THURSDAY, JUNE 20, 1918.

MASONRY DAMS AND IRRIGATION WORK.

(1) *Engineering for Masonry Dams.* By W. Pitcher Creager. Pp. xi+237. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1917.) Price 11*s.* 6*d.* net.

(2) *Irrigation Works Constructed by the United States Government.* By A. Powell Davis. Pp. xvi+413. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1917.) Price 21*s.* net.

(1) THE engineering term "dam" has a diversity of applications; it may be defined to include any work which has for its object the confinement of water, (*a*) so as to produce a rise in level, (*b*) so as to exclude it from a certain area, and (*c*) so as to repress the natural flow to any desired extent. In Mr. Creager's book the subject is approached almost entirely from the point of view of the adaptation of dams to the formation of reservoirs in schemes of water conservation. The briefest reference is made to weirs, anicuts, and the like, in river rectification operations, and none to dykes and embankments in coastal defence works. The general location of the dam is assumed to be already determined, and the opening chapter deals with the selection of the most suitable site for the former within the prescribed area. As might be anticipated, the volume is largely a reflection of American practice, with some few illustrations selected from other countries; we miss, however, any reference to English and French designs, some of which are certainly worthy of note.

Within the purview chosen the treatment is lucid and coherent. We confess to a dislike of the use of numerals as points of reference in a diagram, when the lines and areas they indicate have numerical coefficients assigned to them: there is always some possibility of confusion. But this is a minor defect. Dams are divided into six classes, of which only three come strictly within the term "masonry dam." The author investigates in careful detail the various external and internal forces acting upon such structures. The customary preliminary assumptions are made that the dam is rigid and homogeneous, that the foundation is elastic, and that the distribution of basal pressure follows a law of uniform variation. These assumptions are, of course, not strictly correct, but Sir John Ottley and Dr. Brightmore have shown that calculations based on them give results which, at any rate, are not less than the stresses actually experienced, and that they constitute, therefore, a conveniently safe working hypothesis. Indeed, in the present state of our knowledge no other premises are practicable, and the long-continued stability of existing dams demonstrates the trustworthiness of the principles which have been adopted in their design. It is true that Mr. Atcherley, in his theory of tension in vertical planes, has attacked the soundness of the position, but the weight of evidence is undoubtedly against him. The author notes the controversy briefly, but, in view of the vital importance of the matter, we venture to think that the refutation of Mr. Atcherley's contention (ably maintained as it was by Prof. Karl Pearson) by the experimental investigations of Ottley and Brightmore, and also by those of Messrs. Wilson and Gore, is deserving of rather more than passing allusion in a footnote. If the postulates, however, be conceded, the rest of the reasoning follows. The author lays down six rules which govern the design of masonry dams in all essential respects. Each of these rules is then expressed in the form of a mathematical equation, belonging to one or other of two classes, which are termed respectively equations of determination and equations of investigation. The former of these fix the length and location of successive joints; the latter decide whether the results so obtained are compatible with the proportions adopted for adjacent sections and the design as a whole, the process being, to a large extent, one of "trial and error." Following this, a series of examples is worked out in numerical and graphical detail, including two solid non-overflow dams, a solid spillway dam, and two hollow (reinforced concrete) dams. Arched dams are also treated and illustrated, but we are a little surprised at the absence of any comment on the Bear Valley Dam in California, which is remarkable for its extremely slender proportions; if we mistake not, the line of theoretical pressure, reservoir full, lies almost entirely outside the profile.

Some observations on noteworthy instances of failure—at Bouzy and Habra, for example—would have been serviceable, and the expenditure side of the question certainly deserves consideration; but no particulars of cost are given. Taking it as a whole, however, the work will undoubtedly prove a useful text-book for students and draughtsmen, and we desire to express every appreciation of it as such; but it will scarcely be claimed by the author that he has exhausted the subject.

(2) In quite a number of respects, Mr. Davis's volume is complementary to that of Mr. Creager. He gives a series of articles on reservoir work carried out in the United States, including descriptions of the dams, with detailed statements of cost. Some of these dams are discussed and illustrated by Mr. Creager, but Mr. Davis's presentment is less theoretical and more practical, and his range is more extensive, since he includes timber and earth, as well as masonry structures. At the same time, his survey is limited to irrigation works undertaken by the Reclamation Service of the United States Government. The book is an appropriate record of a great State enterprise which has resulted in the provision of reservoirs and distributing systems whereby water is available for the irrigation of nearly two million

acres of land. In the year 1916 the annual product of the acreage actually under treatment was estimated at more than 22,000,000 dollars. The contents of the book are deserving of careful study by engineers and others engaged in the development of irrigation schemes.

BRYSSON CUNNINGHAM.

MEDICAL ELECTRICITY.

Medical Electricity: A Practical Handbook for Students and Practitioners. By Dr. H. Lewis Jones. Seventh edition, revised and edited by Dr. Lullum Wood Bathurst. Pp. xv+588. (London: H. K. Lewis and Co., Ltd., 1918.) Price 15*s.* net.

DR. LEWIS JONES was chiefly responsible for raising medical electricity to its present honourable position. He rescued it from the depths of disrepute into which it had been thrust by the hands of charlatans. The best years of his life were devoted to this work; by painstaking study he sifted the real from the sham, and by original investigation and patient experiment introduced many new features in well-known electrical procedures. He showed a readiness to adopt new methods of treatment once he had convinced himself of their value. It was owing to the influence of Prof. Leduc, of whom he spoke in terms of affection and admiration almost verging upon reverence, that he first realised the great possibilities of ionic medication.

On the death of Dr. Lewis Jones the question arose whether the book that epitomised the history of medical electricity should be allowed to pass out of existence. If not, where was the champion who would rescue it and keep alive the name of its creator? Dr. L. W. Bathurst answered the appeal. We may say at once that in the new (seventh) edition, which he has revised and edited, he has carried out his difficult task in a worthy spirit. All the essential features of the book, as we know it, have been retained, and such new matter has been added as the experience of recent months has shown to be worthy of adoption.

Dr. Lewis Jones foretold the further expansion of ionic medication and the use of the thermal effects of electricity. Diathermy apparatus is now fully established in surgical practice as a means of coagulating the tissues. The introduction of drugs through the skin from electrodes moistened with them (ionic medication) is becoming more and more recognised as a valuable medical procedure. The drugs mostly used are the chlorides of sodium, ammonium, and lithium, salicylate of soda, sulphate of zinc, the iodides of potassium and lithium, quinine sulphate, and cocaine hydrochloride. Condenser discharges were first introduced into this country by Dr. Lewis Jones as a good diagnostic method of testing for the reaction of degeneration in diseases of the nervous system. These discharges are capable of accurate quantitative adjustment, and their use as stimuli for nerve and muscle gives more trustworthy results than are obtained by the galvanic battery. The methods of using the condenser discharges for treatment are described in detail.

Prof. Leduc's remarkable experiments on the production of "electric sleep" by rapidly interrupted currents passed longitudinally through the nerve-centres are described. "The anode was placed on the hinder part of the back of a dog or a rabbit, and the kathode on the skull. The skin was previously shaved. The current was increased gradually, and at a certain strength the animal became unconscious. When this stage was reached, a state of tranquil sleep was induced, in which the animal remained until the current was stopped. During this period of sleep there was anæsthesia. As soon as the current ceased, the animal jumped up and seemed quite well, and no injurious results followed." In the experiment of which Prof. Leduc had the courage to make himself the subject "the current was not pushed to complete insensibility, the operators believing that this had been attained, although the professor was able to tell them afterwards that consciousness had not been lost, though he was quite unable to communicate with them on account of his peculiar condition, which he compares to that of one in a nightmare, aware of some impending disaster, but unable to move or cry out. The current used in these experiments is the Leduc current (§ 63), with 100 periods a second and with closures of one-thousandth of a second. The application of this electric sleep to practical medical purposes remains untried, but it seems possible that it may one day prove useful."

The subject of death from electric shock is discussed in detail. The action of X-rays and radium in treatment and the subject of X-ray dermatitis come in for reasoned comment, though the scope of the book does not permit of a very full account of this important branch of the subject. Chaps. xi.–xviii. contain classified lists of diseases, with the electric methods of treatment best suited to each disease. Finally, we find a useful appendix containing (1) a table of electro-chemical equivalents, (2) a comprehensive list of the towns of Great Britain and Ireland with particulars of their electric supply, and (3) plates, showing the motor points in the head, neck, and limbs, the areas of distribution of the cutaneous nerves, and the segmental distribution of the sensory nerve-roots.

"Medical Electricity" is a true text-book and a valuable work of reference. A. C. J.

INDUSTRIAL WELFARE AND HEALTH.

Welfare and Housing: A Practical Record of Wartime Management. By J. E. Hutton. Pp. viii+192. (London: Longmans, Green, and Co., 1918.) Price 5*s.* net.

THE employment to-day in munitions factories of women on work to which they were not previously accustomed, and of men rejected by the Army on account of their inferior physique, has raised in an acute way problems of industrial welfare and health upon which efficiency and output are directly dependent—problems with us in

pre-war days, but largely disregarded when labour was plentiful and when the need for its conservation was not so manifest.

An authoritative and informing manual dealing with the whole subject is at the present moment much needed, and Mr. Hutton's book is a useful contribution to the subject; probably he intended it for no more. But it cannot in its present form be regarded as a standard work on the subject. It is curiously uneven. The scope of "Welfare Supervision" is outlined in an early chapter, but only touched upon very inadequately later; the subject of factory medical service—a matter of the utmost importance—is dealt with by another writer, who is allowed but limited space; recreation, which is just receiving much attention, and being thoroughly organised in many industrial centres, is represented only by a few instances from some of the factories of Vickers, Ltd.; while the last chapter, which introduces industrial unrest, and deals with it haphazard by a series of quotations, might have advantageously been omitted, for it openly seeks to drag the peace-making influence of the welfare movement into the unsettled turmoil of economic strife, from which it should be ever guarded.

The six appendices which reproduce from Home Office publications legal and other information do, it is true, give condensed and useful information on many points, but appendices often escape the reader. In fact, we regret that Mr. Hutton did not use all the space he allowed himself for discussing at greater length those branches of the subject with which he is best able to deal—industrial housing, transit, and feeding. The chapters dealing with these subjects are the best, and the information they contain as to how Vickers, Ltd., have dealt with the difficulties they had to face will be turned to, both now and in the future, by others with similar problems to solve. They are undoubtedly of considerable value, but we should like to have learnt more of the workers' point of view—as to whether they take any share in organising and administering, or whether they are just housed and catered for "like dumb-driven cattle." The workers' point of view is too often neglected by those who take a paternal interest in them, and there is a tendency to forget that (using Dr. Renton's words) "there is an inseparable relationship in varying degrees between all work and health and disease, and it is only by intimate knowledge of both that a correct conclusion can be reached, especially if, added to this, one has knowledge of the home conditions and habits of the worker."

OUR BOOKSHELF.

Applied Mechanics. Second Year. By H. Aughtie. Pp. 227. (London: G. Routledge and Sons, Ltd., 1918.) Price 2*s.* 6*d.* net.

THIS book opens with a very good discussion on the relations between movement and force; experimental evidence is obtained by use of a trolley and vibrator. Engineers' units are used freely, in which the unit of mass is *g* pounds. We are rather uncertain, however, as to what exactly the author wishes us to understand by "1 lb. weight." The poundal absolute unit of force is explained, and mention is made of the dyne, but the engineers' metric unit of force of one gram weight or one kilogram weight is not mentioned. There is a slip on p. 11, where, in dealing with momentum, W/g is described as lb., instead of engineers' units of mass. Despite these minor blemishes, this section of the book is a good deal clearer than many similar discussions in other text-books. Some very readable matter on hydrostatics and hydraulic appliances follows, illustrated by appropriate experiments. The chapter on materials will be useful in laboratories possessing but small equipment and under the necessity of using extemporised apparatus. The drawings of apparatus throughout the volume are such as to enable the appliances described to be constructed from them.

Some of the illustrations in the sections of the book dealing with the transmission of motion and power could be improved, especially in the isometric drawings of pulleys and wheels; the distortion in some cases strains the readers' eyes in examining the drawings. The remainder of the book is devoted to the motion of bodies subjected to alternately decreasing and increasing acceleration, motion in a curved path, centrifugal force, and the speed control of engines. The treatment throughout is simple, and the book contains sufficient to interest the student and induce him to push on to the study of the higher branches of the subject.

Glossary and Notes on Vertebrate Palaeontology. By S. A. Pelly. Pp. ix+113. (London: Methuen and Co., Ltd., 1918.) Price 5*s.* net.

IN this little book Mr. Pelly has made a praiseworthy effort to help the inexperienced reader of works on fossil backboned animals and the visitor to museums. It is a laborious compilation, suggested by many visits to the British Museum (Nat. Hist.), and consists of a series of brief memoranda, often quotations, arranged under the names of various extinct animals in alphabetical order. Some of the notes are apt and excellent, but most of them are so inadequate and so lacking in essentials that it is difficult to understand to what type of student they can be of service. A special feature is made of the derivation of each technical name, and in most cases the original Greek words are rightly chosen, but the English equivalents given are not always appropriate to the occasion. There are, however, unfortunate instances of bad guesses (such as those under Goniopholis, Trematapsis, and Uronemus), and the author would have done well to consult the old glossaries of Owen, Page, and Nicholson, which he appears to have overlooked. The book is well edited and remarkably free from misprints, and of a convenient size for the pocket. A. S. W.

