THURSDAY, JUNE 25, 1908.

METEOROLOGY OF INDIAN SEAS.

Meteorological Atlas of the Indian Seas and the North Indian Ocean. Prepared chiefly by W. L. Dallas, under the direction of Dr. Gilbert T. Walker. Pp. viii+36 charts. (Simla: Published by the Meteorological Department of the Government of India, 1908.) Price 17*s.* 6*d.* net.

ALTHOUGH steam has almost entirely superseded sail for the propelling of ships, there nevertheless appears to be a steadily increasing desire on the part of sailors for accurate information relating to marine meteorology, and recognition of its importance in the interests of navigation.

A meteorological atlas, recently published by the Meteorological Department of the Government of India, should therefore be welcomed by seamen who navigate the ocean areas of which it treats.

This atlas is composed of thirty-six charts, printed in colours, beautifully finished, and accompanied with descriptive remarks. Twelve of these are designed to show the average conditions of atmospheric pressure, wind, and sea-surface currents, or "sea currents," as they are termed in this volume. The value of the charts would have been enhanced if results of air-temperature observations had been added. The effect of a prevailing wind upon mean temperature, and the relation between temperature and pressure are problems of interest to students of meteorology.

Nine charts show the monthly tracks of important cyclones, and cyclonic storms, over the Arabian Sea and Bay of Bengal; and fifteen charts the conditions prevailing, and the changes taking place, during the existence of typical storms in those areas.

The charts refer to an area embraced by the parallels of 30° N. and 12° S. lat., and the meridians of 40° E. and 100° E. long. The monthly charts of barometric pressure, wind direction, and force exhibit mean results of 8 a.m. observations (local time) for areas of 4° of latitude and 4° of longitude.

Pressure is shown in red by isobars, but is also given in tenths and hundredths of an inch, in the left-hand upper corner of each 4° square. Wind direction is indicated by an arrow in black, and wind force (by Beaufort scale) by figures at the tail of each arrow, which denote the mean force for the whole of the 4° square to which the arrow refers. The flow of the currents is shown, in blue, by wavy arrows, and the velocity in nautical miles per 24 hours is given, in most cases by figures attached.

In the directions for using the pressure data a table is given for the purpose of reducing readings of the barometer, at any hour of the day, to that of 8 a.m. For the sailor this is a useful table.

A defect in this volume is the absence of any information with respect to the number of observations upon which the results for each meteorological element is based. Wind direction, for instance, may be based on 2, 200, or more observations; they may be all for one year, or may be spread over a number of years; they may be recorded by one ship, or by many ships.

The wind arrows shown on the first twelve charts are said to represent the mean direction of the wind, but the exact meaning of the term "mean direction" is not stated. It may be the prevailing direction that is meant, or it may be the resultant wind. In any case a single wind direction in each square, either for the purposes of scientific investigation or for the uses of the navigator, is inadequate for the representation of wind distribution, even where the wind's direction is most constant. Information relating to wind frequency, in order to be of value to the sailor, should deal with the percentage of frequency of all winds within definite areas; and for the Indian Ocean, Bay of Bengal, and Arabian Sea this is essential. In order to show the march of the south-west monsoon from east to west at its commencement, the gradual changes from north-east and north-west monsoons to south-west monsoon, and the reverse, and to exhibit clearly the northern limit of the south-east trade wind, month by month, nothing short of a complete wind rose will suffice.

The wind directions and forces have been, it is stated, extracted as they stood in the ships' log-books. This may be regarded as sufficiently accurate in connection with wind direction, as the magnetic variation over the area treated is small, and the deviation of ships' compasses is now usually kept within negligible limits; but as regards wind forces it is otherwise. The objections in this respect to the method adopted are, however, recognised, and are alluded to as follows:—

"They may represent the ordinary force of the wind, over the square to which they refer, or they may arise as the average of winds of widely varying velocities."

To meet this difficulty the sailor is referred to the remarks for the month, given in the pages opposite the charts; but it seems doubtful whether these remarks will help the sailor much in all cases, as only the most general information is given in this connection. Owing to the absence of information as to the number of observations on which each wind arrow is based, it is not possible to compare the direction and force of the wind in one square with those of another, or to estimate the chances of experiencing any wind other than the mean wind in any particular square.

The information relating to surface currents has been copied, it is stated, from the "Monthly Current Charts for the Indian Ocean," issued by the Hydrographic Department of the Admiralty. The charts dealing with the track of storms, and those illustrating typical storms in the Arabian Sea and Bay of Bengal, in different seasons of the year, should prove exceedingly valuable to the sailor, especially the former.

It is to be regretted that in this work the term "cyclone," used by most meteorologists to define a characteristic distribution of pressure and wind, has been employed instead to express the force of the wind in a tropical revolving storm. The term was originally adopted by Piddington in his "Sailors' Horn Book"

(1848), when, in reference to the classification of winds, he says:—

"I suggest that we might for this last class of circular, or highly curved winds, adopt the term 'cyclone,' from the Greek κυκλος (which signifies, amongst other things, the coil of a snake), as neither affirming the circle to be a true one, though the circuit may be complete, yet expressing sufficiently the *tendency* to circular motion in these meteors."

In the volume under notice the definitions given in this connection are as follow:—

"A cyclonic circulation in which the winds do not exceed force 10 is termed a 'cyclonic storm,' while a circulation in which the winds are of hurricane force, 11 to 12, is called a 'cyclone.'"

According to the Beaufort scale, storm force is expressed by the number 11; while employing this scale, is it not illogical to define a circulation, in which the winds do not exceed 10, as a "cyclonic storm"?

The copious remarks which accompany the charts are interesting and instructive, and add greatly to the worth of the volume. M. W. C. H.

A TEXT-BOOK OF TROPICAL MEDICINE.

Tropical Medicine, Hygiene, and Parasitology. A Handbook for Practitioners and Students. By Gilbert E. Brooke. Pp. xvi+498. (London: Charles Griffin and Co., Ltd., 1908.) Price 12*s.* 6*d.* net.

THIS is a volume of the well-known medical pocket-book series, and corresponds in size and binding to Davies's "Handbook of Hygiene." It is a book of five hundred pages, and is divided into four sections.

The first section deals with the hygiene of the tropics, and discusses climate, food, exercise, clothing, hygiene of the mouth, pregnancy, and infant feeding in the tropics. The information and advice given in this section are useful and practical. For example, in regard to alcohol the author is of opinion that while it is not absolutely necessary for a man in any climate, a small quantity well diluted is often beneficial in the tropics. Most experienced travellers will agree with this, since the debility and consequent want of appetite brought about by tropical heat renders the stimulating effect of alcohol more necessary in warm than in temperate climates. Three ounces of whisky in the twenty-four hours is stated by the author to be the maximum which should be taken by a man in health. This will be thought by many dwellers in the tropics to be a counsel of perfection, but certainly the advice is sound, practical, and necessary. In regard to mosquito-bite prophylaxis, Dr. Brooke recommends various external applications; but surely experience teaches that these are of little or no practical use. The best protection is a good mosquito net. The author, speaking of mosquito nets, rightly says that the net in common use is a snare and a delusion. The best plan certainly is to have a permanent mosquito-proof room, which can, if necessary, be rigged up with ordinary mosquito-netting at the cost of a few shillings. In this room, or part of a room, there should only be a bed, a table, and a lamp. If one has to dine out where mosquitoes are numerous, a pair of Wellington boots may be found more productive of a calm, equable mind than the ordinary silk socks and pumps of fashion. Dr. Brooke seems to be of opinion that tropical medicine is something quite different from the medicine taught in the schools, and that no one can pretend to treat these diseases unless he has had special training. There seems to be too much made of this nowadays. Surely with a five years' curriculum it should be possible to teach a student the art of medicine sufficiently thoroughly to enable him to recognise a new disease when he comes in contact with it for the first time! A carpenter is not supposed to have made everything during his apprenticeship. He is taught the principles of his trade, and afterwards applies them to his daily work, whatever it may be.

The second section deals with medico-biology, and includes the classification of animal and vegetable parasites, notes on tapeworms, nematodes, mosquitoes, fleas, ticks, and snakes. Here also a great deal of useful information is compressed into some eighty pages; and there are several plates giving figures of the ova, larvæ, and worms most commonly met with. Of course, as is unavoidable in the compilation of a text-book, more or less trivial errors are apt to creep in, such as the name *Streptococcus pyogenes aureus*, or the assertion that *S. scarlatinae* is the cause of scarlet fever, or that the tsetse-flies act as hosts in the spread of *Piroplasma bigeminum*, and such-like slips of the pen; but these do not really take away from the general usefulness of the section.

The third section is devoted to the description of the etiology, symptoms, and treatment of tropical diseases. These are arranged alphabetically, which arrangement has little to commend it, especially as the author has tried his hand at nomenclature and evolved two new names for sun-stroke, Phœbism and Diathermasia! On the whole, the descriptions of the various diseases are clearly given and well illustrated. In a rapidly progressing subject such as that of tropical diseases is at present, it is scarcely possible for a text-book to be quite up-to-date. In the description of dengue, for example, there is no notice of the recent important work which has been done in the etiology of this disease. In Malta fever it is stated that the method of transmission of the disease is uncertain. That is not so. This was clearly established two years ago, when it was shown that Malta fever is carried from infected goats to man through the medium of milk. Since goats' milk was banished from the dietary this fever has practically disappeared from the English garrison in Malta. This fact should be placed in the forefront of the description, and everything else made subsidiary to it. Again, what is the use at the present day of writing that Manson considers the weight of evidence to point to its diffusion by air-currents rather than by food and water? This is an old speculation which ought to be decently buried and forgotten. Further, more than half a page, in the account of the same fever, is devoted to describing some experiments carried out by two naval surgeons. These experiments ought not

to have been made, for several reasons. These gentlemen had no right to risk their lives or health without sufficient reason while in the public service. It was unnecessary to carry out the experiments on man, as lower animals were available. Even if one or both had taken the disease, the experiments would have been useless, as they were living in the endemic zone and liable to take the disease naturally. What was the use, for example, of two non-immunes drinking urine from a case of Malta fever if they neglected in the first place to demonstrate that the urine contained the *Micrococcus melitensis*? As only one sample of urine in ten contains the cocci, it was ten to one against their taking the disease. Such thoughtless experiments ought not to be encouraged by being recorded in text-books as praiseworthy actions or serious attempts in the investigation of disease. With the exception of slight blemishes such as these, which, indeed, are inseparable from text-books, the descriptions of the various tropical diseases are good, and some are excellent. Especially is the description of the symptoms and treatment of these tropical maladies quite practical and useful.

The fourth section is taken up with practical hints in microscopy, photography, disinfection, examination of blood, &c. This part of the book contains much sound advice on the best microscopes and cameras for tropical work, on stains, staining methods, modes of preparing blood and tissues for examination, and should prove very useful to medical men in out-of-the-way places out of touch with books and laboratories.

The book concludes with several appendices on sanitary conventions, vegetable poisons of the tropics, how to collect flies, ticks, &c.

This text-book on tropical medicine can be confidently recommended to colonial surgeons and medical officers of the British and Indian Services as containing a vast amount of data from various sources, with practical hints from the author's personal experience and observation, which makes it an admirable *vade mecum* when the exigencies of travel render the carriage of several books impossible.

DAVID BRUCE.

A MONOGRAPH OF BRISTLE-WORMS.

A Monograph of the British Annelids. Vol. ii., part i. Polychæta, Nephthydidæ to Syllidæ. By Prof. W. C. McIntosh, F.R.S. Pp. viii+232+lxx plates. (London: Dulau and Co., 1908.) Price 25*s.* net.

WHEN Huxley was appointed professor in the Jermyn Street School of Mines, his first great scheme was the publication by Government of a zoological coast survey of Great Britain, and one of the first groups to be selected was this one of the Annelids. Unfortunately for biology, that scheme was never carried out, and the opportunity that presented itself some fifty years ago of obtaining State assistance for what was truly a State work has not recurred. Not only has the publication of systematic coastal work been left to isolated ventures, but many groups, and the Annelids among them, have been so little studied on our own coasts that the work of naming any of the most common littoral species (except perhaps the lugworm) is out of all proportion to the value of its determination. Yet these Annelids are not only of great interest to the zoologist, but, as forming one of the chief foods for fish, they are among the most important factors in the welfare of our fisheries. The Ray Society and the Carnegie Trust are therefore to be congratulated on the issue of another section of this great monograph, which they have subsidised. Prof. McIntosh is known and read of all students of biology, and his unwearied devotion to this work, his wide knowledge, and long experience of these Annelids constitute him a master. He, perhaps of all men, was the only one who could write this work, and the completion of his monograph begun so many years ago is indeed a consummation devoutly to be wished. May he have the health and assistance necessary to that end.

The present instalment contains a systematic account of six families. Its most striking feature lies in the coloured plates drawn by the author's sister, the late Mrs. Günther, and the artist Miss A. H. Walker. These presentations of Phyllodocids, Hesionids, Nephthyds, and Syllids are most beautiful, and suggest many problems of coloration and of movement that are not referred to in the text. The fine green colour of many Phyllodocids tingeing even their egg-masses, the prevalence of segmental spots in most families, and the significance of varietal colorations, are subjects on which we possess very little organised knowledge, for if the systematic study of Polychæt Annelids has been neglected in this country, the bionomics and physiology of the groups have been left to a few Continental observers. It is to be hoped that the issue of this work will stimulate the study of the group in these directions.

There are two serious drawbacks to the value of this work which a little trouble could easily have obviated. If one wishes to find out what families, genera, and species are described in this part, there is no means of doing so except by wading through the text. A table of contents is not much to ask for, but it has been omitted, and as there is no index the labour of finding out what there is in the work is quite needlessly enhanced. The headings of the left-hand pages might well have given the family name under consideration instead of the species as at present. The second drawback is the binding of six extraneous plates right in amongst those proper to the part, sandwiched in between those illustrating two other families. These intrusive plates evidently belong to a later section of the work; yet we find no reference to their presence, and the confusion that is likely to arise ought to induce the council of the Ray Society to take some steps in order to avoid the repetition of, and if possible rectify, what we presume must be an oversight.

To turn from matters of editorial criticism, we are glad to see that Mr. Goodrich has given his skilled assistance and expert knowledge of the nephridia of these animals, so that these organs are adequately referred to and figured in the text. The references to other recent work on this subject show that not

only the merely diagnostic literature, but all that bears upon the subject, has been exhaustively studied.

Among the most interesting sections is the one bearing on the Syllids. It has long been known that these Annelids are capable of asexual reproduction, and that the buds so formed, on assuming maturity, carry their eggs attached to their feet. Prof. McIntosh refers to several interesting cases of bud-formation. Certain American species of Trypanosyllids, for example, give rise to lateral buds, the stock assuming a frond-like appearance. Mr. Crossland has found an East African Syllid which has a crown of buds at its hinder end, and other species which are parasitic on Nemertines, Polychæts, and other hosts. There are some thirty representatives of this family already known from British waters, and their description and changes of form on assuming maturity are fully dealt with.

The distribution of these Polychæt Annelids will undoubtedly form a most interesting mass of evidence when it is collated. In its present form no conclusions can be safely drawn. We can only say that many species have a very wide range, extending to both sides of the Atlantic, and occurring as far north as Greenland and as far south as the Falkland Islands, whilst in some cases the same species is found both in the Atlantic and in the Indian Oceans. It is also clear that the British Polychæt fauna is probably as rich in specific variety as that of any other coasts so far explored. The coasts of Ireland, though not so thoroughly worked as those of the Channel or of the east of Scotland, have yielded many interesting forms, and the careful comparison which the author has instituted between specimens from different localities and between those of our own and of other coasts is but one instance of the careful discrimination and comparison which distinguish the work. We are glad to see that another part is ready for press, and we hope that financial aid will be forthcoming to complete this monograph.

DIRECT-CURRENT ELECTRICAL ENGINEERING.

Principles of Direct-current Electrical Engineering. By J. R. Barr. Pp. viii+454. (London: Whittaker and Co., 1908.) Price 10s. net.

AS the author states in the preface, this treatise was primarily written for the use of intermediate classes in universities and technical colleges, and is based on his lectures to second-year students. It is intended to bridge the gap between the several elementary manuals and the many works on special branches, and in this object the author has succeeded admirably. During the last few years innumerable books dealing with direct-current electrical engineering have appeared, but they are either too elementary or else too highly specialised. This book deals chiefly with principles, but the author has kept not only the theoretical, but also the practical side of the question well in view.

The first two chapters are devoted to the units employed in electrical engineering and the fundamental principles, such as Ohm's law, the heating effect of currents, &c., while the third chapter deals with electromagnetism and the magnetisation of iron. The latter chapter gives the student a clear insight into the magnetic quantities underlying the design of dynamos and motors. A short description is given of Ewing's hysteresis tester and permeability bridge, and the method of using it.

About sixty pages are occupied with a discussion of electrical measuring instruments. The principles governing the construction of ammeters, voltmeters, wattmeters, and electric-supply meters are set out in a clear and practical manner, and even maximum-demand indicators are briefly touched upon.

Two chapters treat of storage batteries and electric lighting, but these are rather disappointing. Surely the short section dealing with metallic filament lamps might have been amplified with some advantage, especially considering the enormous progress made in illuminating engineering. It is, further, somewhat out of date to take up a section with a discussion of 37-volt osmium lamps. Practically speaking, these lamps are not used at all, and in all probability their manufacture has been abandoned for some time. It would have been better to have given us particulars about the osram, wolfram, tungsten, and zircon-wolfram lamps, which are now made for 250-volt circuits, and are of great practical importance. Open, enclosed, and flame-arc lamps are briefly touched upon, as well as illumination and photometry, but on the whole this chapter is, as already said, rather unsatisfactory.

Overhead and underground conductors, and the principal methods of laying cables, as well as the calculation of voltage drop in conductors, are next described in about forty pages.

The last six chapters of the book are devoted to dynamo-electric machinery, its construction, design, and operation, and these chapters are undoubtedly the best in the book. The construction of armatures, commutators, and brushes is very fully dealt with, and the use of coloured diagrams used for illustrating the various methods of armature windings should be extremely useful to students. The theory of the magnetic circuit is gone into very carefully, and it will give the student a clear insight into the calculations required for the design of dynamo-electric machinery.

The methods of determining characteristic curves, parallel operation, and methods of voltage control are also considered, while one chapter deals with motors and controllers. The section on testing is very brief, and it is hoped that in a next edition this may be somewhat enlarged.

