THURSDAY, APRIL 10, 1919.

## MODERN OPTICAL INSTRUMENTS.

*The Theory of Modern Optical Instruments: A Reference Book for Physicists, Manufacturers of Optical Instruments, and for Officers in the Army and Navy.* By Dr. Alexander Gleichen. Translated from the German by H. H. Emsley and W. Swaine. With an appendix on "Rangefinders." Pp. xii+376. (London: His Majesty's Stationery Office, 1918.) Price 12*s.* 6*d.* net.

THE book before us is of special interest, because it is the first of several German treatises on optical subjects which were selected for translation into English by the Standing Committee on Glass and Optical Instruments, appointed in December, 1916, by the Advisory Council for Scientific and Industrial Research.

There can be but little doubt that Dr. Gleichen's book was included by the Committee primarily on account of the unusually complete descriptions and illustrations of modern optical instruments which fill the greater part of the volume. Its title is, in fact, somewhat misleading, for the theoretical part does not go beyond elementary principles, and is not by any means exhaustive even with regard to these. To be really useful, a theory of modern optical instruments must deal chiefly with the aberrations, and especially with those of higher order. For with regard to telescopes a dictum of the elder Steinheil is still true, that "all improvements of these instruments have aimed, consciously or unconsciously, at making them shorter"; with regard to microscopic lenses the chief aim is to increase the numerical aperture and to extend the useful field without loss of definition, and with photographic objectives fine definition, freedom from distortion, rapidity, and a flat field of wide angle are the principal desiderata and subjects of competition. In every case success depends almost entirely on skilful distribution of the higher aberrations and on the discovery of types in which these are of sufficiently small magnitude. On this important subject the book before us is practically dumb.

Following the eighty-four pages devoted to the elementary theory, we find chap. vi., in which the human eye is very fully and clearly dealt with. The author returns to this important subject in chap. xv., in which the more elaborate aids to defective vision are described, and ophthalmoscopes are also reviewed in a very lucid manner.

The description of telescopes is found in chap. ix. Prismatic instruments naturally receive most attention. Designers will welcome the large number of different types of erecting prisms, of which clear illustrations are given, but will look in vain for details of the essential constructional data and for a discussion of the conditions on which perfect results depend.

Rangefinders are dealt with in chap. xi. It will be taken for granted that German instruments monopolise the author's attention. This deficiency is very fully rectified by an appendix to the book, in which the translators (both of whom are members of Messrs. Barr and Stroud's staff) give a full and excellent account of British rangefinders. This appendix concludes with a description and illustrations of a captured German rangefinder made by Goerz.

Chap. xii. will be welcomed by English opticians, because it gives useful information on cystoscopes, which up to the time of the outbreak of war were practically a German monopoly.

The chapter on the microscope is too short to do justice to this instrument.

Photographic objectives are the subject of chap. xiv. This chapter contains a large amount of useful information and numerous detailed formulæ of actual lenses—mostly modern—which will provide interesting material for study by designers of such instruments.

A curious and possibly significant omission in the book is that there is no definite mention at all of submarine periscopes; there is only a vague hint on p. 160 that they "may have a length of several metres."

It will have been gathered that the work, whilst not quite answering to its principal title, contains a large amount of information not otherwise readily accessible, and that it should therefore prove of value as a reference-book. Its utility in this respect is enhanced by a bibliography and a very complete alphabetical index at the end.

The translation is very well done, and, in addition to the appendix already mentioned, the translators have inserted numerous notes at the ends of various chapters and at the foot of pages, all of which are to the point and of decided value.

A. E. C.

## THE USEFULNESS OF PSYCHOLOGY.

(1) *Present-day Applications of Psychology, with Special Reference to Industry, Education, and Nervous Breakdown.* By Lt.-Col. Charles S. Myers. Pp. 47. (London: Methuen and Co., Ltd., 1918.) Price 1*s.* net.

(2) *War Neuroses.* By Dr. J. T. MacCurdy. With a Preface by Dr. W. H. R. Rivers. Pp. xi+132. (Cambridge: At the University Press, 1918.) Price 7*s.* 6*d.* net.

IF evidence be required as to the threadbare condition of the old gibe at psychology as a statement of obvious facts in unintelligible language, we have it in abundance in these books by Col. Myers and Dr. MacCurdy. For, while the clarity of the authors' expression is obviously the natural outcome of a firm grasp of their subjects, the facts which they present are probably far from obvious to the mind which is not conversant with the rapid progress of present-day psychology. Moreover, these unobvious facts are not mere freakish curiosities, but important strands in the material of our social life.

(1) For example, Col. Myers, in discussing the important problem of the length of the working day, does more than state the proved fact—once apparently so paradoxical, to-day merely an item in an alert mind's common sense—that diminution of hours of work may be followed by increase of output; he gives an analysis of the physiological and psychological factors affecting work, an account which explains convincingly how this may come about. We are also reminded of the necessity for helping people to realise the principles underlying efficient work, and to see the distinction between "shorthand methods of work" and "speeding-up." This education is noted as urgently desirable for both employers and employees.

In a condensed, but highly suggestive, form such problems as the investigation of individual differences, the selection of workers for special tasks, and the modern conceptions of the nature and treatment of nervous breakdown are discussed in a way which should convert many to the study of modern psychology. The success attending the early treatment of cases of mental and nervous disorder arising in our armies is graphically described, but we are reminded that "hitherto in this country, during peace-time, such neurasthenic patients have had no treatment beyond a bottle of medicine at the out-patient department of a neighbouring general hospital. They have not been admitted to a general hospital unless they have shown some functional paralysis, nor to an asylum until their condition has become one of certifiable insanity."

(2) In his treatment of the nervous breakdowns of the war, Dr. MacCurdy lays welcome stress upon a part of this subject which has tended of late to become overshadowed by others. Widespread interest has been shown in the striking "objective" disturbances of the war psychoneuroses—the blindnesses, deafnesses, mutisms, paralyses, and contractures—and by their equally dramatic cures. Dr. MacCurdy, however, does not forget that there exists another large class, the "anxiety neuroses," whose mental sufferings, although (perhaps because) they do not express themselves in obvious bodily disturbances, equally call for skilled treatment. He offers an interesting and important speculative analysis of the causes which lead to these two different groups of disability, the "conversion hysteria" and the "anxiety neurosis." The whole book is an expression of his sympathetic understanding of the mental factors which make for success or failure, not only in war, but also in peace.

The wealth of psychological material contained in these two books, and the convincing evidence of its usefulness, adequately support Col. Myers's plea for "institutes of applied psychology in each of our largest cities, which may serve as centres for attacking these practical problems with the help of experts trained both in psychology and in the particular branch in which its help is needed, and with the active, enlightened sympathy of the general public."

## A MELANESIAN DICTIONARY.

*Dictionary and Grammar of the Language of Sa'a and Ulawa, Solomon Islands.* By Walter G. Ivens. With appendices. Pp. vii + 249 + 11 plates. (Washington: Carnegie Institution of Washington, 1918.)

THE Solomon Islands form the racial centre of the Oceanic world. On the south are the Melanesians, on the east the Polynesians, whilst westward the Melanesians blend with the Papuans, and northward the Micronesians link both Melanesians and Polynesians to the Indonesians. In the Solomons, also, are found remnants of a more primitive people who occupied the islands before their present inhabitants came from the west. But, although thus important, the peoples of this region have received comparatively little attention from anthropologists, and there are only partial records of customs, languages, and folk-lore. In this dictionary Dr. Ivens has put together his collections of words in representative languages of one part of the Solomon group. These are the Sa'a, at the southern end of the large island of Malaita, and the Ulawa (Contrariété Island of the charts), about thirty miles to the east of Sa'a. Both languages come from a common stock, and the author has found it quite practicable to adjust grammar and dictionary to the same method of arrangement. The language fairly represents the speech of the island of Malaita, and, with the Tolo and Lau spoken to the north, forms a transition between the languages of San Cristoval and those of Guadalcanar and Florida.

The Sa'a-English part of the dictionary comprises 113 two-column pages of small but very distinctly printed type, with twenty pages of English index. Several subjects of interest are dealt with in the appendices. There is a combined grammar of the languages and an account of Melanesian linguistics, which, besides a general description, deals with such practical matters as the learning of the languages and translation work. Here the author points out the relation between Melanesian and Polynesian, and rejects the theory that Melanesians have adopted Polynesian words and forms of speech. He supports the view that the languages belong to the same family, the Melanesian being the older and less worn type. This will be evident to the student using the Sa'a dictionary. Though examples such as *maa*, eye, *i'a*, fish, might be thought loans from Polynesian, which has the words as *mata* and *ika*, other words, as, *e.g.*, *teru*, bone needle, *ute*, rain, *tala*, path, show no trace of borrowing from the Polynesian equivalents *au*, *ua*, and *ala*, because they have developed—according to fixed laws—from originals which are found even in Indonesia, as, *e.g.*, *jarum*, *ujan*, *jalan*. Sa'a turns *j* into *t*, while Polynesian loses both the *j* and the *r*.

Another linguistic problem which this dictionary may help to solve relates to the connection of the Solomon Islands with New Guinea. The Sa'a phonology is similar to that of New Guinea, espe-

cially about Hood Bay, where the names Bula'a and Hula are suggestive of Ulawa, and of Pululaha on the coast of Malaita. The New Guinea *ama*, father, *ma*, eye, *vio*, hungry, *mauu*, sleep, appear in Sa'a as *ama*, *maa*, *hi'olo*, and *ma'uru*, and there are agreements in grammar as well as in vocabulary.

These are but two of the points which may be raised by the purely linguistic portion of Dr. Ivens's book. The other appendices deal in a general way with Melanesian customs and with the romantic history of the Melanesian mission and the "yacht" cruises of its apostles Selwyn and Patteson. There is a chapter on the "blackbirds" of the labour traffic, and also an account of the Santa Cruz Islands, so tragic in geographical and missionary history.

Dr. Ivens's book will be exceedingly useful to students of Melanesian history and languages, whilst the general reader will find in his supplements a great deal of most interesting information about a region which, although so close to the great southern commonwealth, is singularly little known. SIDNEY H. RAY.

## OUR BOOKSHELF.

*Evolution and the Doctrine of the Trinity.* By the Rev. S. A. McDowall. Pp. xxvi+258. (Cambridge: At the University Press, 1918.) Price 9*s.* net.

IN a previous volume, "Evolution and the Need of Atonement," Mr. Stewart McDowall sought to show the necessity for a teleological interpretation of the evolution-process. He continues his adventurous thinking, which is always welcome, and his aim is to restate the doctrine of the Trinity in terms that are consonant with modern thought, or with certain lines of modern thought. The truth of a doctrine does not stand or fall, he says, with the terminology in which it is expressed, and he considers the doctrine of the Trinity *sub specie evolutionis*, so to speak.

Starting from a theistic position, recognising the Being of God as the Ground of Reality, Mr. McDowall thinks of the material universe as the medium in which a certain definite purpose is realised—namely, the development of personality. This is a unique end which justifies the whole in a way that the Giant Reptiles, for instance, did not. According to our author, Man is in eternal life already, and his nature and experience are the same as God's, differing only in degree. The psychologist divides the mind-states into *cognition*, *affection*, and *conation*; the philosopher analyses human personality into three constituents: *will*, *intellect*, and *emotion*; the theologian conceives God as *Father*, *Son*, and *Spirit*. What is true of the developing personality of man must be *a fortiori* true of the developing personality of God. Hence the evolutionary re-formulation of the doctrine of the Trinity.

Such with all the injustice of condensation is the author's central thesis. To the conventional physiologist who sums up man as mechanism, it will doubtless appear highly metaphorical, but he might be none the worse for carefully studying, for instance, Mr. McDowall's very competent discussion of Freudian psychology. We have much doubt, however, whether the author really answers his own question in regard to the whole evolution-process: "Could the stages, even the human stage, be passing time-phases in the development of something far greater than we can even begin to understand?"

*A Manual of Geometrical Crystallography. Treating solely of those Portions of the Subject useful in the Identification of Minerals.* By Prof. G. Montague Butler. Pp. viii+155. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1918.) Price 7*s.* net.

IN this elementary text-book the information is given mainly in the form of a series of definitions, and is not easy to follow, even with some previous knowledge of the subject. A beginner, especially one attempting to work alone, would very likely soon become hopelessly confused. The book is, however, no doubt intended for the author's own students in the University of Arizona. The various hemihedral and tetartohedral "divisions" of each system are developed by the older method of suppression of certain faces or groups of faces of the holohedral form, and little use is made of the more important ideas of symmetry. The number of the planes of symmetry appertaining to each division is, however, clearly stated; but reference to axes of symmetry is omitted, except in the incorrect definition: "A symmetry axis is a line or direction perpendicular to a symmetry plane and passing through the centre of the object." Another definition runs: "A hemimorphic crystal is one in which the law of axes is violated"; and such crystals are disposed of in some other division. Including hemimorphic crystals, twenty-two of the thirty-two possible crystal-classes are dealt with, but, since for some of them there are no examples amongst minerals, the statement on the title-page is rather beside the point. Precise instructions for "orienting crystals" are repeated under each crystal-class, but, strange to say, few of the text-figures are set quite straight on the page. By an unfortunate error the title of the book appears on the cover as "Geometrical Chrystallography."

*Highways and Byways in Northamptonshire and Rutland.* By Herbert A. Evans. With illustrations by Frederick L. Griggs. Pp. xvi+367 +map. (London: Macmillan and Co., Ltd., 1918.) Price 6*s.* net.