LETTERS TO THE EDITOR.

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

The Food of the Rook.

Is there not even a fallacy in the argument against this bird which is supported by a note in NATURE of June 6, p. 271? You say that because 52 per cent. of the rook's food is injurious, 19·5 per cent. neutral, and 28·5 per cent. beneficial, therefore "it is impossible to ignore the fact that at present this bird does considerably more harm than good," even though, as you admit, 23·9 per cent. of the rook's food consists of injurious insects.

Is it not possible that if these injurious insects—they doubtless consist of many species—had been left unconsumed by the rook, they might have so multiplied that their total depredation upon man's food supply would have considerably exceeded the 52 per cent. of foodstuffs which the bird consumes directly?

As a method more likely to restore the balance of Nature than the indiscriminate destruction of certain species of birds, the rook included, I would suggest a strict preservation of all our birds of prey; and now that game-preservation has to take second place to food production, this would seem to be a matter for practical legislation. SYDNEY H. LONG.

Norwich, June 10.

IF Dr. Long assumes that the 23·9 per cent. of injurious insects left unconsumed might have multiplied, it is surely only fair that he should also assume that, under similar conditions, the 48·5 per cent. of cereals, potatoes, and roots would have multiplied and brought forth a hundredfold. The point at issue, however, is whether, in estimating by the volumetric method the amount of food consumed by the rook per annum the figures express equivalent or economic values. This method has so long been recognised as the only trustworthy one that it is not necessary to reassert its superiority over all others; and as McAtee has so pertinently remarked (*The Auk*, 1912, p. 452), such "criticisms are wide of the mark, for no one claims that percentages do express economic values. They are simply convenient handles to facts, and they must be interpreted." As the result of long experience and the examination of the alimentary system of upwards of two thousand rooks, by which we have obtained the percentages referred to, viz. that of the food consumed by the rook during a whole year, 52 per cent. is injurious, 19·5 per cent. neutral, and 28·5 per cent. beneficial, our interpretation of these figures, in the light of a long experience as to the detailed nature of the food under each heading, leads us to the conclusion that this bird does considerably more harm than good.

The advisability of practical legislation for the strict preservation of birds of prey and the relationship of such to game-bird preservation is a very complicated subject. All statistics, however, go to prove that the preservation of game-birds is beneficial rather than inimical to food production, and there are many other sides of the question which Dr. Long does not seem to have considered. THE WRITER OF THE NOTE.

A Proof that any Aggregate can be Well-ordered.

IN my letter printed in NATURE for April 4, 1918 (vol. ci., p. 84), the class of direct continuations used for well-ordering should have been stated to be "complete"—that is to say, no chain of M outside the class is such that every member of this class is a segment of this new chain. The actual construction of a complete class of direct continuations can be carried out in a perfectly unique manner throughout in terms of the possible chains of M, without assuming that there is any chain of M that exhausts M itself. This construction is given in detail in a paper which will shortly appear in the *Comptes rendus*, and the detail of the consequences of the existence thus proved has already appeared in the *Comptes rendus* for April 2.

PHILIP E. B. JOURDAIN.

The Bourne, Basingbourne Road,
Fleet, Hants, May 31.

Construction for an Approximate Quadrature of the Circle.

THE construction for squaring the circle given by Mr. R. E. Baynes in NATURE for June 6 was described more fully by Mr. T. M. P. Hughes in the issue for April 2, 1914, with a simple extension to the representation of the circumference.

Mr. Hughes suggested the use of a permanent set-square of the proper angle, and it seems that the method was known earlier, for in the Science Museum at South Kensington I have seen a set-square for the purpose. I did not examine it carefully, but I believe it bore the inscription "Edward Bing, Riga, 1876." Perhaps someone else may know the history of this instrument and method. GLENNY SMEAL.

University of Edinburgh, June 8.

THERE are in the Science Museum three examples of the set-square to which Mr. Smeal refers. They have been here since 1876, in which year they were lent by the inventor, Edward Bing, a member of the staff of the Waggon Works at Riga, for exhibition in the Special Loan Collection of Scientific Apparatus. There is a short description in the third edition of the catalogue of that collection, published in 1876, at p. 14, and I have no record of any earlier published description. One of the examples is of steel and the other two of wood, the hypotenuse in each case being about $7\frac{3}{8}$ in. long. The inventor's MS. label inside the mahogany case containing the steel set-square reads:—"Bing's Circular Square. Kreiswinkel. Equerre circulaire. Cosinus $\alpha = \sqrt{\pi}/4$ ($\alpha = 27^\circ\ 35'\ 49{\cdot}636''$)." DAVID BAXANDALL.

The Science Museum,
South Kensington, June 13.

INTER-ALLIED SCIENTIFIC FOOD COMMISSION.

IN a recent speech Mr. Clynes stated that the events of the last two years had revealed the necessity, not only of securing complete unity of action among the Allies, but also of basing any such action on the guiding principles laid down by science. This recognition of the fundamental part which science should play in the successful direction of public affairs is noteworthy as coming from a member of the youngest of our political parties, and augurs well for the future of the country when this party comes to be entrusted with a responsibility commensurate with its political power. In fact, much of the success of the Ministry with which Mr. Clynes is connected may be ascribed to the adoption by Lord Rhondda of a policy based on the collective experience of

scientific men rather than on the political exigencies of the moment. Thus the United Kingdom, alone among the European Allies, has been able to maintain a distribution of bread free from any restriction, at a time when all the others felt themselves constrained to limit the consumption of this, the most essential of all foods, by a system of rationing. This policy does not mean, as is so often thought, that the shortage of breadstuffs in this country was less than that of the other Allies. But Lord Rhondda adopted the scientific policy of economising cereals at the expense of animals, instead of the more obvious expedient of diminishing directly the supply of bread to man.

When the pooling of supplies was decided upon by the Allies meeting in conference, a satisfactory distribution was found practically impossible in the absence of precise knowledge both as to the resources and as to the needs of each nation. The needs of a country depend on physiological facts, and can be deduced from a knowledge of the nutritional requirements of its inhabitants of varying age and sex, and the distribution of these classes of individuals among the population. The question is, therefore, fundamentally a physiological one. The resources of a country can be gathered from the statistical information at the disposal of the Government with regard to agricultural production and trade returns, etc., but the value of these resources as human food is also a question which can be determined only by physiologists. On this account, the Inter-Allied Congress, sitting at Versailles in the autumn of 1917, decided to establish an Inter-Allied Scientific Food Commission, consisting of two representatives of each of the Allied countries, France, Italy, the United Kingdom, and the United States, which should perform towards the Allies as a whole somewhat similar functions to those which had been discharged for the United Kingdom by the Food Committee of the Royal Society. The task of this Commission was, therefore, to examine the resources of each of the Allied countries, to make a forecast of their production for the year 1918–19, and to report on the imports which should be allotted to each country in order that it should be supplied with sufficient food to maintain its population in health and efficiency.

The Commission has held three meetings—at Paris, Rome, and London. In the first two meetings the Commission was mainly employed in establishing certain principles which should serve as a basis for its recommendations as to the imports necessary to meet the deficit of each country. It was of importance in the first place that all countries should make use of the same units of measurement, and base their calculations of food values on the same sets of figures for calorie value and composition of the chief foodstuffs. Thus it was agreed to use the metric ton as the unit of weight, the hectare as the unit of area. A list of the average calorie values of foods, based chiefly on the results of Atwater, was drawn up for use by all Allied countries. As regards the food requirements of the 'average man,' and the relation thereto of women and children of various ages, the Commission accepted the figures given by Lusk. Uniform milling values were arranged, and all countries accepted the principle that the maximum possible amount of cereals, with the exception of oats, should be assigned to human food. It was also agreed that, whereas it is impossible to fix any minimum requirement for meat, it is desirable that the ration of fat should at no time fall below 75 grams per 'average man' per day. The question of a minimum protein ration presented no difficulty, since a sufficient amount of this foodstuff is contained in a mixed diet of adequate calorie value. The Commission thus accepted Bayliss's dictum: "Take care of the calories and the protein will take care of itself." The Commission also laid down the form in which the statistics of production in pre-war years and the forecast of production in the coming year should be presented by each delegation from information supplied by its Government.

We understand that the examination of these balance-sheets for each country has been the work of the Commission during its meeting in London, which has just terminated, and that the Commission will shortly present to the Allied Governments for the use of the Inter-Allied Executives, on whom devolves the task of procuring and apportioning the foods available for import from abroad, a report in which is laid down the relative share in these imports due to each Allied country. It must not be imagined, however, that it is the office of such a scientific commission to effect a rigorous subdivision of the hundred-and-one articles which may enter the Allied countries as food. All it can do is to indicate the principles of such a division and the limits within which it must be carried out. The total food to be imported will be given by the number of food calories due to each country. Some indication as to the distribution of these calories among staple foods, such as meat and cereals, is afforded by the agreement that 75 grams of fat per day should be provided in each country for every 'average man.' In this way a rough subdivision of imports is achieved, but the final division must be left to the Executives, who will be guided by the three controlling factors, viz. supplies, tonnage, and finance.

But this, after all, is the proper limitation of the function of science in public affairs. Science should be the eyes, the informative organ of the State, rather than the organ of volition. The responsibility of action lies with the administration, but the success of the measures adopted will be in direct proportion to the degree in which they are based on the broad principles taught by the body of human experience, which is science.

THE members of the Inter-Allied Scientific Food Commission are as follows:—*France*, Profs. Gley and Langlois; *Italy*, Profs. Bottazzi and Pagliani; *Belgium*, Prof. Rulot; *United States*, Profs. Chitten-

den and Lusk; *United Kingdom*, Profs. E. H. Starling and T. B. Wood. The conclusions agreed upon by the Commission are summarised in the following paragraphs:—

(1) The Commission has decided to state the weights of the various foods produced in each Allied country in metric tons.

(2) The Commission has decided that it is not desirable to fix a minimum meat ration in view of the fact that no absolute physiological need exists for meat, since the proteins of meat can be replaced by proteins of animal origin, such as those contained in milk, cheese, and eggs, as well as by proteins of vegetable origin. The Commission, on the other hand, resolved to fix a desirable minimum ration of fat. This desirable minimum ration amounts to 75 grams per average man per day. The ration will be made up of (i) fats of vegetable origin and (ii) fats of animal origin. If the amount of fats of vegetable origin is insufficient for this purpose, it may be necessary to maintain a certain stock of animals to furnish a sufficient quantity.

(3) The Commission has established the "man value," *i.e.* the number of average men equivalent to the population of each of the Allied countries. This man value is taken as the basis for calculating the exact amount of food which must be provided for the adequate nourishment of the total population of each country.

(4) The Commission has considered estimates in tons of the home productions of the soil furnished by each Allied country for the year 1918–19. These statistics will serve as a basis for determining the amount of food available for men and for animals respectively in each country.

(5) The Commission recommends that each delegation, in calculating the amount of calories available for men, should assign to men the maximum possible proportion of all cereals except oats.

(6) The Commission is of opinion that a uniform average milling extraction of 85 per cent. for wheat be adopted throughout the Allied countries. It is recognised that this extraction may vary from 80 per cent. in summer to 90 per cent. in winter, and that it can apply to the United States only as regards their internal consumption, and then only in case of scarcity.

(7) The Commission recognises that the methods adopted for reserving the maximum possible proportion of the cereal production for the use of man may vary in each country. Man should always take precedence over animals in the allocation of food by the Governments. If this principle be accepted, the Commission is of opinion that in the fixing of prices it is the prices of animal products which should be limited rather than those of such vegetable products of the soil as may serve equally well for feeding men and animals. Thus the production of veal, pork, and poultry at the expense of food available for man should be discouraged, and this is best achieved by fixing a price for those animal products which will make it unprofitable for the producer to feed the animals on cereals.

(8) The Commission reserves for its next meeting the task of examining the figures which will enable it to determine the calorie value of the home production of each of the Allied countries during the year 1918–19. The determination of this figure compared with the needs in calories of the population of each country will enable the Commission to deduce either the amount of imports necessary for the maintenance of the population or the exportable surplus, as the case may be.

(9) The Commission is of opinion that in all the Allied countries any propaganda having for its object the encouragement of food production and of economy in the use of food should be organised and directed by men of science well acquainted with these subjects.

THE NEW STAR IN AQUILA.

CONTINUED observations appear to indicate that the new star in Aquila is following the normal course of such objects, as exemplified especially by Nova Persei (1901) and Nova Geminorum (1912). The increase of brightness from about magnitude 0·9 at the time of discovery on June 8 to a brightness equal to, or greater than, that of Vega (0·1 m.) on June 9 was succeeded by a steady decline, so that on June 16 the star was reduced to about second magnitude. Nova Persei showed a closely similar rate of fading, from near magnitude 0 on February 23 to magnitude 2 on March 2, and if this precedent be followed, Nova Aquilæ may be expected to reach the third magnitude about June 21, and the fourth magnitude about ten days later. Small oscillations, however, may possibly accompany the general decline.