In the last chapter we come to the subject of electricity control, and the author enters fully into the points connected with switchboards. The section dealing with fuses, circuit-breakers, lightning arresters, and switches is excellent, and contains a large amount of practical information. Various examples of switchboard designs, illustrated by working drawings, complete a very interesting chapter. At the end of the book there is an appendix containing practical problems to be worked by the students.

The author is to be congratulated upon the work which he has produced. It is not too practical or too

theoretical, but contains just the information which a second-year student wants. The book is well printed, and contains a great many working drawings and diagrams. It is hoped that the author may find time some day to write a companion volume on alternating-current electrical engineering.

L. C.

EDUCATION AND EMPLOYMENT.

A Handbook of Employments. Specially Prepared for the Use of Boys and Girls on Entering the Trades, Industries, and Professions. By Mrs. Ogilvie Gordon. Pp. 444. (Aberdeen: Rosemount Press, 1908.) Price 1*s.* net.

THE system of apprenticeship, which has been so largely instrumental in producing and maintaining the highly skilled workmen for which English industry has always been famed, is slowly but surely dying out. Especially in the large towns, it is more and more difficult to find employers who are willing to take bound apprentices; they complain that such apprentices take little interest in their work, are not so willing or anxious to please as boy labourers, and that the high rents they have to pay in towns make their bench room so expensive that in these days of keen competition they cannot afford to take apprentices.

On the other hand, there are so many ways in which boys from fourteen to eighteen can earn comparatively high wages in unskilled employments, that the temptation to their parents to abandon any attempt to apprentice them and to make them immediate wage-earners is very strong.

To endeavour to counteract these tendencies, several local authorities have started some form of industrial or trade school, and although these will never probably take the place of apprenticeship, as the conditions in a school can never be the same as in the shops, they will help to stimulate the interest of the boys in manual pursuits, and so form a strong incentive to learn some trade; and they will also make the trade easier to acquire by the training of eye and hand they have received in the school, as well as by the knowledge they have acquired.

These schools may therefore be expected further to increase and develop, and may become gradually a necessity of our industrial system. But whereas the old apprenticeship system automatically regulated the supply to the demand, any artificial system of drafting boys into given trades will need careful control.

The introduction to Mrs. Gordon's book is most interesting and suggestive; the twenty pages show that the writer has not only given great attention to the problems of employment, but has also been in close touch with them in their most important aspects. Mrs. Gordon strongly urges the formation of employment bureaux to give information as to the local prospects of employment, the remuneration offered and prospects of advancement, the qualifications required for the various occupations, and the facilities offered in technical and continuation classes. It is suggested that these bureaux should be managed by committees, on which the education committee, the town or borough council, chamber of commerce, and association of social workers should be represented. We would suggest the addition of employers of labour. A scheme for such a committee is given, from which it appears that the probable cost of a bureau would be between 150*l.* and 250*l.* per annum. For the reasons given above, in addition to those Mrs. Gordon puts forward, we believe that bureaux on some such lines as these will gradually become a necessary part of our educational system.

The remainder and greater part of the book (some 400 pages) is the result of inquiries undertaken in four of the large cities of Scotland as to the conditions of employment in some seventy-six industrial occupations requiring short periods of training, and more than 100 industrial and professional occupations requiring long periods of training. The inquiries were made voluntarily in Glasgow by Mr. R. H. Tawney, an assistant in the Glasgow University, in Edinburgh by Miss Chrystal Macmillan, in Dundee by Mrs. Carlaw Martin, and in Aberdeen by Mrs. Elliot Ogston Clark; and although, necessarily, some of the results are chiefly of local interest, the greater part, with slight modifications of hours and wages, remain true of any district, and the whole forms a most valuable handbook, giving in an easily accessible form the main features of almost every trade and profession.

OUR BOOK SHELF.

Self-Instruction in the Practice and Theory of Navigation. By the Earl of Dunraven, Extra Master. Revised and enlarged edition in three vols. Vol. i., pp. xxvii+272; vol. ii., pp. ix+337; vol. iii., pp. ix+340. (London: Macmillan and Co., Ltd., 1908.) Vols. i. and ii., 17*s.* net; vol. iii., 8*s.* 6*d.* net.

EIGHT years ago the Earl of Dunraven wrote a work in two volumes on the theory and practice of navigation. It was an extraordinary, but in some respects an excellent book. It was extraordinary in the sense that the author had, as he frankly admitted, no great store of information beyond that necessary to satisfy the nautical examiners of the Board of Trade for an extra master's certificate. But if he made little attempt to probe the theoretical principles upon which the practice of navigation rests, he had mastered very thoroughly that portion of the science into which an examiner might inquire. It was an excellent book, because the author knew how to teach; he had the art of successfully conveying to the pupil just that amount of information which would carry him through the ordeal of examination, and we have no doubt that many who write themselves "Extra Masters" are indebted to Lord Dunraven for this qualification. When the choice of a teacher lies between the man of acknowledged mathematical capacity who cannot teach and the indifferently equipped man who can, it is, for the purposes of examination, better to fall into the hands of the man of moderate acquirements.

But there came a time when the Board of Trade raised their standard. As Lord Dunraven puts it, "the Board of Trade in their infinite wisdom decreed that a master mariner . . . must not only be a past-master in the art of navigation, but must also qualify as a naval architect and shipbuilder, be an accurate cartographer, and well advanced in mensuration and

mathematics." What was to be done? Lord Dunraven tells us that he does not pretend to be a master of any of these subjects, but he was determined that his book should do for the extra masters of the future what it had done for those in the past, so he heroically mastered the necessary amount of information, increased his book to three volumes, and brought it up to date.

We have no hesitation in saying that the same capacity for imparting the precise information which characterised the earlier edition is equally noticeable in this. The arrangement of the contents is not materially different. In the first volume we have a good deal of elementary preparation that ought to have been acquired in school, and some technical problems, including the use of the compass under various conditions and a review of the law of storms. The second volume is more particularly devoted to the problems of nautical astronomy, which are necessary in order to obtain a master's certificate. In the third volume we climb to that dazzling height the attainment of which entitles the ambitious plodder to the coveted "blue ticket" of an extra master. There are not only a great many examples given the working of which would be advantageous, but many useful hints that it would be unwise for the intending candidate to neglect.

The London Catalogue of British Plants. Tenth edition. By F. J. Hanbury. Pp. 48. (London: George Bell and Sons, 1908.) Price 9*d*.

SINCE the ninth edition of the "London Catalogue" was published in 1895, important events in connection with the nomenclature of British plants have occurred. At the Vienna congress, rules with regard to priority and other matters were framed, and hardly less important for the "London Catalogue" was the publication of the ninth edition of Babington's manual and other special works on British plants. The chief credit for the present revision is assigned to Mr. W. A. Clarke and the Rev. E. S. Marshall, but various specialists have contributed revisions of genera or sections. The number of plants enumerated in the "Catalogue" is appreciably greater than the list issued from the Natural History Museum, since, according to the preface, it aims at providing a useful working list. Although both lists are compiled on similar lines, it will be found that the species under critical genera, such as Ranunculus, do not coincide, whence it need only be concluded that experts still agree to differ.

Jahrbuch der Naturwissenschaften, 1907–1908. Edited by Dr. Max Wildermann. Pp. xii+509. (Freiburg: Herdersche Verlagshandlung, 1908.) Price 7·50 marks.

THIS is the twenty-third issue of a year-book in which progress in various branches of science is described in a series of articles by different authors, with references to the original publications abstracted. The subjects are dealt with under (1) physics; (2) chemistry; (3) astronomy; (4) meteorology; (5) anthropology, ethnology, and archæology; (6) mineralogy and geology; (7) zoology; (8) botany; (9) forestry and agriculture; (10) geography; (11) hygiene and medicine; (12) applied mechanics; (13) technology; (14) miscellaneous reports. In addition, the volume contains summaries of celestial phenomena observable from May 1, 1908, to May 1, 1909, short obituary notices of men of science deceased in the year surveyed, and an author-and-subject index.

The volume should be of service as a general record of scientific work of which accounts have appeared in periodicals and the publications of societies.

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.*]

Prominence and Coronal Structure.

IN a paper communicated to the Royal Society in December last (Roy. Soc. Proc., A, vol. lxxx., p. 178), an abstract of which appeared in this journal (vol. lxxvii., p. 314, April 2), I directed attention to a peculiar form of prominence which had been photographed with the spectro-heliograph of the Solar Physics Observatory in the "K" light of calcium. This prominence, situated towards the south pole of the sun in the *eastern* quadrant, about position-angle 137°, was recorded on two separate negatives taken at the times 3h. 14m. p.m. and 3h. 50m. p.m. G.M.T. on July 17, 1907. Although on each photograph images of other prominences were recorded, no particular attention was directed to them, as they did not present any unusual features. It may, however, be incidentally remarked that the most intense prominence recorded on both the photographs, and situated near the south pole in the *western* quadrant about position-angle 218°, was reproduced in the paper in Plate iii., Fig. 5. I did not

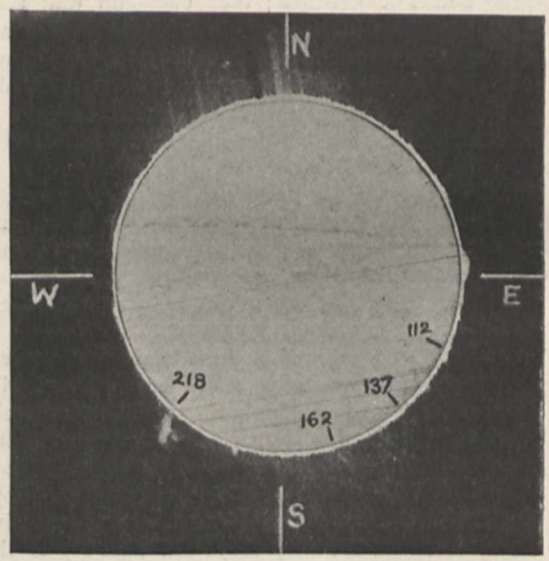


FIG. 1.—The prominences on the Sun's limb photographed in calcium light on July 17, 1907, 3h. 14m. p.m. G.M.T., at South Kensington.

think it necessary for the purpose of that communication to reproduce the whole limb of the sun, but confined myself to the disturbed area in the south-eastern quadrant. The presence of a large prominence in the south-western quadrant has raised questions of identity, so the complete limb is now here reproduced (Fig. 1) to show the relationship between the two prominences and the sun's south pole.

In April last I received from Mr. Philip Fox, of the Yerkes Observatory, U.S.A., a communication in which he wrote:—

"The large prominence which you discuss certainly has curious form. I have examined my plates for July 17, 1907, and find no prominence of unusual form near the south pole in the eastern quadrant, but there is a beautiful one near the pole in the western quadrant at position-angle 215°. I am wondering if by chance you have given the wrong quadrant and if our prominences are identical. I made my exposure at 5h. 56m. p.m. G.M.T."

On both the Kensington negatives there is a large prominence in the south-western quadrant at about position-angle 218°, and it is intense and shows little indication of diminution in brightness. This is, no doubt, the prominence referred to by Mr. Fox, who gives 215°

as its position-angle; its form has, however, considerably changed in the interval of time between the exposures. Mr. Fox kindly forwarded me a photograph of this prominence, which is here reproduced (Fig. 2), and he oriented it in the corner on rather a small scale. This orientation is reproduced by me on a larger scale in white

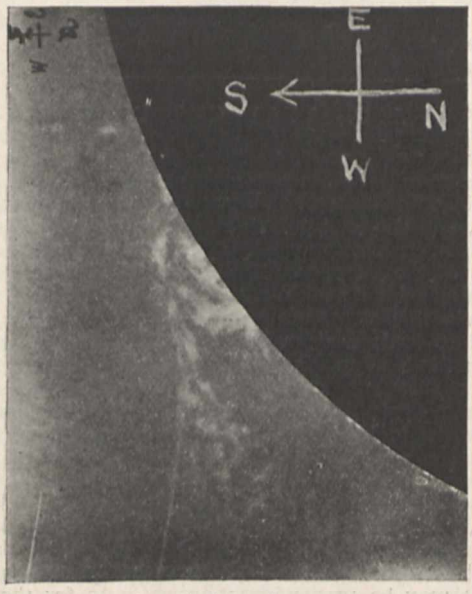


FIG. 2.—The large prominence in the south-west quadrant, photographed in calcium light by Mr. Philip Fox on July 17, 1907, at 5h. 56m. G.M.T., at the Yerkes Observatory, U.S.A.

on the photograph. It will be noticed that the upper portion of the prominence is directed from the south towards the west, but in the Kensington photograph (Fig. 1), and also in Prof. Hale's (Fig. 3), the material is directed from the west towards the south. The question arises, is Mr. Fox's orientation right (his position-angle is correct), or has the material altered its position between the times

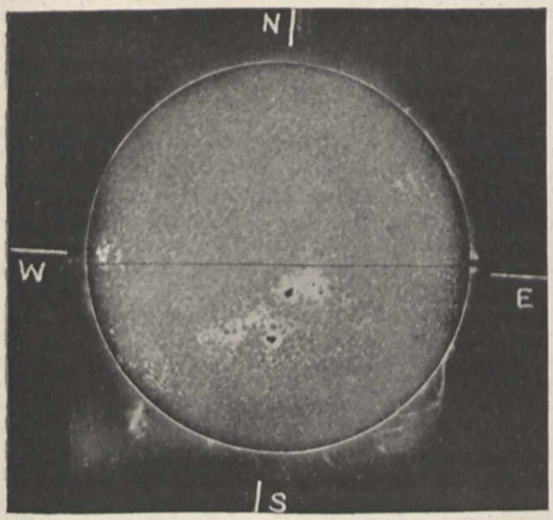


FIG. 3.—The Sun's disc and prominences on the limb, photographed in calcium light by Prof. Hale on July 17, 1907, at 2h. 46m. p.m. G.M.T., at Mount Wilson, U.S.A.

the photographs were taken? I am rather inclined to question the orientation.

Directing attention now to the triple arch prominence about position-angle 137°, which was shown in the first of the Kensington negatives (Fig. 1), I pointed out that in the second photograph, taken thirty-six minutes later, only remnants of the system remained. So rapidly did the whole of this disturbed region wane in intensity that it is not astonishing to hear that two hours later Mr. Fox reported that no prominence of unusual form was there.

The recent communication to this Journal (vol. lxxviii., p. 151, June 18) by Mr. A. A. Buss is of great interest to me, because it made me acquainted with a photograph, secured by Prof. Hale, of the same prominence taken half an hour previous to the first Kensington picture. Through the courtesy of Mr. Newbegin, jun., I received a copy of this very interesting photograph, and one is now able to follow more accurately the sequence of events in the disturbed area. I hope Prof. Hale will forgive me for reproducing his photograph here (Fig. 3), but it is only by showing the two photographs together that a satisfactory comparison can be made. I have ventured to insert the orientation on Prof. Hale's photograph in order to render the identification of the prominences more easy.

The most striking difference between the two photographs is, apart from their form, the great intensity of the large prominence in the south-east quadrant in Prof. Hale's picture (2h. 46m. p.m. G.M.T.) and its comparative faintness in that obtained at Kensington (3h. 14m. p.m. G.M.T.); other prominences are of about the same intensity in each. This diminution of brightness indicates how rapidly the prominence must have waned during the twenty-eight minutes' interval between the exposures. The second photograph taken at Kensington (3h. 50m. p.m. G.M.T.) showed that this rapid waning had continued.

According to Mr. Buss's visual observations, made between 1h. 30m. and 2h. 20m. p.m. G.M.T., *i.e.* before Prof. Hale's photograph was taken, the disturbance as a whole commenced at about position-angle 112°, where an eruptive prominence was situated. The material from this prominence was ejected towards the south pole, dissolving, as he describes, "from a stout, dense and bright stem into a number of bright, more or less parallel layers of striæ." This appearance is shown in Prof. Hale's photograph, but when the Kensington photograph was taken it had assumed the form of concentric arches. These additional facts make me endorse Mr. Buss's opinion, that is, that it is unnecessary to assume that the *material* forming the arch system *originated* from a disturbance below it, or, as I stated in my paper, that "their concentric nature seems to suggest that they were produced at one point of initial disturbance and then moved radially outwards."

It may be added that these new facts in no way invalidate the conclusion drawn in my paper, which was that envelopes, similar in form to those photographed during eclipses, had been recorded in calcium light, thus strengthening the view that they were composed of prominence and not coronal matter.

WILLIAM J. S. LOCKYER.

Mendelism: a Personal Explanation.

I SHOULD be glad if room could be found for this small matter of personal explanation. I fear I may have misled one or two of your readers on a minor point. Those of them who are interested in the interpretation of hereditary phenomena may remember that in the number of this Journal for September 12, 1907, Mr. Punnett took a reviewer to task for saying that "No one has repeated Mendel's experiments with the deliberate intention of testing the Mendelian interpretation" (of the phenomena of inheritance). In my reply I was not content with defending my original position by justifying that statement; but I must needs carry the war into the enemy's country by taking Mr. Punnett to task for not including de Vries's papers in his list of memoirs dealing with repetitions of Mendel's actual experiments, in order to show how familiar I was with the literature of the subject.

I wish to say that if I had been as familiar with the literature of the subject as Mr. Punnett was, I should not have taken the offensive. Mr. Punnett was quite right in not including a reference to de Vries's papers, because Prof. de Vries, though he has watched the results of crossing in other plants, has not worked with peas. I was misled by the commonly repeated statement that

Mendel's papers were re-discovered, and his results confirmed, at the beginning of this century, by Tschermak, Correns, and de Vries, into believing that de Vries had repeated Mendel's experiments on peas; and I rashly assailed Mr. Punnett for not making any reference to papers which I had not read. Mr. Punnett was therefore entirely in the right, and I was in the wrong.

Mr. Lock has also pointed out to me that an experiment, almost identical with the kind of crucial one which I said ought to be performed, has already been done. I am familiar with the experiment to which Mr. Lock refers (one of his own with maize), and though I regard it as very strong evidence in favour of the Mendelian interpretation of hereditary phenomena, I am sure that Mr. Lock will agree with me that an experiment the results of which will be obtained in September, 1909, is an even more crucial one.

A. D. DARBISHIRE.

THE RESEARCH DEFENCE SOCIETY.