PERHAPS no two counties in England have preserved their old-world charm so well as Northamptonshire and Rutland. A great deal of the daily traffic between London and the industrial North and between London and Scotland passes through them without leaving any impress upon their placid existence. Industry has not supplanted agriculture in these two counties; they still retain the characteristics of England of a century or two ago. Mr. Evans has not aimed at writing a guide-

book or a complete account of the geography and history of Northamptonshire and Rutland. He leads his readers in rambles through the countryside, dwelling principally in his descriptions on church architecture and historical anecdote. Modern developments find little place in the book, and the scenery and physical features are only lightly touched on. It is a book written by an archæologist for leisured readers of a like mind to whom Northampton and Rutland are native shires. Judged from that point of view, it is well written and full of interest. More than a hundred drawings by Mr. F. L. Griggs ably illustrate the volume, and there is a well-executed map.

## 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.]*

### Marine Research at St. Andrews.

IN his letter published in NATURE of March 27 Prof. McIntosh states that, while the country is spending large sums of money on international marine investigations, the Gatty Marine Laboratory of St. Andrews is closed for lack of funds. He also points out that the Gatty Marine Laboratory and its predecessor at St. Andrews were the institutions where many marine zoologists, now occupying important positions here and in the Colonies, received their training.

In spite, however, of the manner in which the laboratory has been ignored by the Government Departments which might have been expected to give it support, it has been the centre for important marine research, the results of which must be appealed to and recognised long after much of the undigested material accumulated under more pretentious conditions has been buried under thick layers of dust on Government shelves. It is certainly a pity that in this country the three Government Departments concerned with marine investigations work independently of one another, and that each in turn is prepared to adopt a similar policy with reference to the marine laboratories.

The marine laboratories have claims which, at the present time when schemes of reconstruction are being considered, should not be forgotten—first, as useful adjuncts of the biological teaching of our universities; secondly, as centres for training those who are to take part in marine investigations; and, thirdly, as institutions where marine investigations are carried out, often to a large extent by voluntary workers.

Surely, then, before the Government enters upon schemes of investigation, whether national or international, involving the expenditure of large sums of public money, the first endeavour should be to see that those institutions which have already proved so valuable are maintained and developed to their fullest extent.

A. MEEK.

Dove Marine Laboratory, Cullercoats,
Northumberland, March 31.

### The Machinery of Government.

THE quotation from Carlyle with which the article on the above subject opens in NATURE of April 3 is singularly appropriate—"A man without a purpose is like a ship without a rudder"—and the comments of the writer are very useful. I add another quotation from a more obscure source: "A man of great knowledge and unwearyable perseverance can really, by constantly pressing upon Ministers and Departments, do more than a tired and harassed official to shape public ends." There is a substratum of truth in this. The State Department lacks initiative. The Minister's time is taken up in assisting to run the political machine, in doing what is brought to him from his Department, and in seeing through such things as may arise in Parliament in connection with his Ministry. The Department itself is engaged in administrative work, and has little time, or perhaps little inclination, for devising reforms in the interests of the industry it represents. It may be argued by the Department that such is not the work of an administrative Department; and those relying on a Department for taking the initiative in any reform should consider whether they are entitled to do so.

No one should know better the wants of an industry than the more intelligent and far-seeing among the people who carry it on, and it is for them to see that some means is provided for direct access to the Department for suggestion and consultation. This can be done by the appointment of an advisory council as suggested in the Report of the Machinery of Government Committee. It is a matter of the highest importance to the industries of this country that when a Department is approached with this end in view it should receive the suggestion with sympathy.

The methods of appointing the members of an advisory council should be such as to secure, so far as possible, the appointment of men in whom those in the industry have confidence.

A. J. BRANDER.

### Visualisation of Features.

MAY I direct the attention of readers of NATURE to a strange trick that I have found my memory to play me for many years? It occurs in the process of recollection of visual impressions ("visualisation") of faces.

Suppose, now, that I am attempting to visualise a face not seen for some time, and that I recollect the lower lip to be slightly pendulous, while the nose is large and rather prominent—well, I can visualise each separate feature correctly, but, so soon as I attempt to visualise the face *as a whole*, the features are grotesquely exaggerated, so that the lip (to take the above case) appears as a huge, pendulous, quite unnatural growth, and the nose as an equally absurd and grossly unreal structure.

My meaning may not be very clear to all, but if any other readers have had similar experiences, they will, no doubt, understand it. There is possibly some scientific explanation forthcoming; if so, I should be glad to hear of it.

R. F. POWELL.

Hodgsonites, Charterhouse, Godalming,
Surrey, March 19.

### The "Atom."

"TO-DAY many chemists and physicists think that the chemical atoms of the last century are no longer to be considered as indivisible. In that case the old Greek name 'atom' is no longer fitting, because it denotes indivisibility." The above sentences are quoted from the presidential address of Prof. T. W. Richards, published in NATURE of March 27.

Fifty years ago Prof. Brazier taught us, his students at Aberdeen University, very emphatically that the word "atom" must be taken in its *primary* Greek meaning of *uncut, undivided*—not as indivisible, but as what had not hitherto been divided. This was long before the discovery of radio-activity.

A. A.

## THE DOMINION OF CANADA'S 72-IN. TELESCOPE.

ALTHOUGH the reflecting telescope of the Dominion Astrophysical Observatory, Victoria, B.C., is exceeded in size by the 100-in. Mt. Wilson reflector, now nearly completed, it has had the distinction of being for some months the largest in operation in the world. The Government of Canada is to be congratulated on carrying through to completion during the war this great undertaking, which gives every promise, so far as quality and efficiency of the equipment are concerned, of being a very large factor in astronomical research.

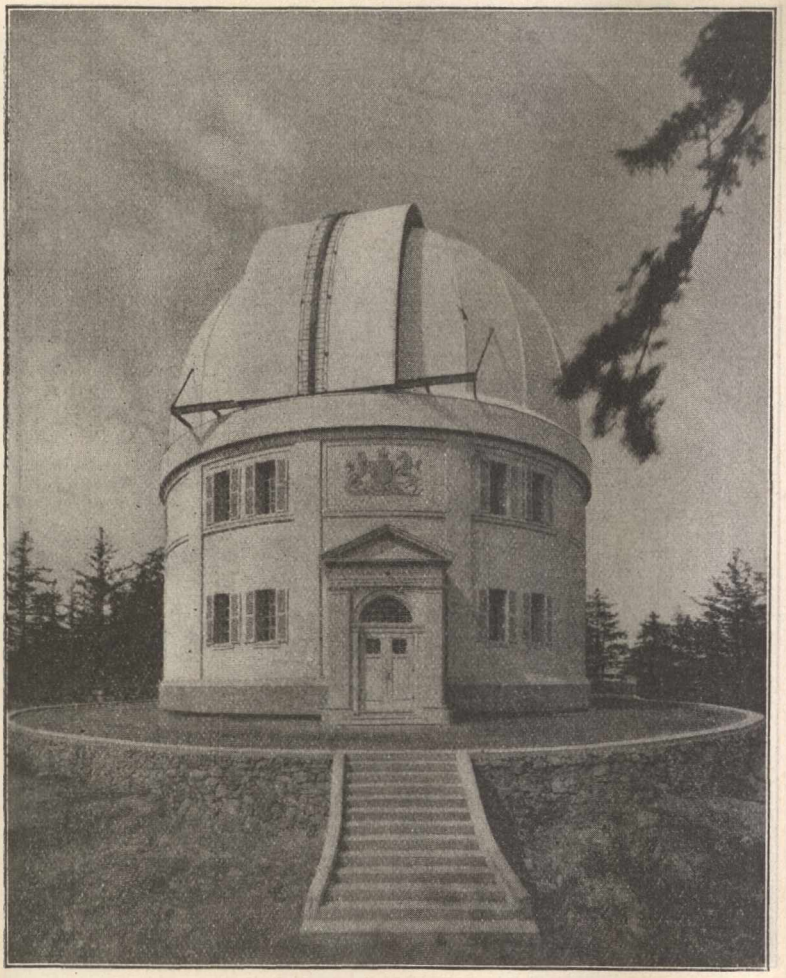

FIG. 1.—The observatory building from the south.

A preliminary description of the mounting of this telescope was given in NATURE of February 15, 1917, but its final completion last May, and its continuous use since then in regular observational work, merit a short statement of the quality of the optical parts and of the work being done and proposed to be done with this splendid instrument.

The mounting was completely erected in its dome and building on Observatory Hill (Fig. 1), about eight miles north of the city of Victoria, in October, 1916, but the principal mirror and other optical parts of the telescope were not finished until April, 1918. The delay was due partly to the impossibility of obtaining a large disc of glass for an auxiliary flat to be used in testing the figure of the paraboloid, and partly to the increased difficulty in figuring caused by the presence of the central hole in the main mirror. However, the figuring was finally completed early in April, 1918, and on testing the mirror at the centre of curvature by visual measurements of the radius of curvature of several zones of the surface, and also by means of the Hartmann method of extra-focal photographic exposures, the whole surface was found to be remarkably close to the required theoretical form. The deviations of any part nowhere correspond with a greater longitudinal aberration at the principal focus than 0·25 mm. (0·01 in.), and this for a median zone. This is equivalent to a lateral aberration of less than one-tenth of this amount, or to a circle of confusion less than one-thousandth of an inch in diameter, which, bearing in mind the size of the mirror, is a remarkable perfection of figure.

The mirror with other optical parts, which arrived in Victoria on April 29, was installed and collimated and the first star spectrum obtained on May 6. Considering the size and hitherto untried features of the telescope, this speaks well for the care used in the design and construction of both optical parts and mounting. The instrument has been used continuously since, mostly in obtaining stellar spectra, and has given the utmost satisfaction.

The tests of the figure of the mirror were obtained in the optical shop under constant temperature conditions, and it was of interest to determine its behaviour under average observing conditions in its dome. Although one of the reasons for the choice of Victoria as a site for the telescope was the low diurnal range of temperature, the total range in twenty-four hours rarely exceeding 5° C., yet it was soon seen that even a smaller change than this introduced considerable aberration in the figure of the mirror. Hartmann tests made after a daytime rise of about 5° C. showed a longitudinal aberration, under correction, of nearly 3 mm., as compared with 0·25 mm.

under constant temperature. A similar test after a daytime rise of about 1·5° C. showed longitudinal aberration of only about 0·5 mm. This corresponds with a very good figure, and it was evident, if the best results were to be obtained, that some means should be adopted for reducing the change of temperature around the mirror. This was effected by permanently covering the closed section of the tube, consisting of two steel castings weighing more than 10 tons, with felted cotton about 2 in. thick. The space between the back and edges of the mirror and the bottom and sides of the cell was also packed with this felt; and a removable pad placed on thin boards laid across the top of the closed section, when the mirror is not open to the sky, completes the enclosure of the mirror.

During the daytime rise of temperature in the dome the 2 tons of glass in the mirror and the 10 tons of steel in the centre section and cell of the tube are protected by this heat-insulating material, with the result that the change of temperature around the mirror is very slow. This change amounts to only about one-third of that in the dome, and does not often exceed 1° C., with the result that the aberration is always so small as to be negligible in increasing the size of the star image in comparison with the enlargement caused by atmospheric disturbances. The quality of the optical parts and their performance since the insulating cover was applied leave nothing to be desired, and although only a few direct photographs at the principal focus have yet been made, the definition is superb, the smallest images being but slightly more than a second of arc in diameter. For use with the spectrograph a Cassegrain combination is employed: the principal mirror of 72-in. aperture and 30-ft. focus, and the convex secondary of 20-in. aperture placed about 7 ft. within the principal focus. The resulting equivalent focal length is 108 ft., and it is sufficient evidence of both the optical quality and the seeing conditions to say that frequently the greater part of the star image appears to be lost in the spectrograph slit, which is 0·3 mm. wide, and that a spectrum, of linear dispersion 35 Å. to the mm. at Hγ, of a star of 7·0 magnitude can be obtained in 20 to 25 minutes under average seeing conditions.

