THURSDAY, JANUARY 11, 1917.

CIVIL ENGINEERING CONSTRUCTIONAL WORK.

(1) *Elementary Strength of Materials.* By Ewart S. Andrews. Pp. viii+216. (London: Chapman and Hall, Ltd., 1916.) Price 4*s.* 6*d.* net.

(2) *Costruzioni di Strade e Gallerie.* By Prof. Salvatore Rotigliano. Pp. xxiii+808. (Milano: Ulrico Hoepli, 1916.) Price 18 lire.

(1) THIS book is an abridged edition of the author's larger work on the subject, and has been specially arranged for the practical man as well as for students in engineering colleges. It is one of the best arranged and most complete of the smaller treatises which have appeared on this subject, and as the author has made use of the latest published results of research on the strength of materials, the book is thoroughly up to date. The book deals very successfully not only with the various problems involved in the calculations of the stresses and strains produced by different kinds of loads, but also with the methods now adopted for carrying out tests of all kinds on the materials used by engineers and architects. The author gives valuable advice as to the precautions which must be taken in order to secure trustworthy results when tests are made, and as to the most suitable types of machines for different classes of tests. Mr. Andrews is to be congratulated on having produced an excellent text-book, which will be of considerable use to both engineers and architects.

(2) The author of this work, Prof. Rotigliano, is engineer-in-chief to the city of Palermo, and the book is based on the lectures delivered by him as professor of road construction at the Royal School for Engineers at Palermo. The book is divided into four sections, the first section dealing with the laying out of roads and railways, the second with the necessary earthworks, the third with the construction and maintenance of roads, and the fourth with the construction of tunnels.

In the first section, after a general introduction, the author deals with the subject of traction on roads and railways and the frictional and other resistances which have to be overcome, giving a number of useful formulæ which enable the tractive force to be determined under known conditions for animal and mechanical traction; the limiting values for gradients and curves are also fully discussed. The third chapter deals with the setting out of curves, both circular and parabolic, and there are a number of practical rules as well as a full theoretical treatment of the subject. The remaining chapters of this section deal with topographical surveys, the laying out of roads and railways in various classes of country, and the general considerations which decide the best route to adopt in a given case. In dealing with the laying out of railways in mountainous districts, as was to be expected in the case of a book written by an Italian engineer, much attention has been paid to the subject of spiral curves, reverse curves, and zigzags.

The first chapter of the second section is devoted to the necessary mensuration for determining cross-sectional areas and volumes of excavation; a number of formulæ are given for the various calculations which have to be made. Chap. viii. deals with the problem of equalisation of cuttings and banks, and the factors which determine the distances through which it is economically possible to transport excavated material. The next chapter deals with the various hand tools which are employed in the work of excavation in ordinary soft ground, and the methods adopted for preparing the shot-holes when explosives have to be employed. The tenth chapter is devoted to an account of the methods usually adopted for transporting the excavated material by wagons running on temporary lines of rails. Chap. xi. deals fully with mechanical excavators and steam navvies, with the employment of aerial lines for the transport of material, and with the utilisation of machinery in modern constructional work. In the final chapter of this section the author discusses the numerous practical problems which the engineer has to solve, more especially when roads have to be constructed in mountainous districts.

The third section is devoted to a description of the various materials employed in constructing the road surfaces of main and district roads and of urban and suburban streets, of the modern methods of testing and preparing these materials, and of the work of laying them on the prepared road-bed. The questions of road maintenance and of the influence of the various classes of traffic on the wear of the road surface are fully discussed.

The fourth and concluding section of the book is devoted to the laying out and construction of tunnels; the author gives a complete treatment of the whole problem. After a brief explanation of the various systems adopted for the setting out of the centre lines, the methods of carrying out the work of driving the tunnels are fully described, and the latest types of compressed-air and hydraulic machinery for operating rock-drills are explained and discussed. One chapter is devoted to a careful account of the timbering which is needed when tunnels are driven in soft ground, and the work concludes with a description of the construction of subaqueous tunnels, with an account of the special difficulties which have to be overcome in such work, and with details as to the various systems adopted for the ventilation of long tunnels.