The spectrum of the nova also appears to have followed the expected sequence of changes, so far as can be gathered from the brief reports presented at the meeting of the Royal Astronomical Society on June 14 by the Astronomer Royal, Mr. Harold Thomson, and Prof. Fowler on the visible spectrum, and by Prof. Newall, Father Cortie, and the Rev. T. E. R. Phillips on the photographic spectrum. The spectroscopic observations may be conveniently summarised by comparison with previous novæ, as discussed by Sir Norman Lockyer in a memoir on the phenomena of new stars published by the Solar Physics Committee in 1914. It is there shown that there are four distinct stages in the history of a nova as revealed by its spectrum: (1) A stage of short duration in which the spectrum is continuous, or continuous with dark lines, occurring during the rise to maximum brightness. (2) The bright-line, or "typical nova," stage, where the outstanding feature is a spectrum crossed by broad bright bands, many of which are accompanied by absorption bands on their more refrangible edges; the brightest lines are those of hydrogen, but enhanced lines of iron are also prominent. (3) A stage marked by the presence of a bright band of unknown origin about $\lambda 4640$, which is sometimes the brightest in the whole spectrum. (4) The nebular stage, characterised by the bright lines of gaseous nebulæ, of which 5007 and 4959 are the brightest in the visible spectrum.

The first stage was shown in Nova Aquilæ by observations immediately after the discovery, and in observations by Prof. Newall and Mr. Thomson on June 9. It is especially fortunate that the latter part of this transient stage was caught by Father Cortie in a photograph taken at Stonyhurst on June 10, in which dark lines, somewhat resembling those of Procyon, are the chief feature in the blue and violet parts of the spectrum, although bright lines in the visible spectrum were noted on the same evening by other observers.

The second, or "typical nova," stage had become well developed by June 11, as shown by

both the visual and photographic observations. The Cambridge photographs of June 13 are particularly valuable in having α Cygni as a comparison spectrum, thereby confirming Sir Norman Lockyer's conclusion that many of the enhanced lines which are so prominent in this star are reproduced as bright lines in the spectra of novæ. Later observations communicated to us by Prof. Fowler show that this stage continued up to June 16, when his last observations were made. The bright C and F lines of hydrogen, and the enhanced lines of iron λλ 517, 502, and 492, have remained the most conspicuous features of the visible spectrum since bright lines appeared, and the diminishing luminosity of the star has been accompanied by a marked reduction in the intensity of the continuous spectrum.

On June 12 it was found that the bright fringe on the red side of the dark band about λ 589 had become a definite bright band, having a narrow dark line near its red edge, the whole group being probably identical with that shown in photographs of Nova Persei taken at the Yerkes and Lick Observatories, which clearly proved that the narrow line was sodium D. Revised estimates of the two bright lines between C and D suggested identity with lines about λ 615 and λ 625 shown in the Yerkes photographs of Nova Persei, and a fainter line was noted about λ 641. Two vague brightenings were also observed between F and G. On June 13 the dark band about D was much reduced in intensity, while that about λ 560 had become considerably stronger. On June 15 and 16 the principal change was the reduced intensity of the continuous spectrum and the consequent greater clearness of the bright lines between 517 and D. If the nova progresses at the same rate as Nova Persei, the third stage may possibly be entered upon about the end of the first week in July.

With reference to the probable distance of the nova, direct determinations of the parallax will necessarily occupy a considerable time. The circumstance that nearly all novæ have occurred in the Milky Way, however, furnishes strong evidence that these objects are actually situated in the Milky Way, and, therefore, at distances of the order of, say, 3000 light-years.

THE NEW SYSTEM OF TIME-KEEPING AT SEA.

AN article in NATURE for April 25 described the new system of time-keeping at sea which was adopted last year by the British, French, and Italian Admiralties. The Board of Trade has now published a memorandum on the subject, with a coloured chart, adapted from a similar one prepared by the "Service hydrographique de la marine française." Reference may also be made to useful explanatory articles by M. J. Renaud in "Annuaire du Bureau des Longitudes, 1918," and in *L'Astronomie* for April, 1918.

The chart illustrates the international time system both by land and sea. The countries and States that have adopted it are coloured either red or blue, red denoting Greenwich time, or time differing from it by an even number of hours, while blue denotes a difference of an odd number of hours. A few countries (India, South Australia, Venezuela) use time differing from Greenwich time by an odd number of half-hours; these are coloured violet on the chart. The remaining countries are coloured yellow. Inspection of the chart shows what great progress the international time system has already made. The whole of Europe except Russia, almost the whole of Africa, Japan, Australia, North America, Peru, and Brazil have adopted it. It is not improbable that its adoption by ships may lead to still further extension of it on land.

It is much to be regretted that the Board of Trade uses the term "zones" to denote the regions that keep the same time. The use of this term ought to be confined to the designation of belts parallel to the equator, not at right angles to it. It is much better to employ the term "fuseau," which the French have adopted, unless a suitable English name can be devised.

Inspection of the chart shows that the boundaries of the "fuseaux" on land do not strictly follow the theoretical meridians; they frequently deviate to some political boundary not far away, in order to keep the same time throughout a country or State. It is obviously convenient for a ship while in territorial waters to keep the time observed on the adjacent coast; local tide tables, etc., would be given in this time. But when on the high seas it should change its clocks at the nearest convenient moment to the time of entering the new "fuseau" (say, at the nearest change of watch).

It is important to note that the change of system is wholly in the direction of greater simplicity. Hitherto there have been two entirely distinct sets of timepieces on board: the chronometers, used in navigating the ship, which keep Greenwich time; and the ship's clocks, used for the ordinary purposes of daily life; these have usually kept local apparent time, being set about noon on each day, sometimes twice a day if the ship was travelling very rapidly. For the future all clocks on ships in all parts of the world ought to show the same minute as the gate-clock at Greenwich, the difference being in the hours only.

The French and English have adopted different modes of numbering the "fuseaux." Both agree to call the Greenwich "fuseau" (extending from $7\frac{1}{2}°$ W. to $7\frac{1}{2}°$ E.) zero; the French number the "fuseaux" to the east of this +1, +2, +3, in succession, up to +23 for the "fuseau" just west of the zero one. These numbers give the correction to apply to Greenwich time to obtain ship's time. The English system uses two series of numbers, each from 1 to 12, negative to the east, and positive to the west, thus giving the correction to apply to ship's time to obtain Greenwich time. It matters little which is done, provided the system is understood. It is recommended that the "fuseau"-number be always displayed on the

ship's clocks, and quoted in all time-readings. Only one ambiguity would remain—that of the Greenwich day. Uncertainty about this might arise in the neighbourhood of the antimeridian of Greenwich; the line of demarcation, which is shown on the chart, is not quite regular, different islands keeping Asiatic or American reckoning according to their political affinities and history.

It was with the view of lessening these difficulties that Commandant Vincent added a day-hand to his chronometer dial (see p. 146). It is clear that the difficulty is considerably increased by the fact that at Greenwich two different systems, the civil and the astronomical, are in use, the day beginning at midnight and noon respectively. It is hoped that the reform of using the former system for all purposes may soon be introduced. From the discussion that is now taking place, it is clear that the only serious difficulty that is felt in the matter is the breach that will be caused in the continuity of astronomical records. This inconvenience will be minimised if in all records, for some years before and after the change, the time-origin employed is clearly stated.

Summer time is not to be used at sea; it would cause needless complication, and the reasons which make it desirable on land are much less potent at sea; it will be remembered that navigation and astronomy were excluded from the scope of the Act, and the Greenwich ball has been dropped throughout at 1 o'clock Greenwich time (2 o'clock summer time).

A. C. D. CROMMELIN.

DAMASCENE STEEL.

DAMASCENE or Damascus steel made its appearance in Western Europe during the Middle Ages. It was manufactured in India, and the origin of the process may be traced back many centuries B.C. The same kind of steel had previously been introduced into Russia, where it was known as "poulad" or "bulat." The external characteristic of this steel was its patterned surface-watering or "jauher" (Persian), which gave rise to the name "poulad jauherder." It was imported into Russia through Persia and the Caucasus, and into Western Europe through Syria and Palestine.

A most interesting and important study of this material was presented by Col. N. T. Belaiew at the spring meeting of the Iron and Steel Institute. According to his researches, there were three principal methods of producing it:—

(1) The old Indian, by which crucible steel was made by melting pure ore with the best kind of charcoal; (2) the Persian, in which case pure soft iron and graphite were the ingredients; and (3) a particular heat treatment which was in the nature of a prolonged tempering.

The greatest care was taken in regard to the temperature and duration of the melting process, since it was known that the best "watering" could be obtained only with alloys which were kept molten for a long time and afterwards very gradually cooled. The fluid alloy was allowed to freeze in the crucible, and removed only when cold in the form of a cake.

These cakes have been described by Tavernier and others, and were brought to this country by Scott. Numerous investigations were carried out on them, notably by Stodart and Faraday in England, Réaumur and Bréant in France, and Anossoff in Russia. The last-named was led so early as 1831 to apply the microscope to the study of polished and etched surfaces, not merely of these steels, but also of all his alloys that were intended for industrial applications. He was the first to classify the patterns of damascene blades, and showed that in steels containing the least carbon the watering took the form of parallel stripes, and that as the carbon increased these became wavy, then mottled, and finally passed into vertebræ, which were considered the most perfect form. To this the Persians gave the name "kirk narduban," or "forty steps of Mahomet's ladder."

Col. Belaiew took up the experimental study of these steels at the instigation of Prof. Tchernoff, who, in lecturing at the Michael Artillery Academy, Petrograd, stated that "the best kind of steel ever manufactured was undoubtedly the bulat." He found that the majority of damascene steels contained from 1·1 to 1·8 per cent. of carbon. The following is a complete analysis of one of them:—

C	Mn	Si	S	P
1·49	0·08	0·005	0·05	0·10

He then proceeded to reproduce the steels artificially at the Putiloff works, using the Eastern Crucible method (soft iron and graphite), and studied both the primary crystallisation (from the melt) and the secondary (from the solid), and showed that the latter differed in its form according to whether the steels were hypo- or hyper-eutectoid, *i.e.* $<$ or $>$ 0·90 per cent. of carbon. Damascene steels all belong to the latter category. He found that in all cases where the alloys were slowly cooled a remarkably clear primary and secondary crystallisation followed. The former consisted of dendrites of austenite of very varying carbon content, the latter of dendrites of cementite which closely followed the orientation of the austenite axes. The higher the carbon the more closely did the primary and secondary crystallisations resemble one another, and a "structure of large crystals" resulted. To understand how, from an alloy with this structure, the beautiful wavy or motley watering of Oriental blades can be obtained, he discusses the life-history of a 1·5 per cent. carbon steel from the molten state. Every cake is either cut in two, in which case each half makes the blade of a sabre, or the central part is cut away and the remaining ring is cut through at one place so as to facilitate subsequent working and then drawn into a bar. If the specimen is only drawn lengthwise the "veins" produced are longitudinal and the watering consists of parallel stripes or ronces. But if the forging is executed in two or more directions, then, "according to the skill of the workman and

the quality of the damask, all the other shades and gradations—the wavy, the motley, and the 'kirk nardubap'—may be obtained." This watering, when examined by the naked eye, represents the macrostructure of the finished article and shows the way in which it has been mechanically treated.

The most remarkable quality of these high-carbon steels is their unusually high degree of malleability. Col. Belaiew shows that while the melting process and the slow rate of cooling are to some extent responsible for this, the real explanation is to be found in the microstructure of the finished article, which reveals the fact that the free cementite (hyper-eutectoid) is no longer present in the sharp, pike-like projections characteristic of the metal in the cake, but is in the form of small, rounded globules resolved at about 50 diameters' magnification, which appear like "milky ways." The main cause of the great malleability of damascene steel is the globulitic microstructure of the cementite produced by forging at a low temperature. This "spheroidising," which has been studied in other connections by Howe, occurs readily at temperatures rather below Ac_1 (730° C.), and is much facilitated by forging. All the Oriental writers, and especially Anossoff, insist on the importance of not exceeding a red heat during this operation; and the reason for this is now clear. This aspect of the results of Col. Belaiew's research has a most important lesson for the manufacturers and users of tool-steel. The low-temperature forging below A_1 is a process capable of manifold application to high-carbon steels, which, without it, are too brittle. It is scarcely too much to say that there are many cases where carbon tool-steel treated in this way could be used instead of the much more expensive alloy steels. H. C. H. C.

NOTES.

SIR WILLIAM CROOKES attained the age of eighty-six on Monday, June 17, and received the congratulations of many friends. He bears the burden of his years lightly, and is still actively engaged in research. This spirit of inquiry has been maintained throughout his life, and we trust that strength will be given to Sir William for some time yet to enable him to continue to satisfy it.

WE regret to announce the death at forty-seven years of age of Dr. E. A. Newell Arber, demonstrator in palæobotany at the University of Cambridge since 1899.

FOLLOWING the precedent of last year, the Conference of Delegates of Corresponding Societies of the British Association will this year be held in London in the rooms of the Geological Society on Thursday, July 4. Dr. F. A. Bather has been nominated as president, and a discussion will be invited upon his address, which will be entitled "The Contribution of Local Societies to Adult Education." The question of afforestation will also be considered.