THERE is evidence of a growing feeling among members of the medical profession that the time has come to disperse the atmosphere of mystery which has hitherto attended their ministrations, and to take the public more into their confidence as to the principles on which health may be preserved or regained. They have every reason to believe that the popular ignorance of medical science not only hinders the progress of hygiene and therapeutics, but also is the soil on which quackeries of all kinds grow and flourish, and that the education of the laity in the elementary principles of medicine would conduce to the public health, and at the same time benefit the physician by freeing him from the competition of the incompetent and unscrupulous.

One of the noisiest sections of the opponents of scientific progress is formed by the numerous small societies the object of which is stated to be the further limitation or the complete prohibition of experiments on animals. It might seem that the evidence given before the Royal Commission on Vivisection would suffice to demonstrate the benefits accruing to humanity from the use of this experimental method in the past, as well as to indicate that its prohibition would relegate medicine to the slow advance it made in the Middle Ages. But it is felt that only a small fraction of the public has the courage to seek knowledge in a Blue-book, and that to reach the multitude information must be conveyed in a less unprepossessing guise.

With this object in view, the Research Defence Society has been formed, with Lord Cromer as president, "to make known the facts as to experiments on animals in this country, the immense importance to the welfare of mankind of such experiments, and the great saving of human life and health directly attributable to them." In his letter to the Press announcing the formation of the society, Lord Cromer directs attention to the evidence given before the Royal Commission that "these experiments are conducted with proper care, and that the small amount of pain or discomfort inflicted is insignificant compared with the great gain to knowledge," and states that the society will "endeavour to make it clear that medical and other scientific men who employ these methods are not less humane than the rest of their countrymen, who daily, though perhaps unconsciously, profit by them." With this object the society proposes to publish articles, to give information to all inquirers, and assist all who desire to examine the arguments on behalf of experiments on animals.

The founders of the society ought to be gratified by the success which has already attended their efforts, for it numbers more than 1200 members, of whom 100 are ladies, and this membership has been drawn from all departments of public life, and includes representatives of every class, including many who have taken an active part in the prevention of cruelty to animals. The medical profession is naturally largely represented, but the great number of members who appear to have no direct connection with either medicine or science indicates that there is a wide-felt impression that the methods adopted by the opponents of vivisection are objectionable, and that they have failed to justify their criticisms of this method of investigation.

The society has lost no time in opening its crusade, for we have already received two pamphlets published under its auspices. The first of these comprises "The Evidence of Lord Justice Fletcher Moulton before the Royal Commission on Vivisection" (Macmillan and Co., Ltd.), and the society is to be congratulated on having had this extremely valuable presentation of the principles of the question available as an introduction to its promised series. For, while the other witnesses on the scientific side were by the nature of things compelled to limit their evidence to a detailed account of the methods adopted in their special branches and the results accruing from them, Lord Justice Fletcher Moulton was able to take a wider view, and pointed out with indisputable logic that the experimental method offers the only way to advance in medical as in other scientific subjects. Far from questioning the justification of using animals for experimental purposes, he holds that it is actually immoral to test any method of treatment in man until it has been ascertained as far as possible by investigations on animals that it may be used without injury. As for the suggestion that investigators should experiment upon themselves, he considers that this is to be deprecated except after full investigation by means of animal experiments, not only on account of the danger to the individual subject of the experiment, but because such a procedure tends to lessen the feeling of the sanctity of human life.

The great value of Lord Justice Fletcher Moulton's evidence has been recognised by all who are interested in the subject. He was the only layman who appeared before the Commission in defence of scientific method, and he has presented his views with a cogency which must convince anyone who is capable of following a simple line of argument, and has not abandoned common sense and ordinary logic.

The second pamphlet is by Colonel David Bruce, and is entitled "The Extinction of Malta Fever (a Lesson in the Use of Animal Experiment)" (Macmillan and Co., Ltd.). It forms an admirable complement to the first, for while Lord Justice Fletcher Moulton is largely concerned with the ethical considerations involved in vivisection and the general principles of scientific investigation, Colonel Bruce gives a concise account of one case in which these principles were applied with remarkable and indisputable benefit. Malta fever formerly accounted for about 75,000 days of illness each year in the garrison at Malta, and hundreds of officers and soldiers had to be invalided to England as the result of its ravages. The old statistical methods had been applied for many years, but had failed to give any clue to the cause of the fever, and no improvement resulted from improved sanitation. Finally, the Government induced the Royal Society to send out a commission under Colonel Bruce to investigate the subject, and they soon satisfied themselves by experiments on animals that the cause of the fever is a micrococcus which gains entrance to the human body by means of the goat's milk, which is largely consumed in the island. About half the goats in Malta harboured the microbe, and 10 per cent. of them secreted it in their milk. Measures were at once taken to pre-

vent further infection of the garrison by this vehicle, and the results are strikingly displayed in two charts. In 1905 the number of cases was 643; in 1907, after the preventive measures came into force, seven cases were admitted from Malta fever. Surely further argument is unnecessary to prove the value of the method which can adduce such results.

On June 19 the Research Defence Society held its inaugural meeting in the hall of the Royal Society of Medicine, 20 Hanover Square. There was a very gratifying attendance of members, nearly half those present being ladies. The honorary secretary of the society, Mr. Stephen Paget, read the report of the committee, and stated that he had received a number of letters from members regretting their inability to attend the meeting. The Earl of Cromer, the president of the society, was in the chair, and delivered a very telling speech, which has appeared in the daily Press, and which was directed to show that there is little or no pain inflicted in the methods used in experiments on animals in this country, and that in this way alone is there any prospect of further advance in medicine. The first motion approving of the aims of the society was moved by Sir Thomas Barlow and seconded by Lord Robert Cecil; the second one, approving of the formation of branches, was moved by Mr. Walter Long, who, referring to his experiences in stamping out rabies, stated that he was inspired to do so only by his faith in Pasteur's results, and was seconded by Prof. C. J. Martin. The very successful meeting was closed by a vote of thanks to the president for his speech, and for the keen interest he took in the society, which was moved by Mr. Butlin and seconded by the Hon. Sydney Holland.

ARTIFICIAL DIAMONDS.

FOR some time past the daily Press has been interested in the production of diamonds artificially. Long articles have been written upon the subject, and various persons, scientific and otherwise, interviewed, owing to the prosecution of M. Lemoine by Sir Julius Wernher on account of his failure to produce diamonds by chemical means after he had stated he was able to do so, and, in fact, had promised to produce diamonds of very large size at a price which would compete readily with the natural product. However, after obtaining large sums of money to build a factory, and apparently carrying out experiments in which small diamonds were supposed to be obtained, M. Lemoine entirely failed to produce large ones. When diamonds said to have been produced in the crucibles were critically examined, experts were able, not only to assure the magistrate that these diamonds were not artificial, but were also able in several cases to identify them as stones which had been bought from known sources. The whole case hinged upon a certain envelope which was originally lodged in an English bank, and in which it was stated a formula was contained by means of which diamonds could be produced artificially. On Tuesday, June 16, this envelope was to be opened before the magistrate, but in the meantime the modern alchemist had vanished. When the letter was opened, according to the *Times* of June 18, the following particulars were found:—

"I, the undersigned Henri Lemoine, declare that to make artificial diamonds, it is sufficient to employ the following process:—(1) take a furnace; (2) take some powdered sugar carbon; (3) place the carbon in a crucible; (4) place the crucible in the furnace and raise the temperature to from 1700° C. to 1800° C. in order to obtain crystallisation; (5) when this high temperature has been obtained apply pressure to the cover of the crucible. The diamonds will then be made, and it remains only to take them out."

From this it will be noticed that the formula contains absolutely nothing new; sugar carbon, being the purest form of amorphous carbon, has always been the starting product when any successful attempts to prepare diamonds have been made. Consequently those daily papers which ridiculed the process because of the fact that sugar carbon was one of the ingredients, showed want of knowledge of the subject. However, now that the whole formula is made public, it is, to say the least of it, absurd.

It will be noticed that the carbon is to be placed in a crucible and heated to from 1700° C. to 1800° C., and then pressure is to be applied to the cover of the crucible. When, in 1896, Moissan succeeded in obtaining diamonds artificially, he did subject sugar carbon, when at a very high temperature, to a very great pressure. It will be remembered that sugar carbon was dissolved in molten iron, and the crucible containing this was heated to a temperature of 3000° C. to 4000° C. While at this high temperature the crucible and its contents were plunged into cold water or mercury in order to cause rapid solidification. When carboniferous iron is cooled, it expands in the act of solidifying. By suddenly quenching the iron, a solid layer or crust is obtained outside the molten metal; consequently when the inside layer commences to solidify it expands, and thus, as it is encompassed with a solid crust, enormous pressure is exerted. On dissolving away the iron by means of acids, minute crystals of diamond were produced.

About the same time Marjorana, by heating a small piece of carbon in an electric arc and then suddenly compressing it by driving a piston down upon it with enormous force, the force being produced by firing a charge of powder in the piston chamber (NATURE, June 7, 1900), also obtained minute diamonds.

In 1905 Sir Andrew Noble exploded cordite in closed steel cylinders, when it was calculated that a temperature of 5100° C. was obtained and a pressure of 50 tons per square inch. Sir William Crookes examined some of the carbon deposited, and found it to contain minute diamonds. It would appear, therefore, that M. Lemoine exploited results well known in the scientific world in order to deceive people engaged in the diamond industry.

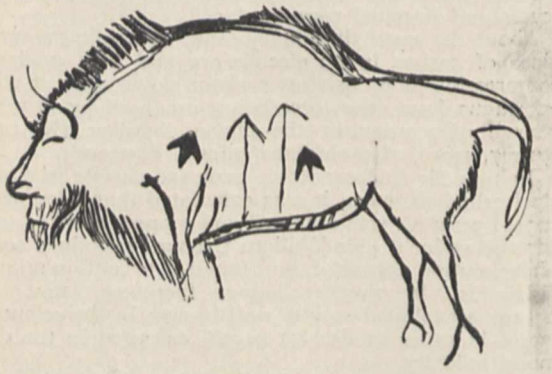
It is a rather remarkable fact that although amorphous carbon can be converted into graphite, and diamond may also be converted into graphite, as was recently shown by Parsons and Swinton, who obtained graphite from diamond by rapid bombardment with kathode rays, it does not appear possible to convert graphite into diamond. It has been found that when amorphous carbon and graphite are heated to a temperature of 3600° C. in the electric arc in an atmosphere incapable of acting chemically upon carbon, they vapourise without first liquefying, and on cooling condense to form crystals of graphite. Diamond, on the other hand, is first converted into graphite, then vapourises, and on condensation forms graphite. It thus appears that carbon must be in a dissolved condition, and must be cooled under pressure in order for a diamond to crystallise out. Possibly, therefore, we shall never be able to obtain the conditions necessary for producing large diamonds in the laboratory. Low down in the earth's crust carbon may be dissolved in iron or other substances, and may at high temperature be subjected to enormous pressure, such as we, even with the wonderful machinery at our command, and capable of exerting pressures of thousands of tons, have not contemplated. In the earth also the cooling while under this pressure will be slow, and therefore there are the conditions necessary for the growth of large crystals.

Although in nature diamonds are found in pipes of

blue clay, this is apparently not the magma in which crystallisation originally took place, for the diamonds may have been forced into the clay by volcanic agencies. Actual blocks of one of the original rocks in which crystallisation took place have been found in blue clay. These blocks consisted of an eclogite containing large quantities of iron, and small diamonds were found, thus suggesting that such was the original mode of formation of the diamond. F. M. P.

PICTOGRAPHS OF ARROWS IN FRENCH CAVES.

THE mural paintings and engravings of the Pyrenean caves is the subject of a series of memoirs by Prof. E. Cartailhac and l'Abbé H. Breuil, now appearing in *l'Anthropologie*. In the current number is an account of the "Grotte des Forges" at Niaux, Ariège. The cave is a narrow gallery more than 1400 m. in length, with several short branches; at 611 m. from the entrance a broad lateral gallery runs due south for a distance of 160 m., and terminates in a rotunda, the walls of which are decorated with bisons, horses, deer, wild goats, and groups of signs. There are no designs of animals in the first half of the main gallery, and only five at long intervals in the second. The authors write with enthusiasm concerning the rotunda. The paintings possess to a supreme



Bison in the Salon noir of Niaux transfixed by three arrows.

degree the style of the period, and represent the same animals that were familiar to the Palæolithic artists of the Pyrenees, the bisons being in the great majority. The drawings, which represent animals in profile, are drawn with a brush in black pigment with a sure and exact touch, and the characteristic traits of the animals are conscientiously delineated. The best polychrome frescoes are to be seen in the caves at Altamira, in Spain, but Niaux is unexcelled in its line work. The black pigment consisted of a mixture of charcoal and oxide of manganese worked up with grease.

Perhaps the most important new feature of the Niaux pictographs is the representation of arrows sticking into many of the animals, thus conclusively proving the existence of the bow and arrow at this early period. The accompanying figure represents a large bison with four arrows, the two lateral being red in colour. Some of the animals are marked by a spot, which may be intended to represent a wound.

A lamp placed on the ground in a corner of the rotunda or "salon noir" revealed, by chance, a series of engravings on the firm clay soil of the cave. The same animals that were painted on the walls were also engraved on the ground. The drawings were of the same style, and some of the animals were pierced with arrows. But it was only on the ground that designs of fish occurred, one of which, 30 cm. in length, is readily recognised as a trout. Even some impressions of the naked feet of the artists were still visible. Of definite objects very little has as yet been discovered, only one small flint scraper of characteristic Palæolithic type, and fragments of bones, pieces of yellow ochre, and ashes. To execute the painting the Cave-men must have had artificial light of some sort.

The sign-pictographs are obscure in their significance. Some look like feathers with long quills; possibly they are arrows, in which case the arrows were feathered. There are several straight or slightly curved broad lines, from near the end of which a prominence is depicted; these appear to represent stone implements let into a thick stick. Other sticks or clubs are straight or slightly curved; these the authors regard as boomerangs. Other markings consist of lines or groups of spots, some of a red colour arranged in a circle surrounding a central spot. These recall the markings on the coloured pebbles of the famous cave of Mas d'Azil.

These discoveries by our French colleagues are shedding welcome light upon the life of the Palæolithic cave-dwellers of western Europe, but doubtless more information will come to hand when the investigation of the wonderful French caves is completed.

A. C. H.

NOTES.

SIR GEORGE DARWIN, K.C.B., F.R.S., has been elected a foreign member of the Amsterdam Academy of Sciences.

THE "Società italiana delle Scienze (detta dei XL.)," of which Prof. Cannizzaro is president, has elected Sir William Ramsay as a foreign fellow (Socio straniero).

THE annual conversazione of the Royal Society of Arts will be held at the Natural History Museum, South Kensington, on Thursday next, July 2.

WE learn from the *British Medical Journal* that Prof. Grassi, whose name is well known in the scientific world in connection with research on malaria and other subjects, has been created a Senator of the kingdom of Italy.

THE annual meeting of the Victoria Institute will be held at Burlington House on Wednesday, July 15. The chair will be taken by the president, the Earl of Halsbury, F.R.S., and an address will be given by Mr. E. Walter Maunder.

THE council of the Royal Society has awarded the Mackinnon studentships for the year 1908 as follows:—one in physics to Mr. J. A. Crowther, of St. John's College, Cambridge, for an investigation of the passage through matter of the β rays from radio-active substances; one in biology to Mr. D. Thoday, of Trinity College, Cambridge, for a research into the physiological condition of starvation in plants and its relation to the responsiveness of protoplasm to stimulation, especially to stimuli affecting respiration.

MR. A. G. BAGSHAWE, the director of the Sleeping Sickness Bureau, who can be addressed care of the Royal Society, Burlington House, London, W., desires it to be known that he will be glad to receive reprints of any papers dealing with sleeping sickness, trypanosomiasis, and cognate subjects, and, indeed, any information relating to the work of the bureau.

REUTER'S Agency learns that a fresh commission is being organised to proceed to East Africa to study sleeping sickness, its object being to continue the work carried

on from 1902 until it was temporarily suspended in 1905, owing to the death in England of Lieut. Tulloch, who contracted sleeping sickness during his researches in Uganda. The new commission will be in charge of Colonel David Bruce, C.B., F.R.S., and, on September 25, will proceed from England, *via* Mombasa, to Lake Victoria, on the northern shores of which the Uganda Protectorate is preparing a laboratory in the province of Chagwe, two miles from the lake, for the purposes of the investigation. The spot chosen will be within five or six miles of one of the concentration camps organised by the Government, where sleeping sickness patients are under treatment. The work of research will include the study of the natural history of the fly, and also of Dr. Koch's theory that crocodiles provide foodstuffs for the *Glossina palpalis*. The commission will also investigate the question whether the lower animals harbour the parasites, and the exact method by which the fly transfers the parasite.

WE regret to announce that Prof. W. R. Cassie, professor of physics at the Royal Holloway College for Women, Egham, and honorary secretary of the Physical Society, died suddenly on June 22. Prof. Cassie, who was born at Fraserburgh in 1861, was educated at Aberdeen University and Trinity College, Cambridge. He was Clerk-Maxwell student of experimental physics at the Cavendish Laboratory from 1891–3; a Cambridge University extension lecturer from 1888–93; Thompson lecturer on natural science, Free Church College, Aberdeen, 1893–4; and in 1893 was appointed to the chair of physics occupied by him at the time of his death.

MR. GEORGE SIM, author of "The Vertebrate Fauna of Dee," died at Aberdeen on June 15 at the age of seventy-three. He was a fine type of the self-trained naturalist, and made many interesting contributions to faunistic zoology. His knowledge of British birds, fishes, and crustaceans was very wide and accurate, and he was remarkably disinterested and generous in placing both specimens and information at the disposal of serious workers. He pursued several lines of inquiry into great detail, having, for instance, a quite extraordinary knowledge of the specific characters of fish-scales. He gave some of his collections to the University of Aberdeen.

THE committee of the Lawes Agricultural Trust held its annual meeting for the inspection of the Rothamsted Experimental Station on June 19. A vote of condolence was addressed to Lady Evans expressing the sympathy of the committee in the loss she had sustained through the death of Sir John Evans, who had been chairman of the committee since the foundation of the trust, and to whose endeavours the organisation and extension of its work had been so largely due. In the afternoon the laboratory and field experiments were inspected.

THE council of the Royal College of Surgeons has given permission to Dr. Elliot Smith and Dr. Wood Jones, of the Cairo Medical School, to carry out, in the museum of the college, an examination of a collection of material found during excavations in the Nile Valley. The material is representative of peoples inhabiting Nubia in ancient times, and is expected to throw light on their pathology and the results of their surgery. The Egyptian Government has expressed its willingness to present the collection of specimens to the museum of the Royal College of Surgeons, and the council has accepted the offer.