The book is extremely well illustrated, and is one of the most comprehensive text-books which have been published on the subject of earthwork construction. As probably few British engineers are able to read Italian, it is to be hoped that some British publishing firm will undertake the work of producing a translation of this book for the benefit of British engineers. T. H. B.

ORGANIC CHEMISTRY FOR AGRICULTURAL STUDENTS.

Organic Agricultural Chemistry (*The Chemistry of Plants and Animals*). By Prof. J. S. Chamberlain. Pp. xvii+319. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1916.) Price 7*s*. net.

THIS volume is intended to solve the difficult problem of providing a course in chemistry for students at agricultural colleges. By common consent the ideal plan is for the would-be agricultural chemist to go through the pure chemical course and take an honours degree. But many cannot do this; their training has to be carried out at the agricultural college, where chemistry as such is strictly subordinated to the matter in hand.

Prof. Chamberlain deals with the problems by picking out those substances that the student will come across in his agricultural studies, and then connecting them together by building up the course round them. Necessarily this prevents discussion of many problems of chemical interest; constitutions have to be taken on trust without even an indication of the way in which they have been established. The course, too, is necessarily altered, and many old friends disappear: the ketones are not mentioned; even acetone is not described.

But the book has to be judged by its suitability for the people for whom it was written, and from this point of view it is satisfactory. The ordinary simple substances are dealt with in sufficient detail, and the experiments are numerous enough to ensure that the student shall familiarise himself with them. Fats, sugars, starches, and proteins are discussed in a simple manner, and various interesting illustrations are given that show the bearing of chemistry on the problems of everyday experience.

The first section of the book having dealt with organic substances, the second is devoted to physiology, both of plants and of animals. It is unfortunate that the lecturer in agricultural chemistry is almost always called upon to teach these subjects, for it is obvious that no man can do justice to physiology when he has to bring it in simply as an "extra." Prof. Chamberlain has courageously introduced the chapters, and no doubt they will supply the teacher's needs. But throughout one has the feeling that agricultural chemistry ought not to be extended to include physiology.

The third section treats of crops, which undoubtedly belong to the subject. An account is given of the proximate and ultimate constituents of the ordinary crops, and of their value to both man and animals. The author classifies them on p. 150 as volatile and non-volatile, using "volatile" to include starch, cellulose, protein, etc., and "non-volatile" for the ash constituents. It would have been better to retain the old terms "organic" and "mineral," or something that does not involve calling cellulose a "volatile" substance.

Several omissions call for remedy. In a book of this kind the student may reasonably expect to find the answers to the questions that arise in everyday practice. What, for instance, is the constituent in cotton-seed cake that has such a "binding" effect on cattle? or the substance in young grass that makes them scour? Why is May grass better than October grass? Why have mangolds to be stored some months before they can safely be used? These are the kind of questions about crops that are perpetually before the agricultural instructor in this country, and a similar variety of questions must be put by inquisitive farmers in the States; they represent the kind of problem that the text-book writer ought to face.

The book has several new features which seem decidedly useful. No space is lost in giving details of analytical methods which, as the author truly observes, can be got out of the analytical text-books. The detailed study of animal nutrition is taken before that of plants—a course which, in the author's experience, gives the student a clearer conception of the biochemical changes involved, and at the same time emphasises both the differences between plants and animals and their fundamental similarity.

No references to original papers are given, but there are references to larger text-books, so that the student seeking further information will know where to find it.

The book is, we believe, the only one of its kind. The well-known volume by Haas and Hill was written from the general biochemical point of view. Prof. Chamberlain is, so far as we know, the only recent chemist who has written organic chemistry for agricultural students. E. J. R.

COLOUR.