However good the optical parts, effective work could not be done unless the mechanical parts were so designed and constructed as rigidly and yet flexibly to carry the optical parts in their correct relative positions, and the mechanism so arranged as to enable the telescope to be pointed quickly and accurately to the desired position, and then to follow accurately the apparent motion of the star. This has been effected in the telescope in a remarkably efficient manner, and I have no hesitation in saying that this mounting sets a new standard for convenience and accuracy in operation. The telescope is set and guided by electric power having three speeds in each co-ordinate: a quick motion of 45° per minute, a fine setting motion of 10′ per minute, and a guiding speed of 0·5′ per minute, one revolution in 8 minutes, 36 hours, and 30 days respectively. The quick motion and clamps are operated from duplicate switchboards on each side of the south pier (one of these can be seen in Figs. 2 and 3), while the fine setting and guiding is done from a small, portable board carried by the observer. No fine circles are provided, but the coarse circles are graduated to minutes of time in R.A., and to 5′ in declination. In consequence, the telescope can be set easily and

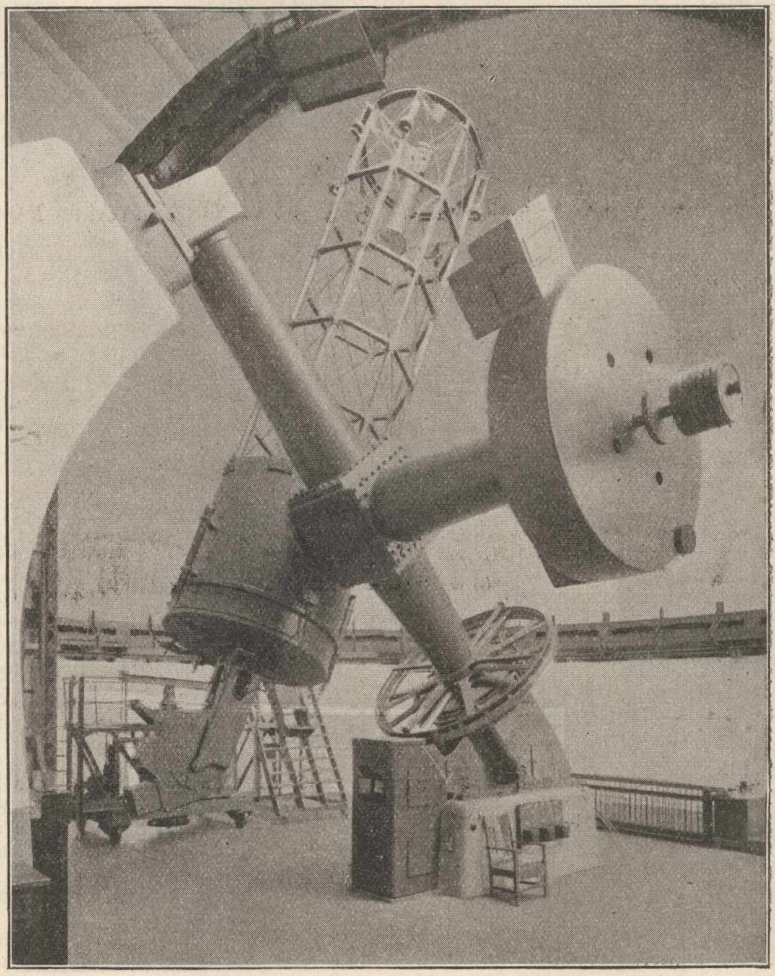

FIG. 2.—The telescope from the north-west.

quickly to within less than 2′ of the catalogue position, and identification is much simplified and charting becomes unnecessary generally for any stars brighter than, say, 7·5 magnitude. The following given by the clock is remarkably smooth and accurate, without a trace of any periodic or other drift in the image, even with the great focal length of 108 ft.; the guiding for the spectrograph is hence very easy. The slit of the spectrograph subtends angular dimensions 3″ by 0·3″, and so accurate is the driving, and so small and sharp the image in good average seeing conditions, that, unless the clock is set to drive slightly fast or slow, so that the image drifts slowly from one end to the other of the slit, the star spectrum would be too narrow or too unevenly exposed to be measurable.

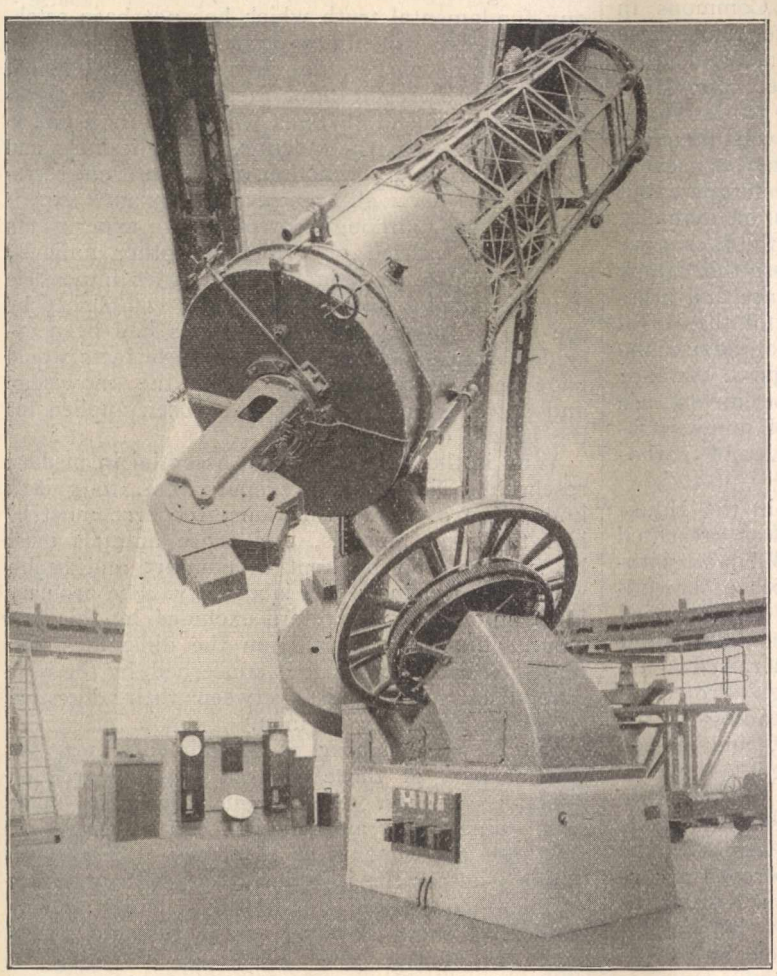

FIG. 3.—The telescope from the south-west.

Although the telescope can be easily operated by one person, ordinarily the observer is assisted by the night engineer, and it is a sufficient commentary on the perfection of the design and construction, and on the smoothness, ease, and accuracy of operation, to state that the average time required to change from star to star in making spectra, the time from the end of one exposure to the beginning of the next, is less than three minutes, and if the stars are not far separated in the sky, frequently only two minutes. When a single person is operating, these times are increased about 50 per cent., and I do not believe, notwithstanding the 45 tons weight of moving parts of this telescope, that one of one-fifth the aperture is generally handled so expeditiously.

I should not be doing what is right and just if I failed to express my appreciation of the successful efforts of the builders of this telescope to make an instrument unequalled in quality, accuracy, and convenience. The John A. Brashear Co. for the optical parts, and the Warner and Swasey Co. for the mounting, have undoubtedly added materially to their already high reputation by their marked success in this great instrument, and my gratitude and that of all interested in the progress of science is due to them for the spirit in which they attacked the problems that confronted them, and by their refusal to be satisfied, no matter what the cost, by anything but the best possible.

As previously intimated, the greater part of the observing time of the telescope since completion has been occupied in making star spectra, 1186 spectra of stars, on the average fainter than the 6th magnitude, having been obtained by December 31, 1918. As a by-product in the measurement of some of these spectra, thirty spectroscopic binaries have been discovered. The present spectroscopic observing programme, arranged in co-operation with Mt. Wilson, consists of about 800 stars from Boss's "Preliminary General Catalogue," the purpose being to determine the radial velocity of all the stars in the catalogue not previously observed and within reach at the observatory and at Mt. Wilson in the shortest possible time. In addition, considerable time has been spent on a piece of work for the late Prof. Pickering, of Harvard, obtaining direct photographs of the Harvard regions with and without a parallel wire grating for the purpose of extending the magnitude scale in these regions to the faintest possible stars. Other work will, of course, develop as time goes on, but in the meantime, and considering the small staff—only the director and Dr. Young being at present avail-

able—it was felt that the time of the telescope would be better devoted to these two pieces of direct, useful, and much-needed work than if it were used in miscellaneous researches which, though possibly more interesting, would certainly not be so generally useful in the advancement of the science.

J. S. PLASKETT.

## THE USE OF ANIMALS IN MEDICAL RESEARCH.

WHEN a Bill to prohibit experiments on dogs was before the House of Commons in 1914, a memorial signed by more than three hundred eminent physicians, surgeons, and other representatives of medical science, protesting against the measure, was addressed to the Home Secretary. The strong conviction was then expressed that the Bill would inflict very severe injury, not only on medicine and surgery, but also on the study of the diseases of animals; and the memorialists added: "We think that we have some right to ask you to oppose this attack on the advancement of medical science and practice, especially as the Final Report of the Royal Commission on Vivisection does not advise the prohibition of experiments on dogs. We are absolutely certain that such experiments are necessary for the complete study of many problems of physiology, pharmacology, and pathology."

The second reading was carried in the House of Commons before this memorial was presented to the Home Secretary, but the Bill was withdrawn in June, 1914, after a number of amendments to the principal clause had been carried in the Standing Committee appointed to consider it. The subject has, however, been raised again by the introduction of another "Dogs' Protection Bill," which received its second reading in the House of Commons on March 21, and passed through the Grand Committee stage last week. Sir Edward Sharpey Schafer, Dr. T. Lewis, Prof. E. H. Starling, and Prof. Leonard Hill have stated the case against the Bill in letters to the *Times*, and we may be permitted to recall a convincing article by the first-named in NATURE of May 7, 1914, where it is shown that the prohibition of the employment of dogs for certain investigations would put a complete stop to the progress of physiology in Great Britain.

The position now is much the same as in 1914, and Sir Edward Sharpey Schafer's forcible statement in our columns of the case against the Bill is as applicable to the new measure as it was to the old. After the brilliant successes achieved during the war by physiological and scientific medicine in the preservation of life and the prevention of suffering in our armies, it might have been thought that the agitation against medical experiments on animals would have received its death-blow. But there are some people who are incapable of learning, and the passage of the Dogs' Protection Bill through the Grand Committee stage suggests that many of them are congregated in our legislature.

Do the supporters of the Bill really imagine that, since it has been proved possible to slaughter millions of human lives and to subject men and women to slow death by starvation, brutality, and disease, the value of human life has really become lower than that of a dog? For it must be remembered that the prevention and cure of disease are possible only by means of an accurate knowledge of the functions of the body, and that, with regard to these functions, there is scarcely any fundamental truth which has not been established by experiments on dogs. The action of the heart and its nerves, the circulation of the blood, the nature of respiration, the processes of digestion, the chemical changes which the food undergoes in the body, the functions of the kidneys and of the liver, and the action of the internal secretory glands, have all been revealed by such experiments. And, although corroborative experiments have been carried out since on other animals, these would have been in many cases impossible if the principles had not first been established by the use of dogs. If these animals had been excluded from experiment, few of these facts would have been found out, nor would the knowledge and power gained thereby have been applied for the benefit of man.

Why is the use of dogs so essential in medical research? No one will dispute that, to gain a knowledge of living functions, recourse must be had to living animals, and those animals must be such as can be kept in comfort and health within the precincts of a laboratory. The ordinary farm animals are therefore excluded by this fact alone, altogether apart from the difficulties presented, so far as medicine is concerned, by the wide differences which exist between their digestive processes and those of man.

For a vast number of experiments, viz. the greater part of those necessary in research on infective disease, the smaller animals—mice, rats, guinea-pigs, and rabbits—can be employed. In these experiments it is chiefly necessary to decide whether the injection of a given organism or microbial poison is followed by death or survival. As soon, however, as it becomes necessary to analyse the processes occurring in separate organs, *e.g.* the heart, the kidney, etc., it is essential to make use of larger animals, and the limitation mentioned above confines these to dogs and cats. Cats are used wherever possible. But the delicacy of their tissues, the small size of their organs, and the marked differences which exist between their food habits and those of man render it necessary to employ dogs for many important lines of research. Thus it comes about that the greater part of our knowledge of the heart's action, of the production of lymph and the causation of dropsy, of the nature of diabetes, and of the fate of different kinds of food in the body, is owing to experiments on dogs, and would

not have been discovered if the use of dogs had been prohibited.

Though the advances in medicine of recent years have been so marked, much remains to be discovered. If this Bill is allowed to become law, all research in this country into such problems as the causes and treatment of diabetes, of Bright's disease, of heart disease, of dropsy, of disorders of the stomach and intestines, and many others, will be hampered to such an extent that progress in our knowledge will come to an end, except in so far as it can be attained by observations and experiments on human patients themselves.

A prohibition of the use of dogs would be equally disastrous for the progress of surgery. The fundamental advances made during the last twenty years, which have proved of such inestimable value not only in civil practice, but also during the war in the treatment of our wounded soldiers, were achieved in the first instance by means of experiments on dogs. By such experiments it was first shown to be possible to excise portions of the alimental canal, to make openings from one part to the other in order to relieve obstruction, to remove part or the whole of the internal organs, to implant bone and tissues so as to restore defects, to deal fearlessly with the cavity of the chest, to sew up wounds in the living and beating heart, to restore continuity of wounded blood-vessels, and to perform many others of the feats which are the triumph of modern surgery.

Much more remains to be achieved in order to abolish or alleviate even a fraction of the pain and suffering which are all around us. But all activity in this direction would be hampered, and much of it brought to a standstill, if the Dogs' Protection Bill is allowed to become law.

Nor would the Bill diminish by one jot any pains at present suffered by dogs. Under the law as it at present stands, the infliction of pain on dogs is already prevented. According to the regulations now in force, the animal has to be under the full influence of an anæsthetic during the whole operation, and to be killed before recovering consciousness. Or, if the object of the experiment requires that the dog should be allowed to survive, it must be at once killed under an anæsthetic should pain supervene at any time after the operation.

These regulations can be justified on purely scientific grounds, since the existence of pain during an experiment is a disturbing factor, which is not only an unnecessary complication, but may also vitiate the whole result of the experiment. The only effect of the Bill, therefore, so far as dogs are concerned, would be that a few more of the stray and homeless dogs that are now used for experiment would be added to the 20,000 or more which are killed by suffocation during each year at the Dogs' Home at Battersea.