QUEEN'S UNIVERSITY, Ontario, has received as a gift from Dr. J. P. Thomson, hon. secretary and treasurer of the Royal Geographical Society of Australasia, Brisbane, a large and valuable collection of specimens for its museum. The collection, which is typical and widely representative, consists of no fewer than 457 ethnological specimens and 140 shells of different kinds from Polynesia, New Guinea, and Australia, many of the specimens being very rare. Dr. Thomson is also sending to the University a large collection of economic minerals, a great number of additional ethnological specimens, some rare birds' skins from New Guinea, and many Queensland butterflies and moths. The thanks of the University have been conveyed to Dr. Thomson, whose valuable gifts are deeply appreciated.

THE Society of Mineral Industry, the most important mining and metallurgical institution in France, celebrated at St. Etienne on June 14–20 its jubilee by a very successful congress, which was attended by 436 engineers from the various mining and metallurgical districts of France. Mr. L. Tauzin, inspector-general of mines, presided; and papers were read by Messrs. Siegler, Vicaire, Bureau, Marsaut, Laur, Fayol, Rateau, de Renéville, and Lemière. Visits were paid to the principal collieries and steelworks in the district. At the banquet on June 17 gold medals were presented to Messrs. Marsaut, Rateau, Fayol, Pourcel, and other distinguished members of the society who had done most for mining and metallurgy during the past fifty years, and congratulatory addresses were presented by Mr. Bennett H. Brough on behalf of the Iron and Steel Institute, and by Mr. Hedley on behalf of the North of England Institute of Mining Engineers.

AT the annual general meeting of the Linnean Society of New South Wales, held in March last, Mr. A. H. S. Lucas delivered his presidential address, taking as his special subject the relations of science and government. Having advanced to his present position in the provinces of nature, man must, he said, fortify the position he has won, and must advance by utilising the knowledge which workers in science alone can provide. This essential fact, he maintained, is not sufficiently recognised by the public or by politicians. The appreciation by Australia of the modern point of view is, he urged, of great importance, because she has begun to learn through the pocket the costliness of ignorance. The Government alone can watch over the permanent interests of the State and see that resources are not impoverished. The scientific method, the method of accurately informed common sense, is the only efficient method in government as in everything else. Science is the natural ally of government. In regard to material questions, the man of science of the twentieth century occupies the position of the prophets of old. Without science no nation can keep its place in the van, for "science is the golden guiding star of practice; without science there can only be a blind groping in the region of undefined possibilities."

WE have to acknowledge the receipt of three papers issued by the University of California, the first of which, by Mr. J. C. Bradley, is devoted to two species of amphipod crustaceans of the genus Corophium from the Pacific coast. The other two, by Mr. C. A. Kofoid, deal with the pelagic unicellular organism Ceratium, more especially from the point of view of exuviation and regeneration.

ACCORDING to the "Aarsberetning" for 1907, the authorities of the Bergen Museum are devoting special attention to the exhibition series, which is being developed much on the lines of our own Natural History Museum. Several of these new exhibits are illustrated by reproductions from photographs, and among them, judging from these illustrations, may be specially commended a pair of

bar-tailed godwits with their young, and the head of a rorqual.

THE history of the Hancock Museum at Newcastle-on-Tyne forms the subject of an article by the curator, issued as an appendix to the Transactions of the well-known northern natural history society. A feature of this institution is that it is owned and maintained by the society, and therefore costs nothing to the ratepayers. The maintenance of such a large institution naturally imposes a heavy burden on the society, the efforts of which in other directions are in consequence somewhat crippled. On the other hand, the society enjoys the advantage of complete and unfettered control of a number of valuable collections which have from time to time been consigned to its custody. The article is illustrated with two views of the museum, together with portraits of Joshua Alder, Albany and John Hancock, and Thomas Atthey.

WE have been favoured with a copy of the first number of the Annals of the Transvaal Museum, at Pretoria, which contains an illustrated account of the origin, progress, and present condition of that institution, together with several papers on the zoology and botany of the Transvaal. The fauna of South Africa is illustrated in a series of saloons specially devoted to that purpose, while other saloons contain the mammals, birds, fishes, &c., of other parts of Africa and the world generally. So far as can be gleaned from the photographs, many of the larger mammals appear to be well mounted, and it is satisfactory to learn that the collection includes a fine example of the white rhinoceros. The museum was founded in 1892, on the initiative of Dr. W. J. Leyds, and since that date appears to have made remarkable progress, although its development is hindered by lack of sufficient funds and space.

IN the course of his presidential address to the South London Entomological and Natural History Society, as reported in the Proceedings of that body for 1907–8, Mr. Robert Adkin directed attention to the advantage accruing from federation among local scientific bodies. The Yorkshire Naturalists' Union set the example of such federation so long ago as 1862, with the result that while numerous advantages were found to follow, no harm was done to the local work of the various bodies which constitute the union. In 1896, at the invitation of the Tunbridge Wells society, the South-eastern Union of Scientific Societies was established, as the result of which it has been found practicable to hold an annual congress at one of the towns within the area covered by the union, to the great advantage of the members. Nor was this all, for in the shape of the *South-Eastern Naturalist* the union publishes a journal which deservedly occupies a high position among literature of this class. The success of this southern federation is indicated by a proposal that the local societies of Essex and Hertfordshire should be eligible for admission to the union.

THE eighth part of vol. iv. of the Annals of the South African Museum contains no less than five papers by Dr. R. Broom on the Permo-Triassic tetrapodous vertebrates of the country. In the first the genus Propappus, originally named from a single limb bone, is stated to be distinct from Pariasaurus, having, among other peculiarities, a dermal armour on the spinal region. New generic types of the carnivorous groups are also described, and it is pointed out that the difference in the structure of the palate between the Permian and the Triassic representatives of these reptiles amply justifies their separation into distinct groups. While the latter, as typified by Galesaurus, have a typically mammalian secondary palate, that region in the former is a modification of the type obtaining in rhynchocephalian reptiles. For these two groups Dr. Broom employs the names Cynodontia (=Theriodontia) and Therocephalia. In the last of the series the author assigns certain Cape labyrinthodonts (one of which had been referred to the American Eryops) to the new genus Rhinesuchus, of which, however, the type is a German species.

MR. T. SHEPPARD, curator of the Hull Museum, has issued another of his useful penny booklets, in which he discusses prehistoric remains from Lincolnshire, and fish and other remains from the Chalk of Lincolnshire and Yorkshire. These relics are mostly of the Bronze age; a few are Neolithic, but Palæolithic man is apparently not represented in this part of the country. They include some fine cinerary urns and an "incense cup" from a tumulus at Kirton Lindsey; and some stone implements, such as a perforated adze axe-hammer, from the Drift. One remarkable perforated adze is suspected to be the handicraft of the notorious Flint Jack. From Burton-on-Humber come a fine bronze palstave and two imperfect axes, probably rejected failures from a founder's horde. The fossils include those of ganoid and teleostean fishes, as well as selachians from the well-known chalk quarries at Barton and South Ferriby. Mr. Sheppard's careful examination of these relics, of which his pamphlet contains good illustrations, supplies an excellent example of the class of work which a local museum under competent management can usefully prosecute.

DR. R. SEMON contributes to the *Biologisches Centralblatt* (April 1) an article on the effects induced in plants by alternations of light and darkness, and the question originally investigated by him whether these effects are transmitted to plants of a subsequent generation. He directs particular attention to the facts that he experimented with seedlings of *Albizzia lophantha*, and used a very weak stimulus.

ATTENTION is directed in the report for 1906–7 on the botanical and agricultural establishments of Antigua to the advantages derived by the presidency from the working of the Imperial Department of Agriculture for the West Indies. In addition to the re-establishment of an efficient botanic station and a revival of the decadent sugar industry, the Department has fostered agricultural education and has developed an appreciable cotton trade. In connection with sugar, it is noteworthy that two central factories are in operation. Reference is made in the report to the celebration of arbor day, when two hundred trees, largely mahogany, were planted. It is noted that for hedges *Malpighia glabra* and logwood, *Haematoxylon campechianum*, have been found useful.

IT will probably be unknown, even to some bamboo fanciers, that certain bamboos in Japan have a special value because they are flecked or coloured. Where the effect is a natural one, it is generally due to lines or stripes of a colour differing from the general ground colour; in other cases the figuring is produced by fungi. Instances of the latter are furnished by a Chinese undetermined species of Phyllostachys and the Japanese plant, *Arundinaria Narahira*. An account of the latter and the parasitic fungus *Miyoshia fusipora* is contributed by Mr. S. Kawamura to the Journal (vol. xxiii., art. 2) of the Royal College of Science in Tokio. Artificial sowings on the bamboos were not very successful, but conidia, perithecia,

and ascospores were obtained in cultures, as a result of which the fungus is made the type of a new genus, allied to Trichosphæria, of the order Sphæriaceæ. The bamboos are converted into walking-sticks, flutes, and small articles.

IN connection with an article on the "Pigmentation Survey of Scotland," which appeared in NATURE of May 21 (p. 68), Mr. J. F. Tocher requests us to state that the survey, which was carried out under the supervision of a committee consisting of Sir W. Turner, Prof. R. W. Reid, Mr. J. Gray, and himself, has up to the present extended only to school children—one-eighth of the total population; that his share in Mr. Gray's report, published in the Journal of the Royal Anthropological Institute, and noticed in NATURE, was confined to supplying a key map and some statistical tables; that he is not responsible for the views expressed in Mr. Gray's article; and that a complete account of the results, with the conclusions which he has drawn from them, is in the press, and will be published at an early date.

THE methods of manufacture of the remarkable Malaita shell bead money current in the Solomon group are described by Mr. C. M. Woodford in the June number of *Man*. Of this there are three varieties:—white, made from the shell of *Arca granosa*; red, from that of *Chama pacifica*; black, from a large black mussel or pinna. The shells are first broken into irregular fragments about the size of a threepenny piece. They are next chipped into the form of a roughly circular disc, in diameter about as large as a pea. Finally, these are ground into shape on a stone, the fragments being fixed on the flat surface of a piece of soft wood of semicircular section. This stone is so rare and valuable that Mr. Woodford was able to secure only a few pieces. After being pierced by means of a pump drill, the beads are threaded on strings, each a fathom or about 5 feet long, the character and colour of the beads determining their values as currency.

AN admirably illustrated description of the Federal Fuel Testing Laboratory at Zurich is given by Prof. E. J. Constam in the *Engineer* (vol. cv., p. 618). The laboratory was started in 1906, and has already done much to ensure that Switzerland receives the proper equivalent for the 3,000,000*l*. annually expended on imported fuel. In the first year of its existence, besides research work, more than 3300 samples of coal and briquettes were examined. Most came from Germany, and the rest from Belgium, France, and England. This extensive examination of imported fuels has tended to enlighten the consumers as to the qualities and economic value of the fuels from the various countries and collieries, and has contributed towards their classification according to heating power. It is to be hoped that before long this latter will be universally adopted for the basis of coal contracts, instead of the vaguely defined evaporation power, or the percentage of combustible matter.

FROM the Pulsometer Engineering Co., Ltd., we have received a catalogue of pulsometers which, in that it contains a detailed description of the working and of the various applications of this useful form of steam pump, is of greater interest than the usual type of manufacturers' price-list. The pulsometer will pump dirty water, it has no moving parts except the valves, it disposes of its own exhaust steam, it can be supported on its suction pipe or slung from a chain. In short, it is essentially a pump that will stand rough usage, and requires no skilled attention. In these circumstances the useful services it is capable of rendering are evident, and the variety of applications of the pulsometer are well shown in the excellent illustrations given in the catalogue.

WE are indebted to Prof. G. Platania for an interesting pamphlet (reprinted from the *Annuario* of the R. Nautical Institute of Catania, 1908) on the determination of wind direction and force at sea, and on the Beaufort scale. The author quotes the results of various comparisons of wind-force estimated by the latter method with the records of anemometers both in this country and abroad, and especially the recent elaborate discussion by Dr. Shaw and Dr. Simpson (Meteorological Office Publication, No. 180, 1906). The author also quotes a useful modification of the scale, suggested by Commander Hepworth, in view of the changed conditions due to the use of steam and to the rig of modern sailing vessels since it was devised by Sir F. Beaufort in 1806. Prof. L. Marini proposed an elegant method of finding the true direction and velocity of the wind from the speed of the ship and the direction of the apparent wind, without reference to its velocity (*Rivista Geogr. Ital.*, 1907), which, although worthy of being known, is not very easy of practical application. Prof. L. Rotch's ingenious instrument, made by Casella, of London (Quart. Journ. R. Meteor. Soc., 1904), is admitted to be more useful in practice.

THE values which have been obtained for the molecular weight of the radium emanation have been based on observations of the rates of diffusion of the emanation and of various gases in the same circumstances. According to Graham's law, the molecular weights should be inversely proportional to the squares of the rates of diffusion, but the values of the molecular weight of the emanation calculated on the assumption of the truth of this law have differed widely from each other. Rutherford and Brooks obtained a number between 44 and 74, while Bumstead and Wheeler more recently found a value about 180. Mr. P. B. Perkins, of Yale, has just completed a comparison of the rates of diffusion of the emanation and of mercury vapour through a porous plug, and publishes his results in the June number of the *American Journal of Science*. He concludes that the molecular weight of the emanation exceeds that of mercury, and probably differs little from that of radium, 227.

ALTHOUGH much has been written on the theory of the Ruhmkorff coil, the simpler single circuit induction coil, so much used in these days to ignite the explosive mixture in gas and petrol engines, has received little attention, and no accurate measurements of its efficiency have been made. The *Physical Review* for May contains an article on the subject which is probably the first ever published. It is from the pen of Mr. B. F. Bailey, and includes both a theoretical treatment and a comparison of theory with experiment. In the case of one of the coils tested the efficiency, that is, the ratio of the energy of the spark to that supplied to the coil, was 54 per cent., while the calculated value was 56 per cent., and the author shows how, by cutting down the time of contact, the efficiency of the coil was raised to 85 per cent.

THE Philosophical Institute of Canterbury is one of the district institutes affiliated to the New Zealand Institute, and is devoted, among other works, to the encouragement of science. It was founded in 1862, and though undergoing many vicissitudes since that date, it has had a continuous existence, and has numbered among its members most of the residents of Canterbury interested in science. The institute holds regular monthly meetings from May to

December, and a syllabus for the present year has been received. Among subjects to be dealt with this session we notice Mendel's law of heredity, physical and geological problems suggested by the construction of the Arthur's Pass Tunnel, bird life in New Zealand, and Antarctic exploration. The council of the institute has in hand the publication of reports that will be made on the collections secured during the recent sub-Antarctic expedition to the Auckland and Campbell Islands, and has taken steps to secure the proper investigation of scientific questions which will be raised by the boring of the Arthur's Pass Tunnel. Mr. E. G. Hogg, of Christ's College, is the president of the institute; Mr. R. Speight, of Canterbury College, the honorary secretary; and Dr. Chas. Chilton, of Canterbury College, the honorary treasurer.

THE issue of *Science* for June 5 contains an interesting symposium at the Illinois State Academy of Science on the opportunities for American young men in science. Prof. J. G. Coulter deals with the opportunities available in botany, Prof. W. A. Noyes with openings for chemists, Dr. H. Foster Bain with the outlook in geology, Prof. H. Crew that in physics, and Dr. H. V. Neal that in zoology. There is a fair unanimity among the contributors that the young man whose primary object is to make money should not select as his life's work the pursuit of pure science. It is curious to remark that Prof. Coulter referred to the lack of interest in science on the part of the American public, and traced it to the same cause as was suggested in the *Times* correspondence arising out of the speeches at last year's Royal Society dinner to account for the similar apathy in this country, that American men of science rarely make it their duty properly to popularise the problems on which they are at work. Prof. Coulter stated that in America the demand for trained botanists continues to exceed the supply. Prof. Noyes estimated that there are about 8000 chemists in the United States, and concluded by saying that the demand for chemists to fill positions in connection with the bureau of chemistry has largely exceeded the supply of suitable men. Dr. Bain made it clear that it may be taken for granted that properly equipped and willing workers in geology may rest assured of positions being open to them. Prof. Crew summarised the opportunities for young men in physics under the headings of research, applied physics, engineering, and teaching, and spoke very hopefully of the outlook in each of these directions. Dr. Neal said, so far as zoology is concerned, that the chances for getting good zoological positions have much improved during the last ten years. Though there is this increased demand, there has been no increase in the supply of men to fill the posts. New fields for employment are being opened, and there is every possibility that the present demand for zoologists will be maintained.

PROF. E. B. POULTON'S "Essays on Evolution" are to be published by the Oxford University Press on July 1, the fiftieth anniversary of the meeting of the Linnean Society at which was read the joint essay on natural selection by Darwin and Wallace. The ten essays cover the period 1889–1907.

MESSRS. E. AND F. N. SPON, LTD., have published, at 4*d.* net, tables of logarithms, antilogarithms, useful constants and the functions of angles, taken from the examination tables of the Board of Education. The tables are mounted on linen, and so folded that they will go into the pocket easily; they can be opened out in such a way that the logarithms and antilogarithms can be examined side by side.

THE first part of the "International Geography" by seventy authors, edited by Dr. H. R. Mill, has now been published separately by Messrs. Macmillan and Co., Ltd., at 1*s.* 6*d.* This section, which deals with the principles of geography, is the eighth portion of this standard book to be issued in a convenient separate form, and at a price which makes it available as a class-book in schools. These parts of the "International Geography" deserve to be widely used in schools where the study of geography is taken seriously.

WE have on previous occasions directed attention to the medical and scientific circulating library conducted by Mr. H. K. Lewis, of Gower Street, London, W.C. The new edition of the library catalogue, revised to the end of 1907, has been published recently at a price of 2*s.* net to subscribers and 5*s.* net to non-subscribers. The catalogue shows that the student and man of science may here obtain the advantage of a very large collection of modern medical and scientific text-books and special monographs. In addition to books on pure and medical science, works on different branches of engineering science and general technology are included. Not only are the books classified under their authors' names, but they are also conveniently arranged in a second section according to subjects.

OUR ASTRONOMICAL COLUMN.