Color and its Applications. By M. Luckiesh. Pp. xii+357. (London: Constable and Co., Ltd., 1915.) Price 16*s*. net.

IT is always difficult, if not impossible, to separate the principles of a science from the applications of them, and the author has, perhaps wisely, not attempted to do so. On the other hand, while a student may be able to master the principles so far as they have been made clear, he can never hope to become practically acquainted with the innumerable applications of such a subject as colour. Therefore, we have here a very good account of the fundamentals, and a similarly good account of some of the applications, while other of the latter are treated in so limited a manner that it can scarcely be claimed that they are fairly presented. With these few exceptions, which indeed the author from his preface evidently appreciates, we have a very useful general treatise on colour which includes 130 well-selected diagrams, curves, and tables, so that for very many purposes the book will be found sufficient in itself. But at the end of every section references are given to other text-books and to original papers to facilitate a more extended study.

About three-fifths of the volume is devoted to

fundamental matters: the nature of light, the production of colour, colour mixture, colour terminology, the analysis of colour, colour and vision, the effect of environment on colour, theories of colour-vision, and colour photometry. In connection with colour mixture we have the subtractive and additive methods dealt with, and also the "juxtaposition method" as if it were a third method, though it is this only from a practical point of view, being really a form of the additive method. The mixture of both the subtractive and additive methods which exists in three-colour typographic half-tones is not referred to, but in omitting this the author only follows in the footsteps of those who have preceded him. It seems to be generally taken for granted, perhaps because "subtractive" colours are used, that this is simply a modification of that method, but the most cursory examination of a print will show that the dots of colour, while often more or less superposed, are also often juxtaposed.

A few pages that should be of much interest to those who need to make critical observations of minute detail, as in some microscopical work, deal with acuteness (or "acuity") of vision. For the same brightness in all cases vision is more acute with monochromatic than with white light, and for this purpose yellowish-green is superior to any other colour. The reviewer would observe that microscopists generally prefer this colour, which is also that for which the eye is most sensitive and for which objectives are generally best corrected. But the superior resolving power of light of shorter wave-length has led to the occasional use of bluish-green light, in spite of its obvious disadvantages. It seems from the figures given that the microscopist may lose more by the reduction of his acuteness of vision, even assuming equal brightness, than he can possibly gain by the increase in resolution, unless he can command a higher magnification without introducing other troubles.

With regard to the applications, colour photography is briefly dealt with in eleven pages, but the next group of chapters, "Colour in Lighting," "Colour Effects for the Stage and Displays," and "Colour Phenomena in Painting" (which deals chiefly with questions of illumination), occupies more than a quarter of the whole volume. This is evidently the subject that most interests the author, as, indeed, one would expect from the position that he occupies. Colour-matching as a special art, an account of various attempts to make "colour-music," borrowing more or less the notation of sound-music, and a few notes on coloured media, complete the volume.

C. J.

QUARTIC SURFACES.

Quartic Surfaces with Singular Points. By Prof. C. M. Jessop. Pp. xxxv+198. (Cambridge: At the University Press, 1916.) Price 12*s.* net.

WE have in analytical geometry a great contrast between the general and the particular. For algebraical curves and surfaces of the *n*th order or class we have a comparatively large number of results, such as those given by Cayley, Cremona, and others half a century ago; but when we take a particular value of *n* and try to investigate, say, the distinct types of surfaces of that order, the task is a very formidable one if *n* exceeds 3. The present work deals with the case when $n=4$, and that only so far as relates to surfaces that have nodes or nodal curves, or both.

Chap. i. shows us very simply the forms of equation corresponding to quartics which have from four to sixteen (ordinary) nodes; this gives twenty-four types of surface, some types having further varieties. As we might expect, the sixteen-nodal surface is the easiest one to discuss in detail; practically we have Kummer's surface and particular cases of it, and by introducing theta-functions we can obtain many elegant properties with ease (this is shown in chap. ii.). Among the six-nodal quartics we have Weddle's surface (discussed pp. 173–188); here double theta-functions are useful auxiliaries.

