta gives an account of photographic surveying from balloons. The articles on animal flight by Prof. Karl Müllenhoff, artificial flight by the late Otto Lilienthal and Mr. Octave Chanute, flying machines, motors and air-screws by Major Hermann Hoernes, complete the various sections of the subject. A list of aëronautical societies, numerous appropriate and useful tables, and an index conclude the volume.

In the preface it is stated that the suggestion of translating this work is due to Mr. Alexander, the well-known authority on aëronautics. English speaking aëronauts, therefore, doubly owe to him their gratitude, for the translator's work is not only excellently done, but he has adapted various tables for the use of English readers, and has added an index.

Blackie's Nature-drawing Charts. (London: Blackie and Son, Ltd., n.d.)

This is a series of fifteen sheets bearing coloured drawings of twigs or portions of a plant to show the nature of the flowers or fruit for use in art schools, more especially in schools of design. It is intended that the charts should be used in combination with living specimens, being displayed to serve as a guide in noting essential features and in producing an artistic drawing. Small figures are given of parts suited to conventional treatment, and several examples of conventionalised designs are presented on each chart. These show the adaptation of plant-forms for such purposes as brush-work ornamentation and the design of stencils, wall-papers, tapestries, &c.

A book of instructions is supplied to explain which charts or designs are suitable for different standards, and to provide other suggestions as to their

utility. The more elementary drawings reproduce the laurel, snowdrop, tulip, and oak; the buttercup, poppy, and wild rose are considered suitable for a higher standard, and the blackberry, narcissus, and marguerite daisy are selected for the most difficult studies. The representations of the plants are botanically satisfactory, except the beech-fruits, that fail in colour and shape. In a few of the adapted designs, while making allowance for conventional treatment, there is unnecessary departure from the natural arrangement. For instance, the opposite insertion of the leaves in the privet is natural and characteristic, and should be maintained; similarly with regard to the pinnate leaves of the rose. It would have been useful to include in the explanatory booklet a short account of such botanical facts as the forms and insertion of leaves, the parts of a flower, their cyclic and acylic arrangements, and similar details. For the most part, however, the designs do maintain and emphasise the natural characteristics, thereby fulfilling the purpose of training students to derive their artistic conceptions direct from nature. The production of the charts is highly creditable, the drawings are bold, and the colour contrasts effective.

Problems in Surveying, Railroad Surveying, and Geodesy, with an Appendix on the Adjustments of the Engineer's Transit and Level. By Howard Chapin Ives and Harold Ezra Hilts. Pp. ix+136. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1906.) Price 6*s.* 6*d.* net.

WITH such a full title-page this book fairly well describes itself. The authors have been engaged in teaching engineering and surveying, and have found this graduated series of simple problems useful for sustaining the interest of their students in their work and for covering the course required by the faculty. The book is addressed to those who are professionally interested in such matters, or who wish to acquire the capacity to carry out certain operations in the field with facility, and with that amount of accuracy which the nature of the work demands. Consequently, there is little reference to theory. We have the ordinary methods of measuring by chain and problems connected with levelling. The compass, theodolite, and sextant come under review, and the mechanical adjustments of these instruments are described, but with no great minuteness. Greater care might have been bestowed on some of the formulæ given; those on p. 36 have apparently been misprinted. The railroad surveying problems are more satisfactory, and seem to be of practical utility.

A chapter on astronomical problems of a most elementary character has been added. In the preparation of this chapter the authors acknowledge the assistance they have received from a third authority. It must strike anyone with surprise that the authors should consider themselves competent to produce a book of this type, and yet feel it necessary to invite or to accept outside aid. W. E. P.

The Sense of Touch in Mammals and Birds, with Special Reference to the Papillary Ridges. By Dr. Walter Kidd. Pp. viii+176; illustrated. (London: A. and C. Black, 1907.) Price 5*s.* net.

HAVING in a companion volume treated of the direction of the hair in animals, Dr. Kidd, in the one now before us, turns his attention to the kindred subject of the structure and function of the papillary ridges on the tactile surface of their hands and feet. Although the subject is by no means new, the author has studied it in a fuller manner than at least most of his predecessors, and has a new theory with regard to the function of the ridges in the Primates, in which alone these structures attain full development. In monkeys, at any rate, it has been generally considered that the main purpose of the rough surface produced by the papillary ridges is to ensure firm hold in grasping. Without denying that this may be a part of their function, Dr. Kidd is, however, of opinion that there are other important uses, which vary in different groups. In man, for instance, the papillary ridges in the hand alone exercise the function of discriminative sensibility, and those in the foot that of maintaining the equilibrium of the body, whereas in the lower Primates both functions are discharged by the ridges of the two pairs of limbs, although sensibility is less marked in the front pair than in the human hand. The most interesting part of the author's conclusion relates, however, to the papillary ridges of lemurs, which are much more complicated than those of apes and man, and are accordingly believed to be subservient to the necessity for special means of preserving the equilibrium in the case of nocturnal creatures.

R. L.

Zur Wirtschafts- und Siedlungs-Geographie von Ober-Burma und den Nördlichen Shan-Staaten. By Dr. H. J. Wehrli. Pp. 130. (Zurich: Lohbauer, n.d.)

THOUGH in completeness and fulness of illustration this popular handbook of the British province of Burma bears, of course, no comparison with Sir J. G. Scott's recent monograph, it contains in a short space all that a merchant or a traveller intending to visit the country needs. The physical geography, climate, ethnology, natural productions, and industries are clearly described in a series of chapters illustrated by four maps and twelve photographic plates. The book is frankly a compilation from the best authorities, of which a full bibliography is appended. The maps, like all German work of the kind, are good, but the political map would be more useful if the boundaries were marked in colours. Except some of the handbooks for emigrants issued by our more important colonial Governments, we have no geographical series in English which corresponds with this. The organisation which has just been started to spread a knowledge of the Empire among British schoolboys might well provide a series of handbooks of this class.

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.*]

International Investigation of the Upper Air.

THE International Commission for Scientific Aëronautics has for some years past arranged that observations in the upper air by means of kites and balloons should be made on certain pre-arranged days, generally the first Thursday in each month. At the conference held at Milan in October last, M. Teisserenc de Bort suggested that better results would be obtained if a series of observations could be made on several successive days instead of on isolated days as hitherto.

It has accordingly been arranged that while the observations on the first Thursday in each month should be continued, some further days should be arranged for a more extended series of observations. The first of these series is to take place in the fourth week in July, and it is hoped that, besides the ordinary observatories that take part in the monthly ascents, as many meteorologists as possible should assist in order that observations may be obtained from a number of widely extended stations

The three principal days of the series are July 23, 24, and 25, but where possible ascents will also be made on July 22, 26, and 27. All the observatories engaged in upper-air research will take part. In addition, the Prince of Monaco will make observations in a high northern latitude, and a German man-of-war will send up *ballons-sondes* between Iceland and Norway. Another German expedition, under Captain Hildebrandt, will go to the neighbourhood of the Hebrides, while a French man-of-war will be stationed near the Azores. Further south, M. Teisserenc de Bort and Mr. Rotch will send an expedition, in their yacht *Otaria*, to the region of the trade winds and doldrums. It is hoped, also, that the Italian Government will cooperate by sending a man-of-war to some point in the Mediterranean. With the addition of Blue Hill Observatory and other North American stations, there will thus be a net-work of observations over a large region of the northern hemisphere.

In this country Mr. W. H. Dines will send up *ballons-sondes* and pilot balloons at a station on the west coast of Scotland; *ballons-sondes* and pilot balloons will also be sent up at Manchester by Mr. Petavel, and at Ditcham Park, Petersfield. Conditions in this country at the end of July are not likely to be favourable for flying kites, but should there be sufficient wind kites will be flown at Glossop Moor, Pyrton Hill, Ditcham Park, and Brighton.

The Royal Meteorological Society is also making arrangements to cooperate in the investigations, and an allowance (in aid of the expenses) has been made to them from the Government grant for scientific investigations.

It may be possible to obtain the assistance of other observers to send up pilot balloons; by the use of two theodolites and a measured base, the velocity and direction of the wind and the heights of clouds may be determined. By using rubber balloons and filling them to a certain size corresponding to a known rate of ascent, useful observations may be made by a single observer using an ordinary theodolite.

The International Commission has also arranged for a series of observations on September 4, 5, and 6, and on November 6, 7, and 8.

CHARLES J. P. CAVE.

Radium and Geology.

THE temperature of 55° C. to which I referred in a former letter is the temperature of the *rock*. I find that Prof. C. Schmidt, of Basel, on his chart of isogeotherms, gives this temperature as attaining 56° C. This is in the dry part of the tunnel, towards the north end.

The difficulty attending the inflow of warm water mainly arose from the *rate* at which heat was thereby brought into the tunnel, necessitating large supplies of cold water to keep down the temperature. Prof. Schardt's paper, to which I have already referred, contains very strong evidence as to the *rôle* of the circulating water. The evidence is far too lengthy to quote here.

Mr. Fisher refers to the Hon. R. J. Strutt's estimates of radium in rocks as capable of accounting for a gradient of 1° F. in 42·4 feet. In point of fact, Mr. Strutt *assumes* this gradient (quoting from Prestwich) as a basis upon which to calculate the thickness of the radium-bearing crust. The gradient in question is, therefore, not derived from Mr. Strutt's observations (nor could it be), but is a gradient taken as a basis of calculation.

That special conditions affect the temperature gradients in mountain ranges appears from the results of observations on the Mont Cenis and the St. Gothard tunnels. Everett's estimate for the former, with correction for convexity of surface, is 1° F. in 79 feet. In the case of the latter there were remarkable variations observed, of which radium will very probably furnish the explanation. The central gradient is 1° F. in 85 feet. At the north end there is a gradient of 1° F. in 38 feet. This brings the general average for the whole tunnel up to 1° F. in 57·8 feet. Dr. Stapff, who conducted the temperature observations in the St. Gothard, subsequently predicted for the Simplon a maximum rock temperature of 47° C., as I have already pointed out.

Trinity College, Dublin. J. JOLY.

AËRIAL LOCOMOTION.

IN December of last year Dr. Alexander Graham Bell delivered an address, under the above title, before the Washington Academy of Sciences. This address recently appeared in the March number of the Proceedings of that academy[1] (vol. viii., pp. 407–448), and the interesting nature of the contents is well worth the attention of the readers of this Journal who have not had the opportunity of perusing it.

In the opening paragraphs Dr. Bell refers to the earlier attempts made to travel in the air, and points out how the problem in the last decade or so has gradually been approached from a different point of view. The principle of the gas bag has taken second place, and the heavier-than-air type of machine is now in the forefront.

The researches of Lilienthal are next referred to, followed by those of Chanute, Herring, the Brothers Wright, and Hargrave. The magnificent work accomplished by Langley is here given its proper position. "To Prof. Langley," as Dr. Bell remarks, "is due the chief credit of placing this subject upon a proper basis, and of practically originating what he termed the art of 'Aerodromics.'"

Dr. Bell witnessed the experiments made by

FIG. 1.—Langley's Aërodrome No. 5 in Flight, May 6, 1896.

Langley on May 6, 1896, when a large model of an aërodrome, with a spread of wing of about 14 feet, was driven through the air by a steam engine under the action of its own propellers. With regard to the actual flight he saw, he wrote:—"No one who witnessed the extraordinary spectacle of a steam engine flying with wings in the air, like a great soaring bird, could doubt for one moment the practicability of mechanical flight." Dr. Bell was fortunate enough to secure a photograph of the apparatus while in the air, and this record, which is reproduced in his article, is here given (Fig. 1). In time it will undoubtedly be of exceptional historical interest.

The circumstances connected with the later experiments of Langley are next described, and Dr. Bell's knowledge and great faith in Langley's work allow him to state his unbiased opinion that the full-sized aërodrome, which the newspapers described as a failure, "would have flown had it been safely launched into the air."

It is with regret, however, that we find no mention made of either Hiram Maxim or Pilcher, for the

[1] See also *The National Geographic Magazine*, vol. xviii., No. 1, January.

former spent a great amount of money and time in valuable experiments, while the latter sacrificed his life in advancing the science of gliding.

Perhaps the most interesting portion of Dr. Bell's address is the account of his own initial experiments in the construction of an aërodrome. He has been at work on this subject for many years, and so far back as 1894 Langley visited him and witnessed some of his experiments.

The progress of his experiments is divided by him into three stages, namely, the kite stage, the motor-boat stage, and the free flying-machine rising from the water.

As the first of these is now complete, it is fully described in this address, and indicates that a distinct step in advance has been made. Dr. Bell's kite is quite different from any other form. It is built up of a great number of small structures or cells, all alike in form and size. Each cell has the form of a regular tetrahedron, and, as he says, "possesses in a remarkable degree the properties of strength and lightness." By connecting several of these figures by their corners a very rigid structure is built up, and the whole possesses the same properties of

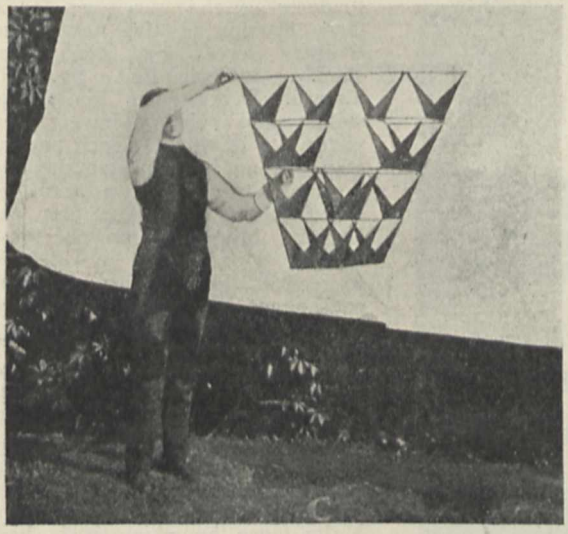

FIG. 2.—A sixteen-celled kite.

strength and lightness inherent in the individual cells themselves.

The *unit* tetrahedral cell is bounded by four equal triangular faces; if two adjoining faces be covered with some kite material, the result is a "winged cell" resembling a pair of birds' wings with their points raised upwards. By coupling four of these unit cells together at their corners, a four-celled structure is formed having itself the form of a tetrahedron, but with an empty space in the middle octahedral in shape. If now four four-celled structures be connected at their corners, a sixteen-cell structure of tetrahedral form is formed (Fig. 2). Experience has shown that when these structures are flown as kites they exhibit remarkable automatic stability in the air under varying conditions of wind.

Up to the present time, the most stable form of kite is that of the "box" or Hargrave type. Dr. Bell is, however, of the opinion that his compound tetrahedral structure is more stable even than this. To make a comparison, he flew both kinds simultaneously in squally weather. Although the tetrahedral appeared to "shiver" when struck by a sudden squall, the box kite "seemed to be liable to a swaying or tipping motion that would be exceedingly dangerous in a structure of large size forming part of a flying machine."

The good behaviour of the former kite is due, as he suggests, to the porous nature of the structure, the squall passing right through between the covered triangles, and lifting the other side of the kite as well as the side first struck; the blow is thus counterbalanced before the kite has had time to upset.