THE RINGS OF SATURN.—In a note published as Bulletin No. 32 of the Lowell Observatory, Prof. Lowell develops rather more fully the idea that the appendages B and C of Saturn are not flat rings, but tores. He arrives at this conclusion, by two independent methods, from a discussion of the phenomena observed at Arizona during November and December last. In the first place, a black core was observed running medially through the length of the shadowy band which then encircled the planet. This core was seen by all the observers at Flagstaff, although not caught by Prof. Barnard at Yerkes nor reported in the Lick observations, and is presumed to be the black shadow of the plane ring A bordered by the particles of the rings B and C scattered above and below the plane of A. That is to say, the rings B and C differ from A in being tores and not flat rings. Then the agglomerations, seen at many different observatories, are shown to be better accounted for by Prof. Lowell's theory of the form of the rings than by the several other theories which have been proposed. An analytical discussion of the perturbing effects to which the ring matter is subjected by the satellites, &c., shows that the assumed heaping up of the particles, as indicated by the agglomerations, is in accordance with gravitational laws. Furthermore, it is shown from the observational results that the inevitable disintegration of the rings is in the process of taking place.

THE FORTY-INCH OBJECTIVE OF THE YERKES OBSERVATORY.—An interesting paper by Mr. Philip Fox, giving the results of an investigation of the 40-inch objective of the Yerkes Observatory, appears in the May number of the *Astrophysical Journal* (vol. xxvii., No. 4, p. 237). The tests, in the first instance, were carried out at the suggestion of Prof. Hartmann, who is desirous that the data might be published for every objective in active use, but they have been extended and comprehensively discussed by Mr. Fox. The method employed was that of the "zonal test," using a perforated diaphragm having sixty holes, each of 2 cm. diameter, located at the corners of squares on fifteen different zones. Briefly, the results indicate, *inter alia*, that the centre of the Yerkes objective is of appreciably shorter focal length than the edge. The variations come, however, well within the limits for which Prof. Hartmann classifies an objective as "preeminently good." Plates taken at varying zenith distances appear to indicate that the performance of the objective varies with the zenith distance, and, should this be confirmed, it appears certain

that, even could the mechanical difficulties of construction be overcome, refractors of greater dimensions than the 40-inch cannot be constructed with the hope of uniform performance at all altitudes.

The same journal contains a discussion by Prof. Hartmann of an improvement of the Foucault knife-edge test in the investigation of telescope objectives.

THE TEMPERATURE OF THE SUN.—In a preliminary note, now published as an abstract from the *Annalen der Physik* (vol. xxv., pp. 905–20, 1908), Dr. Goldhammer discusses anew several sets of results obtained in the determination of the temperature of the sun. From the discussion of Langley's various observational data he arrives at the conclusion that the probable actual temperature of the sun is not less than 10,000° absolute.

THE VARIATION OF THE POLE.—Prof. Albrecht's annual summary, for 1907, of the provisional results derived from the observations made at the various international latitude stations appears in No. 4253 of the *Astronomische Nachrichten* (p. 73, June 5). The extrapolated values for the variation, in the several coordinates, for 1908·0 are:—$x = -0''{\cdot}097$, $y = +0''{\cdot}185$, and $z = +0''{\cdot}012$. The curve showing the departure of the pole from the mean position between 1899·9 and 1908·0 shows that the value of the y variation at the commencement of the current year was approaching the maximum observed during that period.

OBSERVATIONS OF THE PERSEID SHOWER IN 1907.—No. 4253 of the *Astronomische Nachrichten* (p. 83, June 5) contains a note by Prof. J. Sykora in which are given the results of the meteor observations made at Tashkent and Iskander during the nights of August 10–12, 1907; Iskander lies about 44 kilometres to the north-east of Tashkent. From the recorded paths of 178 Perseids the centre of the radiant of the shower, for 1907, was found to be $\alpha = 42°{\cdot}7$, $\delta = +53°{\cdot}8$, and the area covered by the radiants lay between 31° and 55° in R.A. and +49° and +59° in declination. The calculation of the altitudes showed that the mean heights of appearance and disappearance were 167 and 96 kilometres respectively. The trails of nine meteors were photographed, and brief descriptions of trails are given in the paper; several of them indicate marked variations of brightness during the meteor's flight.

RECENT DEVELOPMENTS IN ELECTRIC LAMPS.

IN an article which appeared in NATURE last June the present writer reviewed briefly some of the improvements which had been made and promised in incandescent electric lamps. At the time that article was written, matters were in a condition of considerable uncertainty on account of the great number of new developments which had been announced, the value of which was, to a very large extent, uncertain. The frequent announcements of these improvements, which were appearing almost weekly, led electrical engineers to feel considerable hesitation in adopting any new lamp for fear that it should be superseded almost immediately after its adoption. Since that time the position has become much quieter, and during the past six months the solid progress which has been made in the introduction of these lamps on the market has been remarkable. Now that considerable experience has been obtained of the practical working value of the different types of lamp, a favourable opportunity is afforded of taking a general survey of the present position and prospects for the future. At the same time, a similar survey may be taken of the conditions existing in the field of arc lighting, in which the developments during the past two or three years have been almost equally noteworthy.

Incandescent Lamps.

As was pointed out in the article referred to above, the only two lamps which appeared to merit particular attention were the tungsten and the tantalum lamp. The tantalum lamp has now been in practical use for about two years, and has not undergone any appreciable modification since the time of its first introduction. Difficulties of producing a satisfactory lamp for use with alternating current are still not overcome, and the difficulties of drawing tantalum wire sufficiently fine to enable either low candle-power low-voltage, or medium candle-power high-voltage lamps to be produced still await practical solution. It is true that the range of candle-power with low-voltage lamps has been extended by the introduction of a 16-candle-power lamp, and that announcements have been made from time to time that a satisfactory solution has been found for the manufacture of high-voltage lamps. The fact remains, however, that high-voltage lamps are not yet produced commercially. The tantalum lamp has satisfactorily proved its value for electric lighting. Although the general results obtained seem to show a comparatively short average life of about 700 hours, and though the efficiency is approximately only half that of the newer tungsten lamp, it is apparent that this lamp will have to be reckoned with for some time to come as a very important factor in the field of incandescent electric lighting. Though it may not be able to compete on the score of efficiency with the tungsten filament, yet the greater strength of the filament must always operate to counterbalance these disadvantages.

The tungsten lamp, ever since its commercial introduction into this country under the name of the "Osram" lamp by the General Electric Company, has made rapid strides in popularity. Considering that the lamp has only been on the market for a matter of about nine months, its very widespread use at the present time must mark almost a record in the development of electric lighting. In its practical performance, also, this lamp has fulfilled, or more than fulfilled, the hopes which were raised for it before its introduction. Beyond the blackening which occurs with a small percentage of these lamps, the general experience is that a life of 1000 to 1500 hours is obtained almost without any decrease in the initial efficiency of about 1¼ watts per candle. This blackening appears to be a defect in manufacture which will doubtless be soon overcome, since it is not a characteristic of all lamps, but is only observed in a very small percentage, which generally show this defect almost immediately they are put into use. The tungsten lamp has hitherto possessed the disadvantage, when compared with its tantalum rival, that it could only be used in a vertical position, but a modified type has just been introduced which can be burnt at any angle. On the other hand, the tungsten lamp has the advantage that it is suitable for use on either direct- or alternating-current circuits. Up to the present, the range of voltage for which the lamps can be made is practically the same as that for the tantalum lamps, viz. voltages up to 130, but the tungsten lamp has not yet been made for voltages of 100 in such low light units as the tantalum lamps, the lowest at present obtainable being approximately thirty candles. Tungsten lamps have also been made, but not yet commercially introduced, for high voltages (200 and above), and the introduction of a 40-candle-power lamp for 200 volts is promised very shortly.

It is yet too early to say precisely what will be the effect of the introduction of these two lamps on electric lighting in general. At present, for the most part probably, the lamps have been used for the lighting of factories, shop windows, and public or semi-public places where costs of lighting are very closely considered and artistic effects are of secondary importance. It is perhaps not safe to argue from the success which the lamps have attained in the past year for these purposes that they will meet with corresponding success in private house lighting, especially as in that case the size of the light unit becomes of much greater importance. It is more than probable, however, that the general public will welcome the higher light units if they provide them, as these lamps do, with a means at the same time of actually reducing their lighting bills. The present writer, for example, has substituted two 32-candle-power Osram lamps for a single 16-candle-power carbon filament lamp, and finds that it has resulted in actual saving in money in spite of the fact that four times as much light is obtained. It is noteworthy that the fears which were expressed that the difficulties in running lamps in series would very seriously

affect the introduction of metal filament lamps do not appear to have been well founded.

Beyond these two types of lamp the development in incandescent lighting has been slight. The exceedingly interesting discovery (from a scientific point of view) by the General Electric Company in America of a method for radically altering the nature of the carbon filament unfortunately came too late to have any practical effect. These so-called "metallised" filament lamps, had they come four or five years ago, would have been welcomed as a great step in advance, but coming as they have at the same time as the metallic filaments, are practically doomed to failure, since they possess the same disadvantages, and, in addition, can only be worked at an efficiency of 2½ watts per candle. The same may be said of the Nernst lamp, which is almost bound to give way in the sphere of incandescent lighting to metal filament lamps. It is possible that the Nernst lamp will find a sphere of its own for intermediate lighting where light units of 100- to 200-candle-power are required, but it is much more probable that it will be ousted also from this field by the high candle-power metal filament lamps.

Arc Lamps.

The remarkable change in the prospect of incandescent lighting which has been effected by the introduction of the metal filament lamp has been paralleled by a similar change in arc lighting by the introduction of flame lamps. The gain in efficiency in a metal filament lamp over a

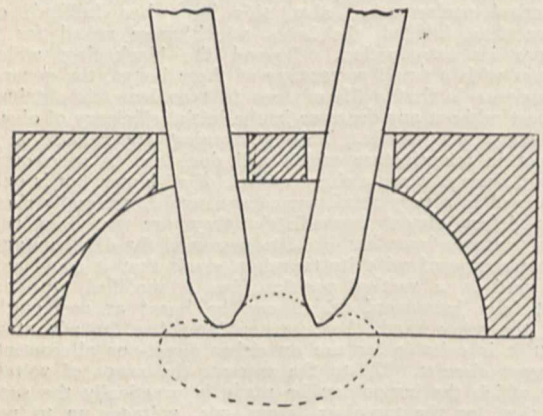


FIG. 1.—Arrangement of Carbons in Flame Arc.

carbon filament lamp is approximately three times, and an almost similar gain is obtained in a flame lamp over an ordinary open type arc lamp. The idea of introducing chemicals into the arc in order to colour the flame is an exceedingly old one, but the practical solution was not obtained until Bremer brought out his mineralised flame carbons. The carbons introduced by Bremer were mineralised carbons in which the flame-producing material was intimately mixed with the material of the carbon rod itself. Alterations were later effected by the various carbon manufacturers by which the flame-producing material, instead of being introduced into the main body of the carbon, was only introduced into the core. This latter type of carbon is by far the most common, but carbons of the Bremer type are still in use, and have been considerably improved recently by M. Blondel, who claims to have succeeded by their employment in producing a far more efficient lamp than the ordinary flame lamp.

Flame carbons are constructed to burn with the carbons arranged vertically above one another, as in ordinary lamps, but the more general construction is to arrange the carbons side by side inclined to one another at an angle of about 15°, as shown in Fig. 1. The arc, which balances between the tips of the carbons, as shown in the figure, is spread out into a fan shape, and kept down at the tips by the use of a magnetic controlling field. Immediately above the arc, both in the lamps for vertical and inclined carbons, is placed an inverted cup, the object of which is to prevent the free upward currents of air and maintain the carbons always in an atmosphere of inert gases, thus considerably lengthening their burning hours. This cup is consequently given the name of an economiser.

The arrangement of the carbons in the inclined lamps causes a very large proportion of the light to be thrown vertically downwards, which is certainly not a desirable condition for the lighting of open spaces, involving as it does hanging the lamps very high if even illumination is to be obtained. The rich golden-yellow colour of the light though useful for the purpose of display, is also to be reckoned as a disadvantage of these lamps. The colour is, however, not so very far different from that given by the incandescent lamp, and has not been found a very serious drawback. Flame arcs of other colours, for example, white and pink, can be produced, but the volume of light in these cases is greatly below that of the yellow arc. The flame arc lamp has an efficiency of approximately 0·4–0·5 watt per mean spherical candle, which is two or three times as good as that of the ordinary open-type arc. The high cost of maintenance in carbons, which are expensive to make and burn rapidly, is very much more than compensated by the low cost of power for a given amount of light. In the Blondel lamp the carbons which are used are of larger diameters, and are arranged vertically one above the other. This has the advantage of giving a better light distribution, and it is claimed that the mean spherical candle-power is nearly double that of the ordinary flame arc.

Whilst the flame arc has been rapidly developed in Europe, it has met with but little success in America on account of the fact that in America the cost of labour for frequent trimming counts much more than it does in this country. For this reason the use of enclosed arcs in America has become almost universal in spite of the fact that they only have about half the efficiency of the ordinary open arc. To meet these somewhat special conditions, experimental work has been carried on during the past two or three years by Messrs. Steinmetz and the General Electric Company of America on the production of a long burning flame lamp. The "magnetite" arc, as it is called, which is the result of this work, utilises electrodes composed chiefly of magnetic oxide of iron. In the latest electrodes titanium oxide, which produces a more intense light in the arc than iron oxide, is used, but iron oxide is still employed to give the electrode conductivity when cold. The actual mixture contains also oxide of chromium, but this plays a purely secondary part in steadying the rate at which the other oxides are evaporated.

The lamp is constructed with the magnetite electrode as the negative, and a solid copper electrode as the positive. In place of copper a special alloy is being introduced. The arc has all the characteristics of a flame arc, but possesses some peculiarities due to the fact that the flame-producing material is contained only in the negative electrode. Its efficiency, from figures which have been published, appears to be in the neighbourhood of 0·8 to 1·0 watt per candle, from which it will be seen that it is a little more efficient than the ordinary open-type arc and twice as efficient as the ordinary enclosed arc, which will be its greatest competitor in America. The electrodes, when 12 inches long, are stated to have a life of 150 hours, which is as much or more than similar sized electrodes in enclosed lamps. It will therefore be seen that the magnetite arc is likely to prove a valuable advance on the enclosed arc, and where economical conditions have determined the use of this lamp it is likely to be superseded by the magnetite arc. It cannot, however, at present compete against the ordinary flame lamp, where the cost of trimming is not so important a factor.

Vapour Lamps.

A word may be said in relation to the development of the mercury vapour lamp. This type of lamp, which has been developed by Mr. Cooper-Hewitt in America, has not met with any extended use on account of the exceedingly unpleasant colour of the light which it gives. Though in some circumstances this may not prevent the adoption of this lamp, there is no doubt that it will always seriously hamper its use in competition with pleasanter coloured

illuminants. Attempts have been made to improve the colour by introducing other metals, such as metals of the alkali group, into the tube, but these have not hitherto proved successful. It is stated, however, that a very marked improvement has been effected by the firm of Heraeus, in Germany, by adopting quartz tubes instead of glass tubes, and pushing the temperature at which the arc is run up to very much higher limits. By working the lamp at such a current density that the internal pressure in the tube is approximately one atmosphere, it is stated that the efficiency of the lamp is more than doubled, and that a continuous spectrum is added to the line spectrum of the mercury, thus giving the light a quite pleasant and almost normal colour. These quartz-tube lamps have the additional advantage that under the conditions of working the length of tube for a given voltage is very much less than when glass tubes are used. The commercial introduction of these lamps is promised for this year.

Reference might also be made to one other type of electric lamp which has during the past year come into commercial use, namely, the Moore tube lamp. This lamp is simply an ordinary vacuum tube of great length, and operated at a very high voltage. The tubes, which are 1¾ inches diameter, can be made up to 200 feet in length, and are fixed up in position by welding together short lengths of tube, high-voltage supply being obtained by means of a transformer the secondary terminals of which are connected to graphite electrodes in the tube. The essential feature of this lamp is the method which has been adopted to overcome the difficulty that the vacuum decreases as the lamp burns, owing to the absorption of gas by the glass tube. In order to maintain the vacuum constant a most ingenious valve is employed. The main tube communicates by means of a branch with the outer air, this branch tube being sealed by a porous carbon plug covered with mercury. The level of the mercury can be altered by the rising or falling of a float; in one position of the float the carbon plug is completely covered, in the other it is partly uncovered. The movements of the float are controlled by a solenoid connected in series with the primary of the transformer supplying the tube. When the vacuum falls the conductivity of the tube increases and the primary transformer current rises; this lifts the mercury float and causes the mercury level to fall, uncovering the point of the carbon plug and allowing a little air to filter into the tube. The conductivity of the tube is thereby decreased, the primary current falls again, and the porous plug is again completely covered with mercury. It is stated that this valve, which operates normally about once a minute, maintains the vacuum in the tube, which is in the neighbourhood of 0·1 mm. of mercury, constant within 10 per cent.

The only installation of this lamp in this country is that in the courtyard of the Savoy Hotel, and those who have seen this will probably agree that the light represents in many respects the ideal form of artificial lighting. The colour of the light given by the tube depends upon the gas which it contains, and is pure white for carbon dioxide, slightly pink for nitrogen or air. Nitrogen is stated to be twice as efficient as carbon dioxide, and slightly more efficient than air. When it is desired to operate the tube with either of these gases the open end of the valve is connected to either a phosphorus tube (to extract the oxygen from the air drawn in) or to a gas apparatus generating carbon dioxide by the action of acid on marble. The efficiency of these lamps is difficult to determine, but appears to be in the neighbourhood of 1·6 to 1·8 watts per candle.

It is interesting to note that the improvements described above in incandescent and arc lamps have once again brought electric lighting on practically the same level for cheapness as gas lighting. The introduction of the gas mantle gave gas lighting so great a superiority on the score of cheapness that for a great many years it has only been possible for electricity to hold its own on account of its many other advantages. Just as the ordinary gas mantle beat the carbon filament lamp, the high-pressure gas-mantle systems competed on an equal, or even on a slightly better, basis with arc lighting. The whole complexion which appears is now changed, since the 1 to 1·5 watt metal filament lamps can compete with the ordinary mantle for small lighting, and flame lamps are superior to the high-pressure gas lamps. It must be remembered that, from a scientific point of view, the efficiency of electric lamps is vastly superior to any type of gas lamp, the main cheapness of gas lighting being entirely due to the difference between the cost of power delivered to the lamp in the form of gas and in the form of electric energy. It is interesting to remark that whereas the improvements in gas lighting have been effected by departing from an incandescent flame to an incandescent solid, the improvements in arc lighting have been obtained by a move in exactly the opposite direction.