We cannot believe the Government is so indifferent to the advancement of medical science and the human suffering which it aims at alleviating that such an act of folly as is contemplated in the Bill now under consideration will be permitted to be placed on the Statute Book because of the importunity of certain private members who disregard all that scientific knowledge of disease has to tell them. The Bill is down for the Report stage on May 23, and we look to Ministers to exert themselves sufficiently on that day to protect us from such a pernicious measure.

## Obituary.

### SIR WILLIAM CROOKES, O.M., F.R.S.

THE few remaining British men of science whose memories extend back to 1862, in reviewing that long period of the past, never lose from the mental vision one remarkable figure. The occasion of the International Exhibition in that year afforded an opportunity by which a young English chemist sprang into sudden fame. The discovery of a new element, however remarkable its properties, would, perhaps, not have proved sufficient to rouse the interest of a mid-Victorian public, but the method of spectrum analysis used in its discovery being then new, coupled with the award of a medal to the exhibit, brought thallium and its discoverer very prominently into notice. The great scientific career thus begun nearly sixty years ago is now closed by the death of Sir William Crookes on Friday, April 4, not only full of years and honours, but also busy in the laboratory to the last.

Crookes was born on June 17, 1832. At an early age he entered as a student at the newly instituted Royal College of Chemistry in Oxford Street, where he remained for some years under Hofmann as demonstrator and assistant. Here he found an atmosphere favourable to the development of his talent for investigation, but it is remarkable that the study of organic chemistry, the chief direction followed by Hofmann and his pupils, never seemed to attract him specially, and many years afterwards he was not ashamed to confess an almost entire ignorance of the work which had occupied so large a number of chemists, especially after Perkin's discovery of the dyes and the general adoption of Kekulé's theory of benzene. His earliest paper records his discovery of the seleniocyanides in 1857, and he was then occupied for a time by the developments then taking place in the processes of photography. The discovery of thallium by the application of the spectroscope gave him occupation for several years, but after completing the study of that element and its compounds it became evident that his preference lay in the direction of phenomena outside the range of ordinary chemical investigation, and that his researches would be pursued along no conventional lines. In passing, it ought to be mentioned that he was instrumental in securing the application of the powerful disinfectant properties of carbolic acid or phenol during the disastrous spread of the cattle plague in 1866.

Meanwhile, Crookes was hard at work on facts

of his own discovery relating to attraction and repulsion accompanying radiation, and in 1873 he astonished the world by the invention of the radiometer. Probably no discovery within our time has given rise to more speculation or has led to a more remarkable development of ideas connected with radiation, and though Crookes did not furnish the true explanation of his instrument, he contributed a large number of experiments which assisted in its ultimate recognition.

From the phenomena shown by the radiometer was an easy step to the study of electrical discharges in high vacua, and henceforward his work on what he called "radiant matter" furnished the starting-point for many of the famous discoveries by others which have led to a completely new field of physics and an utterly novel view of the ultimate constitution of matter. Crookes's study of the rays from the cathode in a vacuum tube in which the gas was rarefied beyond a certain limit led him to consider that the flying particles represented an ultra-gaseous condition which he regarded as a fourth state of matter. This view, which at the time was rather unfavourably received, has been completely justified by further investigations, though his idea of the mass of the radiant particles has had to be modified.

About 1885 Crookes became interested in the phosphorescent spectra of solid bodies, and especially in those of the so-called rare earths. This led him to engage in very lengthy series of experiments on fractionation, and attempts at the resolution of mixtures of these substances into their constituents, and so he was led into the conception of what he called *meta-elements*. He supposed that some oxides, like yttria, might consist of molecules so nearly alike in properties and mass as to be indistinguishable from one another, and inseparable by any known process. Accordingly, these substances were represented in the periodic scheme of the elements as clustering into groups near to certain values of atomic weights. Crookes also devised a spiral model which has become very familiar for displaying the relations of the elements to atomic weight in connection with the periodic law and for illustrating his own views as to the "genesis of the elements." The definition of the term "element" in chemistry, and the characterisation of the recognised elements, formed the subject of his two presidential addresses to the Chemical Society in 1888 and 1889.

During the subsequent thirty years of his life Crookes was much occupied with further experimental work on questions cognate to these subjects. His familiarity with spectroscopy enabled him to pursue successfully an inquiry into the preparation of eye-preserving glass for spectacles, the results of which were published in the Philosophical Transactions so recently as 1914, and have led to valuable practical results, especially in the case of workers in glass and others exposed to furnace glare. The primary object was to find a glass which will cut off as much as possible of the heat radiation, but the experiments were extended to the search for glasses opaque to the ultraviolet. More than three hundred different glasses were investigated, and the compositions of nineteen which have been proved useful are given in the memoir.

It would be impossible in the short space at our disposal now to complete the list of Sir William Crookes's various spheres of activity, but mention must not be omitted of some of his publications. In 1859 he started the *Chemical News*, of which he continued to be proprietor and editor to the end of his life. His famous British Association address at Bristol in 1899 on "The Wheat Problem" attracted for many years considerable attention from economists and agriculturists, and his visits to South Africa in 1896 and in 1905 led to the publication of a small work on diamonds, which has had a large circulation. To these may be added the volume entitled "Select Methods in Chemical Analysis," which is full of useful information, and has passed through four editions, as well as several other books of a technical character.

Crookes was a man of extraordinary genius and immense physical activity, of which his copious published work is evidence. A man of his temperament and his remarkable independence of view in regard to the range of scientific inquiry and the proper attitude of the scientific investigator would naturally be led to look attentively at subjects of all kinds, some of which might be regarded as suspect by other people. It is, of course, well known that he took part in many inquiries concerning psychic phenomena, and that he published a book on spiritualism, in which he recorded certain experiences of his own. These, however, are subjects on which there is too much difference of sentiment and of opinion to be further considered now; they must be left to be handled by the biographer. All that the scientific world now feels is that it has lost a great pioneer worker in the field of natural knowledge.

It is needless to add that honours of all kinds fell thick on Crookes. He was elected into the Royal Society in 1863, and the Royal, the Davy, and the Copley medals were awarded to him by the society, of which he finally became president. He also served as president of several other societies, including the Chemical Society, the British Association, and the Institution of Electrical Engineers. He received a gold medal and a prize of 6000 francs from the French Academy of Sciences in 1880, and in 1899 the Albert medal of the Royal Society of Arts was awarded to him. The Order of Merit was conferred on him in 1910.

It may be of interest to some readers of NATURE to be reminded that in the series of "Scientific Worthies" issued by this journal was published on November 7, 1907, an appreciation of Crookes's scientific work from the pen of a distinguished physicist, Prof. P. Zeeman, of Amsterdam, which affords an estimate of the value of his work by a highly competent authority.

W. A. T.

## NOTES.

WE much regret to record the death on April 2, at sixty-three years of age, of Sir James MacKenzie Davidson, the distinguished ophthalmic surgeon and radiologist. Sir James Davidson received his early education in Buenos Aires. He came to England as a youth, and entered for medicine at Aberdeen University. He also studied at Edinburgh and London. After graduation at Aberdeen in 1882 he became first assistant to the professor of surgery there, and later lecturer on ophthalmology. He was also ophthalmic surgeon to the Royal Infirmary, Aberdeen, and the Royal Sick Children's Hospital, and physician to the Blind Asylum. The experience gained as an ophthalmic surgeon in Aberdeen exercised a great influence on his work when he came to London. In 1896 Röntgen's discovery of X-rays was announced, and with characteristic energy and commendable foresight Sir James Davidson at once grasped the significance of this discovery in relation to medicine. The same year found him making a pilgrimage to Würzburg to interview Röntgen. After removing to London in 1897 he became radiologist to Charing Cross Hospital and to the Royal London Ophthalmic Hospital. At a later date he became consulting radiologist to both these institutions. Henceforth Sir James Davidson's whole energy became absorbed in research work, and he quickly took a leading position amongst the pioneer workers in X-rays and radium. His early training in ophthalmology led him to grasp the value of X-rays in this branch of medicine, and particularly in the localisation of foreign bodies in the orbit and eyeball: the method elaborated by him, and always associated with his name, became recognised as the standard one, and upon it all the modern methods are based. He also advocated the practice of stereoscopic radiography. He received a knighthood in 1012, and at the time of his death held the positions of past-president of the Röntgen Society and honorary consulting radiologist to the London District Command. The development of radiodiagnosis and radiotherapy are intimately bound up with the name of MacKenzie Davidson, and he was recognised in America and on the Continent as the leading radiologist in this country. By his death radiology has lost a distinguished exponent of technique, an original worker of the highest order, and an enthusiastic advocate of its future in medicine and science.

WE regret to learn that Dr. William Allen Sturge died on March 27 in his sixty-ninth year. Dr. Sturge was born in Bristol, and graduated as M.D. in the University of London, but spent the greater part of his professional life at Nice, where he was a highly esteemed medical practitioner. While on the Riviera he devoted much of his leisure to collecting and studying ancient Greek vases and other objects of Greek art, and eventually extended his interests to prehistoric archæology. He collected flint implements from the French caves and other Continental localities, and on his return to England in 1907 he chose his residence at Icklingham, Suffolk, where he could explore one of the richest districts for flint implements in this country. He also acquired specimens from the collections of William Greenwell, Worthington Smith, Allen Brown, and others. Dr. Sturge contributed several papers to the Proceedings of the Prehistoric Society of East Anglia, of which he was one of the founders and first president in 1908. He also did much to advance our knowledge of the Stone age by his stimulating help to fellow-workers. Dr. Sturge's great collection of stone implements is bequeathed to the British Museum.

WE learn from the *Biochemische Zeitschrift* that Prof. R. Kobert died at Rostock on December 27, 1918, at sixty-four years of age. Prof. Kobert had taught pharmacology, physiological chemistry, and the history of medicine and pharmacy in the university of that town since 1899. After having studied medicine at Halle he became assistant to Schmiedeberg at Strasburg in 1882. The latter's pharmacological institute, founded a little earlier, was at that time the only laboratory of its kind in Germany, the others being at Dorpat and Vienna. In 1886 Kobert succeeded Buchheim as professor of pharmacology at Dorpat, where Dragendorff then was professor of pharmacy, but the Russification of the university in 1897 terminated the work of its German teachers, including Kobert. The deceased was a prolific author of compilations on pharmacology, toxicology, etc., and of papers on ergot, the saponins, the vegetable hæmolysins, and other subjects.

SIR AUCKLAND GEDDES, Minister of National Service and Reconstruction, has resigned his office, and will return to McGill University, Montreal, where he will succeed Sir William Peterson as principal. He was professor of anatomy at the University when the war broke out, and stipulated, on accepting the chair, that in the event of hostilities he should be at liberty to resign without notice. His connection with the University was not, however, broken; for the governors did not accept his resignation, and he has been on leave from his chair throughout the war. When he became Minister of National Service it was on the understanding that he should be free at the end of the war to devote his life to politics or return to university work. The Prime Minister has testified that Sir Auckland Geddes's work during the war "has been of inestimable value to the country"; and, as principal of McGill University, his services to scientific education and advancement are likely to have an equally strong influence upon the destinies of the Dominion and the Empire.

DR. E. J. RUSSELL has been elected a foreign member of the Royal Swedish Academy of Agriculture, Stockholm.

MR. R. A. GREGORY has been elected a member of the Athenæum Club under the provisions of the rule of the club which empowers the annual election by the committee of "a certain number of persons of distinguished eminence in science, literature, or the arts, or for public services."

THE death occurred on April 2, at eighty-seven years of age, of Dr. Edward Liveing, emeritus registrar of the Royal College of Physicians of London, and the author of a volume on "Megrim: A Contribution to the Pathology of Nerve Storms."

ACCORDING to the *Münchener medizinische Wochenschrift*, the Griesheim-Elektron Chemical Works now manufacture an almost pure calcium hypochlorite under the name "hyporit." This contains 80 per cent. of available chlorine (as compared with 36 per cent. in the best bleaching powder), and is a stable white powder dissolving readily in water to a very faintly alkaline solution, which can be used instead of Dakin's solution for the irrigation of wounds and for other purposes. The impurities are a small quantity of calcium chloride and very little lime. This is the first stable solid hypochlorite manufactured on a large scale.

A RED CROSS Conference is now being held at Cannes. On April 5 the delegates, presided over by Dr. Herman Biggs, Public Health Commissioner, New York State, discussed the desirability of setting

up immediately a Central Health Bureau with the view of linking up the various national Red Cross societies in a health crusade throughout the world. The proposal was very favourably received, and was supported, among others, by Sir Robert Philip (Edinburgh), Profs. Baduel (Florence), Roux (Paris), Kenwood (London), Sir Ronald Ross, Col. Cumming (U.S. Public Health Service), and Prof. Kabishima. Such subjects as standardisation of nursing methods and the training of nurses, training of public health *personnel*, combating tuberculosis, as well as the promotion of research, were considered by the various speakers to come within the limits of such a crusade.

WE are glad to note that vigorous protests have been raised in the *Times* against the suggestion, emanating from Toronto, that aeroplanes should be used for the purpose of driving caribou by the thousand into corrals, where they might conveniently be slaughtered. The carcasses thus obtained were to be used for increasing the meat supply of Canada and for export. If such a scheme were ever sanctioned the caribou would speedily share the fate of the American bison. The further suggestion that airmen might destroy wolves and feral dogs by machine-gun fire does not sound very practicable, but these deadly weapons could, and probably would, be used against the caribou. It is devoutly to be hoped that no more will be heard of this proposal, which has given offence to all true sportsmen, as well as to those who are concerned with the conservation of wild animals.