Chap. iii. gives an account of quartics with a nodal conic; when this conic is the imaginary circle at infinity, the surface becomes a cyclide. Prof. Jessop might have remarked that since any two conics in space are projectively equivalent, the theory of cyclides includes that of all quartics with a nodal conic. Hence we may, if we like, read chap. v. (on cyclides) and translate all its theorems into properties of every quartic with a nodal conic, and thus deduce the theorems of chaps. iii. and iv. However, the author's sequence has the advantage of introducing us at an early stage to Segre's wonderful projection of quartics from four-dimensional space (p. 55), and to Geiser's one-one relation between points on a plane and those on a general cubic surface (p. 46). The value of Segre's method becomes still more obvious in chap. iv., which ends with his table of types of quartics with a double conic, arranged according to indices of elementary factors; this is one of the most valuable tables in the book.

Chap. vi. deals with surfaces with a double line, among which Plücker's surface appears; chap. vii. with quartics that contain an infinite number of conics (here Steiner's surface comes in); chap. viii. with rational quartics in general; and chap. ix. with determinant surfaces (Weddle's surface being the symmetric case). All are well worth reading; and, in fact, the treatise has the great merit of introducing us to the main methods which have, in this inquiry, replaced tiresome algebra by a combination of abridged notation, pure geometry, and function-theory suited to the particular problem in hand. Without making any invidious distinctions, we may fairly assert that, in this particular domain, Segre and Humbert have, each in his own way, immensely simplified the discussion of the theory.

Prof. Jessop's book has, of course, the defects of its qualities. Among these we may note that he never points out that in writing a treatise on algebraic loci with certain singularities he is at the same time writing on algebraic envelopes

with corresponding singularities. A mathematical student will find it an excellent exercise to dualise all the theorems contained in this volume. Again, in discussing cyclides, the author has missed the chance of referring to Lie's one-one correspondence of lines and spheres in space. A real cyclide is the envelope of a real sequence of spheres; Lie's transformation leads to a sequence of complex lines, and it would be interesting to see what the cyclide corresponds to.

Prof. Jessop duly appreciates the late R. W. H. T. Hudson's book on Kummer's surface; he has himself composed a work of the same kind, in the sense that it is a valuable introduction to some of the latest results obtained by geometricians. G. B. M.

OUR BOOKSHELF.

A Manual of Fire Prevention and Fire Protection for Hospitals. By Dr. O. R. Eichel. Pp. v+69. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1916.) Price 4*s.* 6*d.* net.

THE British Fire Prevention Committee, whose fire surveyors have been undertaking the fire precautionary arrangements in innumerable hospitals throughout the country, recently indicated in one of its reports that medical men who are prone to forethought are particularly ready to take precautions in such establishments as hospitals. We therefore specially welcome the little book before us, from the pen of a medical man connected with the New York State Department of Health. As it is largely based on American practice, much of the detail does not hold good in this country, yet the principles enunciated are sound.

Taking up a question of detail and having regard to the unfortunate tendency of some hospitals in this country to purchase dry-powder extinguishers, we observe that the author deals with them as follows:—

DRY-POWDER EXTINGUISHERS.—"These are the least reliable and most inefficient extinguishers known. Unfortunately, they are also very widely used, and can be found in many hospitals. . . ." Again, referring to another unfortunate type of fire appliance (*sic*), the glass hand grenade, which will be found in many hospitals, the author says:—

GRENADE TYPE.—"These types usually consist of bottles containing fluids, a large percentage of which is water, and are of so little value as to be practically worthless. The false sense of security which may result from their presence, and the time lost in attempting to quench the fire with them, may be very dangerous. They are hardly equivalent in value to a pitcher full of water. . . ."