FROM a statement made by Sir Albert Stanley, President of the Board of Trade, in an address at Manchester on Friday last, June 14, it appears that the Government has decided to take certain further steps in support of the dyes industry. The matter was referred to in a note recently published in these columns (NATURE, May 23), and it is satisfactory to find that, in addition to the control of imports by a system of licences and in order to further financial help to be given among smaller makers, a combination is to be arranged between the two great firms, British Dyes, Ltd., and Messrs. Levinstein, Ltd. The foreigner must be fought with his own weapons, and long ago in Germany it was recognised that mutual support and assistance contributed almost as much as, or perhaps more than, any other condition to the success of the dye-making firms. One of the first things which should now be done in this country is to prepare a general survey of the dye field, to ascertain which firms are best prepared to make particular classes of dyes and their necessary intermediates, to determine in what directions the home industry is weakest, and to pool the results of research. The relation of explosives to the dye-making business must be steadily borne in mind, and the "combine" which is contemplated between Nobel's and other explosive manufacturing concerns is a feature of the situation from which results of the utmost importance may ensue to the dyes industry.

THE death is announced, on June 9, at sixty years of age, of Mr. J. H. Lace, C.I.E., formerly conservator of forests, Burma.

THE Toronto correspondent of the *Times* reports that the Honorary Advisory Council for Scientific Research, which has been studying measures to foster the scientific development of Canadian industries, proposes the establishment of a research institute for the Dominion.

THE third Gustave Canet lecture of the Junior Institution of Engineers will be given on Monday next, June 24. at the Institution of Civil Engineers by Sir Wilfrid Stokes, who will take as his subject "The Stokes Gun." Free tickets of admission may be obtained from the secretary of the Junior Institution of Engineers, 39 Victoria Street, S.W.1.

THE Royal Academy of Science of Turin has announced, we learn from *Science*, a prize of 26,000 lire, to be awarded for the most remarkable and most celebrated work on any of the physical sciences published in the four years ending December 31 next. The prize fund is a bequest from Senator T. Vallauri. Competition is open to Italian and foreign men of science, and the term "physical sciences" is to be taken in the broadest sense.

WE learn from *Science* that the Boston Society of Natural History has awarded the Walker grand honorary prize, which this year takes the form of a one-thousand-dollar Liberty bond, to Prof. Jacques Loeb, of the Rockefeller Institute, New York, in recognition of his many published works covering a wide range of inquiry into the basic concepts of natural history. The Walker grand prize is awarded every five years, under the terms of the will of the late William Johnson Walker, "for such scientific investigation or discovery in natural history," first made known and published in the United States, as the council of the society shall deem deserving thereof.

THE President of the Board of Agriculture and Fisheries has appointed a Committee to consider and report how Government stores which may become available after the close of the war can best be utilised for agricultural and horticultural purposes, and what

methods of purchase by farmers and others should be adopted. The members of the Committee are:—Earl Grey, Mr. J. S. Gibbons, Mr. W. R. Hopkinson, Prof. F. Keeble, Mr. Douglas Newton, Mr. J. W. B. Pease, Capt. Sir Beville Stanier, Bart., Mr. R. Stephenson, Mr. N. Walker, and Major the Hon. E. F. L. Wood. The secretary of the Committee is Mr. E. G. Haygarth Brown, of the Board of Agriculture and Fisheries, 4 Whitehall Place, S.W.1.

THE possibility of exploration in the Himalaya by aeroplanes is discussed by Dr. A. M. Kellas in the *Geographical Journal* for June (vol. li., No. 6). Dr. Kellas believes that there should be no physiological difficulty in flying for some time at an elevation of 25,000 ft. provided oxygen and a suitable apparatus for utilising it were carried. October and November, or, better still, September and May, he considers the best months as regards climatic conditions, but the problem of flying through cloud would have to be solved. Another great difficulty would be landing and starting at great altitudes. The snow at such altitudes is either powdery, or soft beneath a thin hard layer, and would therefore require either rolling or compressing with a heavy stamp to make it firm enough to give the necessary resistance to a moving plane. Dr. Kellas thinks the airmen would have to be acclimatised to high altitudes by many trial flights. In the discussion which followed the paper a number of airmen took part, and their general consensus of opinion seemed to be opposed to the project.

IT was reported in the *Times* of June 12 that British iron and steel manufacturers have taken an important step for securing the future position of their industry, and that they have agreed to form a national council on trade policy. This council is to be representative not only of the iron and steel capitalists, but probably also of the employees. Undoubtedly it would be wise to constitute the new body on this basis, and it would afford another illustration of the effectiveness of the alliance between employers and employed which is coming to be one of the most important results of the war in this country. The function of the council will be to obtain an assured supply of the raw materials of the industry and a proper organisation with regard to production and export. Such a policy has much to commend it. The German iron and steel industry was organised for this purpose for many years before the war, but there was no place for labour in it. A representative conference of masters and men is also said to have agreed to the establishment of a second body, viz. an industrial council to deal with all labour questions in every branch of the iron and steel trade.

BY the death on June 11 of Mr. R. Hooper Pearson, at the age of fifty-two years, horticulture has lost one of its most earnest, capable workers. As managing editor of the *Gardeners' Chronicle* Mr. Pearson exercised a steadying, wholesome influence on the science and practice of an industry, we might say a profession, which in recent years has grown in importance, and in consequence of the war is likely to become one of our principal food-producers. He was a great worker without ostentation. His knowledge of things appertaining to horticulture was exceptional. He had sound judgment and an open mind, and, what was of the greatest value in the position he held, kept steadily to the task of controlling and guiding the art of cultivation along the path that leads to improvement. To those who did not know him intimately he was likely to appear lacking in "push" and "vim," but his habit was to sift and weigh before coming to a decision. This was evident in the journal which he managed with such success. He planned and edited a series of popular handbooks known as "Present-day Gardening," and was the author of the useful "Book of Garden Pests." Mr. Pearson's best work, however, was more personal than books, and his hand will be missed in many channels where he was wont to serve disinterestedly.

THE recently issued annual report of the Decimal Association shows that considerable progress was made during the past year in the movement for the adoption of a decimal coinage and the metric system of weights and measures. The report of the Government Committee on Commercial and Industrial Policy is referred to, and, in explanation of the fact that it does not favour any immediate change, it is pointed out that the Committee appears to have been led to this decision by its anticipation of the exceptional difficulties with which trade will be faced during the period immediately following the war. In a leaflet entitled "Great Britain's Interest in the Metric System of Weights and Measures," which accompanies the association's report, it is maintained that increased competition from our foreign rivals after the war will necessitate the organisation and development of our export trade, and demand the elimination of all hampering influences such as our present weights and measures. The suggestion is put forward that during the transition period it would not be unreasonable for the Government to bear the cost of the reform in certain cases; for instance, by allowing firms to retain out of the amount they would otherwise pay as excess profits a sufficient sum to recoup them for the charges they incur owing to the change.

AFTER the marked failure of wheat all over the world last year, it is pleasant to be able to record that this year's crop promises to be good. According to a leaflet issued by the International Institute of Agriculture, the Argentine Government's estimate of the 1917–18 yield of wheat in the Argentine is 211·3 per cent. higher than last year's crop and 35·8 per cent. higher than the average for the five years 1911–16. New Zealand has issued an amended estimate of the wheat crop in that country, showing an increase of 24·6 per cent. on the 1916–17 yield, but a decrease of 2 per cent. on the five-year average. The total yields of wheat for the southern hemisphere (Argentina, Uruguay, Union of South Africa, Australia, and New Zealand) are estimated at 55·4 per cent. above last year's crop and 34·3 per cent. above the average yield for the five years 1911–16. The total crop of oats in Argentina and New Zealand for 1917–18 is estimated at 123·1 per cent. above last year's crop and 6·5 per cent. above the five-year average. As regards the northern hemisphere, the agricultural situation was an average one in Spain at the beginning of April; in France the weather is generally favourable for the growing crops and for spring sowing. In Great Britain the weather is favourable for all crops, while in Ireland the condition of crops is considered quite satisfactory. It may be stated in summary that on April 1 the condition of crops in the northern hemisphere was excellent in Ireland, good in Great Britain, France, and the United States, and average in Spain, Italy, Switzerland, and Morocco.

WE have recently received a copy of the first number of *Helvetica Chimica Acta*, a new periodical devoted to the advancement of pure chemistry. Before 1914 the contributions to chemical literature emanating from Swiss laboratories had reached a total of, approximately, 380 per annum, but the Swiss Chemical Society has hitherto had no official organ

for the publication of these. Whilst the hospitality of foreign scientific journals is duly acknowledged, and notwithstanding that there has been some hesitation about increasing the number of periodicals dealing with chemical questions, it is now considered necessary for the society to have its own journal—and all the more so since the present postal restrictions are hindering the publication in other countries of chemical researches carried out in Switzerland. In the new periodical it is proposed to give accounts of investigations made, both by chemists living in Switzerland and by Swiss chemists who are domiciled abroad, so that the result will represent, as it were, the whole national effort in this branch of scientific inquiry. Papers will be printed in any of the three national languages (French, German, Italian), and there will be six or eight issues a year. The first number opens well with a contribution by A. Werner on a new type of isomerism in cobalt compounds. This is followed by half a dozen other communications, some of which are excellent examples of research work in pure chemistry. The periodical is clearly printed and neatly produced. Chemists in this country will follow the new venture with sympathetic interest.

THE announcement of the death on May 12 of Dr. R. G. Hebb brought a sense of personal loss to a wide circle of scientific colleagues and friends, felt with particular keenness by the fellows of the Royal Microscopical Society, to whom Dr. Hebb had endeared himself by his tact and geniality, no less than by his erudition and intimate acquaintance with things microscopical during the thirty-three years he had been connected with the society. Dr. Hebb was the eldest son of the late John Hebb, of East Dulwich. A graduate in arts and medicine at Cambridge, King's College Hospital shared with the University in fostering that keenness in microscopy which occupied so large a share of his life's work. Pathology, both naked eye and microscopical, early claimed his energies, and he was undoubtedly seen at his best in the post-mortem room or laboratory; but, at the same time, he was a sound clinical teacher, and made his mark in the out-patient department and in the wards of Westminster Hospital, the staff of which he joined in 1888, and where for many years he held the dual posts of physician and physician pathologist. His association with the Royal Microscopical Society was long and intimate. In 1855 Mr. (now Sir) Frank Crisp, at that time its secretary, enlisted his services on the staff of the society's Journal, and from then onwards Dr. Hebb was a regular contributor to the pages of the Journal. He was elected an ordinary fellow of the society in November, 1885, and appointed to the council a few years later. In 1902, on the death of Mr. A. W. Bennett, Dr. Hebb succeeded to the editorship of the society's Journal (the first number for which he was solely responsible being that for April, 1902), a post he continued to hold to the time of his death. In 1892 he became co-secretary with Dallinger, from which time until 1911 he was virtually responsible for the conduct of the society's affairs. After the resignation of Dallinger in 1907, Dr. Hebb became the senior secretary, and had as associate secretaries, first J. W. Gordon, and afterwards F. Shillington Scales. In 1911 he resigned the post of secretary and was elected a vice-president. During the fourteen years he held office Dr. Hebb proved himself an ideal secretary, and the society, which has lost a devoted officer, fully realises the debt it owes to his exertions.

THOUGH Benjamin Franklin at the beginning of the War of Independence seriously considered the possibility of arming the American troops with the longbow, as a cheaper and more effective weapon than the flint-lock musket, archery among the Indian tribes is nearly a lost art since the introduction of the rifle. There is little evidence to show how these tribes made and used the bow and arrow. Mr. S. T. Pope induced the last survivor, Ishi, of the Deer Creek Indians of North-Central California, to live at the University of California from 1911 to 1916, and from him a mass of information on the subject was obtained, a summary of which has been published in vol. xiii., No. 3, of the University Publications in American Archæology and Ethnology. The process of making bows and arrows is elaborately described. Ishi's greatest flight-shot was 185 yards, which contrasts badly with that of Ingo Simon in France in 1914, with a very old Turkish composite bow, of 459 yards. The greatest recorded flight with the English longbow was made by I. Rawlins in 1794, a distance of 360 yards. The best American flight-shot is 290 yards, done by L. W. Maxson in 1891.

THE Carnegie Institution of Washington has issued an elaborate monograph by Mr. W. Churchill on "Club Types of Nuclear Polynesia." By "Nuclear" Polynesia, a term proposed by the writer, he means Samoa, as the "nucleus," with Niuā, Tonga, and Viti on the perimeter. He divides the clubs of this region into various types—the billet, rootstock, missile, pandanus, axe-bit, lipped, mace, coconut-stalk, and others. In each section is provided a full series of measurements and descriptions, with details of specimens in American and other collections. In previous volumes the author has discussed the linguistic evidence, and the present investigation corroborates the theories already arrived at. "In these wooden artifacts of Nuclear Polynesia, highly evolved in form to correspond with needs not only utilitarian, but even vital in their necessity, most remarkably specialised in ornament, there are found with equal clarity the memorials of such transit and sojourn of the peoples of the Nuclear Polynesia race through and in various parts of Melanesia as has already been established through the study of the many languages of the two Pacific areas."

IN the Bulletin of Entomological Research (vol. viii., parts 3–4, 1918) there is a noteworthy paper by Dr. J. J. Simpson on "The Bionomics of Tsetse-flies in the Gold Coast." By marking a large number of flies and liberating them at various distances from the river near which they had been captured it was ascertained that a few returned from a point four miles away, but no large proportion from more than two miles away. As none were found farther from the river than their place of liberation, it seems that these insects are constantly attracted by water. Mr. H. Tetley contributes a paper of value on the mouth-parts of *Pangonia longirostris*, pointing out some marked secondary sexual differences, and drawing comparisons with corresponding structures in other Tabanidæ. It is doubtful if the minute lobe of the maxilla, described by Mr. Tetley as the lacinia, really represents that element of the typical appendage.