Although the horizontal aëroplane has always an element of instability about it, it has, nevertheless, greater lifting power than similar surfaces arranged obliquely as in the tetrahedral construction. The structure of winged cells is, however, the reverse,

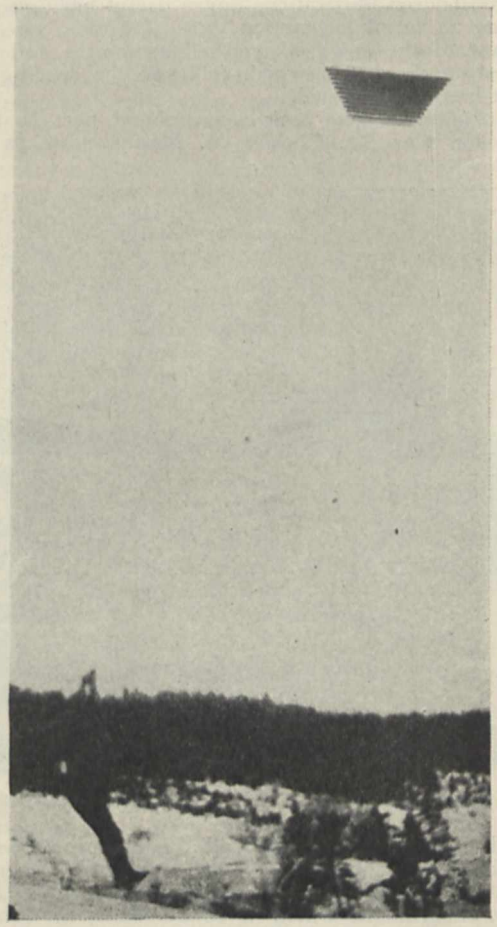

FIG. 3.—The *Frost King* in the air, flying in a ten-mile breeze, and supporting a man on the flying ropes.

being more stable when in the air, but deficient in lifting power. There seems, however, no difficulty in adding to the number of surfaces in the latter construction in order to secure the desired lifting power, while the condition of stability remains. Further experiments have shown that the blank spaces between the groups of winged cells can be filled up with more cells; in fact, the cells can be massed together "without marked injurious effects." Not only, therefore, is the structural strength improved by this increase of size, but the lifting power, which varies directly as the cube of the dimensions, is increased (Fig. 3).

The result of these kite experiments has been to show that it is possible to build a structure of moderate size, composed simply of these winged

cells, that will support a man and an engine in a moderate breeze.

It will be interesting to watch the progress made in the next two stages of Dr. Bell's programme, which literally means the conversion of a kite into a flying machine. These stages consist in mounting his structure on a light catamaran form of boat and propelling it on a water surface by means of aërial propellers until it can be steered upwards into the air. Whether this form of starting is as good or as practical as running it on wheels remains to be seen, but at any rate it seems the safest way to commence with (Fig. 4).

It may be mentioned in conclusion that not only is this printed address accompanied by numerous well-reproduced illustrations and a useful bibliography relating to aërial locomotion, but all details concerning one of the large winged-cell structures and the interesting discussion which followed the reading of the address are inserted.

Among those who took a prominent part in this discussion was Mr. Charles M. Manly, who, as he stated, "had the pleasure and the honour of being associated for some seven years with the lamented Secretary Langley as his assistant in direct charge of the experiments which he conducted at the Smithsonian Institution." In his remarks it is good to read that the work initiated by Langley is not abandoned, but merely temporarily suspended. In fact, it seems quite probable that Langley's machine will again be seen flying through the air, for Mr. Manly proposes to re-equip and launch it again. To use his own words:—

"It is my purpose at the earliest moment that I can possibly spare the time for it, to re-equip the aërodrome with proper supporting surfaces, and, using the same launching apparatus, to give the aërodrome a fair trial, this time over land instead of over the water, when I feel very certain that it will fully demonstrate the correctness of its design and construction and crown Mr. Langley's researches with the success which they so richly deserve, and I trust that the day that this will be achieved is very near at hand. It was the launching apparatus, all will remember, which in both of the experiments caused the accidents that prevented any test of the aërodrome itself. These accidents were not due to defects in the design or fundamental construction of the launching apparatus, for the smaller apparatus of exactly the same design had been used more than thirty times for launching the smaller machines, and without a single failure. Certain minute defects in the releasing mechanism were the sole cause of the trouble."

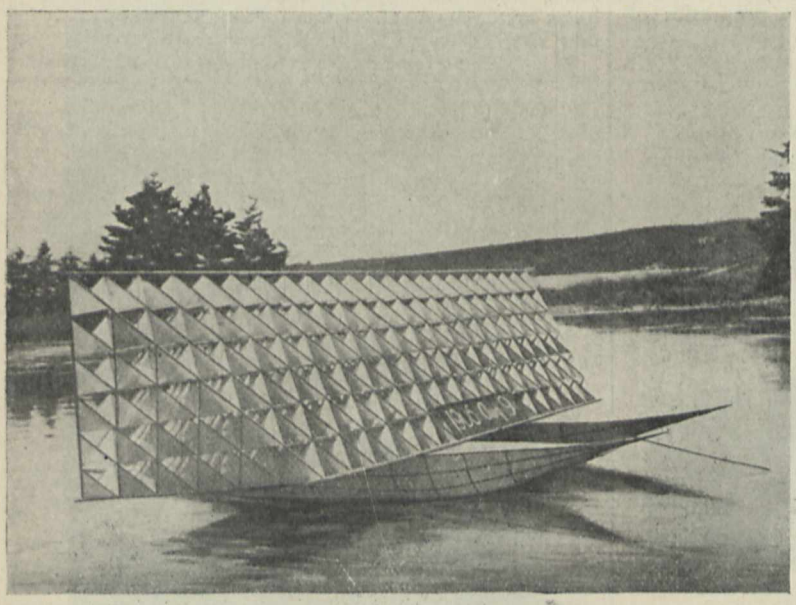

FIG. 4.—A floating kite, adapted to be towed out of the water.

MALTA FEVER.

A LESSON IN PREVENTIVE MEDICINE.

SITUATED in the midst of the Mediterranean, swept by all the winds of heaven, and enjoying brilliant sunshine for several months in the year, the island of Malta should be one of the healthiest of places. Its freedom from swamps or standing water of any kind protects the island from that scourge of warm climates—malaria. For many years past, however, Malta has suffered from the prevalence of a serious local fever, of a most persistent character, which has been the bane of the island, and particularly of the garrison; for a large fraction of the naval and military forces has been constantly incapacitated by this disease. Every year some 650 sailors and soldiers have fallen victims to it, and, as each patient stays on an average 120 days in hospital, this gives a total of about 80,000 days of illness per annum. Moreover, most of these men have to be sent to England to recover their health, and the consequent expense has involved a very considerable loss in money to the Government.

This fever appears to be widely distributed in the world, but is most familiar to us in its incidence around the coasts of the Mediterranean. On the island of Malta it has worked its worst ravages, and hence the name of Malta fever, by which it is best known.

Now, however, all this has been changed by a simple application of the discoveries of science, and widespread gratification will be given by the intelligence, furnished in recently published reports, that since June, 1906, when the new preventive measures were put into practice, Malta fever may be said to have practically disappeared from the garrison of the Island Fortress.

What are these preventive measures, and how has this result been achieved?

The serious ravages of Malta fever made it desirable that a searching investigation should be taken in hand. In 1904 the Royal Society, at the request of the Admiralty, the War Office, and the Colonial Office, undertook to investigate the causes of this fever, and sent out a small commission to Malta for that purpose. This commission, which consisted chiefly of Army and naval medical officers, has been at work for three years, under the supervision of a committee of the Royal Society, and has only lately completed its labours. It is unnecessary to describe the details of the three years' work; it is enough to say that every likely line of research was followed in order to discover how man becomes infected by

this disease. So long ago as 1887 an Army medical officer discovered that Malta fever is caused by the entrance into the body of a minute bacterium, which was named the *Micrococcus melitensis*. This microbe was studied from many points of view, but with no success until a discovery was made which cleared up the mystery. This was the remarkable fact that the goats in Malta are susceptible to this disease, and act, as it were, as a reservoir of the virus. In truth, it is probable that Malta fever is primarily a disease of goats, and that man is infected from the goat, not the goat from man. The goat is very much in evidence in Malta, there being some 20,000 of them, which supply practically all the milk used in the island. It was discovered by the commission that half these animals are affected by Malta fever, and that one-tenth are constantly passing the *Micrococcus melitensis* in their milk. Notwithstanding that the goats show no outer signs of the disease, they continue, possibly for years, to secrete milk containing the poison.

It seemed evident, then, that to banish Malta fever from our sailors and soldiers on the station, all that was required was to eliminate goats' milk from their dietary. This step was taken in June, 1906, with the striking result that the cases of fever fell to one-tenth of what had been their normal number. There is, therefore, reasonable hope that this disease will now disappear from the garrison in Malta, and some 80,000 days of illness be blotted out from the yearly records of the Navy and Army.

If these good results are maintained, this investigation will stand out as one of the most notable examples of successful work in the prevention of disease, and will clearly show the economy of spending a few thousands on a thorough scientific investigation.

The research occupied some time, and from first to last employed some twelve men, but the outlay in time and money are as nothing to the result achieved.

INTERNATIONAL ASSOCIATION OF ACADEMIES.

YESTERDAY morning, May 29, there opened at Vienna the third triennial general assembly of the International Association of Academies, of which the Imperial Academy of Sciences, Vienna, has been the directing academy for the last three years.

Great Britain is represented in this association by the Royal Society of London in the section of natural science, and by the British Academy for Historical and Philological Studies in the section of letters.

The delegates appointed to attend the assembly on behalf of the Royal Society are Sir George Darwin, K.C.B., Sir Norman Lockyer, K.C.B., Lieut.-Colonel Prain, Prof. Schuster, Dr. W. N. Shaw, Prof. C. S. Sherrington, Prof. H. H. Turner, and Dr. A. D. Waller, Prof. Schuster being the delegate charged to deliver the vote of the society; while the British Academy is represented by Prof. Bywater and Prof. Israel Gollancz.

A number of subjects of general scientific importance will be discussed at the meeting, as well as certain questions of internal policy concerning the status of the association, and its mode of working under its statutes.

The Royal Society has put forward two proposals for the consideration of the assembly. One is for the establishment of a uniform lunar nomenclature, and a proposition will be submitted by the council of the association for the appointment of a committee to work out a scheme in furtherance of this object. In this connection the Royal Society propounds suggestions regarding the coordination of lunar nomenclature, which will no doubt form a basis for discussion.

Another proposal of the Royal Society for the co-operation of the International Association in the International Union for Solar Research will probably lead to considerable discussion, not on account of want of sympathy with the movement, but because of questions which have been raised as to the constitutional power of the association to join another organisation.

An important proposal of the Académie des Sciences to create an organisation of meteorological stations at different points on the earth's surface, at the expense of the Governments respectively concerned, will be put forward with the support of the council of the association.

The assembly will also be recommended to approve the resolutions of the committee which met at Frankfurt-am-Main in 1904, proposing changes in the statutes of the International Seismological Association, which have since been adopted. That committee recommends the associated academies to endeavour to induce their Governments to cooperate with the International Seismological Association in dealing with seismic problems of physical interest.

Other matters to be brought before the assembly in the science section are a report of the committee for investigating the anatomy of the brain; reports upon geodetic measurements; a report of the commission appointed in 1904 for the investigation of atmospheric electricity; the consideration of the further working of the committee appointed in 1904 for the magnetic measure of a circle of latitude.

In the section of letters there will be reports presented upon the edition of the works of Leibnitz, initiated by the association; upon the international loan of manuscripts; upon the edition of the Mahabharata; the publication of an Encyclopædia of Islam; the Corpus of Greek records and the Corpus medicorum antiquorum.

THE SMALL PLANETS.[1]

M. MASCART'S summary of his own work is as follows:—

Nous avons voulu montrer l'ampleur de la question des petites planètes, qui ne fut jamais encore exposée dans son ensemble, et si nous avons suscité bien plus de points d'interrogation que nous n'en avons levés, nous serons du moins heureux, peut-être, d'appeler l'attention des astronomes sur quelque problèmes assez mystérieux.

Probably an author has seldom given in few words so excellent and accurate a description of his work. M. Mascart has collected on a large scale, and has thus performed a great service to this branch of astronomy. We may turn to his bibliography containing more than a hundred names with a reasonable confidence that nothing of importance has been omitted.

The subject of the small planets appears to bristle with striking statistical peculiarities. To exhibit their nature we note down a few, and may remark that perhaps in no case whatever has a completely satisfactory explanation been given.

(1) If the small planets be arranged in order of mean distance, or of mean motion, there are marked gaps in the series, first noticed by Kirkwood, corresponding to mean motions twice and three times that of Jupiter.

(2) When the inclination to the ecliptic is large, so also, in general, is the eccentricity, and *vice versâ*.

[1] "La Question des petites Planètes." By M. J. Mascart. Pp. 110.

(3) Occasionally there are striking similarities in the elements of two planets, *e.g.*

	a	*e*	*i*	Ω	ω
(251) Sophie	... 3·10	... 0·09 ..	10° 29′ ...	157° ...	80° 16′
(318) Magdalena..	3·19	... 0·07 ...	10° 33′ ...	163° ...	80° 5′

The resemblance of the elements in the case quoted is far closer than is reasonably probable, even for a selected pair out of several hundred planets. We, however, are much inclined to doubt whether it is more than an accident. A famous case of coincidence is that between the periods of rotation and revolution of the moon. Here there is a controlling cause tending to produce equality, and the equality is exact. Now in the case of the elements of Sophie and Magdalena, we suppose that there are only three possible hypotheses:—(i.) accidental resemblance; (ii.) a cause tending to produce similarity; (iii.) a common origin with no subsequent connection. We may take as analogies:—(i) two watches that have run down, but happen by accident to show nearly the same time; (ii.) two clocks synchronised with each other; (iii.) two clocks, each constructed with the same object of exhibiting mean time, but entirely independent of each other subsequently. Now, as regards (ii.), we may remark that in the present instance the supposed controlling force has done its work very imperfectly. The objection to (iii.) is that a common origin hypothesis can only be applied in a few isolated cases, of which the above is one, and therefore we ourselves feel inclined to fall back upon (i.), the hypothesis of accidental resemblance, although we fully admit its antecedent improbability.

In the early part of the book an estimate is given of the total mass of the asteroids. It would appear that the entire mass is very far short of a quarter of the mass of the earth, very far short indeed of the mass that would have been expected if a single planet had filled the gap in Bode's law between Mars and Jupiter.

In a few cases approximate linear dimensions are given, founded on measures by Barnard in 1894.

We must congratulate M. Mascart on a very interesting and exhaustive work. We regret, however, the absence of a complete list of all known asteroids with their elements. We should have been glad to have seen such a list in several different forms, with the small planets arranged in order of mean motion, eccentricity, longitude of perihelion, and in the various other ways mentioned in the book. It would have enabled us to follow the arguments from statistics with greater appreciation, and the value of the book as a work of reference would have been much increased. The work admirably fulfils the design of the author.

SIR BENJAMIN BAKER, K.C.B., F.R.S.

SIR BENJAMIN BAKER, whose sudden death in his sixty-seventh year we recorded last week, had a distinguished career as an engineer, and was concerned more or less directly with most of the great engineering schemes of recent years. By his death the profession of civil engineering is deprived of one of its leading members, and the scientific world of a man who combined scientific knowledge with practical training and experience. He was a constant contributor to early volumes of NATURE, and his writings and addresses cover a wide field of applied science.

Sir Benjamin Baker was born in 1840, and for the last thirty years or so was engaged in the design and construction of important engineering works at home and abroad. He carried out numerous investigations relating to the strength of materials and of engineering structures generally, and contributed papers thereon to various scientific societies. He was the author of "A Theoretical Investigation into the Most Advantageous System of Constructing Bridges of Great Span," upon which plan the Forth Bridge and six of the largest bridges in the world have been built.

His name will be remembered chiefly in connection with the Forth Bridge and the great dam across the Nile at Assouan. On the completion, in 1890, of the former engineering feat Sir Benjamin Baker was made K.C.M.G., and when the dam at Assouan was finished in 1902 he was made K.C.B., and received at the same time the first-class of the Order of the Medjidieh from the Khedive. Two years ago plans were submitted to him for the raising of the Assouan dam, and since then he had worked more or less continuously at the subject of stresses on dams. A note by him upon the project appeared in the Earl of Cromer's recent despatch respecting the water supply of Egypt; and in it he stated that a design had been evolved which satisfied all the theoretical and practical conditions, and rendered the storage of nearly two and a half times the present quantity of water in the reservoir a simple problem.

Though his name will always be associated first with the famous works mentioned, Sir Benjamin Baker took a very active part in other great engineering enterprises in many parts of the world. He had much to do with making the Metropolitan Railway, and was associated more recently with the construction of the various tubes for electric traffic under London.