IN this first Easter vacation after the cessation of hostilities the Port Erin Biological Station is almost as fully occupied as in pre-war days. About fifty researchers and senior students are working there some time during the latter part of March and April, including four professors and half a dozen demonstrators, with groups of students from London, Manchester, Liverpool, Cambridge, and Reading. Prof. Benjamin Moore, with three other biochemists, is engaged on a research on photosynthesis in relation to the alkalinity of the sea. Most of the others are on faunistic or morphological work. Fortunately, the weather has been favourable for work at sea, and for shore-collecting during the low spring tides. In the plankton the vernal phytoplankton maximum has appeared. Coscinodiscus has been in abundance during the latter part of March, and now Chætoceras is in evidence. The Manx summer herring have made their appearance close inshore unusually early; a few hundred may be caught any night in Port Erin Bay, but a more notable catch of half a dozen mease was secured a few miles along the coast on one of the first nights in April.

"THE Function of Science in the Modern State" and "National Life from the Standpoint of Science" are the subjects of two papers contributed some years ago by Prof. Karl Pearson to the Eugenic Lecture Series (Cambridge University Press). Prof. Pearson has done well to republish these papers in view of the altered circumstances of the nation since the war and the necessity for recognising as soon as possible a better theory of the State than was previously available, especially for the employment of scientific method in the organisation of every department of business, of administration, of education, and of progress in invention and discovery. The executive must be freed from the dominance of minds trained solely on literature and jurisprudence, for in the future the struggle for existence will not necessarily be settled in favour of the biggest or the richest or the best-armed nation. Everything will be determined by organisation of the brain-power which the nation possesses, and by teaching the leaders, as well as the people at large, to prepare for the difficulties of new environment. Prof. Pearson discusses these problems in an interesting way from the point of view of eugenics and the principle of evolution. Hence he lays great emphasis on the importance of preventing so far as possible deterioration as the result of deficient reproduction among the intellectual classes and encouragement of the inferior stocks. In these two pamphlets there is much food for thought for every man and woman, and they should be read by everybody.

A CONSIDERABLE change is made in the Daily Weather Report of the Meteorological Office from April 1. During the war the weather information expanded, and was more complete than in pre-war times; the information, however, was not supplied to the public, but it was widely distributed to the Services and eagerly used. Since the freeing of weather information, subsequent to the armistice, some idea could be formed by the public of the increased activity of the Weather Office. The change now effected is, in a measure, very drastic. Instead of the Daily Weather Report containing home and foreign stations, with maps for each hour at which observations were made, there are now three separate reports: the British Section, the International Section, and the Upper Air Supplement. The British Section and the Upper Air Supplement are issued in lithographic form in the forenoon of the day's observations, and the International Section is issued early on the following day. The British Section gives detailed observations from observatories of the Meteorological Office and stations of the Air Ministry for 1h., 7h., 13h., and 18h., and other Meteorological Office stations for 7h. and 18h., previously included in the Daily Weather Report. It also gives a full-page weather-map, including Iceland, the Azores, and a large part of western Europe, also forecasts for the twenty-four hours commencing at 3 p.m. for twenty districts covering the British Isles. The Upper Air Supplement gives maps of the British Isles with winds at the surface and at elevations of 1000, 2000, 5000, 8000, 10,000, and 15,000 ft. for afternoon, evening, and morning. The International Section practically covers western Europe and the Mediterranean with observations for evening and morning, and there are two full-page weather-maps. Provision is made for wireless reports from the Atlantic.

A MEMORANDUM on the share of "colonies" (institutions for training and for employment) in the treatment of tuberculosis by Mr. J. E. Chapman has been issued by the Local Government Board (Reports on Public Health and Medical Subjects, No. 122). Colony treatment is intended to secure for selected patients beneficial results of a more lasting nature than can be obtained by sanatorium treatment alone. In the earlier colonies the work provided was mainly of an agricultural character, but as few patients continue this occupation after discharge, more recently established colonies aim to fit the patient for an occupation that will be continued. The whole subject is adequately considered in this memorandum, which is illustrated with figures of two types of cottage homes suitable for a colony.

"THE Lessons of the War and Some New Prospects in the Field of Therapeutic Immunisation" was the subject of an important lecture by Sir Almroth Wright delivered before the Royal Society of Medicine on February 25 (see *Lancet*, March 29, p. 489). The natural defences of the body against, and in the presence of, infections were fully dealt with, and a number of ingenious experiments detailed in confirma-

tion of the views expressed. The anti-tryptic power of "wholesome" blood and the leucocytes are the great defensive mechanisms, and the treatment of septic wounds should aim at bringing these into action. A method of "immuno-transfusion" for the treatment of septic wounds was also described, in which blood from a donor is, after withdrawal, first allowed to act upon and digest a given quantum of the infecting micro-organism, after which the treated blood is injected into the patient.

A REPORT by King Edward's Hospital Fund for London on "Pensions for Hospital Officers" has been issued. The inquiry was held by a sub-committee consisting of Mr. W. J. H. Whittall, Mr. H. L. Hopkinson, and Sir William Collins. The final recommendation of the first two members is that pensions should be provided by means of insurance policies paid for by joint contributions of employers and employees, much on the lines of the Federated Superannuation scheme for University colleges. Sir W. Collins dissents on the ground that a scheme based on recourse to insurance companies is not the only possible solution of the problem, and that alternative schemes should be considered at a conference of hospital representatives which it is proposed to summon to discuss the whole question.

ORNITHOLOGISTS who are interested in migration will read with interest in *British Birds* for March some observations by Mr. D. G. Garnett on birds seen in the north-eastern Atlantic and the English and St. George's Channels from August to October, 1917. It has been definitely established that there is a route followed by migrating birds which extends down the western Irish coast, across the approaches of St. George's Channel and the English Channel, to the north-west of France. It is now suggested by Mr. Garnett that, as a consequence of his observations, there seems evidence to show that there is yet another route traversing this, and extending from the south coast of Ireland to the west coast of Spain.

THE food habits of the mallard ducks of the United States forms the subject of a very valuable Bulletin (No. 720) issued by the United States Department of Agriculture. The author, Mr. W. L. McAtee, set himself the task of discovering the food preferences of these birds for the purpose of obtaining information which could be put to good purpose in establishing wild-duck farms and increasing the stock of wild birds on account of their great value as food. Though mainly vegetarian, Mr. McAtee points out the extreme value of these birds as exterminators of mosquito larvæ. Experiments on enclosed water with captive birds showed that in this regard they are far more effective than goldfish, which were used in a control experiment. Hence, he remarks, these birds are of incalculable value in keeping down mosquitoes in swamps that would be extremely costly to drain.

AN interesting summary of suggestions as to the best means of rapidly increasing the produce of food-crops in India by methods within the power of the Agricultural Department has been issued (Bulletin No. 84) by the Agricultural Research Institute, Pusa. The bulletin consists of a collection of notes submitted by representatives of the Department in various parts of the country, and, although there is naturally considerable variety in the specific proposals for the individual areas, it is interesting to note a general agreement that the most effective means of securing a rapid increase in the output of food-crops lies in the dissemination of improved strains of seed. For Bengal alone it is estimated that the substitution of the pure line *Indrasail* developed by the agricultural station at Dacca for the local varieties of transplanted rice commonly used would lead to an increase of 500,000 tons of rice. Similar improvement of the rice crop is also being effected in the Central Provinces, Madras, and Burma. In the Punjab special attention has been directed to wheat, and two varieties which have been found to give from half a maund to three maunds per acre more than local varieties are now being extensively developed. Similar improvements in wheat output are also being effected in the Central Provinces. In many of the reports emphasis is placed upon the improvement which might be effected by better methods of cultivation alone, and by more active participation of the large landowners in the cultivation of their land. More abundant and efficient irrigation is also emphasised as a special need of certain areas. There would appear to be little prospect of increase, however, by the use of manures or by the substitution of food-crops for fibre or other non-food producing crops.

WE have received a copy of a booklet entitled "Decimal Coinage and British Commerce," by Mr. J. Gall Inglis. The author advocates a decimal system of coinage alternative to that proposed in the Bill which was introduced in the House of Lords last year. His scheme involves the decimalisation of the shilling and half-sovereign, instead of the sovereign, while retaining the latter as a coin, but not as a unit. The shilling would remain as at present, but the new penny would be one-tenth of a shilling, and divided into ten "mils." Mr. Inglis points out that for business purposes it is necessary to take into account the relative amount of clerical work involved in our present system and in the proposed decimal schemes, and he has constructed a table showing that the amount of figure-writing with the decimal half-sovereign would be less than is now necessary, and considerably less than with the decimal sovereign. He urges the importance of preserving the shilling as the indispensable pricing unit. A short account is also given of a scheme for decimalising our weights and measures on a metric basis. The booklet, which is published by Messrs. Gall and Inglis, Henrietta Street, Strand (price 1*d.*), is noteworthy for its original and practical outlook, and will appeal to those interested in the question of decimalisation.

IN 1917, for the first time, the annual meeting of the Indian Association for the Cultivation of Science was divided into a business meeting held in September and a science convention held in November. According to the report of the association for 1917, recently received, the division proved an unqualified success. Nine physical, four chemical, and seven biological papers were read at the convention by the staff and students of the association, and they constitute, with the report, a volume of more than 150 pages. The association is doing much to encourage research in India, and the conditions of appointment of their professor of physics will serve as a good example to many institutions in this country. He is required (1) to devote himself to original research in his subject, (2) to stimulate and guide research by advanced students, (3) to superintend the formation and maintenance of the physics laboratory, and (4) he is under no obligation to share in the teaching of the M.A or M.Sc. classes of the university. This professorship is held by Prof. Raman, while Sir P. C. Rây holds the corresponding one in chemistry.

THE February issue of the Journal of the Chemical Society contains an interesting paper by Mr. R. Wright on "The Effect of some Simple Electrolytes on the Temperature of Maximum Density of Water." The author confirms Despretz's law that the lowering

of the temperature of the point of maximum density of water caused by the addition of a solute is directly proportional to the concentration of the latter. Mr. Wright further shows that the lowering of the temperature of the maximum density of water produced by a highly ionised binary electrolyte is composed of two separate independent effects, one due to the acid and the other to the basic radicle, and can therefore be calculated by the addition of two moduli to the lowering produced by a molecular solution of a chosen standard substance. The standard substance chosen was normal hydrochloric acid. The acid salts of the dibasic acids behave normally, but the neutral salts and the salts of bivalent metals do not conform to any simple rule in their effect on the temperature of maximum density. The feebly ionised organic acids show abnormal effects, but their highly ionised salts behave in the normal manner.

CONSIDERABLE interest is attached to the comparatively rare alkaloid hyoscine or scopolamine, owing to its use in the treatment popularly known as "twilight sleep." The hyoscine of commerce, extracted from solanaceous plants, is lævorotatory, but an optically inactive form produced by the action of dilute alkali on the naturally occurring alkaloid is known. At a meeting of the Chemical Society on April 3 Mr. Harold King, of the Wellcome Chemical Research Laboratories, described the resolution of this optically inactive hyoscine into the well-known lævo- form and the hitherto unknown dextro- form. On hydrolysis *l*-hyoscine yields *l*-tropic acid and an optically inactive amino-alcohol, oscine. Mr. King has also resolved the latter into its optically active components. Since, therefore, tropic acid and oscine each contain an asymmetric carbon atom, and are each capable of existing in three forms, two active and one inactive, the possible combinations of these various forms may give rise to ten, or possibly eleven, isomeric hyoscines. It becomes of interest to ascertain which of these forms are represented by the two optically active hyoscines already known. This question is still under investigation, but Mr. King pointed out that as benzoyl *d*-oscine gives optically pure *d*-oscine on hydrolysis, it seems probable that the known hyoscines contain inactive oscine, the optical activity being due to the lævo- and dextro-tropyl radicles respectively.

ON taking over the duties of the chair of metallurgy in the Royal Technical College, Glasgow, last September, Prof. Cecil Desch devoted his introductory lecture to a review of the aims of a Glasgow School of Metallurgy. In this address Prof. Desch laid emphasis upon a change in the methods of industry which has recently been taking place. He quoted from Prof. Patrick Geddes, who has proposed to divide the industrial age into two periods, which he has called the "palæotechnic" and the "neotechnic." In the earlier of these the aim of industry was merely the accumulation of material wealth. Natural resources were squandered recklessly, the one consideration being their rapid conversion into marketable products. Human life was disregarded, the cheapest labour being utilised without reference to the standard of life. In England this was essentially the age of coal. Fuel was cheap and abundant; no care was exercised in its use, and our scenery was disfigured by smoke as the manufacturing districts spread over the country. Housing conditions were such as to accommodate the largest number of persons on a given area at the lowest possible cost, and the results are to be seen in the squalid industrial regions of Manchester, Sheffield, the Black Country of the Midlands, and Glasgow. It is, however, being slowly realised, both by the employers of industry and the workers themselves, that all natural resources must be used with the utmost economy, unnecessary destruction avoided, health and comfort considered in the devising and planning of works, and the erection of squalid dwellings crowded into a minimum of space must give place to town-planning on a scientific and sound basis. The symbol of the palæotechnic age was the furnace fired with raw coal; that of the neotechnic age is the electrical power-house with its clean atmosphere and white-tiled walls. Prof. Desch is to be commended on having laid such emphasis on a matter of vital importance to the future of the country.