IN an interesting memoir on the early development of *Didelphys aurita* (*Quarterly Journal of Microscopical Science*, vol. lxiii., part 1), Prof. J. P. Hill points out a fundamental distinction between the blastocyst of the marsupials (Didelphia) and that of the higher mammals (Monodelphia). In the former the process of segmentation gives rise at once to a hollow blastosphere, the wall of which is composed of a single layer of cells, differentiated into formative and non-formative polar areas. The formative area furnishes both ectoderm and entoderm of the blasto-

cyst; the non-formative is the trophoblastic layer. In the Monodelphia, on the other hand, as is well known, the formative cells always form an inner cell-mass enclosed by the trophoblast. The Ornithodelphia (Monotremata) agree with the marsupials in the arrangement of the formative and non-formative areas, and for the condition exhibited by these two groups Prof. Hill suggests the term "Phanerotypy," the term "Cryptotypy" being proposed for the condition met with in the higher mammals. Precision in terminology is much to be desired, and in this connection we may perhaps point out, without being hypercritical, that the author speaks of four-celled and eight-celled *eggs*. Surely such stages can scarcely be called eggs. Why not call them embryos?

THERE is no fact with which medical men are more familiar than that the nerve-tracts which connect the brain and body are crossed, the right half of the body being united to the left hemisphere of the cerebrum and the left half to the right hemisphere. In 1907 Prof. A. Francis Dixon, Trinity College, Dublin, sought to explain the crossed arrangement by supposing that it was a result of the primary connection between the right halves of the retinæ with the right hemisphere of the cerebrum. The right halves of the retinæ receive rays coming from the left field of vision—the field in which the left half of the body is situated. Prof. Dixon pointed out that there is a manifest functional advantage in having the part of the brain which controls the movements of a limb situated near the cerebral area which receives the visual field in which the limb is situated. To secure that end, the nerve-paths have to be crossed, so that the hemisphere which receives the left visual field will also control the left half of the body. In the Dublin *Journal of Medical Science* (March, 1918) Prof. Dixon has carried his explanation a stage further—an extension due to the discovery by Col. W. T. Lister and Lt.-Col. Gordon Holmes that the retinal picture is inverted in the visual cortex of the brain, the upper half of the field of vision falling on the lower half of the visual cortex. It is well known that the movements of the body are represented in an inverted order in the cortex of the brain, those for the mouth and face being placed lowest down, and those for the lower limb higher up. If the retinal connections are the circumstances which determine the distribution of cortical areas, as Prof. Dixon supposes, the visual fields being inverted in the cortex of the occipital lobes, then we should expect, just as we actually find to be the case, a corresponding inversion of the motor areas—the movements of those parts of the body which lie in the upper field of vision being lowest down on the surface of the brain, and those in the lower visual field highest up.

THE American fuel famine is discussed at length, in the *American Museum Journal* for February, by Prof. C. Berkey and Mr. C. van Hise. The shortage of coal, which is acute, and has demanded drastic legislation, is in no way due, they remark, to any precautionary measures engendered by fear of exhausting the mines, for careful estimates show that at the present rate of consumption, which is enormous, the mines of the United States will continue to yield for something like two thousand years. The scarcity is to be attributed entirely to the unprecedented demands to feed the multifarious industries dependent upon coal and the difficulties of transport. Labour and distribution, in short, are unable to keep pace with the demand. But Prof. Berkey is of opinion that the anthracite reserves are being depleted at a much faster rate than the bituminous coals, and will probably not last more than a hundred years. The rate of production of bituminous coals at the present time in the United States is about 600,000,000 tons per annum.

THE problems in the development of British Guiana, a somewhat neglected Possession, are discussed by Sir Walter Egerton in the Journal of the Royal Society of Arts for May 31 and June 7 (vol. lxvi., Nos. 3419 and 3420). Sanitation, drainage schemes, and improvement of the water supply are all required. These, as well as administrative reforms, are discussed by Sir Walter Egerton, but he lays most stress on questions of population and communication. Nearly 50 per cent. of the inhabitants are East Indians, and their numbers are increasing. The prosperity of the sugar industry rests on their labours. Chinese used to come in large numbers many years ago, and proved most useful, but the Chinese population is now small. Sir Walter Egerton insists that interference with the immigration of East Indian and Chinese of both sexes in equal numbers will prevent the due development of the colony. At present the cultivated area of British Guiana is more or less confined to a coastal strip of plains intersected with drainage and irrigation canals. This gives little scope for an increased white population. The interior of the colony, however, is largely rich savannah land, more healthy than the coast, and well adapted for cattle-ranching. There are also great possibilities in gold and diamond mining. These considerations emphasise the second great need of the colony—railway communication with the interior by a line from Georgetown to Rupununi savanna and the Brazilian frontier. At present the only route to the interior is by water, and it is not easy.

THE May issue (vol. ii., No. 5) of the quarterly Journal of the Society of Glass Technology contains an important article by Prof. Boswell on British supplies of potash-felspar. A good account is given of all the more important localities where potash felspar, orthoclase or microcline, is known to occur in quantities sufficient to warrant the assumption that it may prove to be of economic importance, the questions of purity of the material, quantity available, ease of access, and convenience of transport being all considered. The author holds definitely that felspar from all the known British localities requires to be hand-picked in order to obtain it in a state of purity sufficient to enable it to be used in glass or pottery manufacture or for the extraction of potash. There are practically seven groups of localities represented, namely, (1) Cornwall, (2) between Lochs Laxford and Inchard, (3) between Durness and Eireboll, (4) near Overscaig, Loch Shin, all the three last-named being situated in Sutherlandshire, (5) Belleek, on the borders of Co. Donegal and Co. Fermanagh, (6) Glenties, in Co. Donegal, and (7) Belmullet, in Co. Mayo. It would appear that the purest felspars are those of Cornwall and Belleek, the deposits being in both cases fairly accessible, but the quantities in both places appear to be limited. The other localities show much larger quantities of mineral, but their potash contents are decidedly lower, and the localities are for the most part inconveniently situated in respect of transport. The author does not appear to think that, as a source of potash, any of these felspar deposits is likely to be economically workable in normal times, but is apparently rather more sanguine as to the prospects of the best of these deposits as a source of supply to the glass and pottery industries.

G. VALLAURI, in *Elettrotecnica* for January 25 and February 5 last, discusses at some length the theory

of the audion. Included in the article is a summary of the uses of vacuum tubes with three electrodes for radio-telegraphy, their properties and characteristic curves, approximate formulæ for these characteristics, the possibility of investigating the action of the audion as an intensifier and generator, the study of typical methods of connection, and the possibility of investigating the audion as a receiver and in the more complex cases in which it fulfils several functions at the same time.

W. BLOCK, in the *Central-Zeitung für Optik und Mechanik*, January 20, describes a method of photographing shells in flight by a kinematograph camera having a specially broad film. The film moves forward in jerks, the photographs being taken when it is stationary, through a rotating screen having thin slits cut in it. The length of exposure is varied by varying the width of the slits. Since, however, the time between the successive stationary positions of the film is too great in comparison with the rate of motion of the shell, numerous slits are cut in the screen, and several exposures are made on the same portion of the film so as to show the projectile in various stages of progression.

AN interesting product of cellulose distillation is described by M. J. Sarasin in the *Compte rendu de la Société de Physique* of Geneva (No. 1, 1918). When cellulose in the form of cotton was distilled under reduced pressure (12 to 15 mm.) a semi-crystalline distillate was obtained, which, after purification by crystallisation from hot water or from acetone, proved to be levoglucosane. This compound is not itself fermentable by yeast, but on hydrolysis with dilute sulphuric acid it is converted into α-glucose, which can be transformed into alcohol by fermentation. The interest of the observation lies in the possibility which it suggests of obtaining the glucose, and thence alcohol, by the distillation of cellulosic raw materials on an industrial scale.

Naturen, the Norwegian popular science monthly, contains in its April issue an illustrated account by J. F. Schroeter of Prof. Störmer's aurora-borealis expedition of 1913. The account is based on Prof. Störmer's own papers in *Terrestrial Magnetism* and his address to the Scandinavian Scientific Association, Christiania, in 1916. The observations of the auroræ were taken photographically from Bossekop and Store Korsnes, two stations in the North of Norway 27·5 kilometres apart; and they provide more than 2500 determinations of height which, in general, lie between 86 and 226 kilometres with a maximum number about 105 kilometres. The angular distances of the auroræ from the north magnetic pole of the earth lie between 20° and 25°, with a maximum frequency at about 23°. The following types of display are distinguished:—(*a*) Intense curtains, red below, greenish-yellow above; (*b*) faint curtains, green to greenish-grey; (*c*) arches; (*d*) faint zones; (*e*) isolated rays; (*f*) luminous areas; (*g*) coruscating bands; (*h*) coruscating areas. Although the theoretical examination of these observations is not yet complete, it seems likely that the corpuscular theory, according to which auroræ are due to electrically charged particles entering the earth's atmosphere and describing paths determined by the earth's magnetic field, will explain most of the known facts.

THE U.S. Bureau of Standards has issued a new edition of its publication on polarimetry, with special reference to its technical applications, more especially to saccharimetry and the refractometric examination of solids and liquids. The bulletin deals with the various polarising systems in use, and contains a description of the different polarisers and polariscopes which have been found to be generally applicable to practical requirements, and explains the best methods of their employment so as to secure uniformity and accuracy of results. It treats of the various sources of light to be used in connection with polarimetric work and the several pieces of subsidiary apparatus required, the control and regulation of temperature, the employment of thermostats, temperature correction, etc.—in fact, all the details to be followed in accurate testing work of the kind. It has been put together to serve the needs of the practical man; it is simply and concisely written, and its account of the fundamental principles upon which modern polarimetry is based, whilst sound and accurate, may be readily followed by any ordinarily intelligent reader. The present edition (the second) has been carefully revised, and a considerable amount of additional matter has been included in the appendix. The new material comprises ten tables, new Bureau of Standards Baumé scale for liquids heavier than water, a *résumé* of the work of the International Commission for uniform methods of sugar analysis, a special section on the polarisation of low-grade products, together with a statement of the amendments of the United States Treasury Department sugar regulations. The work is admirably printed and illustrated, and highly creditable to the Washington Government Printing Office. It is now ready for distribution at a price of 25 cents, and those interested may obtain a copy by addressing a request to the Bureau of Standards, Washington, D.C., U.S.A.

DISCUSSING the question of the organisation of chemical research in India, Sir Thomas Holland, president of the Indian Munitions Board, urges in an address given at Lahore that India must be independent not only industrially, but also to a large extent in regard to scientific research. India should have its own research workers carrying out investigations on the spot. The task of training the educated young men of India to qualify for research and technical work should be an essential part of the organisation of every scientific and technical department in that country. Because European beet-sugar has been able to compete successfully with Indian cane-sugar, and synthetic indigo has practically destroyed the Indian indigo industry, it has been generally assumed that tropical countries will not be able to hold their own against European and American competition; but what can be done in Europe under the (relative) disadvantages of a temperate climate could, the speaker argued, be done still more abundantly and successfully in India. It will, however, be necessary to bring the isolated chemists of India into one organisation, and an official scheme to this end had been mooted. At present only the fringe of the various great chemical problems in India has been touched. These include questions relating to agriculture, forest products, drugs, perfumes, dyes, and tanning; the manufacture of salt, sugar, alcohol, and explosives; saltpetre refining, mineralogy, and metallurgy. It is suggested that for administrative purposes researches on these matters might be centred in three groups: (*a*) Agricultural chemistry, with the chief laboratory at Pusa; (*b*) organic chemistry, with two principal laboratories at Dehra Dun and Bangalore; and (*c*) mineral chemistry, with the chief laboratory at Kalimati or Calcutta. The address is reported fully in the *Pioneer Mail* for January 18, and a detailed abstract appears in the Journal of the Society of Chemical Industry for April 15.

OUR ASTRONOMICAL COLUMN.

NEBULOSITY IN STAR CLUSTERS.—In a letter to the *Observatory* for June Dr. Harlow Shapley states that the appearance of nebulosity which has sometimes been noted in visual observations of star clusters has not been confirmed by the Mount Wilson photographs. In the case of the cluster No. 361 of Dreyer's Index Catalogue, the photographs show stars fainter than 18th magnitude, but there is no trace of nebulous matter. The cluster N.G.C. 6760, which has also often been observed visually as nebulous, appears purely stellar on the photographs. The actual connection between luminous nebulosity and star clusters seems to be limited to stellar groups of little condensation and richness, where the brighter stars are mainly of type A or B. In these cases the nebulosity becomes visible because of direct reflection of the light of the surrounding stars, and partly on account of selective secondary radiation. Thus the frequent association of diffuse nebulosity with blue stars of high temperature does not necessarily indicate immediate evolutionary relationship. There is at present no certain evidence of luminous nebulosity in globular clusters.