In conclusion, attention may be directed to the honourable position occupied by this country in the developments of electric lamps. A little more than a century ago an English philosopher, Sir Humphry Davy, discovered the electric arc. Thirty years ago an English inventor, Sir Joseph Swan, shared with an American, Edison, the distinction of overcoming the difficulties attendant upon the production of an incandescent electric lamp of small candle-power. With these two names England's connection with the development of electric lighting begins and ends. The first satisfactory arc-lamp carbons were made by Carré (France). The invention of the cored carbon is due to Siemens (Germany), the practical realisation of flame carbons to Bremer (Germany), and their further development to the Continental manufacturers and to Blondel (France). The magnetite arc has been developed by Steinmetz and the General Electric Company of America. The mercury arc was shown to be practical by Arons (Germany), and was perfected by Cooper-Hewitt (America). Its latest development is due to the firm of Heraeus (Germany). The vacuum-tube lamp we owe to McFarlane-Moore (America). In incandescent lighting the only radical improvement which has been effected in the carbon filament is the metallised filament of the General Electric Company of America. The Nernst lamp is due to Prof. Nernst and the A.E.G. of Germany. The first metal filament lamp was the "Osmin" lamp of Welsbach (Germany), which was followed by the tantalum lamps of Siemens (Germany) and the tungsten lamps which were perfected by Welsbach (Germany), Just and Hannaman (Austria), and Kuzel (Austria).

One may well ask what is the reason for this unsatisfactory state of affairs. The actual reason is not far to seek. In the field of scientific discovery England has always been, and still is, in the front rank, but not any of the improvements enumerated above are in the nature of discoveries, but are all inventions of a type which have been, and can only be, developed by years of costly experiments carried out always with a commercial end in view, a form of research which is for the most part carried out in the laboratories which are to be found attached to the more important Continental and American factories. The question therefore reduces to asking why it is that these laboratories are not to be found in connection with English works. If you ask the manufacturer, he will probably answer that with unprotected markets, unrestricted competition, and the uncertainty of being allowed to enjoy the fruits of his labour, he cannot afford to spend a share of his money in the prosecution of costly research which may only after many years, and possibly never, yield results. If you ask the man of science, he will probably tell you that it is due to the complicated set of facts which were summed up by Prof. Perry in the words "England's neglect of science," of which the most striking examples are afforded by the position which science takes in all our systems of education, and by the attitude of indifference, amounting almost to contempt, which is directed towards it by all our Governments, our men of means, our manufacturers, and almost all classes of the community. Each answer probably comprises part of the truth, and the two together possibly comprise the whole, and whilst everyone is agreed that something ought to be done, we are all too busy arguing which is the best specific to take any steps towards a remedy. In the meantime, further developments are being worked out abroad, and every year is making it harder for this country to make up the leeway which it has lost and is losing.

MAURICE SOLOMON.

RUSSIAN SCIENTIFIC WORKS.

THREE volumes of the Bulletin of the Academy of Sciences, containing the proceedings of the physico-mathematical section, have been received recently. In vol. xxii. Mr. Wyragevitch describes certain Actinozoa of the Black Sea in the neighbourhood of Balaclava, and Mr. A. Borissiak contributes notes on the Black Sea plankton. Mr. K. N. Davidoff's article on the islands of the Indo-Australian archipelago deserves mention. The confusion of European and Malay races in Amboina has produced a curious type, and the Malay tongue has absorbed, it is shown, Dutch and Portuguese words. The barbarous custom of wooing with the head of an enemy still prevails. The Solifugæ of Persia are discussed by Mr. A. Birula. In vol. xxiii. Mr. V. Bianchi writes on Passeriformes and Palæarctic larks, basing his remarks on studies in the museums of London, Tring, and Paris. Mr. N. Donitch contributes observations of the annular solar eclipse in March, 1904, made at Cambogia, and of the total solar eclipse in August, 1905. The latter was observed from Alcala and Assouan. Notes on inundations at St. Petersburg are contributed by Mr. S. Griboyedoff, and studies of rainfall in that capital, with diagrams and tables, are given by Mr. E. Rosenthal. Vol. xxiv. contains the results of lengthy investigations, by Mr. A. Bielopolsky, of the radial velocity of the variable star Algol, and another astronomical paper, by Mme. Zhiloff, on the orbit of the minor planet Doris (48). A new species of pheasant from the mountain regions of western China is described by Mr. V. Bianchi. Details of balloon experiments at the aërodynamic institute at Kutshino are furnished by Mr. V. Kuznetsoff. From fossils collected by the Polar expedition of the late Baron Toll in 1900–3, Mme. M. Pavloff is able to draw deductions as to the changes of climate in east Siberia since the Tertiary period. Several papers on aërial mechanics are contributed by Mr. D. P. Riabushinsky. Mr. M. Golenkin writes on a botanical visit to Java, and the report of the geological museum of Peter the Great concludes the volume.

In series vi., part i., of the Bulletin of the Imperial Academy of Sciences, Prince B. Galitzin describes the seismic station at Pulkovo. Mr. P. Vannari writes on the duration of sunshine in Russia. Part ii. opens with suggestions, by Mr. M. A. Nikatshev, for the establishment of a commission to arrange atmospheric observations in different parts of Russia. A memoir of Prof. D. I. Mendeléeff appears in part iii. Memoirs of the geologist N. A. Sokoloff, the chemist H. Moissan, the German meteorologist W. von Bezold, and Signor G. I. Ascoli, philologist, appear in part iv. Among short abstracts of papers is one by Mr. A. Kuljabko on the application of artificial circulation to heads of fishes after cutting them off, and one by Mr. V. Bianchi on Muscicapidæ. In a note on the temperature of lakes, Mr. V. B. Shostakovitch confirms the opinion of Middendorf that a mass of water heated in summer will retain this heat for a long time in spite of heavy frost and snow on the surface. Part v. contains memoirs of the geologist Bertrand and the chemist Berthelot. Mr. A. S. Skorikoff has made elaborate investigations of the plankton of the Taurida pond, St. Petersburg. Mr. S. P. Popoff has studied crystalline phosphates from the shores of the Gulf of Kertch. Prince B. Galitzin writes in part vi. on lines in the spectrum of mercury vapour. Mr. N. Korostelev reports on actinometrical observations at Tashkent in February of last year. Of geological interest are the papers by Mr. A. Fersmann on stolpenite from the Rhone and pyrargyrite from the Pervoblagodatsk ore in the Urals. In part vii. Mr. V. Bianchi describes forms of Pyrrhospiza.

Papers by Mr. A. Karpinsky on the results of soundings in the Pripet basin, and by Mr. A. Fersmann on the mineralogy of the Simferopol district, will be found in part ix. In part x. Mr. F. N. Tshernisheff writes on the discovery of Upper Trias in the northern Caucasus, based on the researches of Mr. V. I. Vorobieff. Mr. Y. S. Edelstein writes on the discovery of Upper Silurian layers in the neighbourhood of Samarkand. The longest paper is that of Mr. V. I. Vernadsky, on striation in crystalline surfaces, with mathematical illustrations. In No. 11 brief notices are given of papers on different investigations, which are to appear *in extenso* either in the Annals of the Zoological Museum or the Transactions of the Academy. One of the most interesting of these is the abstract of Mr. L. S. Berg's paper on the fish of the Amur basin, where the fish consist of a mixture of Palæarctic and tropical forms. Two articles are devoted to crystallography; Mr. V. V. Karandeieff writes on rotatory power and symmetry, and Mr. V. I. Vernadsky discusses the physical theory of twin formation and crystalline groups. Some critical forms of Centaurea, L., are described by Mr. A. Petunnikoff. A controversial article, "In Defence of Natural Genera," written in English, is contributed by Mr. V. Bianchi, who differs from Dr. E. Hartert over what he calls "genus-lumping."

In No. 12 Mr. V. Lubimenko gives a paper on the influence of light on the absorption of organic substances by green plants. Investigations were directed to (i) has light any influence on the assimilation of organic combinations, where photo-synthesis is entirely absent? (ii) what is the influence of light of different intensities? (iii) is the influence of light dependent on the absorption of different wave-lengths? Experiments connected with light and the absorption of saccharose, glucose, and maltose are described, and Mr. Lubimenko hints that further experiment will provide interesting results. Mr. P. K. Kokovtsov's paper on some Central Asian tombstone inscriptions of Syrian-Christian character belongs to literary archæology. Astronomers will be interested in the calculations (in French) of the elements of Encke's comet, by Mr. Kamensky and Mdlle. E. Korolikov. There are short communications by Mr. O. Backlund upon the rhombic pyroxene of a hypersthenic gneiss, and by Mr. P. Stepanov on the Upper Silurian fauna of the Lake Balkhash district. Prof. G. D. Romanovsky studied the palæontological materials of Turkestan gathered by different investigators, and sedimentary formations belonging to all periods from the Silurian, with the exception of the Permian period, have been identified in that province.

Much research is recorded in vol. iii. of Mr. G. E. Grum-Grzhimailo's description of a journey in western China, round Kuku-nor, through Nan-shan, Bei-shan, and along eastern Tian-shan to Russia. There are handsome maps of Nan-shan, Bei-shan, and Tian-shan, showing the route of the expedition, twenty-five phototypes, and twenty-nine zincographs. The earlier chapters describe the route and adventures; the later chapters and appendices deal with natural history. The women of the Panaks (Kuku-nor Tanguts), who are in a position of humility, maintain an immemorial custom of veiling their faces in their plaited hair before strangers. There are two chapters on the ethnology of Amdo and the Kuku-nor region, the native names of localities being given with explanations and comparisons. One conclusion is that there is a strong white admixture among the Tibetans, who have a legend that their first king came from India. Butterflies (*e.g. Agrotis xanthographa*, F., and *Pseudohadena pexa*) approached the encampment when the temperature was surprisingly low. The Mongols and Tibetans consider the bear as king of beasts, and in the nature of a missing link between man and beast. It is thought that tales of "dumb, hairy savages" may sometimes be traced to inexperienced travellers who have seen bears. A rock was seen bearing an inscription in Mongolian and Tibetan, the Buddhist prayer "Hail, Pearl hidden in the Lotus," probably referring to *nirvana*, the translation and interpretation of which are a mystery. There are explanatory notes by Gabet and Waddell. Two legends with regard to the origin of kite-flying among the Chinese are recorded. When the expedition refused the offer of a convoy, the Chinese commander remarked, "Your men are a hundred times braver than our soldiers." A chapter is devoted to the climate of Tibet. Extensive study of the fauna shows that many examples of Siberian forms occur in Tian-shan, Han-su, and Pamir fauna, and our author traces the probable route of these forms by way of the Caucasus and Hindu-kush. As regards Lepidoptera, the interior regions of Tibet are a *terra incognita*. Several pages are occupied with the distribution and classification of Parnassius and Colias. The wanderings of the Old Believers, mentioned by Prjevalsky and Kozlow, are the subject of a separate chapter.

A rich and interesting ornithological collection of 1500 skins, twenty-two eggs, five nests, and three skeletons, made by Mr. Kozlow, has been entrusted to the experienced hands of Mr. V. Bianchi, and its description is contained in "Mongolia and Cham," vol. v., "Aves expeditionis Kozlowi." Eight new endemic forms were discovered. The name Cham or Kham relates broadly to the whole Alpine country of south-eastern Tibet, and in a narrower sense it refers to the area upon which agriculture is possible at a certain height. In the latter sense the boundaries of Cham are still uncertain. The volume opens with a physicogeographical sketch of the regions traversed by the expedition, passing to tables of distribution and analyses of the different species. The chief interest of the collection is that it was made in localities previously unvisited by European naturalists. Four plates of birds appear at the end, with a map indicating the routes of Mr. Kozlow and his colleagues. The longitude is reckoned from Pulkova, 50°–80°, the difference of longitude between Greenwich and Pulkova being 30° 19′ 40″·10. The classification of diatoms was entrusted to Mr. K. S. Merezhkovsky, and Mr. N. A. Tatshaloff recorded the astronomical results of this important expedition, their work being contained in two shorter volumes.

THE AMERICAN PHILOSOPHICAL SOCIETY.

THE general meeting of the American Philosophical Society was held at Philadelphia on April 23–25. The opening session was on April 23, and morning and afternoon sessions were held on the following days, with an evening lecture by Prof. H. F. Osborn on April 24 at the hall of the Historical Society of Pennsylvania, which was followed by a reception to the visiting members and friends of the society. The sessions were largely attended. The meeting closed with a dinner at the Bellevue-Stratford on the evening of April 25.

Forty-two papers were presented, covering a wide range of subjects, but we are only able to find space for summaries of a few of them.

"Determination of Dominance in Mendelian Inheritance," Dr. C. B. Davenport. In studying heredity, where a single character is considered which one parent possesses and the other lacks, or a character that is contrasted in the parents, it is generally found that the offspring are alike, and like one parent only. From examples of poultry, of insects, of certain mammals, including man, and certain plants, in regard to inheritance that may be described as Mendelian, it is concluded that where a stronger determiner meets a weaker determiner in the germ, dominance is the result. When the character is present in one parent only we have the extreme case and typical Mendelian inheritance, but when the determiners are of nearly equal potency the Mendelian law is obscured.

"A Preliminary Report upon a Crystallographic Study of Hæmoglobins: a Contribution to the Specificity of Vital Substances in Different Vertebrates," Profs. E. T. Reichert and A. P. Brown. The primary object of this research was to determine whether or not corresponding albuminous substances are identical in different species. The results of the investigation, which has covered more than one hundred species of vertebrates, show:—(*a*) the crystals of oxyhæmoglobin obtained from any single genus are isomorphous, but unlike those obtained from other genera unless these genera are closely related or in the same family; (*b*) specific differences in angle and habit are obtained between crystals obtained from species of the same genus, so that it is generally possible to re-organise the species by the crystals; (*c*) the occurrence of several types of crystals of oxyhæmoglobin in the same species; (*d*) indications are found in the crystal angles of a substance in the molecule common to all hæmoglobins, no matter what the system of crystallisation. The application of this method of research to problems in zoological classification and in heredity was pointed out.

"The Effect of Certain Preservatives upon Metabolism," Dr. H. W. Wiley. Details were given of the work that Dr. Wiley is carrying on in the study of the effect upon the human organism of a number of preservatives commonly used in the preparation of foods, such as borax, boric acid, salicylic acid and salicylates, sulphurous acid, sulphites, benzoic acid and benzoates, formaldehyde, copper sulphate, and potassium nitrate. Experiments with the first five of these preservatives show conclusively that their continued use, in quantities such as are used in food preservatives, hinders or prevents metabolism, and may seriously derange the functions of the organism. The other substances enumerated are still under investigation, but the results thus far obtained seem to indicate that they are equally injurious.

"Observations Regarding the Infliction of the Death Penalty by Electricity," Prof. E. A. Spitzka. This paper sets forth the history of "electrocution," the methods employed, and the phenomena observed in this mode of death, together with the *post mortem* findings, detailing the observations of the author, based upon thirty-one electrocutions at Sing Sing, Auburn, Dannemora, and Trenton prisons. Compared with other methods, "electrocution" is the most humane method of inflicting the death penalty, because of its efficiency, quickness, and painlessness, and it should be adopted in every State in the Union.

"A Comparison of the Albino Rat with Man in Respect to the Growth of the Brain and the Spinal Cord," Prof. H. H. Donaldson. A statistical study of the growth of the brain and the spinal cord in the white rat, in which the weight of the brain and of the spinal cord is recorded and compared with the body weight at various stages of the development of the animal. The results are plotted, and from these records logarithmic curves are drawn. When compared with the curves derived from the same data in the case of man, and plotted to a corresponding scale, a close similarity in the curves is noted.

"The Classification of the Cetacea," Dr. F. W. True. The opinion is expressed that the Cetacea are not directly derived from Zeuglodonts, and that their origin is not at present known; also that the white whale and the narwhal should not be removed from the family Delphinidæ, and that the river dolphin, Stenodelphis, should, for the present at least, be placed in that family.

"Results of the American Museum Exploration in the Fayûm Desert of Northern Egypt," Prof. H. F. Osborn. The camp of the American Museum Expedition was located to the west of Qasr el Sagra, near the bone quarries opened by Beadnell. Remains of Arsinoïtherium, Palæomastodon, and Mœritherium were obtained from these quarries. A reconnaissance into the Zeuglodon valley, near Gar el Gehannem, was described. The restorations of Mœritherium and Palæomastodon, made by Mr. Charles R. Knight under the direction of Prof. Osborn, were exhibited. From northern Africa the elephant stock migrated south through Africa, north into Europe, and north-east and east through Asia into the Americas. From a comparison of the ancestral elephant Mœritherium with the Sirenian Eotherium, it is believed that the sea-cows and elephants are derived from the same stock.

"Additional Notes on the Santa Cruz Typotheria," Dr. W. J. Sinclair. A presentation of the general conclusions reached as a result of two years' study of the Typotheria from the Santa Cruz formation of Patagonia. They appear first in the Notostylops beds (uppermost Cretaceous or basal Eocene), and become extinct in the Pampean (Pleistocene). It is generally assumed that the rodents and conies are related to Typotheria, but this does not appear to be the case; the resemblances are probably due to convergence. The Toxodontia and the Typotheria probably had a common origin. The Typotheria do not lend much support to the idea of a former land connection with Africa, showing no relationship with the recently discovered Eocene mammals from the Fayum province of Egypt.

"Progress in the Demarcation of the Boundary between Alaska and Canada," Prof. O. H. Tittmann. Details are given of the methods employed in determining the Alaskan boundary. The length of the boundary is about twelve hundred miles, extending from the Arctic Ocean south along the 141st meridian to near Mt. St. Elias, and thence along the coast strip of south-eastern Alaska. In south-eastern Alaska aluminium-bronze monuments are placed wherever it is practicable to do so, but, as most of the turning points in the line are inaccessible snow-clad peaks, they will be defined by triangulation connection with the

work of the Coast and Geodetic Survey. The initial point on the 141st meridian, which is also being marked by monuments, was determined by a telegraphic longitude circuit extending overland from Vancouver through Canadian territory, and by way of Seattle and the United States Government cables to Valdez, and thence overland to the boundary.