COPIES have reached us of Nos. 2 and 3 of the *Children's Newspaper*, a weekly periodical edited by Mr. Arthur Mee, and published by the Amalgamated Press, Ltd. Mr. Mee was editor of the "Children's Encyclopædia" and "Harmsworth's Popular Science," both of which are among the best works of their class. The new periodical shows the same interest in scientific matters and originality in presenting them to juvenile readers. Its aim is to give "the story of the world to-day for the men and women of to-morrow," and we are glad to see that the world includes Nature as well as man. We should like to think that when the boys and girls who now derive pleasure and profit from the newspaper published especially for them become adults they will expect like fare to be provided in the public Press. The *Children's Newspaper* will be a valuable aid in this direction, and we cordially welcome it.

*Messrs. A. and C. Black, Ltd.*, will publish shortly a book on "Cerebro-spinal Fever," by Drs. C. Worster-Drought and A. M. Kennedy. The authors were responsible for the treatment of the disease among the troops in the Woolwich military district. The following works have been arranged for appearance in the University of Chicago Science Series (*Chicago: The University of Chicago Press; London: The Cambridge University Press*):—"Black Body Radiation," Prof. C. E. Mendenhall; "Mechanics of Delayed Germination in Seeds," W. Crocker; "The Rigidity of the Earth and of Materials," Prof. A. A. Michelson; and "Linear Integral Equations in General Analysis," E. H. Moore. The new list of *Messrs. Longmans and Co.* includes "The Design of Propellers for Aircraft," H. C. Watts; "The Design of Aero Engines," Major A. T. Evans and Capt. Adams; "Engineering Machine Tools and Processes," A. G. Robson; "The Principles and Practice of Electrical Testing," R. G. Allen; and "Garden First in Land Development," W. Webb. *Mr. H. Milford* announces "The Place of the University in National Life," the Right Hon. H. A. L. Fisher (No. 4 of "Barnet House Papers").

THE latest catalogue (No. 387) of Mr. F. Edwards, 83 High Street, Marylebone, W.1, appears at an opportune moment, seeing that it deals with books relating to Europe. It is historical and descriptive, and conveniently arranged according to the various countries of the Continent. Doubtless it will be of interest to many readers of NATURE at the present time. Copies are obtainable upon application.

## OUR ASTRONOMICAL COLUMN.

THE APRIL METEORIC DISPLAY.—The shower of Lyrid meteors in April dates from antiquity, and some of the early displays appear to have been of an exceptional and striking character. In 1803 a brilliant exhibition was witnessed in America, and in 1851 it was repeated in Indian skies. In 1863 its visitation as viewed from England was conspicuous, if it lacked the grandeur of old-time spectacles. It is evidently not a phenomenon with attractive features which we can await with confidence every year as in the case

of the August Perseids. It is rather an event with possibilities which cannot be definitely predicted because it is affected by irregularities not fully understood. Usually it must be confessed that the shower provides few meteors and disappointment. However, meteoric astronomers anticipate its brilliant revival at any time, and watch the spring skies with a keenness which merits success.

The meteors are due on the night of April 21, when the moon will be at her last quarter, and does not rise until nearly an hour after midnight. But it will be advisable to watch on the preceding night also, and the hours after midnight are likely to be the most productive, the radiant point at 271°+33° being at a much greater altitude than in the evening hours. The really active stage of the shower is limited to a few hours, but the whole duration is much longer, and certainly extends from April 18, when radiation is from 266°+33°, to April 26, when it has advanced to 278°+33°.

UNIFICATION OF THE ASTRONOMICAL AND CIVIL DAY.—The Lords Commissioners of the Admiralty have given instructions to the Superintendent of H.M. Nautical Almanac Office that in the Almanac for 1925 the day shall be considered as beginning at midnight, to make the astronomical agree with the civil day. This change has been resolved on after consultation with the Royal Astronomical Society, which issued a circular to the superintendents of the ephemerides of other nations and to the representatives of other bodies asking for opinions and suggestions. It appears that the change is to be made chiefly in the interests of seamen, who will find it more convenient to have the same time system in use for purposes of navigation and for ordinary life on board ship. It may be remembered that a vigorous attempt to secure this unification of the civil and astronomical day was made about the year 1885.

THE EVOLUTION OF BINARY SYSTEMS.—Mr. J. H. Jeans, in the Monthly Notices of the Royal Astronomical Society for December, 1918, examines some of the problems of double-star orbits. While in the solar system the angular momentum is too small for the system to have broken up through rotation, in the majority of binary systems it is too large for this to have happened. Tidal action cannot increase the latus rectum by more than some 60 per cent. in the case of equal masses (Russell). Large alterations of latus rectum, and hence of period, cannot, therefore, arise from the mutual action of the stars. Either the periods have retained approximately their present values throughout the star's career (this hypothesis is rejected), or there must have been sensible disturbances from other stars. This leads Mr. Jeans to the interesting conclusion that the stellar system was initially of about 1/1000 of its present volume. He suggests that the outward movement may still be in progress, and notes the observed excess of positive radial velocities as evidence of this. In its earlier compressed condition mutual encounters of stars would have been frequent. Incidentally, he finds 0·637 as a mean value of eccentricity of orbits as produced by encounters. This accords well with observed facts.

It is advisable to direct attention to one sentence of the summary. Mr. Jeans says:—"The dwarf M stars have velocities which show no preference for particular directions in space, and there seems to be no correlation between the magnitude of their velocities and the parts of the universe they occupy." But, in fact, we are acquainted only with those dwarf M stars that are in close proximity to the sun; for such stars are intrinsically so faint that they do not appear in our catalogues at all if they are distant.

## AERIAL PHOTOGRAPHY.

PHOTOGRAPHY from the air reached a wonderful degree of excellence during the war, as is demonstrated by the pictures that have been published and shown at various exhibitions; but for obvious reasons the instruments used for this work have only quite recently been made public. The experts who have compared the various lenses suitable assure us that those made by English opticians were found to be not only equal to those of Zeiss and Goerz, but markedly superior to them. With regard to cameras, the editor of the *British Journal of Photography* has had an opportunity of seeing the whole range of cameras used by the Royal Air Force, and describes them in an article in his journal of March 21. Within a few months of the beginning of the war the value of aerial photographs began to be recognised, and specially made cameras were first used early in 1915. The first camera was of a very primitive type, and fitted with a Mackenzie-Wishart adapter for 5×4 plates. Early in 1916 a magazine-changing arrangement was used with the plates in metal sheaths, the foremost—that is, the lowest—plate being pushed sideways after exposure into the receiver by a horizontally moving metal plate. So far the cameras were of wood, but in 1917 a metal camera was introduced, and the changing done by pulling a cord instead of pushing a metal plate.

The next improvement (early in 1917) was to provide a mechanical method of changing, the motive power being produced by a small propeller, which was brought into action by simply releasing a Bowden lever, the shutter being automatically actuated at the same time and by the same means. In 1918 this camera was further improved in several ways. The shutter was made replaceable by another, if necessary, as on account of derangement, and lenses of focal lengths from 4 in. to 20 in. might be used on the same camera. Among other patterns was one, first used in 1916, which would take a continuous series of photographs, up to 120, on a roll of film. The exposures were made automatically at intervals corresponding with a certain number of revolutions of the propeller, and by means of a small supplementary lens each negative had recorded on it the height of the machine and its compass bearings. Major C. W. Gamble, of the R.A.F., in a lecture before the Optical Society on March 13, after describing the various cameras used, said that, although the most rapid plates were desirable so that exposures might be made late in the day and when the light was poor, it was found that the density-giving capacity of the plate was of at least equal importance. As time progressed the tendency was to use panchromatic rather than orthochromatic plates, and, finally, three-fourths or more of the plates used were panchromatic, a suitable light-filter being employed.

## NEW KNOWLEDGE OF A PUZZLING GROUP OF GYMNOSPERMS.

THE abundance of large fronds in Rhætic, Jurassic, and Wealden rocks, closely resembling in habit those of some recent Cycads, and the occurrence of hundreds of petrified trunks in Jurassic and Neocomian strata in North America and, in smaller numbers, in many other parts of the world, have led palæobotanists to speak of these periods as the "age of Cycads." It is, however, a remarkable fact that the reproductive shoots of these Cycad-like plants differ very widely from the corresponding organs in the true Cycads; had we possessed no knowledge of the vegetative organs, the reproductive shoots would

not have been styled cycadean. The differences between the reproductive organs of the recent and extinct forms find expression in the reference of the Jurassic and Lower Cretaceous plants to a separate group, Bennettitales, the existing cycadean genera being included in the Cycadales.

Dr. Marie C. Stopes has recently made two important contributions to our knowledge of the Bennettitales in a paper published in vol. ccviii. of the Philosophical Transactions of the Royal Society, containing descriptions and many admirable illustrations of a new species of seminiferous cone and a cone-bearing stem. The new cone, named *Bennettites albianus*, was discovered in the Gault of Folkestone by Mr. G. C. Walton. A French specimen of Bennettites was described some years ago by Prof. Lignier from beds in Normandy, believed by him to belong to the Gault, but with that exception all Bennettitean cones are from Jurassic or Wealden strata. The preservation of the English species is unusually good; the type-specimen is a portion of the broad domical apex of a cone about 120 mm. in diameter, containing several hundred seeds, many of them with embryos. In general plan it agrees with previously described Bennettites cones; each seed is closely invested by seven interseminal scales, with expanded and laterally confluent truncate apices, forming a strong protective covering to the surface of the "fruit." It is suggested that the lacunar tissue surrounding the stalks on which the erect exalbuminous seeds are borne, and the tubular cells of the arillus-like basal cup in which each seed is embedded, drew up and retained water like the water-storage tissue of a bog moss, thus keeping the interior of the fruit moist. It is pointed out in support of this ingenious view that the seeds are deficient in vascular-conducting tissue.

The careful and detailed investigation of the complex structure of the seeds does not afford support to the view advanced by some writers that the Bennettitean seed agrees closely with that of Gnetum, nor are any new facts brought to light which favour an alliance between Bennettites and the Angiosperms.

It is probable that the plant which bore the cone described by Dr. Stopes was one of the latest representatives of the Bennettitales; the habit and the anatomical characters of the vegetative organs were, in the main, retained by the Cycads as we know them to-day—a small group, for the most part tropical in their distribution, and probably of comparatively recent origin. On the other hand, it has yet to be shown that the complex reproductive shoots of Bennettites gave rise to any direct descendants.

The thorough examination by Dr. Stopes of the Lower Greensand stem named by Carruthers *Bennettites maximus* shows that it agrees anatomically with other species except in the absence of any undoubted secretory cells in the ground-tissue of the stem and leaf-bases. The abundance of thick-walled, pitted cells, or "transfusion elements," which physiologically may represent secretory cells, is a characteristic feature. The most important point made by the author is that *Bennettites maximus* bore bisporangiate cones similar to those described by Wieland from America, and differing from the apparently unisexual cones previously recorded from Britain.

A. C. SEWARD.

## EDUCATION AND SCIENCE IN THE CIVIL SERVICE ESTIMATES.

THE Estimates for Civil Services for the year ending March 31, 1920, amount in Class IV. (Education, Science, and Art) to 41,251,610*l*. The following are among the Estimates:—

*United Kingdom and England.*

| Service | 1919–20 | Compared with 1918–19 Increase |
|---|---|---|
| | £ | £ |
| Board of Education ... | 31,353,111 | 12,243,406 |
| British Museum ... ... | 209,714 | 83,572 |
| Scientific investigation, etc. | 113,974 | 59,733 |
| Department of Scientific and Industrial Research ... | 242,815 | 94,465 |
| Universities and Colleges, United Kingdom, and Intermediate Education, Wales ... ... ... | 945,700 | 624,000 |
| Universities, etc., special grants ... ... ... | 500,000 | 470,000 |
| *Scotland.* | | |
| Public education ... ... | 4,677,220 | 1,635,675 |
| *Ireland.* | | |
| Public education ... ... | 2,721,356 | 519,752 |
| Intermediate education ... | 90,000 | — |
| Science and art ... ... | 190,498 | 27,105 Decrease |
| Universities and colleges ... | 85,000 | 11,350 |

Details of some of these Estimates of particular interest to men of science are as follows:—

SCIENTIFIC INVESTIGATIONS, ETC.

| | £ |
|---|---|
| Royal Society: | |
| (i) Grant in aid of (*a*) scientific investigations undertaken with the sanction of a committee appointed for the purpose (4000*l*.) and (*b*) scientific publications (1000*l*.) ... ... ... ... ... | 5,000 |
| (ii) Grant in aid of salaries and other expenses of the Magnetic Observatory at Eskdalemuir ... ... ... ... | 1,000 |
| Meteorological Office ... ... ... ... | 47,000 |
| Royal Geographical Society ... ... ... | 1,250 |
| Marine Biological Association of the United Kingdom ... ... ... ... ... ... | 1,000 |
| Royal Society of Edinburgh ... ... ... | 600 |
| Scottish Meteorological Society ... ... | 100 |
| Royal Irish Academy ... ... ... ... | 1,600 |
| Royal Zoological Society of Ireland ... ... | 500 |
| British School at Athens ... ... ... | 500 |
| British School at Rome ... ... ... ... | 500 |
| Royal Scottish Geographical Society ... ... | 200 |
| National Library of Wales ... ... ... | 8,900 |
| National Museum of Wales: | |
| Grant in aid of the expenses of the museum | 4,000 |
| Special building grant in aid ... ... ... | 20,000 |
| Solar Physics Observatory ... ... ... | 3,000 |
| School of Oriental Studies ... ... ... | 4,000 |
| North Sea Fisheries Investigation ... ... | 1,250 |
| Imperial Mineral Resources Bureau ... ... | 11,000 |
| Edinburgh Observatory ... ... ... ... | 1,974 |