INTERPRETATION OF STELLAR TYPES.—In a communication to the National Academy of Sciences, Washington, March, 1918, Prof. C. D. Perrine makes the interesting suggestion that the spectral class of a star is in part dependent upon the amount of cosmical matter in its neighbourhood and the relative velocity of the star and matter. Many of the A, B, and O stars, the gaseous nebulæ, the novæ, and possibly the Cepheid variables, on this hypothesis, are confined to the galaxy because there the energy derived from the matter swept up is in excess of that lost by radiation. The direction of spectral change under such conditions will be towards the nebulæ. In regions where there is little or no cosmical matter the energy gained from external sources is not sufficient to compensate for the loss of radiation, and the direction of change will be towards the later types. Upon this hypothesis the stars are probably all pursuing one definite course of very slow change towards extinction, but each individual star will be pursuing a course which may have many whole or partial cycles due to varying external causes.

THE STRATHMORE METEORITE.—This remarkable meteorite fell on December 3, 1917, at 1.18 p.m. Though in full sunshine, its brilliance was compared with the limelight, and it left a trail. It was seen so far away as Hexham, 120 miles from the earth-point. Prof. R. A. Sampson gives an interesting account of it in the Proceedings of the Royal Society of Edinburgh (vol. xxxviii., part i., No. 10). He fixes the explosion point as twenty miles above Collessie, Fife. Four fragments have been found, one penetrating a roof near Coupar Angus; the largest, weighing 22½ lb., fell at Easter Essendy Farm, near Loch Marlee; it made a hole 20 in. deep, the rubbish being piled to the north-west, showing the direction of motion, which agrees with other indications. The fragments did not fall until some minutes after the sounds of explosion were heard, showing how much the speed (which must initially have been some miles per second, to account for the brilliancy) had been reduced by atmospheric resistance. Prof. Sampson explains the heating of meteors by supposing that the air in front of them has not time to escape, so is rapidly compressed. Assuming probable figures for mass and velocity, he shows that a temperature of 2000° might be produced. The meteor is of the stony class, to which many people assign a volcanic origin. In view of the difficulty of understanding how it could have escaped from our atmosphere without rupture, if expelled from a terrestrial volcano, Prof. Sampson suggests a lunar origin. In this case it might either describe an orbit within the earth-moon system, or, with a higher speed, a planetary orbit about the sun. The latter would seem the more likely, Mr. Denning having shown that it probably came from a known radiant in Sagitta, which is active early in December. The lunar origin would then imply that a large shower of fragments was expelled from the moon during a single eruption.

Meeting, 1918, London

THE SOUTH-EASTERN UNION OF SCIENTIFIC SOCIETIES.

THE twenty-third annual congress of the South-Eastern Union of Scientific Societies was held at Burlington House, in the Linnean Society's rooms, on May 29 and three following days, under the presidency of Sir Daniel Morris. The presidential address was entitled "The Geographical Distribution of Plants," and was, to some extent, concerned with the various means of dispersal of seeds and the manner in which geographical distribution was effected. The destruction of the flora of the Island of Krakatoa by volcanic eruption and the comparatively rapid growth of a new flora gave valuable evidence as to the manner and time required for replacing a destroyed flora. Transport by water-currents, through a powerful agent, would be assisted by the agency of birds, and meteorological agencies must not be wholly left out of the reckoning. Many seeds reach our own shores from tropical America by the agency of the Gulf Stream, but these have not been known to germinate in a natural state after transportation.

Mr. Percy Webb's paper on "Romano-British Mints" was an excellent summary of the subject. Mr. Webb pointed out that it was probable that the province of Britain, accustomed to use and strike coins for nearly two hundred years before the Roman invasion, kept its mints in some operation even under Roman rule. There is no clear identification of mints owing to the system of mint-marking not commencing until a late period. Claudius struck types of coins relating to Britain, but they were no doubt issued and used in Rome. Hadrian issued bronze pieces on which appears the seated figure of Britannia, her first appearance in history. These coins, and others of the same type issued by Antoninus Pius, suggest in their less accurate mintage, and from the fact that they have come to light in numbers in British finds, that they are of colonial origin. From Carausius and Allectus we have indisputable British issues, the former the founder of the short-lived first British Empire, the latter defeated and slain by the Romans on Wolmer Common, near Liss, where his military chest was exhumed in 1873, having been buried before battle with its contents of nearly 30,000 coins.

The subject of "Mosquitoes in England" was introduced for discussion by Sir Ronald Ross, and amongst those who took part in the discussion were Col. Buchanan, of the Local Government Board; Capt. MacDonald, and Mr. A. J. Grove. Sir Ronald Ross pointed out that malaria had formerly been prevalent in Britain, but had afterwards died out. Anophelines, however, continued to exist in certain low-lying parts, and recently evidence has been found to suggest that malaria has really continued all the time to be endemic to a very small degree in parts of Kent. Last year some cases undoubtedly occurred in this country. Certain alarmists are seriously perturbed by the possibilities of its greater prevalence. Sir Ronald came to the conclusion that the spread of malaria in a community must depend upon about fifteen different factors. "Of all the millions bred in a locality, pos-

sibly only a few can ever succeed in biting a human being at all. Then only a proportion of these will generally have bitten an infected human being; and, again, only a smaller proportion will have bitten an infected person whose blood contains sexual parasites suitable for transmission into a mosquito. Hence the chances usually are that only a very small proportion of all the Anophelines in a place will ever become infected at all. But how many of these will infect healthy persons? A mosquito must live for about ten days at least before the parasites can mature in her body and enter her salivary glands, and of the small proportion of mosquitoes which may live long enough for this a still smaller proportion are likely to succeed in biting and infecting healthy persons afterwards. Men and mosquitoes may vary in individual resistance to parasites. Both will be infective to each other only at certain times. The general equations for diseases common to two species of hosts contain fifteen independent constants, or, rather, parameters—namely, the birth-rate, death-rate, immigration, emigration, immunity, infectivity, and recovery ratios for each species of host, and the contact ratio common to both; and the total proportion of infected individuals of either species must depend on all of these combined in certain mathematical functions." A special appeal was made to the members of local societies to make a study of the bionomics and distribution of mosquitoes in Britain.

A lecture was given by Mr. Reginald Smith, of the British Museum, on the "Geology of Flint Implements." In the course of many interesting remarks, the Mousterian cave-finds from St. Brelade, Jersey, were illustrated, and compared with certain surface-finds in England. The hope was expressed that further research in England, which had the advantage of the boulder-clay, might decide man's relation to the glacial period by associating definite types of flint-working with deposits both before and after the most intense glaciation of the country. Much information had been lost to science by inattention to the labelling of specimens as to their place of origin and the position in which found.

Other papers were: "Meteorological Instruments and How to Read Them," by Mr. R. Corless, of the Meteorological Office, and by Lieut. R. W. Ascroft, of the Food Production Department, on "Allotment Pests." Among the afternoon excursions may be mentioned visits to the New Transport Co.'s works at Battersea, where heavy goods are sorted by machinery, on the principle of a central goods clearing-house; to the church of St. Bartholomew the Great; to the classic Charlton Pits, under the guidance of the veteran geologist, Mr. W. Whitaker; to Kew, under that of Lieut.-Col. Sir David Prain and Prof. G. S. Boulger; and to the diving and mine-rescue apparatus works of Siebe, Gorman and Co., under the direction of Dr. J. S. Haldane. The congress was well attended, and apparently justified the council in deciding to hold it this year as usual.

THE TREATMENT OF MALARIA.[1]

THE treatment of malaria has engaged the attention of the medical department of the War Office since the outbreak of the war. So soon as cases of this disease began to return to England malaria hospitals were opened, and in certain large hospitals special wards were set apart so that all patients could be concentrated and treated by physicians with special knowledge of malaria. This branch of the medical work was placed under the supervision of Col. Sir Ronald Ross, K.C.B., F.R.S., consultant in malaria, War Office, and an interim report now published by this officer gives the results of treatment of a number of cases in four of the hospitals under his control up to the date of publication.

Before commencing treatments, 193 patients who had previously taken quinine, but who had recently discontinued the drug, were observed without further medication with the view of determining approximately the liability to relapse without further treatment. Of these 193 patients, 88 had relapses within twenty-seven days. Owing to illness (unfortunately not specified), 76 had to be given quinine without continuing the control. After a month, only 15 per cent. were free from relapse, and were considered well enough to be discharged; 85 per cent. were still showing symptoms of the disease.

Two thousand four hundred and sixty cases of malaria were treated under one or other of the following methods:—

(*a*) *Anti-relapse Quinine Prophylaxis.*—Quinine sulphate in small doses by different methods up to 60 grains weekly was given to 1040 cases. A dose of 10 grains daily was found to be more effective than one of 5 grains, and was more suitable than one of 15 grains, because, as well as being equally effective, it was better tolerated. Under these treatments relapses were reduced to 10 per cent., and even in relapses not so reduced the severity of the paroxysms was diminished.

(*b*) *Short Sterilising Treatments.*—Large doses of quinine sulphate, hydrochloride, or bi-hydrochloride were given daily for seven days, or on consecutive days up to ten days, to 334 cases. A high percentage of these cases relapsed.

(*c*) *Long Sterilising Treatments.*—Large doses of the same salts of quinine as in treatments (*b*) were given daily over long periods, continually, or on consecutive days, or at intervals of several days. Some of these treatments appear to have given the best results, especially the three treatments (*c*) 15, 16, and 17. Two of these were combined in the later stages with iron and arsenic. It may be noted that, in the experience of some observers, much intolerance is shown during the large dosage as here used, without more appreciable diminution of the number of relapses than results from less heroic lines of treatment.

(*d*) *Mixed Treatments,* including the administration of drugs other than quinine in the combinations generally used, were given in different doses for varying periods. The drugs used were tartar emetic, acid arsenoids, sodium quinine sulphonate, ethyl quitenine hydrochloride, and collosol quinine. Only a few cases were treated with each drug, as nearly all these relapsed.

Sir Ronald Ross points out that he has not noticed any marked superiority in the oral, intramuscular, or intravenous methods of administering quinine. He advises that a much larger number of cases should be controlled before the efficacy of any particular drug over others can be determined. Obviously it is necessary to observe cases carefully for a much longer period than twenty-seven days after they leave hospital before it is possible to decide what is the actual liability to relapse.

A generous diet is recommended during treatment, with a little stimulant in the form of beer or wine. Opinion seems divided as to whether patients should be kept in bed or not during treatment.

A second paper expressing the opinions of medical officers in the Salonika area as to the value of prophylactic quinine and on the treatment of malaria under different conditions of service was afterwards read by Sir Ronald Ross before the Society of Tropical

[1] Society of Tropical Medicine. (1) An Interim Report on the Treatment of Malaria. (2) Report on a "Discussion on the Treatment of Malaria." Both by Sir Ronald Ross.

Medicine. Of 111 officers interrogated on the prophylactic value of quinine in 10-grain doses twice weekly, their opinions were divided, the majority holding that it was of little or no value, and some even saying that it was detrimental. For treatment in an advanced dressing station for three days, one officer considered that quinine should be given in 80-grain doses daily. The majority (about 63 per cent.) were in favour of 30 grains daily.

For treatment after return to duty subsequent to the above, nine officers advised stoppage of all quinine; seventy-three considered that the drug should be continued for from one to three and a half months in daily doses, according to different opinions, of 10, 20, or 30 grains. Some recommended gradual reduction of the amount of daily quinine during the same period.

In treating cases following discharge from hospital the treatment advised was much the same, the medical officers expressing the same opinions practically as for cases leaving dressing stations. Subsidiary treatment was recommended by some. Continuance of quinine until the end of the malarial season had also some supporters.

Both these papers include an account of a large amount of work done by many skilled officers, and should serve as a valuable guide to officers and medical men who have charge of malarial cases or intend carrying out further investigation work on this very important subject. It is desirable that an effort be made to ascertain definitely why quinine, so successful in the majority of cases, should fail in others.

An interesting addendum to the first report deals with the excretion of quinine in the urine. It seems that there is a tendency for the excretion of quinine to reach a concentration of 7–11 grains per litre of urine. These results obtained no matter what salt was given or how administered, except, perhaps, in the case of the lactate. F. W. O'CONNOR.

SCIENTIFIC PROBLEMS OF DISABLED SOLDIERS.

WE commend to the attention of our readers the April issue of *Recalled to Life*, a journal edited by Lord Charnwood, and devoted to "the care, re-education, and return to civil life of disabled sailors and soldiers." Its articles are written by men who are seeking for practical solutions of the problems presented by disabled soldiers—problems which are both medical and sociological. Half of the men who are wounded require special treatment for the restoration of movement to damaged limbs. Great military hospitals have been, and are being, established in various centres throughout the country for the treatment of these orthopædic cases. The establishment of these great "orthopædic" centres has been accompanied by a real educative movement, in which surgeon and soldier have been equally involved. It is true that no new principle of treatment has been introduced; the old methods have been adapted to new conditions and applied on a scale which no one had ever anticipated.

Sir Robert Jones, who contributes an article on "The Problem of the Disabled," was the first to realise that success in the treatment of orthopædic cases was largely a problem of education—to teach soldiers how to bring back lost movements to damaged joints by voluntary and natural movements of the limbs. The introduction of "curative workshops" to military hospitals is one of the most profitable innovations of the war. Of the men treated in orthopædic hospitals about three-fourths return again to military service; the remaining fourth is discharged as unfit for further service. It is now the business of the Ministry of Pensions to look after the welfare of that discharged fourth.