Sir Benjamin Baker was elected a Fellow of the Royal Society in 1890, and in 1895 he became president of the Institution of Civil Engineers. Honorary degrees were conferred upon him by the Universities of Cambridge and Edinburgh, by the Irish Academy, and other learned bodies. He was closely associated with the various engineering societies, and was actively interested in the work of the British Association and the Royal Institution. He was a member of the council of the Institution of Mechanical Engineers, and an honorary member of the American and Canadian Societies of Civil Engineers, and the American Society of Mechanical Engineers. His unexpected death will be deplored wherever pure and applied science are studied, and his personal friends have suffered a loss that cannot easily be realised by those who did not know his broad interests and sympathetic nature.

NOTES.

THE Senate of the State of Pennsylvania has voted 70,000*l.* to the American Philosophical Society to provide a fitting memorial to Benjamin Franklin.

SIR WILLIAM RAMSAY, K.C.B., has received through the Foreign Office the Order of Commendatore della Corona d'Italia from the King of Italy, together with King Edward's permission to wear it.

AT the anniversary meeting of the Linnean Society on May 24, the Linnean medal, awarded by the council to Dr. Melchior Treub, director of the State Botanic Garden at Buitenzorg, Java, was formally handed to Mr. Van Royen, councillor of the Netherlands Legation, who undertook to transmit the medal to Dr. Treub.

MR. ANDREW WATT has been elected meteorological secretary of the Scottish Meteorological Society in succession to the late Dr. Buchan, F.R.S. Mr. Watt has since 1900 been closely associated with Dr. Buchan in the discussion of rainfall and other important meteorological problems.

THE Maccabæans, a society of Jewish literary and scientific men, gave a dinner at the Hotel Great Central on May 22, at which some of the leading members of the medical profession were present. Before the dinner a telegram was dispatched to Lord Lister, sending him respectful salutations. Lord Lister replied, returning his warmest thanks to the Maccabæans for their message.

THE Transvaal Government Gazette of April 20 announces the appointment of a commission, consisting of the following gentlemen, Dr. Kynaston (Geological Survey Department), Mr. T. N. Leslie (Vereeniging), Mr. J. P. Johnson (Johannesburg), and Prof. R. B. Young (Transvaal University College), "to report to the Government on the Bushmen paintings and stone etchings existing in the Transvaal, and as to what steps should be taken to preserve them from decay and mutilation."

SPEAKING at the forty-seventh annual dinner of King's College, London, on Monday, May 27, Dr. Headlam, the principal, referred to the loss which the college has sustained by the death of Dr. MacFadyean, and suggested that there should be a public recognition of one who died as a martyr in the cause of science, and for the sake of amelioration of disease and the benefit of the human race. Alluding to the incorporation of the college with the University of London, and to the appeal for funds made in connection therewith, he mentioned that the Goldsmiths' and the Clothworkers' Company have each contributed 5000*l*., and that other promises and donations bring the amount subscribed up to the present time to 15,000*l*.

REUTER'S representative at Upsala records that the celebrations at the University of Upsala on the occasion of the 200th anniversary of the birth of Linnæus took place on May 23. The Crown Prince Regent, the Duke and Duchess of Vester-Gotland, and the Dukes of Nericia and Scania, were present. A speech was made by M. Schuck, the Rector of the University, after which the foreign guests read addresses. The speakers were afterwards presented to the Crown Prince. On May 24 the University held a solemn session in the cathedral for the purpose of conferring the doctorate on distinguished Swedes and foreigners on the occasion of the Linnæus celebrations. Among those upon whom honorary degrees were conferred were Mr. Francis Darwin, F.R.S., and Mr. W. Carruthers, F.R.S. The Crown Prince Regent, the Duke of Scania, and the Duke and Duchess of Vester-Gotland attended the ceremony. We hope to give later an account of the celebrations by one of the British delegates now in Upsala.

WE learn from the *Lancet* that a movement for the institution of an Italian Association for the Advancement of Science, proposed at Milan last year, has now taken form and development under capable organisers, including Prof. Romiti, of Pisa. The first meeting will be held at Parma in September next, when it is hoped that the sister Powers of Europe, as well as those of the New World, will assist in an auspicious "send-off." Italy has many associations for the advancement of special sciences, but, as Prof. Romiti has put it, she has yet to form an association which shall "represent the synthesis" of them all. Attempts were made in 1839 and 1875 to start such an association on the British model, but they have had no successor. It is hoped and believed that the attempt which has now been renewed will result in the establishment of a permanent institution.

THE Aëro Club of the United Kingdom is very active in promoting many aspects of aërial navigation. On Saturday last nine balloons started from the Ranelagh Club, Barnes, in a race for the Harbord Cup, the first balloon leaving at 4 p.m. and the last at 6 p.m. The point to which the balloons were piloted was Goring, in Oxfordshire, and the winner will be the competitor who landed nearest this point. The committee will meet and examine certificates of descents before issuing an official list of placings. On Saturday, June 29, there will be a race for the Hedges Butler Challenge Cup, which will be awarded for the longest voyage in any balloon, airship, or aëroplane on that day. The club offers a silver medal for the best set of photographs taken by a member from a balloon during this year, and a silver and bronze medal for the best set of meteorological observations. Arrangements have also been completed for carrying out a series of important practical experiments in connection with aërial navigation.

THE report of the Departmental Committee appointed to inquire into the probable economic effect of an Act of Parliament limiting work in coal mines to eight hours per day has been issued. It is a document that has been prepared with great care, and forms a valuable addition to economic literature. While, on the whole, the committee is of opinion that its immediate effect would be a reduction in total output of about 26,000,000 tons per annum, it is concluded that because the pits would be worked with more energy, the total reduction would be only about one-half this, while the introduction of improved machinery might still further diminish the reduction. The scientific interests of mining were well represented on the committee by Prof. S. H. Cox, of the Royal School of Mines, and by Prof. R. A. S. Redmayne, of Birmingham.

MR. WALTER WELLMAN, who proposes to make another attempt to reach the North Pole by means of his airship *America*, has left for Norway, on the way to Spitsbergen, where the balloon will be inflated. In the first week of July there will be trials of the airship until it is demonstrated that it is ready for the voyage. The start for the Pole will be made on the first favourable opportunity afterwards, probably between July 20 and August 10, but, if necessary, Mr. Wellman is prepared to start as late as August 20. Mr. Wellman has given Reuter's representative the following particulars of his plans:—The airship has been made 18 feet longer and its lifting power increased by 3000 lb., giving a total lifting force of 19,500 lb. The balloon is 184 feet long and 52 feet in its greatest diameter, its cubic volume being 265,000 cubic feet. With the single exception of Count Zeppelin's airship, this is the largest ever built. The keel or backbone of the airship consists of a steel tank 18 inches in diameter and 115 feet in length, with a capacity for holding 1200 gallons of petrol. At the stern of the vessel is a rudder of some 900 square feet, in the form of a bicycle wheel, which, despite its great size, only weighs 30 lb. A little forward of the centre is placed a very heavy motor, built for endurance and safety, of 70 horse-power, and having a weight of 900 lb. In this new airship the propellers are placed in the centre on either side of the vessel. They consist of two blades of steel, 11 feet in diameter, and capable of 380 revolutions per minute. The living quarters of the airship are in triangular bunk-like spaces within the enclosed steel car. These are capable of accommodating ten or twelve men, twelve dogs, together with the provisions and equipment. The total weight of the steel car

and tank is 2200 lb. The motors, screws, and machinery weigh 1350 lb. In the tank will be carried 6800 lb. of petrol, capable of running the motor for 150 hours at a normal speed of 14 knots. The total radius of action is believed to be 2500 miles, or double the distance from the base to the Pole and back again. The balloon will not ascend more than 300 feet to 500 feet, and a guide-rope will trail over the surface of the earth. Instead of employing a steel line a leather tube has been made, 15 inches in diameter and 130 feet long, and weighing about 1400 lb. This is filled with reserve food weighing 1200 lb., and is suspended from the airship by means of a steel rope. The airship will carry 3000 lb. of food, or enough to enable the crew to subsist on its own stores for a period of ten months.

To vol. iii., No. 11, of the zoological series of the Publications of the University of California, Messrs. E. C. Starks and E. L. Morris contribute a descriptive list of fishes taken off the coast of southern California.

WE have to acknowledge the receipt of a copy of the first of a series of "guides" to the Peabody Museum of Natural History at Yale University. This deals with the evolution of the horse family, a subject which has been treated in a very satisfactory manner by Dr. R. S. Lull. The "guide" has previously appeared in the form of an article in the *American Journal of Science*.

A VERY satisfactory result has attended bird protection in a certain district of Norfolk, the black tern (*Hydrochelidon nigra*), which had ceased to breed in that county for a period of something like seventy years, having this season re-established itself in its old nesting haunts. Several nests are recorded, and it is sincerely to be hoped that the species will once more be entitled to a permanent place on the British breeding list.

A PAPER in the Annals of the Natal Government Museum (vol. i., part ii.), by Messrs. E. Hill and L. G. Haydon, on the characters of the larva in certain mosquitoes of the group Anophelina, is of importance in connection with the endeavour to stamp out malaria. All the fifteen species described are referred to genera other than the typical Anopheles. In a second article in the same issue Dr. R. Broom records, for the first time, the occurrence of remains of anomodont reptiles in the Karoo rocks of Natal. They are referred to the genera Dicynodon, Lystrosaurus, and Scymnosaurus, the representatives of the first and third being regarded as new species.

THE evolution of the colour-pattern on the shells of South African land tortoises, more especially those included in the genus Homopus, forms the subject of a paper by Dr. J. E. Duerden in the Records of the Albany Museum (vol. ii., part i.). Starting with species in which each shield of the shell is of the normal horn-colour, the author finds that the first stage is the development of a dark border, followed later by a dark centre. Next the whole shield becomes dark, excepting light lines radiating from the centre, after which the dark area may break up into spots or flecks. In a second paper the same author describes a giraffe head from British East Africa, provisionally identified with *Giraffa camelopardalis tippelskirchi*.

IN a paper on the geographical distribution of closely related species, as exemplified by plants, Mr. R. G. Leavitt, in the April number of the *American Naturalist*, comes to the conclusion "that the study of specific distribution in the vegetable kingdom is not likely to be unfavourable to mutation, regarded as a method, but perhaps not the sole method, of evolution." After putting aside certain cases which may be ascribed, for want of a better name, to "geographical effect," the indications suggest that a good many instances favourable to mutation will be forthcoming, and that those who seek to discredit the mutation theory will find it difficult to procure weapons to support their attack from plant evidence.

WE have received from the author, Mr. James Drummond, a copy of a paper on foreign birds acclimatised into New Zealand, published as a Bulletin of the Agricultural Department, and likewise copies of the *Lyttelton Times* of March 23 and 30 containing an account of the bird-sanctuary at Little Barrier Island, near Cape Rodney. As regards the introduction of small birds, which commenced, mainly for sentimental reasons, some sixty years ago, it appears that, on the whole, this has been a mistake, correspondents urging that no more kinds should on any account be admitted. Although sparrows are admitted to have done good in the early days of the colony, when insects were, literally, on the war-path, they are now unmitigated pests, while greenfinches, blackbirds, and even larks (which do enormous damage to young wheat) and thrushes are included in the same category. Little Barrier Island, we are told, comprises 10,000 acres, of which all but about fifty are hilly or mountainous, with abundant timber. It thus appears admirably suited for a bird-sanctuary, and efforts are being made to introduce from the mainland many species not naturally represented on the island.

FOUR parts have been received of the scientific results of the voyage of the *Belgica* (Expédition Antarctique Belge), now in course of publication at Antwerp, in which Mr. E. Hérouard describes the holothurians, Prof. G. W. Müller the ostracods, and Mr. O. Maas the medusas, while a number of writers deal with the comparatively small collection of insects. Out of nine holothurians obtained, no less than five are new, one being referable to a new generic type. All the Antarctic members of this group belong to the family Elpidiidæ, of which only a single representative (*Elpidia glacialis*) occurs in Arctic seas. The ostracods of the Antarctic plankton include four species of Conchœcia, of which one is new. Jelly-fish (medusas) are but poorly represented, although two out of the small number of species collected by the *Belgica* are regarded as new. As regards insects, the number of species recorded from the neighbourhood of the Antarctic circle is still infinitesimal as compared with those from the opposite pole, the list comprising merely certain colembolids taken near the Canal de Gerlache by the *Belgica* expedition, a podurid and a pediculid collected by the *Southern Cross*, and a dipterid (*Belgica antarctica*) and a larva described in the fasciculus before us. That fasciculus includes, however, descriptions and figures of a considerable number of insects from the lower part of South America and the Falklands, several of which have received new names.

THE *Philippine Journal of Science* for March (ii., No. 1) contains a paper on filariasis in the Philippines, by Messrs. P. M. Ashburn and C. F. Craig. They consider that the filaria met with in these islands is a new species (named *F. philippinensis*), owing to its lack of periodicity and certain morphological characters. It develops in *Culex fatigans*. Dr. Musgrave contributes an exhaustive paper on paragonimiasis (infection with the fluke, *Paragonimus westermanii*) in the Philippines. The journal is illustrated with a number of plates.

IN the Journal of the Royal Sanitary Institute for May (xxviii., No. 4), Prof. Ronald Ross, F.R.S., discusses some points of interest in connection with tropical sanitation, and Major Horrocks describes some interesting experiments made to determine the conditions under which "specific" bacteria derived from sewage may be present in the air of ventilating pipes, drains, sewers, &c. It would appear that the bursting of bubbles, the separation of dried particles from the walls, and the ejection of minute droplets from flowing sewage, may determine the ejection of specific bacteria from the sewage into the air.

BULLETIN No. 4 of the division of pathology and physiology, issued from the experiment station of the Hawaiian Sugar Planters' Association, has been received. It contains the substance of a lecture, delivered by Dr. N. A. Cobb before the association, on some elements of plant pathology relating to disease in the sugar cane.

MR. D. MCALPINE communicates to *Annales Mycologici*, vol. iv., No. 6, an account of the hymenomycete fungus, formerly called *Isaria fuciformis*, as it exists in Australia. Growing on various native grasses and rye-grass, the fungus often forms a conspicuous pest in wet seasons. In general appearance it resembles a Clavaria, but the hymenium or spore-producing layer is borne mainly or entirely on the portion of the fungus attached to the host plant, so that the author refers it to the genus Hypochnus as *Hypochnus fuciformis*.

A SHORT paper by Mr. R. Fitch appears in *Annales Mycologici* (vol. iv., No. 4) describing some experiments on the action of insoluble substances in modifying the effect of deleterious agents upon fungi. It is known that the action of certain toxic solutions on plants varies according to the degree of concentration and that a very weak solution often stimulates growth. Nägeli discovered that the addition of certain solid materials to solutions reduced the toxicity. Similarly it is found by Mr. Fitch that the introduction of sand or glass is equivalent to weakening the proportion of poison in a given solution.

MR. E. R. BURDON contributes to the *Journal of Economic Biology* (vol. ii., No. 1) an article on the spruce-gall and larch-blight diseases caused by the genus Chermes of the Aphidæ. He points out that, according to investigations made in Germany and Russia, both diseases are induced by the same species, and draws up in a tabular form the sequence of generations. Starting from the gall-foundress generation on the spruce, some of the winged insects of the subsequent generation migrate to the larch, pine, or fir, upon which two generations are developed before there is a migration back to the spruce previous to the sexual generation. The galls are only produced on the spruce and by one of the generations. In order to prevent migration, it is recommended that spruce and larch should not be planted together, but should be separated by a belt of other trees. The author discusses various remedies, among them a paraffin emulsion, with which he washed the trees in winter.