SCIENTIFIC AND INDUSTRIAL RESEARCH.

| | £ |
|---|---|
| Salaries, wages, and allowances ... ... | 11,870 |
| Travelling and incidental expenses ... ... | 1,500 |
| Grants for Investigation and Research: | |
| (1) Grants for investigations carried out by learned and scientific societies, etc. ... | 13,570 |
| (2) Grants for investigations directly controlled by the Department of Scientific and Industrial Research ... ... ... | 55,000 |
| (3) Grants to students and other persons engaged in research ... ... ... | 25,000 |
| (These grants will be distributed by a Committee of the Privy Council, on the recommendation of an Advisory Council, to promote the development of scientific | |

| | £ |
|---|---|
| and industrial research in the United Kingdom, and will be subject to such conditions as the Committee may think necessary.) | |
| Fuel Research Station ... ... ... ... | 12,775 |
| National Physical Laboratory[1] ... ... | 154,650 |

UNIVERSITIES AND COLLEGES, UNITED KINGDOM.

| | £ |
|---|---|
| University of London ... ... ... ... | 8,000 |
| Victoria University of Manchester ... ... | 2,000 |
| University of Birmingham ... ... ... | 2,000 |
| University of Wales ... ... ... ... | 4,000 |
| University of Liverpool ... ... ... | 2,000 |
| Leeds University ... ... ... ... | 2,000 |
| Sheffield University ... ... ... ... | 2,000 |
| Bristol University ... ... ... ... | 2,000 |
| Durham University ... ... ... ... | 2,000 |
| Scottish Universities, grant in aid under section 25 of the Universities (Scotland) Act, 1889,[2] 42,000*l.*; additional grant in aid, 42,000*l.* ... ... ... ... ... ... | 84,000 |
| Grant in aid of the University Colleges Grants Deposit Account, to be employed in making grants in aid of certain Colleges in Great Britain giving education of a university standard in arts and sciences and technology ... ... ... ... ... ... | [3] 210,000 |
| Grant in aid of the expenses of the University Colleges of North Wales, South Wales and Monmouthshire, and Aberystwyth (4000*l.* to each) ... ... ... ... ... | 12,000 |
| Additional grant in aid of the expenses of the University of Wales and of the University Colleges of North Wales, South Wales and Monmouthshire, and Aberystwyth (2500*l.*, 5125*l.*, 7750*l.*, and 5125*l.* respectively) ... | 20,500 |
| Grant in aid of the expenses of the Imperial College of Science and Technology ... | 32,000 |
| Supplementary grant in aid of maintenance of Universities and Colleges in the United Kingdom ... ... ... ... ... | [4] 531,500 |
| Total for Universities and Colleges ... | 916,000 |

SPECIAL GRANTS.

| | 1919–20 £ | 1918–19 £ | Increase £ |
|---|---|---|---|
| Special grants in aid of Universities, Colleges, Medical Schools, etc. | 500,000 | 30,000 | 470,000 |

Certain of the universities, colleges, and other similar institutions which are in receipt of Parliamentary grants are in need of special assistance in order that they may, so far as possible, resume their full work under favourable conditions, and may not be hampered by extraordinary expenditure involved by the prolonged interruption of their activities and development caused by the war. The special grants in aid for 1918–19 were provided to meet particularly urgent cases in which some measure of assistance could not be delayed until the conclusion of hostilities without risk of grave permanent detriment to the institutions concerned.

[1] Services rendered without payment for other Government Departments are estimated as follows:—Admiralty, 6500*l.*; Air Ministry, 36,350*l.*; Ministry of Munitions, 63,000*l.*; War Office, 500*l.* The testing fees at the National Physical Laboratory and charges for special investigations amounted to 26,500*l.*

[2] In addition to an annual sum of 30,000*l.* payable to these Universities from the Local Taxation (Scotland) Account under Section 2 (2) of the Education and Local Taxation Account (Scotland) Act, 1892.

[3] Of this amount 60,000*l.* will be devoted to grants in aid of technological education.

[4] This sum, together with 84,000*l.* provided in Class IV., 18, is intended to raise to 1,000,000*l.* the total amount of the grants paid out of the Exchequer during the year 1919–20 for the maintenance of University Institutions in the United Kingdom.

UNIVERSITIES AND COLLEGES, IRELAND.

| | £ |
|---|---|
| Queen's University of Belfast ... ... | 18,000 |
| University College, Dublin ... ... ... | 32,000 |
| University College, Cork ... ... ... | 20,000 |
| University College, Galway ... ... ... | 12,000 |
| National University of Ireland and University College, Dublin ... ... ... | 1,000 |
| Additional grant towards increasing the resources of University College, Galway ... | 2,000 |

## *UNIVERSITY AND EDUCATIONAL INTELLIGENCE.*

CAMBRIDGE.—The Cavendish professorship of experimental physics, recently vacated by the Master of Trinity, has been filled by the appointment of Sir Ernest Rutherford. This office carries with it the direction of the Cavendish Laboratory. An adequate continuation of the very remarkable line of occupants of this important position, represented by the names of Clerk Maxwell, Rayleigh, and J. J. Thomson, has thus been secured.

At the same time the University fortunately continues to be in a position to profit by the services of Sir J. J. Thomson on an honorary basis. A special professorship of physics without stipend has been created for him, and accommodation and resources will be provided, so far as finances permit, for the prosecution of his scientific work and his activities in the stimulation of research in physical science.

It is hoped that the University will very soon find itself in a position to embark upon the structural developments which will be required in order to take full advantage of this great accession of strength in the most fundamental of the sciences, and to maintain the repute and activity of the Cavendish Laboratory at the level that the national interest in the coming time will more than ever demand.

LONDON.—The Ramsay Memorial Committee has offered to the University a sum of not less than 25,000*l.* towards the foundation of a laboratory of chemical engineering at University College. The Senate has gratefully accepted the offer, and is allotting a site for the purpose.

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ON the invitation of the governors of Birkbeck College, London, Lord Haldane has accepted the position of president of the college, in succession to the late Lord Alverstone.

APPLICATIONS for grants from the Dixon Fund of the University of London for assisting scientific investigations must reach the Academic Registrar of the University before May 15 next.

THE Lindley studentship in physiology will shortly be awarded by the University of London. It is open to students qualified to undertake research. Applications must be made to the Academic Registrar, the University of London, South Kensington, before April 30.

A COMMITTEE of the Royal College of Physicians of London and of the Royal College of Surgeons of England will shortly appoint a Streatfeild research scholar in medicine and surgery. The annual value of the scholarship is about 250*l.*, and the tenure three years, at the discretion of the committee. Applications, stating the nature of the proposed research, the place where it is to be carried out, and the status of the applicant, should be sent to the Registrar, Royal College of Physicians of London, Pall Mall East, S.W.1, marked "Streatfeild Scholarship."

MR. ARTHUR HENDERSON, secretary of the Labour Party, appeals in the *Times* of April 8 for a large and

immediate increase in the Exchequer grants to universities and university colleges. The financial position of our universities in comparison with those of the United States and Germany was surveyed in an article in NATURE of August 15, 1918, and is stated in detail in a report published by the British Science Guild on "Industrial Research and the Supply of Trained Scientific Workers." The main facts stated by Mr. Henderson are given in these publications, and are familiar to most of our readers, but they cannot be brought under the notice of the public and our legislators too often.

MISS MAUD MARGARET GIBSON has placed in the hands of the Royal Society of Medicine a sum of money sufficient to provide a scholarship of the yearly value of about 250*l.* for medical research by women, in memory of her father, the late Mr. William Gibson, of Melbourne, Australia. The scholarship will be awarded from time to time by the society to qualified medical women who are subjects of the British Empire, and is tenable for two years, but may, in special circumstances, be extended to a third year. The scholar will be free to travel at her own will for the purpose of the research undertaken by her. There will be no competitive examination, nor need a thesis or other work be submitted. Applications must be sent in not later than May 3. Particulars may be obtained from Mr. J. Y. W. Macalister, secretary of the Royal Society of Medicine, 1 Wimpole Street, W.1.

SCIENTIFIC workers who are endeavouring to secure professional recognition by Government through a new degree to be granted by our higher technical institutions will be much interested in Prof. Camichel's account of what is proposed in this direction in France (*Revue générale des Sciences*, January 30, 1919). M. Pottevin has introduced a Bill in the Chambre des Députés for the establishment of autonomous technical institutes in connection with existing universities, the rector of the university being president in each case of a council which is to include representatives of the teaching staff, the Ministry, the departments, the municipalities, associated or private benefactors, chambers of commerce, and local workmen's organisations. It is proposed that these institutes should have power to grant degrees in applied science in the name of the State, such degrees, unlike those of the universities, carrying Government sanction for professional practice, as is already the case in the safeguarded degrees in medicine, advocacy, and pharmacy.

A BILL has been introduced in the United States Senate to create a Department of Education with a Secretary of Education, and granting money for educational purposes in co-operation with the States. The Bill proposes to distribute money to the States on condition that they raise equal amounts for the same purposes. It authorises an annual appropriation of 20,000,000*l.*, to be apportioned among the States for the following purposes:—(1) To encourage the States in the removal of illiteracy, 1,500,000*l.* (2) To encourage the States in the Americanisation of foreigners, 300,000*l.* (3) To encourage the States in the equalisation of educational opportunities, and for the partial payment of teachers' salaries, providing better instruction, extending school terms, and otherwise providing equally good schools for all children, 10,000,000*l.* (4) To encourage the States in the promotion of physical and health education and recreation, 4,000,000*l.* (5) To encourage the States in providing facilities for preparing and supplying better teachers, 3,000,000*l.* According to the New York *Tribune*, there are 700,000 illiterate males in the United States between the ages of twenty-one and thirty-one unable either to understand the principles for which they were called upon to fight or to read the Constitution they were expected to defend. There are at the present time in the United States 8,592,000 illiterates and persons unable to speak English, of whom 1,006,000 live in New York State and 621,000 in Pennsylvania. The Bureau of Education has reported that the average annual salary paid to American teachers in 1918 was about 126*l.*, which is about 49*l.* less per annum than the average wage paid to charwomen in the United States Navy Yard.

## SOCIETIES AND ACADEMIES.

### LONDON.

**Royal Society**, April 3.—Sir J. J. Thomson, president, in the chair.—Dr. T. R. **Merton** and Prof. J. W. **Nicholson**: Note on the intensity decrement in the Balmer series. Twelve members of the Balmer series of hydrogen have been observed in vacuum tubes containing a trace of hydrogen in helium at a pressure of 41 millimetres of mercury. In contrast with the diffuse appearance of the last of these members in pure hydrogen, they were observed in the present instance as sharp, though faint, lines. A quantitative comparison of the intensity distribution in these tubes with that in tubes containing pure hydrogen, water-vapour, and a mixture of hydrogen and helium at low pressure has shown that the visibility of the higher members of the series in the high-pressure tubes is most probably due to the fact that the energy under these conditions is concentrated within narrow limits of wave-length, instead of being distributed through a broadened line the energy-content of which is, in fact, greater. The observed results seem to be incompatible with the quantum theory of the hydrogen spectrum developed by Bohr.—Prof. E. W. **Brown**: The determination of the secular accelerations of the moon's longitude from modern observations.—Dr. W. **Rosenhain** and S. L. **Archbutt**: The inter-crystalline fracture of metals under prolonged application of stress. The authors' observations have shown that in a number of metals, including lead, mild steel, and an alloy of aluminium with zinc and copper, the prolonged application of stress will, in certain cases, produce an abnormal type of fracture in which the crystals become separated from one another, instead of being broken or torn across in the normal manner. An exact similarity to this type of fracture is found in the "season cracking" of brass. In the latter case the applied stress is an internal one arising from elastic deformation. The authors base an explanation of this type of fracture on the hypothesis, formerly advanced by one of them and widely accepted among metallurgists, that the constituent crystals of metals are held together by thin layers of an amorphous inter-crystalline "cement," the properties of which resemble those of a greatly under-cooled liquid.—Dr. J. R. **Airey**: Zonal harmonics of high order in terms of Bessel functions.

**Physical Society**, March 14.—Prof. C. H. Lees, president, in the chair.—C. C. **Paterson** and N. **Campbell**: Some characteristics of the spark discharge and its effect in igniting explosive mixtures. The object of the investigation was to determine the relation between the electrical characteristic of a spark discharge and its power of igniting explosive mixtures. The results show that the igniting power of a spark increases with both the capacity discharging and the spark potential, and that the energy required for ignition decreases rapidly as the spark potential increases. Various other properties of sparks are described.

### MANCHESTER.

**Literary and Philosophical Society**, March 18.—Mr. W. Thomson, president, in the chair.—Prof. G. Elliot **Smith**: The bird's brain. It has always been an

enigma that, in spite of their very scanty equipment of obvious cerebral cortex, birds should display, in their powers of tactile, visual, and acoustic discrimination, their associative memory, and their ability to learn by individual experience, such outstanding evidence of functions which are intimately associated in mammals with the activities of the cortex. The explanation of this apparent discrepancy between the morphology of the brain and the bird's aptitude to profit by experience is provided by the fact that a great part of the structure usually called "corpus striatum" is cortical in origin and in its fibre-connections.—M. **Christy**: The ancient legend as to the hedgehog carrying fruit upon its spines. This legend, at least two thousand years old, had been repeated by most of the classical and medieval writers on natural history, many of them adding to or improving upon the original story. The author reviewed the forms in which it had been presented, showing that the fruit said to have been carried varied geographically. He cited two instances which had come under his notice; both, though second-hand evidence, he believes to have some foundation in fact. He concludes that the hedgehog does eat fruit, and may occasionally intentionally carry it on its spines.