Various writers describe the organisations which are being brought into existence to meet the needs, not only of the men discharged from orthopædic hospitals, but also of the large numbers rejected by the Army on account of a permanent breakdown in health due to exposure in the field, resulting in rheumatism, tuberculosis, disordered action of the heart or of the brain. To meet the needs of the discharged unfit the Ministry of Pensions is establishing throughout the country centres of treatment and superintendence. An ideal form of "village centre" for the cure and training of discharged men is described by Mr. Warwick Draper. Major Dundas Grant contributes an article on the training of the deaf soldier. Everywhere the importance of "self-help" is emphasised. Capt. Wilbur C. Lowry, of the Canadian Army Medical Service, while giving an account of the "remedial exercises" practised in the orthopædic gymnasium Granville Canadian Special Hospital, Buxton, mentions the fact that the best teachers are to be found amongst the men who themselves have undergone gymnastic treatment.

CLIMATOLOGY OF PARIS.[1]

M. FLAMMARION, in the comprehensive report referred to below, not only gives a summary of the meteorological conditions in Paris during the years 1915 and 1916, but also carries the comparison of the seasonal variations of the principal climatic elements back to 1886. The year 1915 had a mean temperature equal to 10·4° C., or 0·2° above the normal, while 1916 was in even closer accordance with the average. The rainfall of 1915 was 574 mm., and of 1916 698 mm., or respectively 3 per cent. and 22 per cent. above the average. The author concludes that "in spite of the frightful intensity of the cannonades, they have exerted no influence on the rainfall in the region of Paris." In 1915 less than half the average fell in the months of March, May, and October, the only month showing an excess being December, when, however, the rainfall was more than double the average. This was followed by a very dry January (1916), with less than a quarter of the average. Although somewhat wetter than 1915, no month in 1916 had an excess of rain greater than one-third of the average.

Some remarkably low barometric pressures are referred to, the most notable being those of November 12–13, 1915, and November 18, 1916. On the former occasion pressure fell to 723 mm. (28·46 in.), the rise after the minimum being extremely rapid, amounting to 25 mm. (0·99 in.) in fifteen hours. On the latter date pressure descended to 713 mm. (28·07 in.), this being the lowest reading in the vicinity of Paris since December 24, 1821. In 1915 temperature was somewhat abnormal, the coldest month, November, having a mean temperature 4° C. lower than that of December. In 1916 the lowest temperature occurred as late as March 8, while the month of June was colder than May. An interesting diagram is given for each year of the daily variations of the various elements of climate, the phases of the moon being also shown, as the author remarks that "the ignorant" still continue to associate weather phenomena with the lunar period.

[1] "Rapports sur les Travaux de la Station de Climatologie agricole de Juvisy pendant les Années 1915 et 1916." Par M. Camille Flammarion Directeur de la Station. Pp. 41.

THE STORY OF A GRASS.[1]

GRASSES form one of the largest and most widespread families, adapted to very different conditions of soil and climate, but with a remarkably uniform plan of structure. Wherever conditions allow of plant-life on land, there, almost without exception, the family is represented. In number of species the grass family falls short of other great families of flowering plants, Compositæ, Leguminosæ, or Orchids, but in the aggregation of many individuals of one and the same or a few species, either growing alone or densely scattered through a mixed herbage covering large areas, it forms a pre-eminent type of the earth's vegetation—as, for instance, in the grass-carpets forming the meadows or pastures of temperate or cold climates, or the coarser growth prevalent over vast areas, as in steppe or prairie vegetation.

These sociable grasses play an important part in the general scheme of plant-life; they protect the soil from too great evaporation of water, and cover up other plants in the resting stage, such as bulbs, tubers, etc., during the cold or dry season. The penetrating effect of the roots and underground stems helps to break up a stiff soil and fit it for other plants. Examples of the great variety of habitat in which grasses thrive are seen in the short turf which covers limestone areas, where the soil is too dry and thin to support trees or shrubs; in the luxuriant growth of meadow-land where it thrives together with a variety of other herbs; in the reed-grasses which are associated with water; in the coastal mud-flats in Hampshire and Sussex, which are being rapidly reclaimed by the growth of *Spartina Townsendi*, a vigorous-growing hybrid which has spread over large areas during recent years; or the sand-dune grasses, which bind and fix the sand dunes and prepare the way for a more varied and permanent type of vegetation.

The adaptation necessary to accommodate the plant to widely differing conditions of life does not involve changes in general plan of structure; for instance, in hot, dry, or exposed areas, where excessive loss of water by the plant must be avoided, this is effected by narrowing the leaf-surface, or rolling it over from margin to margin to protect the upper face on which are the water-transpiring stomata. The structure of the stem, a slender, hollow cylinder, strengthened by a band of supporting fibres beneath the outer layer, or strips accompanying the water-conducting tissue, gives sufficient strength, with the greatest economy of material, for the purpose required, namely, to carry up into the light and air the leaves, flowers, and fruits for the short period of active life, and to allow of the swaying motion which favours the processes of nutrition, of transfer of pollen, and of distribution of the mature fruits.

The mode of development of the branches at the base of the stem determines the habit; a tufted growth results from the upward growth of the buds in the interior of the leaf-sheath, as seen, for instance, in the "tillering" of cereals; while the turf- or sod-formation is due to the penetration of the sheath-base by the young shoot and its lateral development in the soil. Branching from the upper part of the stem is rare in grasses of the temperate zone, but occurs in tropical genera, and is characteristic of the bamboos, in which the woody stem often attains tree-like proportions.

Points of interest in the structure of the grasses are the mode of growth in length of the stem by a zone of growth above the place of insertion of each leaf, the rigidity of the stem at this tender-growing zone being maintained by the stiff, encircling leaf-sheath; the swollen "node" round the base of each leaf-sheath, which is able by a geotropic growth response to an alteration in its position to raise again to a vertical position a stem which has been laid; and the short prolongation of the leaf-sheath above the line of its union with the leaf-blade to form the membranous "ligule" which protects the entrance to the tube formed by the sheath.

The grass-flower and the association of flowers to form the inflorescence are very characteristic. The unit is the spikelet which contains one to several, sometimes many, flowers. The character of the spikelet is determined by the bracts or glumes, the green membranous or papery scale-leaves which enclose the single flower and overlap each other in a double row when several flowers are present in a spikelet. The bract-leaf is a general method of protecting the flower-bud; in the iris, for example, each flower-bud is enveloped by a pair of bracts—the outer, farther from the main stalk, green and leaf-like, the inner, between the bud and the main stalk, thin and hyaline with a double keel on the back. In the iris the bracts wither as the flower opens, in the grass the bracts remain as the character-giving feature during flowering and fruiting, the flower itself being reduced to those organs which are directly concerned in the setting of the fruit. The pollen is distributed by means of air-currents, and the petals are represented merely by a pair of minute fleshy scales (lodicules) at the base of the flower, which, by absorbing water, swell and cause the bracts to separate, and thus allow the thread-like stamens to grow out and exposé the delicately hung anthers, from which the light dusty pollen is scattered by the wind; the feathery stigmas protrude later to catch the pollen-grains. In the great majority of grasses there are three stamens, as in the Iris family, and a single ovary bearing a pair of long, feathery stigmas and containing a single egg. The remarkable variety in the form of the spikelet and the inflorescence is achieved by variety in the form, size, and number of the glumes which constitute the spikelet and the degree of branching of the inflorescence. The colour of the inflorescence is due to the colour of the pendulous anthers, and disappears when these drop after shedding the pollen. Fertilisation of the ovule succeeds pollination of the stigma, and the ovule becomes the seed, which, except in a few genera, is permanently enclosed in and inseparable from the fruit. The fruit also generally remains enclosed in one or more of the glumes, which fall with it and by their light, papery consistency help in its distribution by wind. Frequently the outer glume bears a stiff awn on the back or tip, which is an effective aid to distribution, as it will cling to the coat or plumage of an animal or bird. In the steppe grasses of the genus Stipa the awn is sometimes very long and feathered, forming an admirable device for distribution by wind. The stiff awn is frequently spirally coiled in its lower portion and hygroscopic, and its coiling or uncoiling with the varying degree of moisture in the atmosphere is arranged so as to drive the pointed end of the glume, in which the fruit is enclosed, into the ground.

The seed contains the embryo at the lower part of one side; the rest consists of a food store of starch and gluten to nourish the embryo on germination. The embryo has a well-developed stem-bud or plumule and root; the plumule is enveloped by a sheath (coleoptile), which appears above ground in germination as the slender pointed green seed-leaf from which the true leaves successively break. The food store in

[1] Abstract of a discourse delivered at the Royal Institution on May 17 by Dr. A. B. Rendle, F.R.S.

the seed is rendered soluble and absorbed by a flat sucker (scutellum), which is attached to the base of the coleoptile, and together with it represents the single cotyledon characteristic of the division of flowering plants, Monocotyledons, to which the grass family belongs.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

BIRMINGHAM.—Sir William Ashley, Dean of the faculty of commerce, has been invited to become Vice-Principal in succession to Dr. R. S. Heath, whose resignation takes effect at the end of the current session. The post of registrar, hitherto occupied by Dr. Heath, is to be filled by Prof. Alfred Hughes, Dean of the faculty of arts.

CAMBRIDGE.—The governing body of Emmanuel College offers two exhibitions, each of the value of 50*l*. and tenable for two years, to research students commencing residence at the college in October, 1918. The governing body may also make additional grants to students whose means are insufficient to cover the expense of residence at Cambridge or whose course of research may entail any considerable outlay in the provision of apparatus or materials.

OXFORD.—Prof. Horace Lamb, professor of mathematics in the University of Manchester, has been appointed Halley lecturer for next year.

THE *Times* correspondent at Toronto states that a prominent citizen, whose name is not yet disclosed, will give from 100,000*l*. to 600,000*l*. to endow chairs in the faculty of medicine at the University of Toronto.

BY the will of Sir G. H. Philipson, the sum of 2000*l*. has been left to the University of Durham College of Medicine, Newcastle-upon-Tyne, for the foundation of two Philipson scholarships to be awarded to the undergraduate of the college obtaining the highest marks at the M.B. final examination.

THE sum of 2500*l*. has been given to the Armstrong College, Newcastle-upon-Tyne, by Miss Stephenson, for the endowment of a studentship in the faculty of arts, in memory of her late father, Sir W. H. Stephenson; and Messrs. Cochrane, Ltd., of Middlesbrough, have given 3000*l*. to the same institution for the foundation of scholarships, primarily for residents of Middlesbrough and New Brancepeth.

THE Regulations for Secondary Schools for 1918–19 (Cd. 9076, price 2*d*.), now published by the Board of Education, are in substance the same as those for the present year. The definition of advanced courses for pupils remaining in secondary schools until eighteen years of age has been revised and modified. It will be remembered that the Board's circular of 1913 on the curricula of secondary schools pointed out that the legitimate requirements of the great majority of pupils would be met by the provision of three different types of advanced course, viz. (*a*) science and mathematics, (*b*) classics, and (*c*) modern humanistic studies. The requirement that the work of an advanced course in group (*a*) must include both science and mathematics has now been relaxed. In schools, especially girls' schools, where biology occupies a prominent place in the curriculum, it is not always possible without risk of serious overstrain to require the inclusion both of mathematics and of the auxiliary sciences of chemistry and physics. The Board has therefore reserved discretionary power to dispense with the requirement of mathematics in such cases. It is expected that chemistry will always be continued in the advanced course in connection with biology, and that physics will also be continued unless it has previously been carried to an adequate standard. The claims of geography for recognition as an advanced course are discussed in an explanatory note to the regulations, and it is stated that the Board is prepared to give sympathetic consideration to any practicable proposals made by suitable schools for advanced courses in which geography is made a predominant subject.

ONE chapter of the recently published report of the Board of Education for the year 1916–17 (Cd. 9045) is concerned with the work of universities and university colleges. It includes a section dealing with the gifts and bequests received during the year under review by the university institutions which come within the scope of the report. The majority of the foundations were directed to promoting the study of subjects the importance of which has been emphasised by the war. Among the gifts recorded the following may be mentioned:—A legacy to the University of Birmingham of 5000*l*. from the late Sir Charles Holcroft, the income of which is to be devoted to research work in science and engineering; a bequest of 10,000*l*. from the estate of Miss Craddock for the purpose of founding a chair of commerce at the University of Liverpool; 25,000*l*. under the will of Sir George Franklin for the foundation of chairs at the University of Sheffield; 30,000*l*. contributed to the Ramsay Memorial Fund; some 30,000*l*. given towards the erection of new science buildings at Bangor University College; 20,000*l*. promised by anonymous donors to Aberystwyth College for buildings required by the Agricultural Department; and at Cardiff 25,000*l*. received from Sir W. J. Tatem towards the provision of new chemical laboratories, a bequest of 20,000*l*. to the Medical Department, and a sum of 30,000*l*. from Miss Emily Talbot to endow a chair of preventive medicine. Altogether, well over 200,000*l*. was found by private donors for the improvement and development of higher education, in addition to the gifts of land, like the site of nine acres in the heart of Bristol given to the University there by Mr. Henry Wills, part of which is marked out for the erection of a department of physics. The benefactions to universities and colleges in the United States exceed 5,000,000*l*. annually, or twenty-five times more than the gifts to similar institutions in Great Britain.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, June 6.—Sir J. J. Thomson, president, in the chair.—N. B. **Dreyer** and Prof. C. S. **Sherrington**: Brevity, frequence of rhythm, and amount of reflex nervous discharge as indicated by reflex contraction. A single momentary stimulus of moderate intensity, *e.g.* a break-shock, even though not far above threshold value of stimulation, applied to the afferent nerve of a spinal reflex-centre, evokes from that centre not uncommonly a repetitive series of volleys of motor impulses. It tends to do so more as the stimulus, within limits, is increased in intensity, but the state of the reflex-centre at the time is also a decisive factor. The rhythm of repetition of volley-discharges from the spinal reflex-centre was traced, by the ordinary mechanical method, to be of synchronous rate with that of stimulation of the afferent nerve up to a frequence of 55 per sec., and by a mechanical resonance method up to a frequence of 65 per sec. By a "doubling frequency" method it

was shown further that the frequence-rate of the reflex discharge has not reached its limit under a stimulation of 75 per sec., but surpasses that degree, though by what amount the method cannot say. The maximal mechanical power of a muscle contracting under spinal reflex action is frequently as great as the maximal which can be evoked from it by direct faradisation of the motor nerve itself.