"A Living Representative of the most Primitive Ancestors of the Plant Kingdom," Dr. G. T. Moore. Chodat has derived the green algæ from the Palmellaceæ. In this family he points out that there exist three principal stages or conditions:—(1) the zoospore condition; (2) the sporangium condition; and (3) the tetraspora condition. The author thinks that a better starting point is found in Chlamydomonas, which also shows three corresponding conditions in addition to the zoospore type, namely, the volvex type, the tetraspora type, and the endosphæra type. The tetraspora type of Chlamydomonas has developed into the Palmellaceæ, and thence into the algæ and higher green plants. Even as high as the mosses and ferns a Chlamydomonas stage is to be seen in the male gamete.

"The Explosion of the Saratoga Septic Tank," W. P. Mason. The explosion of a tank used for the storage of sewage, and supposed to be due to the ignition of an explosive mixture of marsh gas and air, is discussed. The marsh gas is derived from the fermentation of the sewage, and the ignition is assigned to the generation of phosphine, which is supposed to have ignited spontaneously.

"Some Chilean Copper Minerals," Prof. H. F. Keller. The author describes a number of rare minerals containing copper from the mines in the province of Tarapaca, Chile. Among them the most interesting are peloconite, a manganese ore containing a considerable proportion of copper; a new double sulphate of copper and magnesium isomorphous with chalcanthite; and a beautifully crystallised sulphate and arsenate of copper, which could not be identified with known species.

"Absorption Spectra of Solutions," Prof. H. C. Jones. The object of the present investigation was to ascertain whether combinations between the solvent and dissolved substance had any effect upon its power to absorb light. Certain salts in the anhydrous state have very different absorption than when combined with water. A solution of anhydrous neodymium chloride in absolute alcohol gives absorption bands differing from those obtained when a few per cent. of water is added. The application of this observation to the author's theory of hydration is discussed.

"Effect of an Angle in a Wire Conductor on Spark Discharge," Prof. F. E. Nipher. The problem to be solved is to determine the real current direction in a wire through which a spark discharge is passing. The spark discharge was that of a long eight-plate machine. One terminal was grounded on a water pipe, the other was grounded in the air. A small wire bent at a sharp right-angle was placed vertically in the lines of the earth's magnetic field, and so connected that the negative discharge could be sent either up or down around the angle, and its effect recorded on a photographic plate placed under the angle. Very interesting photographic results were obtained, but the author does not consider that the main question was conclusively answered.

"Some Results of the Ocean Magnetic Work of the Carnegie Institution of Washington," Dr. L. A. Bauer. Dr. Bauer described the work of the *Galilee* expedition in the Pacific since August, 1905. The work accomplished, briefly stated, is as follows:—(*a*) magnetic observations have been made on the ocean areas which closely approach land observations in accuracy; (*b*) errors found in magnetic charts of the Pacific Ocean amount to 1° to 5° in declination (or variation of the compass) and in dip, and about 0·04 in the horizontal magnetic force. The correction of such errors, especially the error in declination, is of great importance for the safe and rapid navigation of vessels.

"The Investigation of the Personal Error in Double-star Measures which Depend on the Position of the Angle," Eric Doolittle. This paper gives the result of the determination of the constant personal errors, and also of the probable uncertainty of the measures of double stars made during the past ten years at the Flower Astronomical Observatory of the University of Pennsylvania.

"Relative Advantages of Various Forms of Telescopes for Solar Research," Prof. G. E. Hale. Prof. Hale discussed different types of telescopes for solar research, describing particularly the equipment at the solar observatory of the Carnegie Institution at Mount Wilson, California. The advantages of the fixed horizontal telescope with heliostat were pointed out. The author also described the large spectroheliograph of this observatory, and exhibited a number of examples of photographs taken by means of this instrument, including solar prominences, faculæ, and sun-spots.

"Photographs of Daniel's Comet," Prof. E. C. Barnard. The comet was photographed on thirty-eight nights with the Bruce photographic telescope of the Yerkes Observatory. The photographs showed that the most active period in the comet's history occurred nearly a month before perihelion, at which time changes occurred so rapidly that the appearance of the comet changed from night to night. Indeed, on comparing the Yerkes Observatory photographs with photographs made at M. Flammarion's observatory in France and at the Lick Observatory on the same night, marked differences in the photographs could be seen.

SOME RECENT AGRICULTURAL PUBLICATIONS.[1]

(1) A CONSIDERABLE change has come over the Journal of the Royal Agricultural Society during the last few years. Founded in 1839, its earlier numbers contained many papers of great scientific and practical interest, and the student of agricultural science frequently has occasion to refer back to them for the writings of Daubeny, Pusey, Way, Lawes and Gilbert, A. Voelcker, and others of the great masters who contributed some of their best work to its pages. It cannot be said that recent numbers are up to the high standard of the older ones. Several causes have contributed to bring about this result. The journal only appears once a year, and men are often unwilling to hold back their papers from publication for so long a period. Much of the work done at the various colleges is directly or indirectly financed by county councils, who like to see something for their money; the results are therefore issued as separate bulletins by the councils or colleges concerned, and distributed among the farming community. Recently, too, some very vigorous competitors, including the Journal of the Board of Agriculture and the Journal of Agricultural Science, have arisen, and these publish much of what would, in the past, have found its way to the Royal Agricultural Society's Journal. The present volume is smaller in size even than the first one issued nearly seventy years ago! There has been a considerable change in the character of the papers. The original paper has almost disappeared; there is, for instance, in this volume not a single contribution from the various teaching centres, if we exclude the report of the zoologist and Mr. Archibald's notes on certain birds, while Rothamsted only contributes a short note. Instead, the papers are of a "practical" or a text-book nature; they describe accepted good practice on certain matters, or give information which could be found elsewhere if the reader knew where to look for it. There is much to be said for this, and the utility of some of the papers in the present volume is beyond question, but it is doubtful whether this is quite the best line to take up. The journal would almost certainly be more valuable to the practical man if it aimed at furnishing him with a record of the progress of agricultural knowledge in its various branches so that he could apply the newly discovered facts to his own methods, if he thought he would gain thereby, and be in possession of definitely established principles to guide him whenever it became necessary profoundly to modify his practice, as happened to many of the wheat-growers a generation ago, and is happening to the hop-growers now. Such a record would include a critical survey of the numerous county council feeding and

[1] (1) The Journal of the Royal Agricultural Society of England, vol. lxviii. (1907.)
(2) Bulletins 1 to 8 of the Midland Agricultural and Dairy College (Field trials in 1907).
(3) Results of Experiments at the College Farm, 1907, University College, Reading.
(4) Bulletin No. 7 Armstrong College, Newcastle-upon-Tyne.
(5) Field Experiments in Staffordshire and Shropshire for 1907.

manurial trials, of progress in soil management, plant breeding, in bacteriology, in our knowledge of plant and animal requirements, so far as practical agriculture is concerned, besides dealing with questions of cost and with practical methods ascertained to give good results and worthy of wider trial.

To come, however, to the actual papers. Two on pigs deal respectively with the general problem and with the bacon-curer's requirements in a way that will appeal to the practical man. Mr. Archibald completes a series of notes on wild birds begun in the journal for 1892 and continued in the 1894 number; if these could be bound up into a separate booklet they would doubtless prove very attractive to the agricultural community. The report on the prize farms in Lincoln is a valuable revival of a practice discontinued since 1892; some of the best things in the literature of practical agriculture are found in the old reports. Mr. Güssow's article on poisonous plants is of interest both to botanists and to practical men.

Dr. Voelcker's report on the work carried out at Woburn is as interesting and suggestive as usual. In the pot-culture station, lithium salts have been found to be very poisonous to wheat, as little as 0·05 per cent. reducing the yield to one-quarter, whilst manganese and iron salts increased the yield. A connected account of the work is promised, and will be awaited with interest. In the field experiments it has been thought desirable to alter the scheme of manuring consistently adhered to since 1876, and we cannot help thinking that this is a great mistake. Stackyard field is one of the best experimental fields in the kingdom, and would prove an almost ideal place for solving problems in soil physics and in soil bacteriology when the methods of working are sufficiently developed. Manures take so long to act on the soil, and we know so little about the action, that it would surely have been better not to break the continuity of treatment, but to leave the fields as material for future workers just as is being done at Rothamsted.

(2) to (5) These bulletins are typical of much of the work executed under the auspices of county councils. The field trials fall under two heads, variety and manurial trials; in the former a number of the varieties of a plant are grown to see which gives the biggest yield, in the latter a scheme of manuring is designed to test the effect of the various fertilisers. Properly executed with duplicate plots and accompanied by adequate chemical analyses, the manurial trials are capable of furnishing results both of practical and scientific interest. Without soil analyses the results have only a temporary value, and are, indeed, often useless to those who do not know the actual field on which the trial was made. Although no analyses are recorded in the bulletins, it is to be hoped they exist. The Midland College bulletins speak well for the energy and enterprise of the staff. Some refreshing departures from the conventional *motif* are found in the Reading report, the experiments on weeding and on cultivation being particularly interesting. E. J. R.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The Public Orator, Dr. Sandys, spoke as follows in presenting to the Chancellor the five representatives of mathematics and natural science who received the degree of Doctor in Science *honoris causa* on June 17:—

THE HON. CHARLES ALGERNON PARSONS, C.B., F.R.S., Honorary Fellow of St. John's.

Regiae Societatis praesidis, Astronomiae fautoris maximi filius, quem hodie decoramus, etiam in ipsa pueritia machinarum novarum inventor felix fuisse dicitur. Postea Dominae Margaretae Collegii alterius scholaribus adscriptus, honorum mathematicorum in classe prima, Dominae Margaretae in nave prima, locum insignem est adeptus. Deinde Archimedis aemulis hodiernis additus, non grammophoni tantum tubam terribilem sonitus suaviores edere docuit, sed etiam navium vi vaporis impulsarum more novo movendarum opus difficillimum exitu prospero est aggressus. Machinae genus illud novum, a Societate Regia numismatis aurei honore approbatum, etiam navibus maximis oceanum transeuntibus postea est accommodatum. Quod si Neptunum ipsum alumni nostri de meritis interrogare volueritis, sine dubio Neptunus ipse protinus respondebit:—

Experto credite quantus
Per pontum properet, quo turbine torqueat undas.

SIR ANDREW NOBLE, Bart., K.C.B., F.R.S.

Ballistarum scientiam hodiernam baronetti huius ingenio plurimum debere inter omnes constat. Milites nostri, machinarum bellicarum in apparatu neque terra neque mari rerum novarum cupidi, viri huius praesertim consiliis admoniti, meliora didicerunt. In ballistis vero nostris in melius mutandis, atque etiam imperii Iaponici in navibus aedificandis, nemo Archimede nostro venerabili plus effecit. Nemo operariis nostris cessantibus et mercedem maiorem flagitantibus potiora suasit. Quid autem est praeclarius quam honoribus perfunctum senem posse dicere idem quod apud Ennium dicat ille Pythius Apollo, se esse eum unde sibi et populi et reges et omnes sui cives, summarum rerum incerti, consilium expetant?[1]

SIR WILLIAM CROOKES, F.R.S.

Cancellarii nostri auspiciis nunc demum eum ipsum praesentem videmus quem diu desideravimus, quem alia ex alia scientiarum in studiis occupata Societas praesidem suum olim suspexit. De scientia chemica et physica exploranda per annos plus quam quinquaginta praeclare meritus, in rerum primordiis primis spectri (ut aiunt) auxilio examinandis eam ipsam provinciam feliciter exploravit, quae etiam scientiae physicae in officina nostra maximo cum fructu indagata est. In observando quam acutus est, in experiendo quam peritus, in rebus difficillimis investigandis quam pertinax! Viri tanti exemplo Vergili dictum denuo praeclare confirmatum est:—"Labor omnia vicit improbus."

PROF. HORACE LAMB, F.R.S., Late Fellow of Trinity Professor of Mathematics in the Victoria University Manchester.

Abhinc annos septem et triginta Newtoni in Collegio alumnum nostrum Newtoni disciplinam perquam feliciter coluisse constat. Postea in Australia professor nominatus, in colonia nostra remotissima studiorum mathematicorum, studiorum physicorum, diu duratura posuit fundamenta. Deinde scriptorum eius propter merita insignia a Mancuniensibus domum revocatus, ea quae ipse de vi electrica disputationum suarum in regione pura invenerat, ab aliis in machinis fabricandis vita nova donata vidit. Peritis nota sunt "Hydrodynamica" eius, in editione nova in maius exaucta. Etiam aliis innotuit oratio Societatis Britannicae in conventu Cantabrigiensi haud ita pridem pronuntiata, in qua primum studiorum mathematicorum historiam recentiorem dilucide delineavit; deinde etiam in studiis illis severis aliquid audendum, aliquid periclitandum esse dixit; denique rerum naturam nondum omnem esse exhaustam, sed miraculis etiam nunc esse plenam, quae scientiarum cultores per plurima in posterum saecula sint exercitura.

PROF. GEORGE DOWNING LIVEING, F.R.S., Fellow of St. John's.

Abhinc annos duo et sexaginta Cantabrigiam primum petivit vir intra proximum quinquennium in disciplina mathematica et in rerum naturae studiis honores summos adeptus, qui, post itinera sua Berolinensia, scientiae chemicae inter nosmet ipsos docendae sese strenue dedicavit, et Divi Ioannis in Collegio primam scientiae illius officinam Cantabrigiensem aedificandam curavit. Postea Universitatis professor nominatus, horum studiorum officinae amplissimae publice condendae summam diligentiam, summam operum exterorum experientiam, feliciter adhibuit. Lucis vero radiis spectri (ut aiunt) ope retexendis, et rerum naturae penetralibus examinandis, quot annorum labores dedicavit! quot discipulis studiorum uno tenore assidue peractorum exemplar quam pulchrum praebuit! In operibus bonis adiuvandis liberalissimus, in negotiis academicis partium liberalium defensor indefessus, per tot annos inter tantas rerum vicissitudines animum serenum, aequum, prudentem, modestum conservavit.

[1] Cicero, "De Or.," i. 199.

Virum talem preconio eodem dignum esse crediderim, quo populi Americani praeses quidam magnus, professoris nostri in anno primo munus suum ingressus, populi sui a poeta eximio postea est laudatus :—

En vir benigne intentus, fortis, providus,
Sagax patiensque, laudem non culpam timens.[1]

On June 17, Lord Rayleigh was formally installed as Chancellor of the University in succession to the late Duke of Devonshire. At a luncheon given by the master and fellows of Gonville and Caius College to the Chancellor, the recipients of honorary degrees, and a large party of guests, Sir Andrew Noble announced that several of Lord Rayleigh's friends, non-resident members of the University, proposed, in order to express the gratification of the scientific world at his election, to offer to the University a fund large enough to provide an annual award to be associated with the name of the Chancellor.

The Harkness scholarship for 1908 has been awarded to T. O. Bosworth, and the Wiltshire prize to W. C. Smith. The John Winbolt prize has been awarded to L. B. Turner, for his essay on "The Elastic Breakdown of Materials submitted to Compound Stress." The examiners were also of opinion that the essay sent in by E. T. Busk was deserving of honourable mention.

The special board for biology and geology has approved a grant of 200*l.* from the Balfour fund made by the Balfour managers to J. Stanley Gardiner, in aid of researches in the Seychelles, Aldabra, and the neighbouring islands.

The professorship of chemistry is vacant by the resignation of Prof. Liveing. The electors will meet for the purpose of electing a professor on Saturday, July 25. Candidates are requested to communicate with the Vice-Chancellor on or before July 13.

OXFORD.—The Drapers' Company has offered to make a grant of 22,000*l.* for a new electrical laboratory at the University, and to contribute 1000*l.* toward its equipment. This generous offer will be brought before Convocation in October.

LIVERPOOL.—The council of the University has instituted two new chairs, one of Celtic studies and the other of mediæval archæology. Prof. Kuno Meyer, who already holds the endowed chair of German in the University, has been appointed to the first of these new chairs, and Mr. F. P. Barnard to the second.

A COURSE of lectures and demonstrations on the scientific study of fisheries has been started this summer session in the University of Aberdeen. It is being conducted by Dr. T. Wemyss Fulton, scientific adviser to the Scottish Fishery Board.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, April 30.—"A Photographic Determination of the Elements of the Orbits of Jupiter's Satellites." By Bryan **Cookson.** Communicated by H. F. Newall, F.R.S.

During the opposition of Jupiter in 1902, the author was engaged in making a series of measurements of the relative positions of the four Galilean satellites with the 7-inch heliometer at the Cape Observatory. Simultaneously with these visual observations, photographs were taken with the astrographic telescope. This paper contains a short account of the work done in connection with the photographs; a detailed account has appeared as vol. xii., part iv., of the "Annals of the Cape Observatory."

The investigation with the heliometer was undertaken with the object of determining the mass of Jupiter and correcting the best available elements of the orbits of the satellites, which observation showed were considerably in error.

The mass of the system of Jupiter, in terms of the sun's mass, was determined with great care from the heliometer observations. The value finally deduced is

$$1 : 1047{\cdot}30 \pm 0{\cdot}06.$$

In the case of the second satellite, which has an orbit at an inclination of 0°·48 to Jupiter's equator, the node retrogrades 12° per annum, and of this motion 82 per cent. is due to the compression of Jupiter, 4 per cent. to the influence of satellite I., 13 per cent. to that of III., and 1 per cent. to that of IV.

The fifth satellite discovered by Barnard is so near to the primary that the node of its orbit revolves through about 912° per annum, and second-order terms begin to make themselves felt. A careful measurement of this motion would be of much value, for a comparison of the compression of Jupiter, deduced from the motion of the node of V. with that deduced from the motion of the node of II., might provide information concerning the distribution of mass in Jupiter.

June 4.—"On the Decay of the Radium Emanation when dissolved in Water." By R. B. **Moore.** Communicated by Sir William Ramsay, K.C.B., F.R.S.

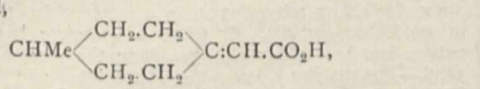
The results obtained by Ramsay and Cameron on dissolving radium emanation in water and in copper sulphate solution have made it advisable to investigate the behaviour of the emanation, when dissolved in such solvents, from a radio-active standpoint. The present note deals with the rate of decay of the radium emanation when dissolved in water. The emanation accumulated by 110 milligrams of radium bromide in two days, with the accompanying oxygen and hydrogen, was collected in a gas burette over mercury. After exploding, a small amount of water was run into the burette, and the solution of the emanation thus obtained, together with the slight excess of hydrogen, was transferred to a glass tube 2 inches long and 5 mm. in diameter, which had previously been exhausted. The solution filled about five-sixths the volume of the tube. The latter was sealed, and the decay curve of the emanation was obtained by means of the γ rays, sheet lead being used to cut down the rays to the required amount. The half-time period found was 3·8 days. It may, therefore, be assumed that the emanation decays at the same rate when dissolved in water as it does in air.