AN important addition to the literature on the Phycomycetes will be found in the fifth number of the botanical series of Memoirs of the Department of Agriculture in India, wherein Dr. E. J. Butler furnishes an account of the genus Pythium and some of the Chytridiaceæ. The memoir contains a phylogenetic review and systematic revision of the genus Pythium, for which eighteen species are distinguished, and of these *indigoferae*, *diacarpum*, *palmivorum*, and *rostratum* are new. The account of the life-history is based upon the examination of ten species collected in Europe and India. Full details are given of the development and liberation of the zoospores in *Pythium proliferum*. The observations on the Chytridiaceæ made on species of the genera Pleolpidium, Pseudolpidium, Olpidium, Olpidiopsis, and Nowakowskiella enable the author to describe the life-histories of these parasitic fungi.

ON September 2, 1906, twenty years had elapsed since the opening of the Sonnblick Observatory, at an altitude of 10,190 feet above sea-level. From Dr. Hann's summary of the results, it appears that the monthly mean barometric pressure is lowest in March and highest in August. The mean yearly minimum temperature is $-22°\cdot2$, the mean maximum $49°\cdot3$; the absolute extremes were $-35°\cdot0$ in January, 1905, and $56°\cdot8$ in July of the same year. The relative humidity is the opposite to that which obtains in the plains—the winter is the driest and the spring and summer the dampest; the afternoon is the dampest period of the day. The mean yearly precipitation amounts to 70·71 inches, of which only about 4·77 inches fall as rain, the remainder being chiefly due to snow. The amount is fairly uniformly distributed throughout the year, the mean number of "rain-days" being 212. Fog occurs on 253 days on an average.

THE report of the committee appointed by the Governor of Hong Kong to inquire whether earlier warning of the disastrous typhoon of September 18, 1906, could have been given to shipping has resulted in the exoneration of Dr. Doberck and the observatory staff from blame in the matter. The committee was composed of Sir H. S. Berkeley, K.C., Lieut. H. Butterworth, R.N. (King's Harbour Master), A. B. Skottowe (Eastern Extension Telegraph Co.), and Captain A. Sommerville. The evidence taken by the committee, and the documents referred to, are appended to the report. On the afternoon of September 17 the observatory received telegraphic reports from various stations, including Zi-ka-wei (Shanghai), Swatow, and Manila; the barometer readings at those places pointed to the conclusion that there was a gale in Formosa Channel, apparently travelling N.N.W., but in the opinion of the committee these observations did not call for the hoisting of any typhoon signal in Hong Kong on September 17. The evidence as to the appearance and state of the weather on the evening of September 17 and morning of September 18 is conflicting; the Consul for France thought that the appearance of the sky on September 17 indicated a typhoon not far off. But, reviewing the evidence as a whole, the committee found that prior to 7h. 44m. a.m. on September 18 there was no indication of a typhoon approaching Hong Kong, and that by hoisting the signal drum on the morning of September 18 warning was given as soon as was practicably possible.

AN address on the "Education of the Professicnal Chemist," delivered by Prof. C. F. Mabery in his capacity of chairman of Section C of the American Association for the Advancement of Science, is printed in *Science* for May 3. It contains a number of points of educational interest. The methods of teaching chemistry in the elementary schools of the United States are severely criticised; they appear very similar to those which have been attacked in this country during the past fifteen years. "The pupil is taught a text-book rather than chemistry," and has inflicted on him a series of definitions and theoretical principles before he has learned correctly to observe a single fact. In spite of this, the students of technical

chemistry appear to be able to overcome at the university such early disadvantages; and we learn that as a result "most manufacturers have a high respect for the advantages afforded by scientific education," and are "ready to receive the young graduate with open cordiality." The lot of the young chemist seems, indeed, to be a particularly happy one in the States in view of the "unprecedented demand for good men." Statistics show that the average salary of the graduates in chemistry of five years' standing from the Case School of Applied Science is about 3000 dollars per annum. At all colleges "there is a far greater demand for graduates than can be supplied." A powerful aid to research has recently arisen in the immense funds devoted by many individuals to this purpose; amongst these the Carnegie foundation for the retirement of teachers is mentioned, "as it relieves the teacher during his earlier years from the anxiety of later need and gives him courage to devote his residual energy in some efforts for the advancement of knowledge."

WE have received a copy (printed for private circulation) of the Friday evening discourse delivered by Prof. A. H. Church at the Royal Institution on April 12 on the "Conservation of Urban Stone-work and Wall-paintings." The most active among the agents tending to destroy the stone-work of buildings of historical interest in large towns is undoubtedly the sulphuric acid produced by the combustion of coal used as fuel. It has been estimated that at least half a million tons of sulphuric acid are formed annually in London in this way. Rain charged with the acid gradually converts the surface of the limestone of public buildings (such, for instance, as St. Paul's Cathedral) into gypsum, the increase of volume accompanying the change being responsible, moreover, for a greater or less degree of disintegration of the more delicate mouldings and tracery. An account is given by Prof. Church of the remedial treatment adopted in such cases, based on the use of a solution of baryta, which has the property of re-cementing together the particles of the decayed stone-work. The baryta acts by forming an insoluble sulphate with the gypsum and liberating lime, which, under the influence of carbonic acid from the air, regenerates the original binding cement of the stone. This treatment is applicable, not only to limestones, but also to sandstones which were originally compacted by a calcareous cement. The success attending its use is well illustrated by the experience obtained in the case of the Chapter House at Westminster. "Before treatment a touch of the finger sufficed to bring away the surface of the carving, afterwards the stone was as sound as that newly quarried and harder." To render the stone subsequently resistant to the action of acids it may be covered with a suitable waterproofing coating of paraffin wax. The conservation of mural paintings or frescoes needs in each special case, according to its character, a different process. A number of typical cases of treatment are described.

AN interesting article on the life and work of Linnæus, by Mr. G. W. Murdoch, appeared in the *Newcastle Daily Journal* of May 23. We congratulate that journal upon being one of the few daily papers to publish a special article upon Linnæus on the 200th anniversary of his birth.

THE *Brazilian Engineering and Mining Review*, which has now reached its fourth annual volume, is a high-class monthly technical journal published in English at Rio de Janeiro. Looking through some back numbers recently sent to us, we notice many articles of permanent value regarding the mineral resources of Brazil, and, continued from number to number, a very important bibliography of the geology and palæontology of Brazil compiled by Prof. John C. Branner.

SEVERAL plates of illustrations of the zoology of the Royal Indian Marine Survey ship *Investigator* have been received from the Indian Museum. The illustrations include Crustacea (Malacostraca and Entomostraca) and Mollusca, and have been prepared under the direction of Dr. A. Alcock, F.R.S., Dr. N. Annandale, and Mr. A. C. MacGilchrist.

A "HANDY Guide to Photographic Requisites," which is a conveniently arranged price list of photographic apparatus, materials, and pure chemicals, has been published by Messrs. Reynolds and Branson, Ltd., of Leeds.

THE much-discussed question of the structure of cyanic acid forms the subject of a communication by F. Carlo Palazzo and E. Carapelle in the *Gazzetta* (vol. xxxvii., ii., p. 184). It is pointed out that, while Nef's experiments have shown that esters of the structure OR.C:N derived from normal cyanic acid do not exist, he still adheres illogically to the view that the free acid and its alkali salts are of the normal constitution. The argument that Nef advanced, that the free *iso*-acid, CO : NH, would be unstable in presence of water and undergo change into the normal acid, should, on his own showing, from the great power of addition possessed by the group .C N, be reversed. Cyanic acid when esterified at so low a temperature as −5°, by means of diazomethane or diazoethane, gives esters of the *iso*-type CO : NR alone. In view of the fact that the somewhat analogous α-pyridone gives only oxygen esters under similar conditions, and of the probability that isomeric change is excluded at so low a temperature, it is concluded that the free acid and its salts have the iso-structure. The same conclusion was also recently arrived at by Chattaway and Wadmore using a less direct argument.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES IN JUNE:—

June 1. Mars. Apparent Diameter = 17″·6.
9. 1h. Vesta in conjunction with Moon. Vesta 0° 11′ N.
10. 23h. 37m. Mercury in conjunction with ε Geminorum (mag. 3·2). Distance between centre of planet and star about 25′.
12. 14h. Mercury in conjunction with Neptune. Mercury 2° 51′ N.
15. 8h. Mercury in conjunction with Jupiter. Mercury 1° 41′ N.
18. 10h. 46m. Minimum of Algol (β Persei).
19. Uranus ½° S. of ν^2 Sagittarii (mag. 5·2).
22. 2h. Sun enters Cancer, Summer commences.
23. Uranus ½° S. of ν^1 Sagittarii (mag. 5·0).
24. 11h. 40m. to 12h. 48m. Moon occults ξ Ophiuchi (mag. 4·5).
26. Mercury at greatest elongation (25° 28′ E).

MAGNITUDES OF MIRA, DECEMBER 14, 1906, TO FEBRUARY 16, 1907.—The results of a number of naked-eye observations of Mira, made at the Radcliffe Observatory during the recent maximum brightness of this star, are published in the Monthly Notices (R.A.S.) for April (vol. lxvii., No. 6, p. 412), together with some notes on the star's colour.

The greatest magnitude, 2·06, during the period of observation was recorded on December 27, when Mr. Robinson found the colour of Mira to be similar to that of α Arietis, *i.e.* yellow. Examined with the Barclay equatorial on January 11, the image of Mira showed red

spiculæ around the margin, but the margin was not so broad, nor so deep a red, as that seen by the same observers around Nova Persei in 1901. The image was, however, quite distinct in appearance from those of two other coloured stars, α Ceti and Aldebaran, when the same optical means were employed.

THE INTERNATIONAL EROS CAMPAIGN.—After suffering numerous delays, Circular No. 12 of the International Astrographic Conference of July, 1900, has just been published by the French Academy of Sciences. It contains the results of some thousands of visual and photographic observations of the position of Eros during the favourable opposition of 1900–1 at eleven different observatories. The plates taken at the Upsala Observatory, and part of those taken at Minneapolis, have been reduced at the Paris Observatory, and, in order not to delay the publication of the collected results any longer, the work of the Algiers Observatory is omitted from the present Circular, to be published when ready by the Algiers authorities themselves. A collection of all the important documents relating to the orbit of Eros is included in the present publication.

MARS.—At the coming opposition, which will take place on July 6, the planet's southern hemisphere will be presented, and the apparent diameter will be 22″·8, but, owing to the large southerly declination, the altitude of the planet as seen from Greenwich will be only 10°, therefore the observing conditions will be very poor.

CATALOGUE OF VARIABLE STARS.—The second Harvard catalogue of variable stars, compiled by Miss Cannon, appears as vol. lv., part i., of the Annals of the Astronomical Observatory of Harvard College. It contains all the known particulars of 1957 variable stars, and includes those found in globular clusters, but not those discovered in the Magellanic clouds. The latter number 1791, so that altogether there are now 3748 known variable stars, 2909 of which have been discovered at Harvard.

In addition to the tabulated data for each star, the present catalogue contains a valuable set of notes giving further particulars of numerous individual stars and a brief review of all previous catalogues which have appeared since Argelander published the first, including eighteen variables, in 1844.

ABBREVIATIONS FOR THE NAMES OF STAR CATALOGUES.—No. 4176 (May 14) of the *Astronomische Nachrichten* contains a useful list of abbreviations for star catalogues. The names of the numerous catalogues, to which frequent references are essential, are often lengthy, and different writers use different abbreviations. To obviate the consequent confusion, Dr. A. Auwers has compiled the present list, which includes all the important catalogues from Baily's Flamsteed catalogue (abbreviated to B.Fl.) of 1690 up to the Greenwich second nine-year catalogue ($9y_2$) of 1900.

THE NATAL OBSERVATORY.—The report of the Government astronomer of Natal, for the year 1906, is chiefly devoted to the publication of the meteorological results secured at various stations, as in previous years. Observations of the magnetic elements and the distribution of time signals were carried on as usual, and a number of observations of comet 1905c were made with the large equatorial telescope by Mr. Rendell, who, early this year, resigned the position of chief assistant to which he was appointed in March, 1903.

ANNIVERSARY MEETING OF THE LINNEAN SOCIETY.

THE Linnean Society of London, which may be said to have a preeminent position amongst the Linnean societies of the world as the faithful custodian of Linnæus's own library, manuscripts, herbarium, and other collections, along with many personal relics, holds annually its business meeting for the election of officers and the reception of the president's address on May 24, the reputed birthday of Linnæus.

In his presidential address at the meeting on Friday last, Prof. W. A. Herdman dealt with the special circumstances of this year, when the celebration of the 200th birthday of the illustrious Swede has been made the occasion of congratulatory meetings in Sweden and elsewhere throughout the civilised world wherever natural science is cultivated and the debt of the naturalist to Linnæus is gratefully acknowledged.

The Linnean Society has sent to Upsala and Stockholm as its representative on the occasion Mr. William Carruthers, F.R.S., a past-president who has made a special study of the work and the personal history and relics of Linnæus.

Mr. Carruthers, accompanied by the general secretary of the society, is now in Sweden, bearing to the ancient University of Upsala the society's Linnean gold medal, specially struck for the occasion, and conveying both to the University and to the Royal Academy of Sciences at Stockholm congratulatory documents, signed by the president and secretaries, and bearing the seal of the society.

At the conclusion of the section of his address dealing with the Linnean celebrations, the president moved that a telegram in the following terms be sent to the Rector Magnificus of the University of Upsala:—"Linnean Society of London assembled at anniversary meeting congratulates University of Upsala on historic Linnean celebration." The proposal was received with acclamation, and the telegram was dispatched forthwith from the meeting.

In further celebration of the occasion the Linnean Society proposes to hold a social gathering of the fellows and their friends, at the society's rooms in Burlington House, on the evening of June 7, when the society's Linnean relics will be on exhibition, and several short addresses on interesting recent discoveries in natural history will be given by fellows of the society.

THE JUBILEE OF THE SOCIÉTÉ CHIMIQUE DE FRANCE.

A NUMBER of scientific men from all parts of Europe met in Paris on May 16 and the two following days to celebrate the fiftieth anniversary of the Société chimique de France. Founded by a few students for mutual instruction, the society is better known as the Société chimique de Paris, the change in name having taken place a short time ago. British chemists were well represented; Sir W. Ramsay and Dr. H. Brown came on behalf of the Chemical Society; Drs. Markel and Lewkowitsch and Mr. Walter F. Reid for the Society of Chemical Industry. Sir W. Perkin, Prof. Armstrong, and Mr. C. E. Groves were also present.

The proceedings commenced on May 16 in the amphitheatre of the École supérieure de Pharmacie in the Avenue de l'Observatoire. The chair was occupied by M. Bouveault, president of the Société chimique de France, who was supported by M. Reynal, representing the French Government. The president welcomed the guests in a short speech, after which Dr. Graebe, who, with Dr. Liebermann and Dr. von Martius, represented the Deutsche Chemische Gesellschaft, read a somewhat lengthy address in German, and made a short speech in French which was well received. A second German address was presented by Dr. von Martius on behalf of the Verein Deutscher Chemiker, after which Prof. Piutti, of Naples, made a sympathetic speech in Italian which was much applauded. Senator Paternó, also a polished orator, was to have represented Italian chemists, but was detained in Russia on a tariff mission. Sir William Ramsay next read and presented the address of the Chemical Society, saying at the same time a few appropriate words in French. Mr. Walter F. Reid then made a short French speech, and presented the congratulatory address of the Society of Chemical Industry. Other speakers followed representing Russia, Norway, Switzerland, and other countries, after which M. Reynal, representing the French Government, welcomed the foreign delegates and referred to the numerous services rendered to the State by chemists, especially in connection with hygiene, agriculture, and the detection of adulteration and of crime generally.