PARIS.

**Academy of Sciences,** March 17.—M. Léon Guignard in the chair.—J. **Hadamard**: Remark on the residual integral.—C. **Richet** and G. **Noizet**: An unsinkable garment, protecting against cold. The garment is made of vulcanised cloth, similar to that used for balloons, lined internally with a thickness of about 15 mm. of kapok. In an apparatus for saving life at sea protection against cold is as important as protection against sinking. The garment made of the above material has been successfully subjected to actual tests; as a safety apparatus it has one drawback: it takes ten minutes to put on unassisted, or three minutes with assistance.—The Permanent Secretary announced the death of Edmund Weiss, correspondant of the Academy for the section of astronomy.—B. **Gambier**: Surfaces applicable one on the other.—H. **Cramer**: The zeros of the function $\zeta(s)$.—M. **Petrovitch**: Integral functions connected with the first numbers.—V. **Brun**: The theorem of Goldbach.—E. **Cotton**: The formula of Bernoulli.—C. **Raveau**: Carnot's calculation of the mechanical equivalent of heat. An unpublished document.—C. **Chéneveau** and R. **Audubert**: Absorption by turbid media. Influence of the diameter and the number of the particles. Lord Rayleigh's theorem is limited to the case in which the suspended particles are small with respect to the wave-length of the incident light. From experimental data a modified formula is proposed dealing with the case of larger particles.—L. **Abonnenc**: The laws of flow of liquids by drops in cylindrical tubes. If D and $d$ are the external and internal diameters of the tube from which the drops are falling, T is the surface tension of the liquid, $\eta$ its viscosity, $\rho$ its density, N the frequency of fall, $m$ and $n$ successive powers of 2, then the weight of a drop $p$ is given by the formula

$$p = \mathrm{ATD} + m\mathrm{B}\eta\mathrm{N} - n\frac{\mathrm{C}}{d}\rho\mathrm{N}^2,$$

where A, B, and C are constants independent of the liquid.—P. **Nicolardot**: The tempering of lead, tin, and thallium. These three metals can be tempered. They anneal themselves spontaneously at the ordinary temperature, with a rapidity increasing with the temperature.—O. **Bailly**: The action of alkyl iodides on neutral sodium phosphate in aqueous solution. The reaction takes place according to the equation

$$\mathrm{PO(ONa)_3 + RI = PO(ONa)_2 - OR + NaI},$$

the proportion of the phosphoric ether formed falling from 73·5 per cent. for methyl iodide to 10·6 per cent. for isobutyl iodide.—R. **Dubuisson**: The magnetic anomalies of the Paris basin.—J. **Lévine**: The periodicity of atmospheric waves. A curve of the annual barometric minima for the period 1700 to 1919 shows a recurring period of about ninety-six years.—H. **Hubert**: The prediction of squalls in western Africa.—A. **Trillat** and M. **Fouassier**: An apparatus designed for the study of the formation and persistence of fogs.—M. **Dechevrens**: The diurnal variation of the vertical electric current of the earth in the air (observations made at Jersey).—F. **Vlès**: Some optical properties of bacterial emulsions.—G. **Sanarelli**: The pathogeny of cholera.

March 24.—M. Léon Guignard in the chair.—A. **Rateau**: Quantity of total motion and mean velocity of a jet of gas emerging from a reservoir by a *tuyère*.—A. **Blondel**: The conditions of stability of synchronised alternators connected to a constant-pressure network.—H. H. **Hildebrandsson**: Preliminary reflections on the general movements of the atmosphere. From a study of experimental data only, without regard to any existing theories, nine conclusions are drawn of atmospheric movements, the most important being that there is no evidence of a direct higher current from the equator towards the poles, neither is there a lower current in the opposite sense.—G. **Julia**: Some general properties of integral functions related to Picard's theorem.—A. **Petot**: The analytical theory of hydraulic turbines.—C. **Rabut**: Static synthesis of constructions.—G. **Guillaumin**: Ram strokes in pipes of variable diameter.—R. **Ledoux-Lebard** and A. **Dauvillier**: The spectral structure of the J rays. The spectrum of the J rays, discovered by Barkla and White, should be very simple, possibly one radiation only. Boron appeared to be indicated as a suitable source of these rays, and experiments with this material are described. No line of wave-length near $\lambda = 0{\cdot}43$ Å.U. could be detected.—H. **Copaux**: A method of extracting glucina from beryl. The mineral is heated to 850° C. with sodium fluosilicate, and the fritted mass extracted with boiling water. The greater part of the silica and alumina remains undissolved.—L. **Benoist**: A reaction and method for the estimation of ozone. The method is based on the destruction of the dye fluorescein by ozone, and can detect and estimate quantities down to a millionth of a milligram of ozone.—A. **Guébhard**: A new point of view in metallogenesis.—Ph. **Glangeaud**: The volcanic group, Banne d'Ordanche, Puy-Loup, and Puy-Gros, of the Monts Dore massif. A remarkable volcanic and hydrothermal fault.—G. **Reboul** and L. **Dunoyer**: The mutual actions of low and high barometric pressures.—A. **Baldit**: Cold storms and their trajectories.—F. **Maignon**: Study of the mechanism of the action of fats in the utilisation and assimilation of albuminoids. A theory is developed to explain the experimental results published in earlier communications. It is supposed that the amino-acids arising from the partial digestion of the albuminoids can recombine with fatty acids from the fats. This would explain not only the increased assimilation, but also the observed reduction in the toxic power of the albuminoids.—L. L. **Dantan**: The origin of the sexual cells in *Parantipathes larix*.—F. **d'Hérelle**: The *rôle* of the filtering anti-bacterial micro-organism in typhoid fever. The study of twenty-eight cases of typhoid fever has led to conclusions similar to those arrived at for dysentery. Coincident with improvement in the patient, there appeared in the fæces a substance possessing a powerful bactericidal action upon the typhoid bacillus, which can only be attributed to an antagonistic micro-organism.

## BOOKS RECEIVED.

Van Nostrand's Chemical Annual. Fourth issue. 1918. Edited by Prof. J. C. Olsen, assisted by Lieut. M. P. Matthias. Pp. xviii+778. (London: Constable and Co., Ltd.) 15*s*. net.

The Century of Hope. By F. S. Marvin. Pp. vi+352. (Oxford: At the Clarendon Press.) 6*s*. net.

Report on an Inquiry into the Silk Industry in India. Vol. i.: The Silk Industry. By H. Maxwell-Lefroy. Pp. ii+211. Vol. ii.: Present Condition of the Silk Trade of India. By E. C. Ansorge. Pp. vi+115. Vol. iii.: Appendices to Vol. i. By H. Maxwell-Lefroy. Pp. 227. (Calcutta: Superintendent Government Printing, India.) Vol. i., 3*s*.; vol. ii., 2*s*.; vol. iii., 4*s*. 2*d*.

The Journal of a Disappointed Man. By W. N. P. Barbellion. With an introduction by H. G. Wells. Pp. x+312. (London: Chatto and Windus.) 6*s*. net.

Catalogue of Lewis's Medical and Scientific Circulating Library. New edition, revised to the end of 1917. Pp. vi+492. (London: H. K. Lewis and Co., Ltd.) 12*s*. 6*d*. net.

The War Work of the Y.M.C.A. in Egypt. By Sir J. W. Barrett. Pp. xx+212. (London: H. K. Lewis and Co., Ltd.) 10*s*. 6*d*. net.

Strife of Systems and Productive Duality: An Essay in Philosophy. By Prof. W. H. Sheldon. Pp. x+534. (Cambridge, Mass.: Harvard University Press; London: Humphrey Milford.) 15*s*. net.

Concealing-coloration in the Animal Kingdom. By G. H. Thayer. With an introductory essay by A. H. Thayer. New edition. Pp. xix+260+xvi plates. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd.) 25*s*. net.

Criminology. By Dr. M. Parmelee. Pp. xiii+522. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd.) 10*s*. 6*d*. net.

Soils and Fertilizers. By Prof. T. L. Lyon. Pp. xx+255. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd.) 6*s*. 6*d*. net.

The Mastery of Nervousness, Based upon Self-Re-education. By Dr. R. S. Carroll. Third revised edition. Pp. 248. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd.) 10*s*. 6*d*. net.

The Living Cycads. By Prof. C. J. Chamberlain. Pp. xiv+172. (Chicago, Ill.: The University of Chicago Press.) 1.50 dollars net.

Le Rocce: Concetti e Nozioni di Petrografia. By Prof. E. Artini. Pp. xx+636+plates xxxii. (Milano: U. Hoepli.) 18.50 lire.

Self and Neighbour: An Ethical Study. By E. W. Hirst. Pp. xix+291. (London: Macmillan and Co., Ltd.) 10*s*. net.

Aids in Practical Geology. By Prof. G. A. J. Cole. Seventh edition, revised. Pp. xvi+431. (London: C. Griffin and Co., Ltd.) 10*s*. 6*d*. net.

The Elements of Astronomy for Surveyors. By Prof. R. W. Chapman. Pp. x+247. (London: C. Griffin and Co., Ltd.) 5*s*. net.

Les Principes de l'Analyse Mathématique: Exposé Historique et Critique. By Prof. P. Boutroux. Tome ii. Pp. 512. (Paris: A. Hermann et Fils.) 20 francs.

## DIARY OF SOCIETIES.

*THURSDAY*, APRIL 10.

INSTITUTION OF NAVAL ARCHITECTS, at 11 a.m.—A. E. Seaton: The Work of the British Marine Engineering Design and Construction Committee.—Signor S. Orlando: Italian Two Floodable Compartment Cargo Steamers Built during the War.—Sir E. H. Tennyson d'Eyncourt and T. Graham: Some Recent Developments towards a Simplification of Merchant Ship Construction.—At 3.—C. I. R. Campbell: Development of Airship Construction.—W. L. Scott: Concrete Shipbuilding in the United States of America.—At 7.30.—The Hon. Sir C. A. Parsons and Stanley S. Cook: Investigation into the Causes of Corrosion and Erosion of Propellers.—J. H. Gibson: The Michell Thrust Block.

ROYAL INSTITUTION, at 3.—Prof. A. Findlay: Colloidal Matter and its Properties.

INSTITUTION OF MINING AND METALLURGY, at 5.—Major H. Standish Ball: The Work of the Miner on the Western Front.

ROYAL HISTORICAL SOCIETY, at 5.—R. A. Gregory: Science in the History of Civilisation.

INSTITUTION OF ELECTRICAL ENGINEERS, at 6.—R. J. Kaula: Notes on Surface Condensing Plants, with Special Reference to the Requirements of Large Power Stations.

OPTICAL SOCIETY, at 7.30.—J. W. French: The Unaided Eye.—T. Smith: The Spacing of Glass-working Tools.

*FRIDAY*, APRIL 11.

INSTITUTION OF NAVAL ARCHITECTS, at 11 a.m.—W. H. Gard: Some Experiences with Electric Welding in Warships.—Dr. J. Montgomerie: Further Experiments on the Stress Determination in Flat Steel Plates.—A. T. Wall: The Tonnage of Modern Steamships.—At 3.—J. L. Kent: Model Experiments on the Effect of Beam on the Resistance of Mercantile Ship Forms.—J. Semple: Some Experiments on Full Cargo Ship Models.

ROYAL ASTRONOMICAL SOCIETY, at 5.—J. H. Jeans: The Origin of Binary Systems.—*Probable Papers:* Dr. A. A. Rambaut: A Short Table for Directly Converting Estimates of Brightness into Stellar Magnitudes on Pogson's Scale.—Rev. T. E. R. Phillips: Note on a Remarkable Change in the South Tropical Region of Jupiter.

ROYAL INSTITUTION, at 5.30.—Sir J. J. Thomson: Piezo-Electricity and its Applications.

*SATURDAY*, APRIL 12.

ROYAL INSTITUTION, at 3.—Sir J. J. Thomson: Spectrum Analysis and its Application to Atomic Structure.

*MONDAY*, APRIL 14.

ROYAL GEOGRAPHICAL SOCIETY, at 5.—Dr. J. Ball and H. K. Shaw: The Astrolabe à Prisme.

INSTITUTION OF ELECTRICAL ENGINEERS, at 7.30.—Dr. R. D. Gifford: Opener of a Discussion on Electrical Instruments.

*TUESDAY*, APRIL 15.

ROYAL STATISTICAL SOCIETY, at 5.15.—Dr. A. L. Bowley: The Measurement of Changes in the Cost of Living.

INSTITUTION OF PETROLEUM TECHNOLOGISTS, at 5.30.—C. Greenway: Valedictory Address.—Sir F. W. Black: Presidential Address, Some War Problems of Petroleum Supply.

*WEDNESDAY*, APRIL 16.

ROYAL METEOROLOGICAL SOCIETY, at 5.—A. A. Barnes: Rainfall in England; the True Long-average as Deduced from Symmetry.—C. E. P. Brooks: The Secular Variation of Rainfall.

ROYAL AERONAUTICAL SOCIETY, at 8.—Dr. F. C. Lea: Aluminium Alloys for Aeroplane Engines.

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