Geological Society, June 3.—Prof. W. J. Sollas, F.R.S., president, in the chair.—The fossiliferous rocks of the southern half of the Tortworth inlier: F. R. **Cowper Reed** and Prof. S. H. **Reynolds.** This paper is a continuation of that on the igneous rocks of this area published in 1901 (Quart. Journ. Geol. Soc., vol. lvii., p. 267). The rocks are affected by the Hercynian flexures which produced the Bristol coal-basin, and the outcrop of the beds in the main follows the horseshoe-shaped outcrop of the Old Red Sandstone. This regularity is lost at Daniel's Wood and Middlemill. Two important transverse faults traverse the outcrops, which are further obscured by the overlap of unconformable Trias. The trap-bands are found to be confined to the Llandovery, the number of recorded fossils has been largely added to, and previous statements as to the thinness and imperfect development of the Ludlow rocks and as to the probable exposure of the district to erosion in Ludlow and Lower Old-Red-Sandstone times are confirmed.

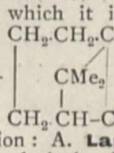
Chemical Society. June 4.—Sir W. Ramsay, K.C.B., F.R.S., president, in the chair.—The interaction of copper and nitric acid in presence of metallic nitrates considered with reference to the existence of hydrates in solution: E. H. **Rennie,** A. J. **Higgin,** and W. T. **Cooke.** The authors consider that the acceleration caused by some nitrates and the retardation induced by others on the dissolution of copper in nitric acid are due to the withdrawal by the salts of water or nitric acid from the solution, and the consequent concentration or dilution of the acid.—The triazo group, part iv., allylazoimide: M. O. **Forster** and H. E. **Fierz.** Allylazoimide prepared in small yield and with some difficulty from allyl chloride and sodium azide is a mobile refractive liquid which boils at 76°·5 under 760 mm. pressure.—Aromatic arsonic and arsinic acids: F. L. **Pyman** and W. C. **Reynolds.** The following new substances are characterised:—bis-2-aminotolyl-5-arsinic acid, bis-2-acetylaminotolyl-5-arsinic acid, bis-*p*-aminophenylarsinic acid, and bis-*p*-acetylaminophenylarsinic acid.—Condensation products from aminopinenedicarboxylic acid: W. **Godden.**—A delicate test for bromides alone or in solution with chlorides: J. S.

[1] (Abraham Lincoln),
"The kindly-earnest, brave, foreseeing man,
Sagacious, patient, dreading praise, not blame."
Lowell's "Commemoration Ode," vi. *ad finem.*

Jamieson. The solution is heated with dilute sulphuric acid and potassium dichromate, shaken with chloroform, and the chloroform layer washed with water two or three times, and finally shaken with dilute potassium iodide. In the presence of a bromide the chloroform is coloured violet. —Experiments on the synthesis of *l*-methyl*cyclo*hexylidene-4-acetic acid,



part i.: W. H. **Perkin**, jun., and W. J. **Pope**.—A method for the measurement of rate of change in solid alloys. Preliminary note: G. D. **Bengough**.—Viscosity determinations at high temperatures: C. E. **Fawsitt**.—Dinitrodiphenylamine-*o*-sulphonic acid. Preliminary note: S. **Smiles**.—The study of the absorption spectra of the hydrocarbons isolated from the products of the action of aluminium chloride on naphthalene: Miss A. **Homer** and J. E. **Purvis**. These hydrocarbons (Trans. Chem. Soc., 1907, xci., 1103) have absorption curves which agree with the view that $C_{14}H_{16}$ is a naphthalene derivative, whilst $C_{40}H_{26}$ has a constitution similar to that of $\beta\beta$-dinaphthyl, and $C_{26}H_{22}$ that of an alkyl derivative of picene, and not of dinaphthanthracene, as had been previously suggested. —The synthesis and constitution of certain pyranol salts related to brazilein and hæmatein: W. H. **Perkin**, jun., R. **Robinson**, and (in part) M. R. **Turner**.—Brazilin, hæmatoxylin, and their derivatives, part ix., on brazilin, hæmatin, and their derivatives: P. **Engels**, W. H. **Perkin**, jun., and R. **Robinson**.—The effect of constitution on the optical activity of nitrogen compounds: R. W. **Everatt**.—The electrolytic oxidation of some hydroxybenzoic acids: A. G. **Perkin** and F. M. **Perkin**.—Note on morindin: A. G. **Perkin**. It is suggested that the morindin of *Morinda citrifolia* obtained by Oesterle and Tisza is different from that of *M. umbellata*, since it appears to be different in composition and to yield a different sugar on hydrolysis.—Some esters of arsenious acid: W. R. **Lang**, J. F. **Mackey**, and R. A. **Gortner**. Descriptions of a number of alkyl esters prepared by heating alcohols and phenols in contact with arsenious oxide, using a reflux condenser with a Soxhlet attachment containing anhydrous copper sulphate to remove water formed, are given.—α-Methylcamphor and fenchone: W. H. **Glover**. It is shown that α-methylcamphor and fenchone are essentially different in type, and on this ground exception is taken to Wallach and Semmler's formula for fenchone, which it is proposed should be represented as



follows:— .—Ester hydrolysis and theories of esterification: A. **Lapworth**.—Experiments on the formation and hydrolysis of esters, acetals, and allied compounds. Preliminary note: E. **Fitzgerald** and A. **Lapworth**.

Linnean Society, June 4.—Dr. D. H. Scott, F.R.S., president, in the chair.—Note on the spicules of *Chirodota geminifera*, Dendy and Hindle: Prof. A. **Dendy**. A correction to the paper recently published in the society's journal, Zoology, xxx. (1907), pp. 95–124.—The Caryophyllaceæ of Tibet: F. N. **Williams**. The collection was made during the recent military expedition to Lhassa, and it raised the known species to forty-three, from the eleven reported by Messrs. Hemsley and Pearson in the society's journal, Botany, xxxv. (1902), pp. 169–170. The route taken by the marching column was virtually unexplored previously, hence the number of novelties, namely, nineteen new species.—*Koonunga cursor*, a remarkable new type of malacostracous Crustacea: O. A. **Sayce**.—The Polychæta of the Indian Ocean: F. A. **Potts**; and the Stylasterina, from the same, elaborated by Dr. S. J. **Hickson** and Miss Helen M. **England**.—A contribution to the mycology of South Africa: W. N. **Cheesman**; with a supplement by T. **Gibbs**.

EDINBURGH.

Royal Society, June 1.—Dr. John Horne, vice-president, in the chair.—Note on some points in the anatomy of a Trilobite, *Calymene blumenbachii*: Dr. Malcolm **Laurie**. The "hypostome" in Calymene does not articulate with the doublure of the carapace. The margins turn back and articulate about one-third of their length from the front with the inside of the glabella. Movement on this joint draws the front of the hypostome away from the doublure, with which it is connected only by a membrane. There is also a plate articulated by a round joint behind the rostral plate which seems capable of turning into a horizontal position. It becomes a question whether the mouth in this form was in front of or behind the "hypostome."—Experiments with Heusler's magnetic alloy: J. G. **Gray**. The points mainly investigated were the magnetic properties of the alloy between 0° C. and 400° C., and the effects of quenching after heating to high temperatures, and of cooling in liquid air. The effect of the low temperature was to increase the susceptibility. In this respect it resembled Hopkinson's nickel-iron alloy, which begins by being non-magnetic at ordinary temperatures, but becomes magnetic after having been cooled to about −50° C. This result is the more curious inasmuch as Hopkinson's alloy is composed of magnetic materials, but is non-magnetic at the start, whereas Heusler's alloy is magnetic, but is composed of non-magnetic metals.—Note on the electrical resistance of spark gaps: Dr. R. A. **Houston**. The method employed was by use of the resonance curve after the manner introduced by Bjerknes. The resonator was adjustable, and the maximum resonance was detected by means of a galvanometer deflection produced by a thermo-couple, which was heated by the discharge. A deflection was also taken when the resonator had its self-induction slightly altered on each side of the adjustment for the maximum effect. From these and other data the logarithmic decrement of the oscillator can be calculated by means of a formula due to Drude, and thence, knowing the capacity and self-inductance, we can estimate the resistance of the spark gap. Results were obtained for different materials of the electrodes (zinc, aluminium, cadmium, tin, iron, &c.), and for various lengths of spark gap. These were somewhat irregular, but in the case of nickel and aluminium increase in length of spark caused a striking decrease in the decrement.—Treatment of aneurism by electrolysis: Dr. Dawson **Turner**. The many attempts to utilise electrolysis in aneurisms have been made in the hope that clotting might occur round the pole and thus serve as a nucleus for further coagulation and deposits of fibrin, with partial filling of the aneurism cavity. The experiments showed that silver and platinum, which have been mostly used by surgeons, had no action of the kind desired, and, besides, gave off gas bubbles in quantity. There is similarly no advantage in using iron or nickel, for no precipitates are formed. Lead, copper, and zinc, however, all produce precipitates, and of these zinc is to be preferred, both because of the character of the precipitate and because of the complete absence of gas bubbles.—Dr. Dawson **Turner** also exhibited some of Prof. Leduc's photographs of growth due to osmosis, and the microscopic structure of such growth.—The "negative viscosity" of aqueous solutions: Dr. W. W. **Taylor** and T. W. **Moore**. The results brought forward in this paper proved the insufficiency of any of the recognised explanations of this phenomenon.

PARIS.

Academy of Sciences, June 16.—M. H. Becquerel in the chair.—A partial differential equation relating to a closed surface: Emile **Picard**.—Researches on the rotation and lustre of the various atmospheric layers of the sun: H. **Deslandres**. A description of a modification of the method given in 1902 for the study of the rotation of the planets, and now applied to the sun. Instead of rotating the spectroscope, which becomes inconvenient with the large dispersion possible for the solar rays, the image of the sun upon the slit is inverted by a suitably mounted prism. The results of comparisons of the iron and cobalt lines (λ 3935·96 and λ 3936·12) and the calcium line K_3 lead to the conclusion that the upper layers of the solar atmosphere vary considerably in the velocity of rotation, and these may be different in the two hemispheres.—The organs and mode of vegetation of the Neuropterideæ and other Pteridosperms: M. **Grand'Eury**.—The ninth campaign of the *Princesse Alice*: the **Prince of Monaco**. This voyage in the Arctic regions lasted from June 16 to September 12, 1907, and was much hindered by unusual

quantities of ice and by fog. Work was done in the fields of meteorology, oceanography, geography, zoology, and physics. A curious fact with regard to Lumière autochrome plates is noted. Commencing at about latitude 69° 40′ N., a blue veil appeared on the plates, increasing in intensity with the progress north up to the highest point reached, 79° N. The inverse effect was noted on the return south.—Bilinear forms: M. **de Séguier.**—The partial differential equation of vibrating membranes: S. **Sanielevici.**—The flocculi of hydrogen photographed with the rays Hα and Hδ: G. A. **Hale.** The flocculi appear to move less rapidly than the gaseous atmosphere in which they float.—The apparent dispersion of light in interstellar space: Pierre **Lebedew.** The experimental results on variable stars obtained by Ch. Nordmann, and confirmed by G. Tikhoff, have been explained by these authors by the hypothesis that light undergoes a dispersion in interstellar space comparable with the dispersion in air at a pressure of 7mm. at 0° C. In the present paper this hypothesis is shown to be improbable and unnecessary.—An arrangement for the study of the sensitiveness of electrolytic detectors: P. **Jégou.** The method described does not require the mental comparison of the loudness of a sound heard in the telephone with a sound previously heard under another set of conditions. The instrument figured gives readings on an arbitrary scale corresponding to no sound in the telephone. The apparatus has been applied to study the effect of temperature on the sensitiveness of the electrolytic detector.—The photography of speech: M. **Devaux-Charbonnel.** A microphone is placed in series with a battery and an oscillograph, and the movements of the latter photographed. A study of the vowels showed that the curves are always the same for each, provided that care be taken to pronounce them in the same manner. This condition was easy to fulfil for I and U, more difficult for A, O, E′, and most difficult for the mute E.—The ultimate rays of the metalloids: tellurium, phosphorus, carbon, silicon, and boron: A. **de Gramont.**—Researches on the solubility of silver iodide in ammonia: H. **Baubigny.** In previous determinations of this constant sufficient care has not been taken to define the temperature and the strength of the ammonia. At 16°, in ammonia of density 0·926, the solubility is of the order of 1/6000, or less than half the solubility usually accepted.—Ammoniacal chloride of arsenic: MM. **Besson** and **Rosset.** The composition of the compound formed by the action of ammonia on $AsCl_3$ is held to be $AsCl_3.4NH_3$. The products separated by M. Hugo by the action of liquid ammonia do not correspond to the original compound, the liquid ammonia behaving rather as a reagent than as a solvent.—The alkaline chloroiridates and chloroiridites: Marcel **Delépine.**—The hydrates of the phosphoric acids: H. **Giran.**—The hydrates of the fatty acids: D. E. **Tsakalotos.**—Colloidal barium sulphate: A. **Recoura.** A solution of sulphuric acid in pure glycerol is neutralised with barium ethylate. The liquid remains limpid, and diluted with ten times its volume of water gives a colloidal solution of barium sulphate, without any precipitation taking place. Solutions of metallic salts, with the exception of mercuric chloride and salts of barium, determine the precipitation of the sulphate.—Constitution of the tetramethyldiaminobenzhydrylmethylenic compounds. The replacement of the hydroxyl of Michler's hydrol by the alkylmethylenic residues: R. **Fosse.**—The action of alkalis on mono- and di-methylarsinic acids and on their iodo-substituted derivatives: M. **Auger.**—The lactone of 3 : 4-dioxybutyric acid: P. **Carré.** Details are given of the most advantageous method of preparing the dioxybutyric acid from monochlorohydrin, and of the isolation of the lactone.—The double phosphate of magnesia and monomethylamine: Maurice **François.** Magnesium phosphate cannot be employed to separate ammonia from methylamine, since the latter forms a double phosphate analogous to the ammonio-phosphate. Magnesium phosphate in excess can be used to separate ammonia or methylamine from di- and tri-methylamine.—A modification of the properties of gluten in presence of sulphurous acid: J. **Dugast.**—The increase of the vital capacity and thoracic perimeter in children: M. **Marage.** A set of respiratory movements was taken by the children for five minutes twice daily. The beneficial effects were very marked, and are set out in tabular form.—The action of the zinc ion in microbial media: Joseph **Mendel.**—Contribution to the study of the constitution of proteid materials. A new method of hydrolysis with hydrofluoric acid: L. **Hugounenq** and A. **Morel.** Hydrofluoric acid at 20 per cent. strength, and at the temperature of the water bath, possesses many advantages as a reagent for the hydrolysis of proteid materials. It gives a complete hydrolysis, and causes less secondary changes than the reagents at present used.—Researches on the hybrids of barley: L. **Blaringhem.**—The hovering of birds: P. **Amans.**—Reply of M. Marcel **Deprez** to the criticism in the preceding note.

DIARY OF SOCIETIES.

THURSDAY, JUNE 25.

ROYAL SOCIETY, at 4.30.—Have Trypanosomes an Ultra-microscopical Stage in their Life-history? Colonel D. Bruce, C.B., F.R.S., and Captain H. R. Bateman.—A Search for Possible New Members of the Inactive Series of Gases (Introductory Note to the Papers by Mr. H. E. Watson and Prof. R. B. Moore): Sir William Ramsay, K.C.B., F.R.S.—A Further Investigation of the Lighter Constituents of the Atmospliere: H. E. Watson.—An Investigation of the Heavier Constituents of the Atmosphere: Prof. R. B. Moore.—On the Atomic Weight of Chlorine: Dr. E. C. Edgar.—Note on the Vapour Pressure and Osmotic Pressure of a Volatile Solute: Prof. H. L. Callendar, F.R.S.—Eutectics Research No. 1, Alloys of Lead and Tin: W. Rosenhain and P. A. Tucker.—The Emission and Transmission of Röntgen Rays: G. W. C. Kaye.—Further Note on a Luminous Glow generated by Electrostatic Induction in an Exhausted Vessel made of Silica: Rev. F. J. Jervis-Smith, F.R.S.—The Action of Chlorine upon Urea whereby a Dichloro Urea is Produced: Dr. F. D. Chattaway, F.R.S.—On the Reflection of Waves from a Stratum of Gradually Varying Properties, with Application to Sound: Dr. J. W. Nicholson.—Preliminary Account of the Habits and Structure of the Anaspididæ, with Remarks on some other Freshwater Crustacea from Tasmania: Geoffrey Smith.—The Ω-Functions—a Class of Normal Functions: E. Cunningham.—And other papers.

MONDAY, JUNE 29.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Some Aspects of the Nile Valley: Capt. H. G. Lyons, F.R.S.

WEDNESDAY, JULY 1.

BRITISH ASTRONOMICAL ASSOCIATION, at 5.

CONTENTS.

	PAGE
Meteorology of Indian Seas. By M. W. C. H.	169
A Text-Book of Tropical Medicine. By Colonel David Bruce, C.B., F.R.S.	170
A Monograph of Bristle-Worms	171
Direct-Current Electrical Engineering. By L. C.	172
Education and Employment	173
Our Book Shelf:—	
Dunraven: "Self-Instruction in the Practice and Theory of Navigation"	173
Hanbury: "The London Catalogue of British Plants"	174
"Jahrbuch der Naturwissenschaften, 1907–1908"	174
Letters to the Editor:—	
Prominence and Coronal Structure. (*Illustrated.*)—Dr. William J. S. Lockyer	174
Mendelism: a Personal Explanation.—A. D. Darbishire	175
The Research Defence Society	176
Artificial Diamonds. By F. M. P.	177
Pictographs of Arrows in French Caves. (*Illustrated.*) By A. C. H.	178
Notes	178
Our Astronomical Column:—	
The Rings of Saturn	182
The Forty-inch Objective of the Yerkes Observatory	182
The Temperature of the Sun	183
The Variation of the Pole	183
Observations of the Perseid Shower in 1907	183
Recent Developments in Electric Lamps. (*With Diagram.*) By Maurice Solomon	183
Russian Scientific Works	186
The American Philosophical Society	187
Some Recent Agricultural Publications. By E. J. R.	188
University and Educational Intelligence	189
Societies and Academies	190
Diary of Societies	192