In the afternoon a special boat conveyed the delegates and many members of the French society to Sèvres, where

the porcelain works were visited under the guidance of several chiefs of departments. While not inferior to any other porcelain factory in its perfection of technical handling of the material and artistic treatment of form and colour, Sèvres undoubtedly surpasses all its rivals in the wide range of pigments which it possesses. Many of these are due to the scientific researches of the eminent chemists who have directed the operations of the factory, and research work is still continuously carried on, especially with the rarer elements which modern chemical progress has rendered available. A yellow titanium glaze was much admired, and a new method of decoration produced by the crystallisation of zinc oxalate in combination with various pigments promises to become a valuable adjunct to the decoration of vases and other decorative objects of porcelain. The dazzling white of the Sèvres material is said to be due, not only to the purity of the ingredients used, but also to the kind of wood used as fuel, namely, birch. No doubt there is some reason for this belief, because the heat in the furnaces is so intense that the greater part of the ash of the fuel is volatilised, and, although the ware is carefully packed in saggers and protected as much as possible from the furnace gases, the volatilised ash must to some extent permeate the whole mass. The waste during burning has been reduced of late years by the adoption of an electric pyrometer which enables those in charge of the firing operations to regulate the temperature within a few degrees. An interesting hour was spent in the museum, which contains a unique collection of porcelain from all parts of the world. Of special interest are the specimens of different pigments and glazes, and the ladies of the party regarded with curiosity the artificial rubies and sapphires made by Ebelmen. These were small, and cannot be compared with the beautiful specimens prepared by Hautefeuille which are preserved in the Museum d'Histoire naturelle; but they were the first of their kind, and the precursors of the gems now made in considerable quantities by Moissan's process. It may be remarked that even artificial emeralds are now being produced having the same chemical composition as the natural stones, from which they can only be distinguished by optical tests.

In the evening a banquet was given at the Palais d'Orsay which was attended by the foreign delegates and a number of French scientific men. Among the former were Sir W. Ramsay, Dr. H. Brown, Mr. C. E. Groves, Dr. Lewkowitsch, Dr. Markel, and Mr. W. F. Reid. From Germany came Graebe, Liebermann, and Dr. von Martius; from Italy, Prof. Piutti; from Switzerland, Werner, Guye, and Willstaetter; from Russia, Antonow and Jacovlew. Many distinguished French men of science had assembled to welcome their colleagues from other lands. M. Bouveault, president of the Société chimique de France, presided, ably seconded by M. A. Béhal, secretary of the society, well known for his researches in organic chemistry; M. Lindet, secretary of two international congresses of applied chemistry: MM. Poirrier and Lauth, representatives of the dye-stuffs and pigment industries; Prof. G. Bertrand, discoverer of oxydases; Le Bel, in whose fertile brain the idea of stereochemistry originated; Prof. Cazeneuve, whose researches on the derivatives of camphor are well known; M. Tanret, to whom we owe much of our knowledge of sugars; Le Chatelier, who is still investigating hydraulic cements; M. Haller, member of the institute; M. Armand Gautier, late president of the society; and a number of others no less distinguished.

M. Pichon, Minister of Foreign Affairs, represented the Government, and made an eloquent speech pointing out the advantage to the whole civilised world of such amicable meetings of scientific men of all nations, united in the common wish to promote science and thus advance the well-being of the human race. The British delegates present could not help thinking how unfavourably the action of our own Government contrasted with that of France. The latter had offered decorations of the Legion of Honour to three of the delegates, Sir W. Perkin, Sir W. Ramsay, and Mr. W. F. Reid, but the British Government raised objections, and at the time of the jubilee celebration these had not been withdrawn. The current explanation was that some mediæval rule exists that foreign orders are only to be received by British subjects connected with the Army or Navy. But the Legion of Honour is not a military order, and was specially founded for men of such eminence as Sir W. Ramsay and Sir W. Perkin, and Mr. W. F. Reid, who originated the modern industry of smokeless powder, may certainly claim to be placed on as high a level as Mr. Thomas Atkins, who uses it. It is high time that our Government paid more attention, if not to the claims of scientific men, at any rate to those of international courtesy. Their action in this matter has not given satisfaction in the French capital, and contrasts very unfavourably with that of Germany, which accepted gratefully what was, of course, intended as a graceful international compliment.

On Friday, May 17, proceedings commenced at the early hour of 8.30 a.m. with an exhibition of products and apparatus of the members of the Société chimique de France. Among many important exhibits, two especially aroused the interest of the visitors. Abbé J. B. Senderens showed a number of products obtained by a new method of catalysis. Amorphous phosphorus prepared at a low temperature is placed in a tube and heated to about 300° C. in a current of hydrogen gas. The vapour of the substance to be decomposed is then passed through, with the result that water is formed and condenses in the receiver with the product of the reaction. M. G. Bertrand exhibited about forty samples of products obtained by the action of a bacterium which he has isolated from sorbose. These contained a number of substances of extreme interest to the chemist, including several artificial sugars. At 10 o'clock a general meeting took place, at which M. Armand Gautier, a former president of the society, read an account of the work done by members of the society since its formation. Few societies can show such a record of discoveries of the first magnitude.

A distribution of prizes to the successful students of the École supérieure de Pharmacie then took place. At 1 p.m. a special train started for Chantilly, where the priceless art treasures presented to the nation by the Duc d'Aumale were inspected. In the evening a meeting of the Société chimique de France was held, at which country members only were entitled to read papers. Some communications of importance were read, and will be published in the Bulletin.

On Saturday a reception was held in the Hotel de Ville by the municipality. The president of the municipal council, Dr. Lefèvre, is himself a biological chemist, and made some humorous allusions to the important part played by chemists in modern municipal work. The beautiful paintings with which the building is decorated were shown and explained to the visitors, who also witnessed some of the preparations that were being made for the reception of the delegates of the University of London in the ensuing week.

During the evening a theatrical soirée was given at the Palais d'Orsay, which terminated the proceedings officially. There were, however, numerous private offers of hospitality extending into the following week, and the British delegates were loth to part from their hospitable colleagues of the Société chimique de France.

STUDIES FROM A NORTHERN UNIVERSITY.

THE two contributions to science referred to below[1] form part of the publications issued by the University of Aberdeen when the quatercentenary of its foundation was celebrated in September of last year. When men move northwards to occupy chairs in the most outlying university of the kingdom, it has been said that the isolation and absence of external incentives are apt to cause a premature cooling of their zeal for science. However that may be, these two volumes contain convincing evidence that in recent years Aberdeen University has been

1 "Studies in Pathology." Written by Alumni to celebrate the Quatercentenary of the University of Aberdeen and the Quatercentenary of the Chair of Pathology therein. Edited by William Bulloch, M.D. Pp. xxx+412. (Aberdeen, 1906.) Price 15s.

"Proceedings of the Anatomical and Anthropological Society of the University of Aberdeen, 1904-1906." Pp. viii+241; illustrated. (Aberdeen University Press, 1906.)

able to produce graduates who are both willing and able to widen the bounds of real knowledge.

The volume containing the studies in pathology is of such merit that the history of its origin deserves a brief mention. In reality, its preparation was commenced five-and-twenty years ago, when Sir Erasmus Wilson wisely presented the University with sufficient funds to establish a chair of pathology—the second created in this country. By a happy inspiration Prof. D. J. Hamilton was asked to occupy it. Out of the raw material provided by the surrounding country Hamilton has raised the school of pathologists which has produced the volume under review, and very fittingly dedicated it to him. The studies are seventeen in number, and illustrate the diverse directions in which pathology has branched in recent years. To the old pathology—the morbid anatomy of Rokitansky and Virchow—only three of the studies belong, those of Dr. A. Keith, on the malformations of the heart; Dr. A. Low, on epignathus; and Dr. G. Duncan, on exophthalmic goitre. Experimental pathology, a recent development, is represented by Prof. A. Cushny's excellent paper on paroxysmal irregularity of the heart, and by Dr. J. J. R. Macleod's study of the condition that follows a direct diversion of the portal blood into the systemic circulation.

All the other studies, with the exception of that by Prof. St. Clair Symmers on bilharziosis, are concerned with bacteriology—a subject which has expanded into its present gigantic proportions since Prof. Hamilton went to Aberdeen in 1882. Five of the researches deal with a matter of the very utmost importance—that of immunity. To this group belong the papers by Dr. G. Dean, on plague immunity; Dr. Wm. Bulloch, on *Bacillus pyocyaneus*; Dr. G. G. Macdonald, on pneumococcal infection; Dr. R. D. Keith, on the relationship between hæmolysis and phagocytosis of red blood corpuscles; Dr. J. G. G. Ledingham and Dr. Wm. Bulloch, on the relation of leucocytosis to the opsonic content of the blood serum. The question of infection of the body from the alimentary canal is discussed by Prof. Hamilton in connection with his investigations of the disease in sheep known as "louping-ill." The bacteria found with this disease are described by Drs. J. M. Adam and B. R. G. Russell. Dr. Wm. Hunter has employed the data he collected as bacteriologist in Hong Kong to demonstrate that there is a very direct relationship between the epidemics of plague amongst rats and men. The administrative means which may be employed for the prevention of human tuberculosis are discussed by Dr. W. L. Mackenzie; the results of experiments on the efficacy of certain disinfectants are given by Dr. A. R. Laing. The manner in which these studies have been edited and arranged reflects the greatest credit on Dr. Wm. Bulloch.

To the quatercentenary publications the Anatomical and Anthropological Society of the University contributed a special volume of its Proceedings. Prof. R. W. Reid, the president of the society, has organised a fully-equipped department of anthropology in the University, with the result that graduates bring back most valuable information regarding the people of the countries or colonies in which they have stayed, and contribute their observations to their old society. In this volume appear five papers which deal with native races. Mr. George Moir writes on the natives of the Malay Archipelago; Mr. F. S. Maxwell contributes notes on Hausaland; Mr. D. Horn deals with the people of the New Hebrides; Captain A. W. C. Young, with the Tibet mission force to Lhassa; and Dr. R. H. Spittal describes skulls of New Guinea. Important papers on ancient or prehistoric subjects are contributed by Dr. Alex. Low, by Mr. A. Macdonald, and by Dr. J. S. Milne. Dr. A. Keith writes on the results of an anthropological investigation of the external ear, and Dr. R. J. Gladstone on the variations in shape and size of the skull. The paper on the development of the lower jaw in man, by Dr. Alex. Low, deserves especial commendation, both for the importance of its facts and for the very exact and complete manner in which he has recorded his observations. There is also an excellent paper by Miss A. V. Baxter on 1500 finger-prints which are recorded in the archives of the anthropological laboratory of the University.

THE FLOWERING PLANTS OF THE MESOZOIC AGE, IN THE LIGHT OF RECENT DISCOVERIES.[1]

THE subject which I have chosen for my address relates to plants of Mesozoic or Secondary age, ranging from the Trias, through the Jurassic, to the Cretaceous, the great period which bridges the gulf between the antique vegetation of Palæozoic days and the essentially modern type of flora which characterises the Tertiary formations.

We have abundant evidence of the existence of seed-plants in very early days, in fact, practically as far back in the Palæozoic as our records of terrestrial plants extend. On this occasion, however, I am going to speak of flowering plants, by which I do not mean the same thing as seed-plants, though the two terms have often been used as synonymous. One of the results of recent discoveries in Palæozoic botany has been to show that the seed-bearing and flower-bearing characters by no means coincide, for the fern-like seed-plants of Palæozoic age were in no sense of the words flowering plants. The evidence shows that their seeds, like the fructification of ordinary ferns, were borne on leaves differing but little from the vegetative fronds, and not aggregated on any special axis as are the parts of a flower. The nearest and, indeed, the only analogy to be found among recent seed-plants is in the female plant of Cycas, to which we shall return presently. The Mesozoic plants, however, with which we are now concerned were not only seed-plants, but they bore their reproductive organs in a form which everyone would naturally describe as a flower. They were flowering plants in the full sense of the term, however different in other respects from the flowering plants of the present day.

The Mesozoic floras from the Upper Trias to the Lower Cretaceous maintain, on the whole, a very uniform character, widely different from that of the preceding Palæozoic vegetation. True ferns were abundant, more so, no doubt, than in the earlier period; true conifers, often much resembling recent genera, were a dominant group; the family now represented by the maidenhair tree (Ginkgo) was prevalent, but the most striking feature of the vegetation was the abundance, in all parts of the world, of plants belonging to the class of the cycads, now so limited a group.

We will concentrate our attention on the cycad-like plants, or Cycadophyta, to adopt the broader class-name, appropriately suggested by Prof. Nathorst. The living Cycadaceæ are, it will be remembered, quite a small family, embracing only nine genera, and, according to a recent estimate, about 100 species, inhabiting the tropical or subtropical regions of both the old and new worlds, but nowhere forming a dominant feature in the vegetation. Throughout the Mesozoic period, however, at least until the Upper Cretaceous is reached, plants with the habit and foliage of cycads are extraordinarily abundant in all regions from which secondary fossils have been obtained; they are as characteristic of Mesozoic vegetation as the dicotyledons of our recent flora.

The most important point in questions of affinity is the fructification. Throughout the recent cycads this is of a simple type; in all the genera the staminate fructification is a cone, consisting of an axis densely beset with scales or sporophylls, each sporophyll bearing on its lower surface a number—often a very large number—of pollen-sacs, grouped, like the sporangia of a fern, in small sori. In eight out of the nine genera the female fructification is also strobiloid, each sporophyll bearing two marginal ovules. In Cycas itself, however, so far as the female plant is concerned, we find a much more primitive arrangement; no cone at all is differentiated, but the carpels are borne directly on the main stem of the plant, in rosettes alternating with those of the vegetative leaves. The carpels themselves are lobed and extremely leaf-like, bearing as many as six ovules in many cases, though in one species the number is reduced to two. Thus in Cycas the seeds are borne on organs still obviously leaves, and

[1] Abridged from the presidential address delivered by Dr. D. H. Scott, F.R.S., before the Royal Microscopical Society on January 16, and published in the Journal of the Society for April.

nothing of the nature of a flower is differentiated. No other living seed-plant is so primitive as this, but the cycads as a whole are undoubtedly the most primitive family of present-day Spermophyta, as is most strikingly shown in their cryptogamic mode of fertilisation by means of spermatozoids, which they share with Ginkgo alone among seed-plants.

When we go back to the Mesozoic age we might, on what one may call the elementary view of evolution, expect to find the Cycadophytes, which were so abundant at that period, still simpler and still nearer the cryptogamic condition than the members of the class which have come down to our own day. But this is by no means the case; there were, no doubt, a certain number of cycads in Mesozoic times which were about on the same level of organisation as their living representatives, but the great majority, so far as the available evidence shows, attained a much higher organisation, at least in their reproductive arrangements, far surpassing any of the gymnosperms now known to us. This is one of the many facts in palæontology which show that evolution is by no means the obvious progression from the simple to the complex which many people have imagined. Just as the lycopods and the horsetails of the Coal-measures were not simpler, but far more complex than their successors, so the Cycadophyta of Mesozoic age were, on the whole, on a much higher level than the surviving family Cycadaceæ, which now represents them. The history of the vegetable kingdom, so far as its records are known, is the history of the ascendancy of a succession of dominant families, each of which attained at some definite period its maximum, both in extent and organisation, and then sank into comparative obscurity, or died out altogether, giving place to some other race, which, under changing conditions, was better able to assume the leading *rôle*. The cycadophytes of the Mesozoic were, in their day (and it was a long one), a dominant group, almost as much so as the dicotyledons are now, and they equipped themselves with a correspondingly high organisation, even rivalling the angiospermous flowering plants (perhaps cadets of the same stock), which ultimately displaced them.

Among the Mesozoic Cycadophyta there were some, as already mentioned, which seem to have been essentially similar to our recent cycads. I do not, however, propose to dwell on this line of descent, but will now pass on to those Mesozoic Cycadophyta which attained a higher level of organisation, giving them a better title to the name of "flowering plants" than any of their predecessors or contemporaries.