Geological Society, June 5.—Mr. G. W. Lamplugh, president, in the chair.—W. D. **Lang**: The Kelestominæ, a sub-family of Cretaceous cribrimorph Polyzoa. The Kelestominæ are a sub-family of Pelmatoporidæ. The latter are a family of Cretaceous cribrimorph Polyzoa, the costæ of which are prolonged upwards as hollow spines from the median area of fusion of the intraterminal front wall. The broken ends of these spines form a row of pelmata (or, if small, pelmatidia) on the intraterminal front wall. The Kelestominæ are Pelmatoporidæ with an apertural bar, each half of which is bifid; and the proximal and distal forks of each half are fused with the corresponding forks of the other half. The fused distal forks are also fused with the proximal pair of apertural spines, which are greatly enlarged. The simplest known form of this arrangement is seen in the genus Kelestoma, Marsson. Morphasmopora, unlike Kelestoma, retains a small number of costæ and a short œcium; but the thickness of the proximal apertural spines, which are scarcely recognisable as such, is enormously increased; the thickness of the bifid apertural bar is also increased.—Dr. R. L. **Sherlock**: The geology and genesis of the Trefriw pyrites deposit. This pyrites deposit is worked at Cae Coch Mine, on the western side of the Conway Valley (North Wales), about one mile north of Trefriw. A band of pyrites, about 6 ft. thick, and of considerable purity, rests on the inclined top of a thick mass of diabase, which is shown to be intruded into the Bala shales that cover the ore-body. Pyrites deposits are classified by Beyschlag, Vogt, and Krusch into four groups:—(1) Magmatic segregations; (2) formed by contact-metamorphism; (3) lodes; (4) of sedimentary origin. None of these modes of origin, however, will account for the Trefriw pyrites. The conclusion arrived at is that the diabase was intruded below a bed of pisolitic iron-ore. Hot water containing sulphuretted hydrogen given off from the intrusion combined readily with the pisolites, which were in the form either of oxide or of silicate of iron, and formed pyrites. The graptolitic horizon at which the pisolitic ore occurs usually contains some pyrites, and this would be added to that derived from the above reaction.

Linnean Society, June 6.—Sir David Prain, president, in the chair.—C. C. **Lacaita**: A revision of some critical species of Echium as exemplified in the Linnean and other herbaria, with a description of *Echium julaeum*, a new species from Palestine.—Capt. A. W. **Hill**: A series of seedlings of Cyclamen. Normally only one cotyledon develops, the other remaining as a rudiment at the apex of the hypocotyl or tuber. If the lamina of the cotyledon be removed, new laminæ arise as outgrowths from the petiole just below the cut surface; but if the cotyledon with its petiole be removed, the rudiment of the second cotyledon is stimulated to develop into an assimilating organ. On removal of the lamina of this second cotyledon new laminæ will be formed from the inner edges of its petiole close to the apex, exactly as is the case with the cotyledon proper. When plumular leaves are so treated no new laminæ are regenerated. Further, cotyledon leaf-cuttings will produce roots from the base of the petiole, while plumular leaf-cuttings remain rootless.—R. **Paulson** and S. **Hastings**: The relationship between the symbionts in a lichen. *Cladonia digitata*, Hoffm., is the lichen used as material for many of the authors' preparations. This plant grows at the base of trees in shady woods in Hertfordshire and Essex, as well as in most northern localities. The gonidium is spherical, except when subject to pressure from other gonidia. The diameter of fully developed cells ranges from 8 to 15 μ; the chloroplast in the mature gonidium has an uneven surface; after fixing and staining, minute reticulation of the cytoplasm is evident; the so-called pyrenoid is large and central, and exhibits a distinct structure throughout the substance, its diameter is roughly one-third that of the chromatophore; a small lateral body stains darker than the pyrenoid, it is very conspicuous in many of the preparations surrounded by a very lightly stained area. Twin gonidia frequently occur; there is no vegetative cell-division of the gonidium; the increase in the number of gonidia results from the formation of autospores, reduced zoogonidia; there is no penetration of gonidia by hyphæ.

Mathematical Society, June 13.—Prof. E. W. Hobson, vice-president, in the chair.—Prof. M. J. M. **Hill**: An assumption in the theory of singular solutions of ordinary differential equations of the first order.—Col. A. J. **Cunningham** and Th. **Gosset**: Quartic and cubic residuacity tables.—Col. A. J. **Cunningham**: Lucas's process applied to composite Mersenne numbers.—Dr. A. E. **Western**: The Gaussian period numbers and the conditions that 2 should be a residue of a 16th or 32nd power.—T. W. **Chaundy**: The aberrations of a symmetrical optical system.—T. L. **Ince**: The rotation groups of the regular figures in four or more dimensions.—J. H. **Grace**: (1) An analogue in space of a case of Poncelet's porism. (2) Note on enumerative geometry.—E. K. **Wakeford**: Posthumous MS. discovered in his kit.

EDINBURGH.

Royal Society, June 8.—Dr. John Horne, president, in the chair.—Miss L. H. **Huie**: The formation of the germ-band in the egg of the holly tortrix moth (*Eudemis naevana*). The following main results were obtained. The egg laid in July and August is much flattened, having the form of an oval scale, the ventral surface of which adheres to the leaf. The shape of the egg and the transparency of the envelopes make this a convenient material for the study of the early development of a lepidopterous insect. An account was given of the stages leading to the formation of the blastoderm, the ventral plate, the amnion, the germ-band, and the "inner layer." This last becomes segmented almost at once, but the ectoderm remains unsegmented during the winter.—Prof. R. A. **Sampson**: Studies in clocks and timekeeping. No. 2.: The circular equation. The present communication is the second of a series of studies executed at the Royal Observatory upon precision clocks and timekeeping. The astronomical interest of these studies comes from their ultimate bearing on the rotation of the earth, which is our standard of timekeeping. Their plan is to accumulate with sufficient care and detail the necessary observations and discussions upon all points at present obscure or imperfectly treated which may affect the timekeeping of a clock. The present paper contains the calculation of the theoretical effect upon the clock's rate of any variation of arc of oscillation of the pendulum. The formulæ, which are known, are here reduced to tables for convenient reference. The comparison of these theoretical results with actual performance is reserved for future members of the series.—Dr. C. **Davison**: The sound-waves and other

air-waves of the East London explosion of January 19, 1917. This is the complete report of the facts collected on the occasion of the East London explosion on January 19, 1917 (see NATURE, February 1, 1917, p. 438, and August 2, 1917, p. 450, in which the main conclusions were anticipated).—Sir Thos. **Muir**: The quadratic relations between the determinants of a 4-by-8 array. The main idea of the paper was to develop a convenient notation to facilitate the analytical use of these arrays.

CAPETOWN.

Royal Society of South Africa, April 17.—Dr. J. D. F. Gilchrist, president, in the chair.—Dr. J. D. F. **Gilchrist**: Luminosity in a South African earthworm and its origin. Luminous earthworms are found on the slopes of Table Mountain. The luminosity proceeds from a discharge from the mouth and anus, which consists of cells heavily laden with inclusions of different kinds. The smaller inclusions consist of a substance allied to fat, by the oxidation of which the light is produced. The cells arise from the body cavity, and are discharged into the anterior and posterior parts of the alimentary canal by definite communications between the cœlom and alimentary tract.—Sir Thomas **Muir**: Note on the adjugate of Bezout's eliminant of two binary quantics.—I. B. P. **Evans** and Averil M. **Bottomley**: The genera Diplocystis and Broomeia. Some specimens of Diplocystis have recently been obtained by the authors from Portuguese East Africa, and this is the first recorded occurrence of the interesting genus from Africa. The African material is not identical with that from Cuba, and the authors describe it as *Diplocystis Junodii*, nov. spec.—Ethel M. **Doidge**: South African Perisporiaceæ, ii. Revisional notes. This communication consists of a revision, due to work on a number of fresh collections of South African Perisporiaceæ, of a previous communication on the subject by the author.—F. G. **Cawston**: Fresh-water snails as a cause of parasitic diseases. The author describes a number of snails collected by him from various districts in South Africa, and found to be infested with the cercarial stages of the various trematode worms.—J. **Moir**: Colour and chemical constitution, part iv. The remaining phthaleins. The absorption spectra of complex phthaleins are described, these being partly duplex compounds of the phenol-anthrol type and partly of a new class (*e.g.* thymol-naphthol) derived from thymoylbenzoic acid. The additive nature of the effects of different substitutions is emphasised by means of a table giving the numerical value of the change of wave-length for different substituting groups.

BOOKS RECEIVED.

The Chemical Analysis of Iron. By A. A. Blair. 8th edition. Pp. 318. (Philadelphia and London: J. B. Lippincott Co.) 21*s.* net.

Fisheries of the North Sea. By N. Green. Pp. vii +178. (London: Methuen and Co., Ltd.) 4*s.* 6*d.* net.

Map Work. By V. S. Bryant and T. H. Hughes. Pp. 174. (Oxford: Clarendon Press.) 5*s.* net.

Is Man the Product of Evolution? By S. J. Whitmee. Pp. 24. (London: Headley Bros, Ltd.) 6*d.* net.

Wayfarings: A Record of Adventure and Liberation in the Light of the Spirit. By W. J. Jupp. Pp. 234. (London: Headley Bros., Ltd.) 6*s.* net.

Methods of Measuring Temperature. By Dr. E. Griffiths. Pp. xi+176. (London: C. Griffin and Co., Ltd.) 8*s.* 6*d.* net.

DIARY OF SOCIETIES.

THURSDAY, JUNE 20.

ROYAL SOCIETY, at 4.30.—Croonian Lecture: The Physiological Basis of Thirst: Major W. B. Cannon.

LINNEAN SOCIETY, at 5.—Les espèces d'Alpheidæ rapportées par M. J. Stanley Gardiner de l'Océan Indien: Prof. H. Coutière.—(1) A Selection of Ferdinand Bauer's Landscapes, *c.* 1784. (2) Ten British Plants: G. Claridge Druce.—Exhibition of Lantern-slides representing a Series of Intermediate Forms of the Diatom Genera Navicula and Cymbella: Sir Nicolas Yermoloff.—Sex-segregation in the Bryophyta: E. J. Collins.—Phenological Observations in an Elementary School: A. O. Walker.

ROYAL SOCIETY OF ARTS, at 4.30.—Indian Cotton and the Cotton-mill Industry: The Hon. Sir Dinshaw E. Wacha.

MONDAY, JUNE 24.

ARISTOTELIAN SOCIETY, at 8.—The Moral Argument for Theism: Rev. W. R. Matthews.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Address by the Hon. Arthur Meighen, Canadian Minister of the Interior, attending the Imperial Conference.

TUESDAY, JUNE 25.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 5.—Sociology of the East Coast People, Formosa: S. Ishii.

AERONAUTICAL SOCIETY (Central Hall, Westminster), at 8.—Wilbur Wright Memorial Lecture: Some Outstanding Problems in Aeronautics: Prof. W. F. Durand.

THURSDAY, JUNE 27.

ROYAL SOCIETY, at 4.30.—*Probable Papers:* Periodic Irrotational Waves of Finite Height: Prof. T. H. Havelock.—The Diffraction of Electric Waves by the Earth: Dr. G. N. Watson.—Concerning Emotive Phenomena. II.: Periodic Variations of Conductance of the Palm of the Human Hand: Dr. A. D. Waller.—The Mechanism and Control of Fibrillation in the Mammalian Heart: Prof. J. A. MacWilliam.—The Development of the Sea Anemones, *Actinoloba dianthus* and *Adamsia palliata*: Dr. J. F. Gemmill.—The Occurrence of Multinucleate Cells in Vegetative Tissues: R. Beer and Agnes Arber.—The Epithelial Sheath of Hertwig in the Teeth of Man, with Notes on the Follicle and Nasmyth's Membrane: Dr. J. H. Mummery.—*And other Papers.*

FRIDAY, JUNE 28.

PHYSICAL SOCIETY, at 5.—A New Method of Measuring Alternating Currents and Electric Oscillations: I. Williams.—Demonstration of Coupled Vibrations: Prof. E. H. Barton and Miss H. M. Browning.

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