The genus Bennettites was founded by Carruthers in 1868[1] for certain cycadean stems, of Oolitic and Lower Cretaceous age, with fruits borne on secondary axes, not protruding beyond the bases of the petioles. The species on which, for many years, our knowledge of the group was principally based is *Bennettites Gibsonianus*, of which a magnificently preserved specimen was discovered, just fifty years ago, in the Lower Greensand of Luccombe Chine, in the Isle of Wight. Some years later a second specimen was found in the same locality, but no others have as yet come to light. In *B. Gibsonianus* and other species the external appearance of the stem was similar to that of many recent cycads, its surface being completely invested by an armour of persistent leaf-bases. Anatomically, there is also a marked agreement, the chief distinction consisting in the simpler course, in the case of the fossil, of the vascular strands which pass out from the stem into the leaves. A striking feature is the presence, in great numbers, on the leaf-bases and bracts, of flat, scaly hairs, of the same nature as the ramenta characteristic of ferns. Even in external appearance, however, a Bennettitean stem, if in the fruiting condition, differs conspicuously from that of any recent cycad in the presence of a number of short, lateral branches, like large buds, wedged in between the leaf-bases, and arising in their axils (see Fig. 1, from an American species). These bodies are the fructifications, the characteristic feature of the Bennettiteæ. In structure, as well as in position, they differ totally from any form of fructification met with in recent cycads or other gymnosperms.

The peduncle bears many spirally arranged bracts, which completely enclose the fructification. The end of this peduncle expands into a convex receptacle, on which organs of two kinds are borne, the one fertile, the other sterile. The fertile appendages consist each of a long, slender pedicel, terminating in a single orthotropous seed, with the micropyle directed outwards. The seed-bearing pedicels are present in large numbers; the sterile appendages, or interseminal scales, are still more numerous. They form a dense packing between the seed-pedicels, and somewhat overtop the seeds themselves, expanding at their apices to form an almost continuous envelope, leaving only small perforations, into which the micropylar ends of the seeds are fitted. They form collectively a kind of pericarp, differing, however, from that of an angiospermous fruit in the presence of openings for the micropyles of the seeds. The whole complex fruit is enclosed in the mantle of overlapping bracts. In *Bennettites Gibsonianus* the fruits discovered are practically ripe, for each seed contains a large dicotyledonous embryo, with somewhat fleshy cotyledons. The embryo almost fills the seed, which was thus nearly, if not quite, exalbuminous—an unprecedented condition in

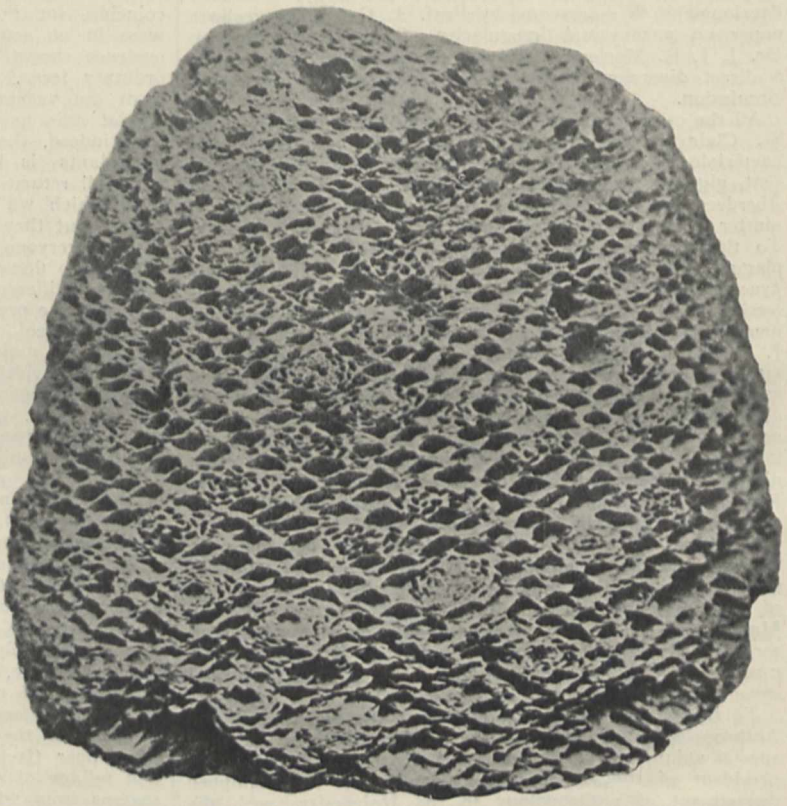

FIG. 1.—*Cycadeoidea marylandica*. The earliest described American fossil Cycad. From an original daguerreotype. Nearly thirty young fruits are marked in the present view by the groups of bract scars interpolated between the old leaf-bases. About one-fourth natural size. From Wieland's "American Fossil Cycads."

[1] "On Fossil Cycadean Stems from the Secondary Rocks of Britain." Trans. Linn. Soc. London, xxvi.

a gymnosperm. This plant, and a few of its immediate allies, afford the only instances, so far known, of the preservation of the embryo in a fossil seed.[1]

In the whole arrangement of the floral organs, the presence of a pericarp, and the character of the seed, the fructification differs entirely from anything known in gymnosperms, and the inclusion of Bennettites in Saporta's class "pro-angiosperms" appeared justified on grounds of analogy if not of affinity.

So far, however, nothing whatever was known of the staminate organs of these plants, and no one suspected that the fructifications already known were other than unisexual. The complete elucidation of the subject was reserved for the American palæontologists, who possess a wealth of material for the investigation of Mesozoic Cycadophyta far exceeding anything that Europe can show. No less than sixty species of silicified cycadean trunks have now been described from the Mesozoic of America, ranging from the Upper Triassic to the Lower Cretaceous.

The specimens are often extremely numerous; thus the twenty-nine species from the Black Hills of South Dakota are represented by nearly 1000 more or less complete trunks. In fact, the Cycadophyta of the American Mesozoic are as important to the botanist as the gigantic saurians (with which they are often associated) are to the zoologist.

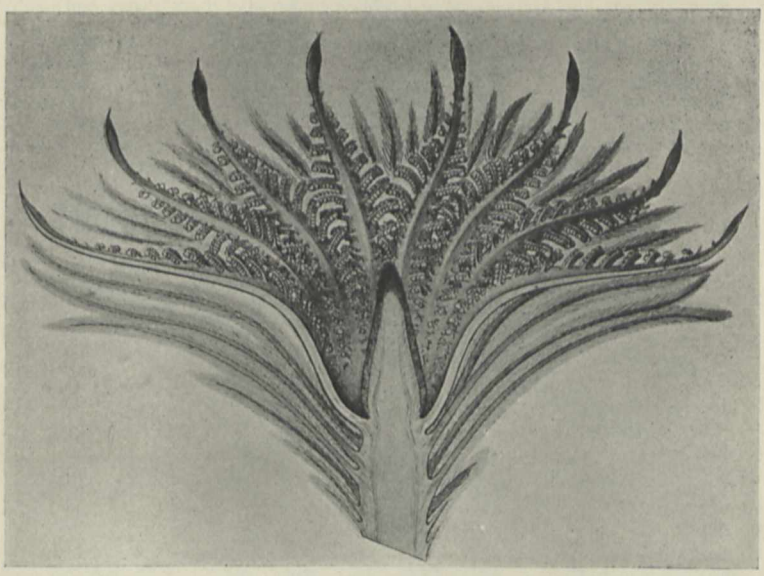

FIG. 2.—*Cycadeoidea ingens*. Restoration of an expanded bisexual flower in longitudinal section, showing the central ovuliferous cone, the compound stamens bearing numerous synangia, and the surrounding bracts, hairy with ramenta. About half natural size. From Wieland's "American Fossil Cycads."

Fig. 1 represents the first American fossil cycad ever discovered; it was found about 1860 in Maryland, between Baltimore and Washington, by the geologist, Philip Tyson, and well illustrates the external features of the group. A third of a century elapsed before any further discoveries were made, so the present magnificent material has been accumulated within quite a short period. The systematic arrangement of the specimens has been principally the work of Prof. Lester Ward, while the morphological investigation has fallen to the share of Dr. Wieland, of Yale University, to whom the discoveries we have now to consider are due. In referring to Dr. Wieland's work, I shall follow him in using the name Cycadeoidea, but it must be understood that this is synonymous, so far as we can tell, with Bennettites.

In external features, as well as in anatomical structure, the American species so far investigated agree wonderfully closely with the European species of Bennettites, but it must be remembered that the vast extent of the material will necessitate many years of arduous research before its investigation can be completed. During the eight years or so that Dr. Wieland has been at work, a marvellous amount has been accomplished. His results are embodied in a magnificent volume issued last August by the Carnegie Institution of Washington.[1]

The male organs of the Bennettiteæ were first found in 1899, in the species *Cycadeoidea ingens*.[2] Two years later the important fact was established that the organs of both sexes occurred in the same fructification, the whole thus constituting a "hermaphrodite," or bisexual flower.[3] Twenty-five trunks bearing bisexual flowers have now been investigated, belonging to seven American species. The conditions in *Cycadeoidea dacotensis*, one of the cases most fully investigated, are as follows. The whole fructification has a length of about 12 cm., and protrudes beyond the leaf-bases of the trunk. About half the length is occupied by the peduncle, the upper part of which bears 100 or more spirally arranged bracts, enclosing the essential organs. The centre is occupied by the ovuliferous cone, about 4 cm. in height, corresponding to the receptacle, with its seeds and other appendages, as found in *Bennettites Gibsonianus*. In *C. dacotensis*, however, the stage of development is far earlier, immature ovules taking the place of the ripe seeds of the more advanced European specimens. We have to do, then, in this case with an organ in the stage of a *flower*, as distinguished from the *fruit* previously described. The ovuliferous cone, or gynæcium, is completely surrounded by the hypogynous staminate disc, as Dr. Wieland calls it, springing from the rim of the receptacle at the base of the cone (see diagram, Fig. 2). The stamens are numerous (eighteen to twenty in *C. dacotensis*), and arranged in a whorl; their stalks are united to form a continuous sheath, which extends to about the level of the top of the gynæcium. Here they become free from each other; each stamen is a compound, pinnate sporophyll, about 10 cm. long altogether, and is folded inwards towards the gynæcium, the deflexed tip reaching down nearly to its base. The alternate pinnæ, of which there are about twenty pairs, are likewise bent inwards. The pinnæ, with the exception of those at the apex and base of the frond, which are sterile, bear the pollen-sacs in two rows, ten in each row on the longest pinnæ. Thus the stamens are highly complex organs, resembling the fertile fronds of a fern rather than the stamens to which we are accustomed in our modern flowering plants. The complexity, however, does not end here, for each pollen-sac is itself a compound structure containing two rows of loculi, ten or more in each row. It thus constitutes a *synangium*, comparable to that of the marattiaceous ferns, and especially the genus Marattia. The similarity to the fructification of such a species as *Marattia Kaulfussii* is, in fact, surprisingly close.

It appears that all the specimens actually investigated were in the bud condition, the stamens being still infolded, as described above. Presumably the stamens eventually opened out, and the diagrams introduced in Figs. 2 and 3 show them in the expanded condition. The ground-plan of the open flower, shown in Fig. 3, is based on *Cycadeoidea ingens*, a species in which the number of stamens is smaller than in *C. dacotensis*.

The leading features in the organisation of the Bennettitean flower may be briefly recapitulated as follows:—The centre is occupied by the gynæcium, seated on the convex receptacle, and consisting of numerous long-

[1] Solms-Laubach, "On the Fructification of *Bennettites Gibsonianus*." English translation in Ann. of Bot., v. 1891.

[1] "American Fossil Cycads." By G. R. Wieland (1906).

[2] "A Study of some American Fossil Cycads." Part i. The Male Flower of Cycadeoidea. Amer. Journ. Science, vii., 1899.

[3] Op. cit., Part iv. On the Microsporangiate Fructification of *Cycadeoidea*, Amer. Journ. Science, xi., 1901.

stalked ovules, imbedded among the interseminal scales. Surrounding this central body is the hypogynous whorl of stamens, fused below to form a tube, and expanding above into the pinnate sporophylls, bearing very numerous compound pollen-sacs or synangia, filled with pollen. The whole is surrounded by an envelope of spirally arranged bracts springing from the upper part of the peduncle. The general arrangement of parts is manifestly just the same as in a typical angiospermous flower, with a central pistil, hypogynous stamens, and a perianth. The resemblance is further emphasised by the fact, long known, that the interseminal scales are confluent at their outer ends to form a kind of pericarp or ovary-wall. When to these general features we add the practically exalbuminous character of the seed, with its highly organised dicotyledonous embryo, the indications of affinity with the higher flowering plants become extremely significant. The comparison was drawn by Dr. Wieland in 1901, immediately on his discovery of the hermaphrodite flower. The angiosperm which he specially selected for comparison was the tulip-tree, Liriodendron. The elongated strobiloid fruit, with many carpels spirally arranged in the receptacle, no doubt suggests similarity, and, on general grounds, we should naturally look for analogies among the less specialised polypetalous dicotyledons, such as Magnoliaceæ, in some of which the leaves of the perianth are spirally arranged. Analogies may also be found in our familiar Ranunculaceæ, such as Anemone, or, still better, the globe-flower (Trollius), with its numerous sepals, or, again, in the water-lilies (Nymphæaceæ). In certain respects, indeed, the Bennettitean flower was in advance of these more primitive dicotyledons, as seen in the arrangement of the stamens, which have abandoned the spiral phyllotaxis of the other organs to range themselves in a definite whorl, while at the same time their stalks are fused into a tube, thus becoming "monadelphous," as in the mallows of our own flora.

The flower, with its great stamens, 10 cm. long in some species, must have been a striking object when it opened (Figs. 2 and 3). As, of course, we can know nothing of the coloration of the perianth and other parts, we cannot tell how brilliant its appearance may have been; the bright tints of the carpels and ovules in some recent cycads, such as species of Cycas and Encephalartos, suggest the probability that the attractions of colour were not wanting to the more elaborate flowers of the older Cycadophyta; the possibility of a relation to the insect life of the period cannot be ignored. It is not my intention to push further the comparison of the Bennettitean fructifications with the angiospermous flower; the deeply interesting questions which must suggest themselves to the mind of every botanist, as to how far these manifest analogies are likely to indicate an immediate affinity, will be fully discussed elsewhere by others. Enough has been said to show that the remarkable organs discovered by Dr. Wieland fully merit the name of "flower," in the same sense in which we apply it, in everyday language, to the flowers of our gardens and fields.

As stress has been laid so far on the points of agreement with the flower of the angiosperms, some reference must now be made to characters which indicate relations in other directions. The structure of the gynæcium renders it probable, if not certain, that the Bennettiteæ were still gymnosperms as regards their mode of pollination, for the openings between the scales of the pericarp leave the micropyles of the seeds exposed. One must therefore suppose that the pollen was received by the ovule directly, without the intervention of a stigma, so that functional angiospermy had not yet been attained. This is, no doubt, a primitive condition, but it by no means excludes an affinity with angiosperms. Just as in Lagenostoma, the seed of the pteridosperm Lyginodendron, the beak of the nucellus was still the receptive organ for the pollen, in spite of the presence of an integument,[1] so, in the Bennettitean flower, the micropyle of the seed was still the receptive organ in spite of the presence of a pericarp. The integument in the one case and the pericarp in the other might be termed a "prophetic organ" in the only sense in which such organs exist, *i.e.* an organ which has not yet assumed all the functions to which it is destined.

The stamens, while by their arrangement and position they suggest those of a typical angiosperm, carry us back by their structure and form to the sporophylls of a fern (see Figs. 2 and 3), so that the characters of the flower as a whole may almost be said to bridge the gulf between cryptogams and the higher flowering plants. The fern-like characters, however, have probably come to the Bennettiteæ, not directly from true ferns, but through the intermediate group of the Palæozoic pteridosperms. The fact that the pollen-grains are borne in compound pollen-sacs, or synangia, like those of the Marattiaceæ among ferns, is one of great significance.[2] It is impossible to emphasise too strongly the extraordinary combination of characters which the Bennettitean flower presents, uniting in itself features characteristic of the angiosperms, the gymnosperms, and the ferns, and suggesting that the passage from the Filicineæ to the higher flowering plants may have been (comparatively speaking) a short cut. The complexity of this earliest known type of a true flower indicates the probability, as Dr. Wieland points out,[3] that

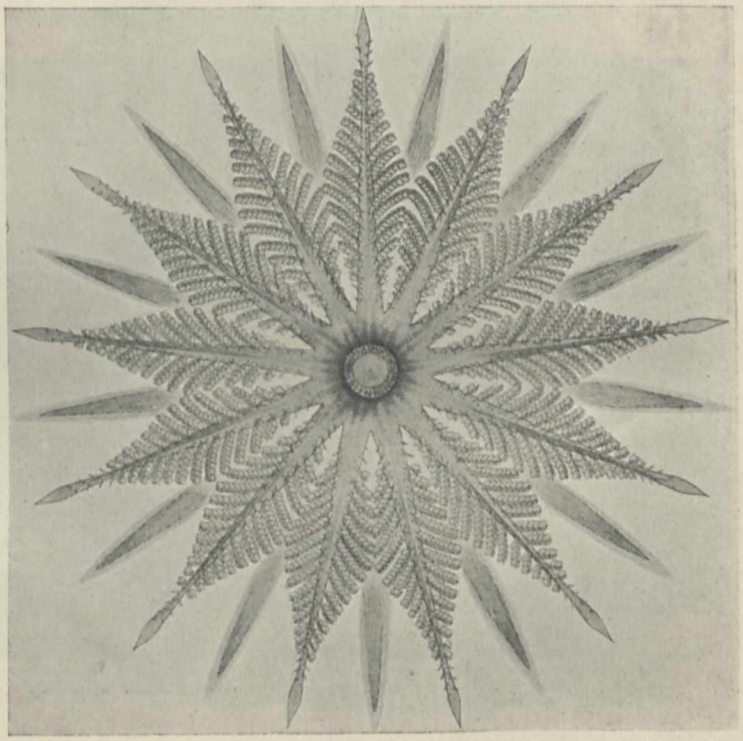

FIG. 3. – *Cycadeoidea ingens.* Plan of bisexual flower consisting of a central ovuliferous cone, a hypogynous whorl of compound stamens, united at the base, and a series of spirally inserted enveloping bracts, all shown diagrammatically on about the same scale as Fig. 2, and as if pressed out flat. From Wieland's "American Fossil Cycads."

[1] See Oliver and Scott, "On the Structure of the Palæozoic Seed *Lagenostoma Lomaxi*," Phil. Trans. Roy. Soc., Series B., 197 (1904), p. 231.

[2] The general question of the relation of the early seed-plants to fern is discussed in my article, "On the Present Position of Palæozoic Botany," Progressus Rei Botanicæ, Heft 1. 1906.

[3] "American Fossil Cycads," p. 143.

the evolution of the angiospermous flower was a process of reduction. There is thus no longer any presumption that the simplest forms among the flowers of angiosperms are likely to be the most primitive. The tendency of the older morphologists to regard such flowers as reductions from a more perfect type appears fully justified by the discovery of the elaboration of floral structure attained by the Mesozoic Cycadophyta before the advent of the angiosperms themselves.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The special board for biology and geology has approved a grant of 150*l.* from the Balfour fund made by the Balfour managers to W. E. Agar, of King's College, in furtherance of his proposed expedition to the Paraguayan Chaco.

The board of agricultural studies reports that the fund for providing the department of agriculture with a permanent building of its own has received substantial additions during the year, the conditional contribution of 5000*l.* by the Drapers' Company having been secured. The fund now amounts to 13,030*l.* 10*s.*

MANCHESTER.—Mr. F. T. Swanwick, Richardson lecturer in mathematics, has been appointed Fielden lecturer in mathematics in place of Mr. R. F. Gwyther, who is now devoting his whole time to the joint matriculation board of the northern universities. Mr. J. E. Littlewood (Cambridge) has been appointed Richardson lecturer in mathematics; he was bracketed senior wrangler in 1905, and was placed in the first division of the first class of part ii. of the mathematical tripos in 1906. Mr. H. M. Priestley (Cambridge) has been appointed assistant lecturer in mathematics; he was fifth wrangler in 1905, and was placed in the second division of the first class of part ii. of the mathematical tripos in 1906.

Plans have been prepared for new engineering laboratories, and building will shortly be commenced on a site on the north side of Coupland Street, near the present physical laboratories. For some time past need has been felt for this extension, and the new buildings will afford ample space for the whole work of the engineering department to be carried out under one roof. In addition to the main laboratory of 75 feet by 166 feet, lecture rooms, a large drawing room, and a boiler house are to be erected.

SIR ARTHUR RÜCKER, F.R.S., principal of the University of London, will distribute the prizes to the successful students at Guy's Hospital on Thursday, July 4.

SIR JOHN KENNAWAY, BART., M.P., will preside at the commemoration day proceedings of Livingstone College, Leyton, E., on Wednesday, June 5. Livingstone College exists for the purpose of solving one of the greatest problems connected with missionary effort, viz. the preservation of the health of missionaries and others in tropical climates.

IT is stated in *Engineering* of May 24 that the Technikum at Ilmenau, in Thuringia, is one of the few technical schools that are conducted in direct connection with commercial works. The director is also head of a firm of engineering and electrical works, and the students are, at all times, when not occupied by their regular lectures and laboratory practice, admitted into the works, in which advanced pupils can receive further training. The combination seems to answer.

IN the *Engineering Magazine* (vol. xxxiii., No. 2) Mr. H. Cole Estep discusses the attitude of technical students towards the engineering-apprenticeship courses which are offered by the leading manufacturers of the United States. He finds the attitude unsympathetic. The present low flat-rate system of wages is discouraging rather than encouraging to the average college student. The objections are also raised that the courses are too long, that there is no reward at the end, and that the invention clause existing in many apprenticeship contracts is unfair.

A COURSE of instruction in natural history has been arranged at the Horticultural College, Swanley, for students who, having passed through the ordinary training in gardening, wish for additional training in natural-history subjects, in order to qualify as teachers of gardening and nature-study. Other students will be admitted to the course provided they can show they are able to take full advantage of the instruction. Students will be given an insight into field work in natural history based on laboratory instruction; the work will be practical, and students will be shown how to prepare their own material and to construct their own apparatus. The course will last a year, of which the first two terms will be devoted to general work in botany, zoology, and geology, and the third term to special subjects. Fuller particulars may be obtained from the principal at the college, Swanley, Kent.

IN his presidential address to the Royal Geographical Society on Monday, May 27, Sir George Goldie again directed attention to the omission of geography in examinations for the Foreign Office and other branches of the Civil Service. For a good many years the Foreign Office stood in an exceptional position amongst the Civil Services of the Crown by including geography amongst the subjects for the entrance examinations of candidates and making a pass in this subject compulsory. After next month, however, geography will cease to be a subject which candidates for the Foreign Office may select even voluntarily. So many sons of the well-to-do classes of this country compete in examinations controlled by the Civil Service Commissioners that the standing in the whole educational sphere of any subject depends to some extent upon whether it is or is not a means of gaining marks in the civil and military examinations, and it may be asserted that if geography is included as one of the subjects of examination, it will very shortly take its place in Great Britain, as it has long since done in the United States, Germany, and other countries, as one of the fundamental and indispensable elements in the education of childhood and youth. That this has not been the case up to now is probably due to the unintelligent and unmethodical manner in which the subject was taught until a few years ago, with the result that the majority of those who are to-day in a position to speak with authority retain an entirely incorrect impression of its scope and objects. It is to the University of Oxford, supported, Sir George Goldie added, by the Universities of Cambridge, London, Edinburgh, and other great centres of education, that geographers must look for a satisfactory solution of this important question; for, so far as can be gathered from the correspondence on the subject which appeared some months ago, the Civil Service Commissioners are willing to consider the admission of geography as one of the voluntary subjects for examinations, provided the great universities will give a lead. In taking such a step, both the universities and the commissioners would have behind them the pressure of public opinion, owing to the sudden awakening both of interest in the Empire as a whole and of recognition of our widespread ignorance of its geographical conditions.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, January 31.—"On the Thermo-chemistry of Flame Spectra at High Temperatures." By Prof. W. N. **Hartley**, F.R.S.

(1) The oxides of calcium, strontium, and barium are not dissociated by heat alone, because they show no spectrum in a carbon monoxide flame; (2) they are reduced by the combined action of heat and hydrogen in the oxy-hydrogen flame and by the action of cyanogen in the cyanogen flame; (3) the flame coloration is due to the metal, because not only is the flame spectrum from lime essentially the same as that of the metal calcium, but also the heats of formation of CaO, SrO, and BaO have very nearly the same value, and that where calcium oxide can be reduced the other oxides could, on that account, undergo a similar reduction. Whether the compound of strontium or barium in the flame be a sulphide or an oxide, the same spectrum is emitted, but there is some

uncertainty as to whether the barium sulphide is not converted into oxide by water-vapour in the flame.

The explanation given by Lenard, of the flame coloration by the alkali salts, appears to be inapplicable to the coloration of the carbon monoxide flame by the haloid salts of the alkaline earth metals.

February 21.—"Longitudinal Symmetry in Phanerogamia." By Percy **Groom**. Communicated by Dr. D. H. Scott, F.R.S.

The paper describes a graphic method of recording the longitudinal distances apart of plant members, and gives results obtained by the method, which is as follows:—

On squared paper the successive internodes (or other segments) are recorded as successive ordinates, and the resultant curve is termed the internode curve (or other curve).

In a typical herb the internode curve of the main axis is a regular ascending-descending one, while those of the successive branches commencing at the base of the herb more or less completely and gradually change from this complete curve to a purely descending one. These internode curves are shown to be inherent, though liable to modification by external conditions.

In alternate-leaved Chenopodiaceæ the internode curve invariably shows a periodic zigzag form, and, by connecting the alternate ordinates, can be analysed into two "subcurves" which are frequently not synchronous in period. Both these subcurves of the main axis are of the ascending-descending type, while those of the successive branches traced from below more or less change into the purely descending form. Of the two subcurves, one is the "internode subcurve" and the other is the "displacement subcurve." Evidence is given in favour of the view that the original phyllotaxis of the Chenopodiaceæ was opposite, that the internode subcurve represents a modification of the original internode curve, and that the displacement subcurve represents a series of intercalated segments registering the distances up which single leaves have been displaced from the original opposite arrangement.

This view is confirmed by the fact that a similar displacement curve is formed by recording the heights of the successive branches above their subtending leaves in certain Boraginaceæ. It is shown, too, that the Boraginaceæ are probably opposite leaved in design, and that in *Solanum Dulcamara* the familiar leaf displacements high up the stem are foreshadowed by others lower down.

One point of significance in connection with these assumed hereditary displacements is that they follow the rule formulated by de Vries in reference to the dimensions and distribution of monstrosities.

The paper also discusses smaller or more fluctuating displacements of leaves; double-leaves; the correlation of alternate rather than successive internodes and nodes where phyllotaxis is cyclic; and the theory of stem structure.

Finally, the applicability of the method to other morphological problems is tested by observations on sympodes, with a positive result in the case of *Ampelopsis hederacea*.

March 14.—"Capillary Electrometer Records of the Electrical Changes during the Natural Beat of the Frog's Heart." By Prof. Francis **Gotch**, F.R.S.

The chief points brought forward in this communication are the following:—(1) The electrical changes during the natural rhythmic activity of the frog's heart, when kept *in situ* and supplied with blood, resemble in all essentials those observed by Waller, Starling, Bayliss, Einthoven, &c., in the mammalian heart, but do not correspond with those observed by Engelmann, Burdon-Sanderson, &c., in the excised frog's heart artificially excited. (2) The more prolonged character of the activity of the frog's heart, and the ease with which the locality of any change can be determined, render it clear that the special feature of the natural beat is the occurrence of two chief electrical changes of similar sign. (3) This is explicable as due to the first or base change being more prolonged and of greater magnitude than the apex change. (4) The increased duration and magnitude of the base change is mainly caused by the circumstance that, although the base change occurs first, the whole of the base is not involved, the portion around the spring of the aorta remaining quiescent until the activity has occurred at the apex; this aortic portion then becoming active produces the terminal effect. (5) Each contraction wave thus starting at the auriculo-ventricular junction is propagated to the apex, and returns from the apex to the part of the base around the start of the aorta; from this it spreads to the aortic bulb; at 15° C. the propagation rate is about 130 mm. in one second, *i.e.* 6/100″ after the first base change, an apex change is perceptible, and 6/100″ after the apex, a second aortic base change. (6) The return wave is brought into prominence when the heart is distended with blood, or has been so distended, and is associated with the persistence of the early tubular condition which prevails in the heart of the tadpole. (7) The return wave reveals itself in the records as a double reversal of the electromotive condition of the whole base contact; this is at first galvanometrically negative (base activity), then suddenly positive (apex activity), and then, again, suddenly negative (second aortic part of base activity). It is confirmed by records made under a variety of conditions, comprising local alterations of temperature, local injury, and altered position of electrometer contacts. All the records were those of the displacements of the capillary meniscus, photographed upon moving sensitised plates.

Entomological Society, May 1.—Mr. C. O. Waterhouse, president, in the chair.—*Exhibits.*—Coleoptera from Iceland: Mr. O. E. **Janson** exhibited a small collection of Coleoptera made by him in Iceland in July, 1906, comprising thirty-nine species, of which some were previously unrecorded as inhabiting that island. He also directed attention to the affinity between the beetle fauna of Iceland and of Scotland, only one of those taken, *Colymbetes groenlandicus*, Aubé, not occurring in both countries.—Larvæ of *Otiorrhynchus sulcatus*: Mr. J. A. **Clark** brought for exhibition living larvæ of *Otiorrhynchus sulcatus* feeding on the roots of ferns.—Coleoptera from the south of France: Commander J. J. **Walker** showed living specimens of *Oxythyrea stictica*, L., *Epicometis hirtella*, L., and *Anthaxia parallela*, taken by Dr. T. A. Chapman at St. Maxime, Var, S. France.—Mimetic relation of *Leuceronia argia*, ♀: Dr. F. A. **Dixey** exhibited specimens of seven different forms of the variable female of *Leuceronia argia*, Fabr., showing that each form stood in mimetic relation with a separate model. The models belonged to the genera Belenois, Phrissura, Pinacopteryx, and Mylothris, and the association was probably in every instance synaposematic.—Mimicry in Coleoptera: the **President** exhibited some Coleoptera collected in Pahang by Mr. H. C. Robinson, and recently received at the Natural History Museum.—Living luminous Coleoptera: Dr. G. B. **Longstaff** exhibited living specimens of the Elaterid *Pyrophorus noctilucus*, Linn., brought from Trinidad by Dr. F. L. J. M. de Verteuil, R.N.—*Quedius riparius* and *Trypodendron quercus*: Mr. H. St. J. **Donisthorpe** exhibited on behalf of Prof. T. Hudson Beare and himself specimens of *Quedius riparius*, Kell., and *Trypodendron quercus*, Eich., taken by them at Porlock, Somersetshire, on April 16 and 17. Also *Hydrovatus clypealis*, Shp., taken by them on April 14 at Worle, near Weston-super-Mare.—Dipteron associated with ants: Mr. **Donisthorpe** also showed the larva and pupa of a Dipteron of the genus Microdon, taken in a nest of *Formica fusca* at Porlock last month.—*Hemimerus talpoides*, Walk.: Mr. R. **Shelford** exhibited a specimen of the curious parasitic orthopterous insect *Hemimerus talpoides*, Walk., from Portuguese Guinea.—*Paper.*—A case of homœotic variation in a cockroach: R. **Shelford.**

Linnean Society, May 2.—Prof. W. A. Herdman, F.R.S., president, in the chair.—The respiratory mechanism in certain elasmobranchs: A. D. **Darbishire.** The author exhibited living examples of the dog-fish, ray, and angel-fish, and explained that the primary object of the investigation was to determine the question whether water went in, or was expelled, from the spiracle of the dog-fish. The method employed to elucidate this point consisted in liberating from a pipette some powdered carmine suspended in sea-water in the immediate vicinity of the spiracle. The cloud of carmine was seen to be vigorously drawn in at each inspiring phase. A remarkable difference was discovered to exist between the respiratory mechanism in the

dog-fish and the ray on the one hand, and the angel-fish, *Rhina squatina*, on the other, for whilst in the case of the former two fish the gill-covers are purely passive agents in determining the respiratory current, in the case of Rhina the undulation of the gill-covers seemed to be solely responsible for the flow of water into the spiracle and mouth.—The common elements of the fauna and flora of Abyssinia and West Africa: Prof. E. B. **Poulton.** The author based his remarks on his observations of a group of African butterflies. The paper was illustrated by a series of lantern-slides and a large orographical map.—The fauna of the Sudanese Red Sea: Prof. W. A. **Herdman.** Four papers of a proposed series on this subject were laid before the society; they consisted of (1) an introduction, by the president; (2) a narrative of Mr. Cyril Crossland's explorations; (3) Mr. Crossland's account of the formation of certain shore-cliffs in Egypt; and (4) of the Red Sea coral reefs; with (5) Mr. E. R. Sykes's enumeration of the Polyplacophora collected.—Pseudo-scorpions: C. J. **With.** The specimens described all belong to the British Museum. They comprise in the Australasian group, under the family Cheliferidæ, Hagen, four new species of the genus Chelifer, Geoffroy. In the Asiatic group three species of the same genus are re-described, one of them, which Pocock in 1900 referred to *C. javanus*, Thorell, being now named as a distinct species, *C. pococki*. A single species of Chelifer from Africa is the subject of comment, but notice is taken of the large additions to our knowledge of the Chelifer fauna in that continent recently made by Ellingsen. Under the family Garypidæ, Hansen, a new species of Garypus, Koch, is described from the island of Grenada; a new species of Olpium, Koch, from St. Vincent; and another from Stewart Island, New Zealand. Further, a species from Funafuti, which Pocock in 1898 referred to *Olpium longiventer*, Keyserling, is here transferred to the genus Garypinus, Daday, as an independent species, *G. oceanicus*; and another species, from Kauai in the Sandwich Archipelago, assigned by Eugène Simon in 1900 to *Olpium longiventer*, now becomes *Garypinus mirabilis*, n.sp. An appendix reviews the species *Chiridium ferum*, Simon, fam. Cheliferidæ, and *Ideoroncus cambridgei*, Koch, fam. Obisiidæ, chiefly with regard to peculiarities in the structure of the antennæ. The paper is accompanied by numerous illustrations, and contains many notes on distribution.

Zoological Society, May 7.—Mr. G. A. Boulenger, F.R.S., vice-president, in the chair.—Original drawings of *Spirochaeta anodontae* from the crystalline style and intestine of *Anodonta cygnea*: H. B. **Fantham.** This was the first record of the occurrence of this parasite in the British pond-mussel, though Keysselitz recorded probably the same organism from *Anodonta mutabilis* about a year ago, without giving its dimensions. The organism was found to be about 40 μ long and about 0·7 μ broad, with pointed ends and an undulating membrane. Its motion was most rapid, but seemed to be both spiral and vibratory.—The Cephalopoda of Zanzibar and East Africa collected by Mr. Cyril Crossland in 1901–2: Dr. W. E. **Hoyle.** The collection was not extensive either in point of individuals or species, and a large proportion were young individuals to which it was impossible to affix definite names in the present state of our knowledge. Five were identical with forms contained in a collection recently made by Prof. Herdman near Ceylon, whilst others occurred also in the Red Sea, thus showing a marked similarity in the cephalopod fauna of the whole of this region. Advantage had been taken by the presence of several specimens of *Sepioteuthis loliginiformis* to give a full description of that species. Some octopod embryos showed epidermal structures very similar to, if not identical with, those described by Chun as constituting a bristle coat in young octopods, and an account of these, as full as the material allowed, was given.—The mammals collected by Mr. M. P. Anderson during the Duke of Bedford's exploration of eastern Asia: O. **Thomas.** The present paper (the fifth of the series) gave an account of a collection from central Korea, just north and south of Seoul, the capital. Seventy-three specimens were dealt with, belonging to thirteen species, of which several were new, additional to those already discovered by Mr. Anderson during a previous visit to the southern part of the peninsula.—Some new buildings in Continental zoological gardens, based upon recent visits to those of Stellingen, Hamburg, Berlin, Dresden, Breslau, Vienna, Budapest, Frankfort-am-Main, Amsterdam, Düsseldorf, Rotterdam, and Antwerp: A. **Trevor-Battye.**

Physical Society, May 10.—Prof. J. Perry, F.R.S., president, in the chair.—Stereoscopy with long base-line illustrated on the screen: Dr. T. C. **Porter.** The use of a long base-line for telestereoscopy occurred to M. Selb, of Brussels, and in 1903 he obtained stereoscopic mountain photographs. The applications of the method for military, geographical, and meteorological purposes, although obvious, do not seem to have been used before, and the author discusses the possibilities of these applications.

PARIS.

Academy of Sciences, May 21.—M. A. Chauveau in the chair.—New determination of the metre in terms of lengths of luminous waves: R. **Benoit,** Ch. **Fabry,** and A. **Perot.** The length of the standard metre in terms of wave-lengths of the red ray of the spectrum of cadmium at 760 mm. pressure and 15° C. on the hydrogen scale was found as a mean of four series of experiments to be equal to 1,553,164·13 λ, whence $\lambda = 0{\cdot}64384696\ \mu$. These four series were selected from seven series which together gave a mean of 1 metre = 1,553,163·99 λ and $\lambda = 0{\cdot}64384702\ \mu$, but three of these seven series are to be omitted in calculating the absolute value. The authors point out, however, that the mean of the seven series agree in a remarkable manner with the value obtained at the International Bureau of Weights and Measures by Michelson, the originator of the idea, and M. Benoit in 1894, namely (after due correction), $\lambda = 0{\cdot}64384700\ \mu$. From the authors' results it is easy to see that if all standard metres were destroyed, a determination to within one ten-millionth of the actual value could easily be made.—The reduction of diketones by hydrogen in presence of reduced nickel: Paul **Sabatier** and A. **Mailhe.** Typical α-, β-, and γ-ketones were studied. Diacetyl, $CH_3.CO.CO.CH_3$, gives

$CH_3.CH(OH).CO.CH_3$ and $CH_3.CH(OH).CH(OH).CH_3$

on reduction. Three-fourths or more of the acetyl-acetone tested split up according to the equation

$$CH_3.CO.CH_2.CO.CH_3 + H_2 = CH_3.CHO + CH_3.CO.CH_3,$$

while acetonyl-acetone, $CH_3.CO.CH_2.CH_2.CO.CH_3$, gave chiefly oxyhexane 2·5, $CH_3.CH(\text{—}CH_2.CH_2\text{—})O.CH_3$. The authors are to continue similar work with the quinones.—Observations of the sun made at the Observatory of Lyons during the first quarter of 1907: J. **Guillaume.** Tables are given of the distribution of spots and faculæ as regards latitude.—The variation of double integrals: M. **Hadamard.**—Continuous, infinite, and simple groups of transformations (mathematical analysis): E. **Cartan.**—The surfaces produced by a circular helix: M. **Barré.**—The absolute sensibility of the ear: Henri **Abraham.** The sensibility of the ear was determined in absolute value by producing in it variations of pressure of known amplitude. The variations of pressure were produced in a cylinder of known volume by the vibrations of the membrane of a telephone, which formed one of the bases of the cylindrical cavity. The other base of the cylinder was also closed, except in the centre, where an opening connected with a bell-shaped orifice, which could be applied against the ear, was arranged. The results obtained seem to show that the limit of the sensations of the normal ear corresponds to variations of pressure having a magnitude of four ten-millionths of a millimetre of mercury. The author points out that his results agree approximately with those of Max Wien, who measured variations of pressure in Helmholtz resonators, but that they do not agree—being much smaller—with the values of different authors, who have used methods analogous to that indicated some time ago by Lord Rayleigh.—The ultimate lines of metals in dissociation spectra: A. **de Gramont.** A summary of the lines which may be regarded as specially characteristic for a number of common metals is given, and it is indicated that the lines termed ultimate by the author are the same

In the condenser-spark, in the ordinary spark discharge without condenser, in the electric arc, and in very hot flames.—Application of Trouton's law to the determination of molecular rise of boiling point of solutions: D. E. **Tsakalotos.**—Explosive mixtures of air and ether: J. **Meunier.** The lower limit of inflammability is about 58 to 60 milligrams of ether per litre of air, and the upper limit is about 200 milligrams. From 100 to 175 milligrams per litre it is more or less explosive.—The removal of water from alcohol by the catalytic action of red phosphorus and the phosphates: J. B. **Senderens.**—The action of magnesium amalgam on the aldehydes: André **Kling** and Paul **Roy.** Certain compounds such as polymerised formaldehyde (trioxymethylene) and chloral do not react, but others, *e.g.* acetic and benzoic aldehydes, react readily.—The double compounds of aluminium sulphide with the protosulphides of chromium, nickel, cobalt, and magnesium: Marcel **Houdard.** Al_2S_3MnS, Al_2S_3FeS, and Al_2S_3CrS were isolated and analysed. They are considered to be similar to spinels in crystalline form and structure.—The dissociation of silicates of lithium: Edgard **Derome.**—Study of the calcium salt of paraoxybenzoic acid: Œchsner **de Coninck.**—The products formed by the condensation of ethyl oxalate with dimethylaniline in presence of aluminium chloride: A. **Guyot.**—Synthesis of ketones of the hexahydroaromatic series: G. **Darzens** (*cf. Comptes rendus*, vol. cxlii., p. 714).—Metallic thiosulphocarbamates: preparation of sulphocarbimides of the fatty series: Marcel **Delépine.**—The respiration of the vegetative aërial organs of vascular plants: G. **Nicolas.** The author summarises his results as follows:—(1) the different aërial organs of vascular plants have each their own intensity and special respiratory quotient; (2) the stalk and the petiole have generally intensities and respiratory quotients similar to each other; (3) of all aërial organs, those which are essentially charged with the assimilatory function are those which have the greatest respiratory intensity and the lowest respiratory quotient.—Properties of the pigments of batrachians: A. **Magnan.** The properties, including solubility, of green, yellow, brownish-yellow, red, and black pigments are described.—The reaction of the tissue of the iris to light: A. **Nepveu.** The iris is irritable to light in cephalopods, fish, and birds, but not in mammals.

DIARY OF SOCIETIES

THURSDAY, MAY 30.

ROYAL SOCIETY, at 4.30.—The Solubility of Air in Fats, and its Relation to Caisson Disease: Dr. H. M. Vernon.—Mitosis in Proliferating Epithelium: Dr. J. O. Wakelin Barratt.—An Experimental Inquiry into the Nature of the Substances in Serum which Influence Phagocytosis: Dr. G. Dean.—The Correlation of Ovarian and Uterine Functions: E. S. Carmichael and Dr. F. H. A. Marshall.—Report of Private Expedition to Philippeville, Algeria, to view the Total Solar Eclipse, August 30, 1905: Dr. T. C. Porter and W. P. Colfox.

ROYAL INSTITUTION, at 3.—Chemical Progress—Work of Berthelot, Mendeléeff, and Moissan: Sir James Dewar, F.R.S.

SOCIETY OF ARTS, at 4.30.—Irrigation Colonies in India: Laurence Robertson.

FRIDAY, MAY 31.

ROYAL INSTITUTION, at 9.—Recent Journey Across Africa: A. Henry Savage Landor.

SATURDAY, JUNE 1.

ROYAL INSTITUTION, at 3.—The Contest between Guns and Armour: Sir William H. White, K.C.B., F.R.S.

MONDAY, JUNE 3.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—The Nature of, and Changes involved in the Production and Setting of Plaster of Paris: W. A. Davis.—The Analysis of White Lead: W. A. Davis and C. A. Klein.—A Calorimeter for Volatile Liquid Fuels, specially adapted for Petrol: W. Hansen Rawles.—Influence of Temperature of Dyeing on Resolution: W. P. Dreaper and A. Wilson.—The Loss of Nitre in the Chamber Process, Part iii.: J. K. H. Inglis.

INSTITUTE OF ACTUARIES, at 5.—Annual General Meeting.

TUESDAY, JUNE 4.

ROYAL INSTITUTION, at 3.—Malaria, Sleeping Sickness, Tick Fever, and Allied Diseases: Prof. G. F. Nuttall, F.R.S.

WEDNESDAY, JUNE 5.

ENTOMOLOGICAL SOCIETY, at 8.—Bionomic Notes on some South African Insects: Dr. G. B. Longstaff and Dr. F. A. Dixey.

GEOLOGICAL SOCIETY, at 8.—Brachiopod Morphology: Cincta, Eudesia, and the Development of Ribs: S. S. Buckman.—A Marine Fauna in the Basement-beds of the Bristol Coalfield: Herbert Bolton.

SOCIETY OF PUBLIC ANALYSTS, at 8.—Note on Horse Fat and "Animal" Oil: H. Dunlop.—A Method for Determining Caustic Lime in Fertilisers: J. Hendrick.—The Rapid Estimation of Total Solids in Milk: C. Revis.—The Reducing Action of Hydrogen, iii., The Reduction of Molybdic and Vanadic Acids: A. C. Chapman and H. D. Law.

THURSDAY, JUNE 6.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: On the Two Modes of Condensation of Water Vapour on Glass Surfaces, and their Analogy with James Thomson's Curve of Transition from Gas to Liquid: Prof. F. T. Trouton, F.R.S.—The Mechanical Effect of Canal Rays: A. A. Campbell Swinton.—The Distribution of the Blue and Violet Light in the Corona on August 30, 1905, as derived from Photographs taken at Kalaa-es-Senam, Tunis: Prof. L. Becker.—On the Velocity of Rotation of the Electric Discharge in Gases at Low Pressures in a Radial Magnetic Field: Prof. H. A. Wilson, F.R.S., and G. H. Martyn.—The Osmotic Pressure of Compressible Solutions of any Degree of Concentration: A. W. Porter.

LINNEAN SOCIETY, at 8.—Contributions to our Knowledge of the New Zealand Holothurians: Prof. A. Dendy and E. Hindle.—Observations on Australasian Polyclads: Prof. W. A. Haswell.—Report on the Marine Fishes collected by Mr. J. Stanley Gardiner in the Indian Ocean: C. Tate Regan.—The Lithothamnia of the *Sealark* Expedition: M. Foslie. Notes sur les Ixcdidæ recueillis dans les îles de l'Océan Indien, par M. J. Stanley Gardiner: Prof. L. G. Neumann.—*Exhibitions: Orobanche Ritro*, and some New Varieties of Plants from the Channel Islands: G. Claridge Druce.

ROYAL INSTITUTION, at 3.—Chemical Progress—Works of Berthelot, Mendeléeff, and Moissan: Sir James Dewar, F.R.S.

CHEMICAL SOCIETY, at 8.30.—The Relation between Absorption Spectra and Chemical Constitution, Part vii., Pyridine and some of its Derivatives: F. Baker and E. C. C. Baly.—The Interaction of Methylene Chloride and the Sodium Derivative of Ethyl Malonate: F. Tutin.—Molecular Weight of β-Naphthol in Solution in Solid Naphthalene: E. P. Perman and J. H. Davies.—Synthesis of Hexatriene Derivatives, Preliminary Notice: I. Smedley.—The Constitution of the Diazo-Compounds: J. C. Cain.—*p*-Cresol Sulphoxide and Sulphide: S. Smiles and T. P. Hilditch.—*p*-Dioxyphenylsulphoxide: S. Smiles and A. W. Bain.—Coloured Azo-derivatives of 1:3-Diphenylbarbituric Acid. Dynamic Isomerism among the Hydrazones of 1:3-Diphenylalloxan: M. A. Whiteley.—Dibromoaminoazobenzene: J. T. Hewitt and N. Walker.

FRIDAY, JUNE 7.

ROYAL INSTITUTION, at 9.—Studies in High Vacua and Helium at Low Temperatures: Sir James Dewar, F.R.S.

GEOLOGISTS' ASSOCIATION, at 8.—The Chalk of Surrey, Part ii., The Western Area: G. W. Young.

SATURDAY, JUNE 8.

ROYAL INSTITUTION, at 3.—The Contest between Guns and Armour: Sir William H. White, K.C.B., F.R.S.

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