Whilst we have mentioned specific examples of the author's comments on appliances, we should like to emphasise that he wisely gives fire prevention precedence to fire extinction. He deals with lighting hazards, heating hazards, etc. He also has some words to say on the organisation of the staff from the fire point of view, *i.e.* what he describes as the "Hospital Fire Department."

The Portland Cement Industry. By W. A. Brown. Pp. x+158. (London: Crosby Lockwood and Son, 1916.) Price 7*s.* 6*d.* net.

THE cement industry presents striking resemblances to the aniline dyes industry. The first aniline dye was discovered and manufactured in England. Afterwards the sustained attention devoted to the subject by trained minds in Germany so changed the conditions through the introduction of new colours and cheaper methods of production that eventually a monopoly was acquired. Similarly, Great Britain first produced cement—Parker's (afterwards called Roman) cement in 1796 and Portland cement in 1824, to which may be added reinforced concrete (covered by Elkinson's patent) in 1854. So, too, though partly from different causes, the cement industry has developed far more rapidly in Germany and the United States than here. The remarkable progress in America is attributed to the close co-operation during the past fourteen years of Associations of Cement Manufacturers and Cement Users. Fortunately, British cement machinery is now equal to any made in Germany, though it cannot compare favourably with American machinery. The improvement of cement has been facilitated by the general adoption of the "British Standard Specification," but ample scope remains for research with a view to increased economy and efficiency in the manufacturing processes.

The book before us is eminently practical, and deserves serious consideration because the author has had important American experience, and is now managing a large modern cement works in South Wales. Special attention is bestowed on the vital question of costs, particularly working costs for economical production, and the book may be profitably consulted by those interested in the industry. There are numerous illustrations, including thirty-six full-page plates, and some notes on physical testing constitute a valuable feature. J. A. A.

Actualités Scientifiques. Le Principe de Relativité. By E.-M. Lémeray. Pp. 155. (Paris: Gauthier-Villars et Cie, 1916.) Price 3 fr. 75 c.

THE aim of this work is not to give a historical or critical survey of the development and significance of the principle of relativity, but rather to develop some of its consequences for dynamical theory so far as they are independent of all hypotheses as to the electrical constitution of matter. Three principles are assumed: the constancy of the velocity of light, the principle of virtual work, and the fundamental law of inertia, the last only for the most restricted case. From these the author develops conclusions as to the limitations to be placed upon the theorem of equality of action and reaction, upon the law of gravitation, and upon the meaning of mass. The extent to which the principle agrees with and requires experimental results is barely touched upon, but this is probably because the book is the record of a series of lectures aiming at a presentation of a particular point of view.

LETTERS TO THE EDITOR.

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Meteorology and Wheat Shortage.

IN looking through some old papers I came across one entitled "The Law of Sequence in the Yield of Wheat for Eastern England for 1885–1904," contributed by Sir Napier Shaw to the *Hann Band der meteorologischen Zeitschrift*, 1906, pp. 208–16 (Brunswick: Fried. Vieweg und Sohn, 1906). From a study of the rainfall and its connection with the amount of the harvest, Sir Napier Shaw applied the method of harmonic analysis to the quantity in question, and obtained a formula according to which its fluctuations are periodic, the period being eleven years. In Fig. 42 (p. 212) curves are shown in which the agreement between the calculated and observed results is very close. It now becomes interesting in the light of recent events to extend Sir Napier Shaw's predictions for a further period of eleven years, with the following results, the numbers representing average yield in bushels per acre:—The highest maximum of about 35·5 should have occurred in 1909–10, followed by a minimum of about 29·5 in 1911–12. The predicted yield next rises to about 32·5 in 1912–13, and then decreases, the lowest minimum being about 27·0 bushels per acre and occurring at the beginning of the war, in 1914–15. From now on the predicted yield should increase, but would not reach its former maximum of 35·5 until 1920–21. For the period 1915–17 the predicted yield is not much more than 29 bushels per acre. It will be seen, therefore, that, according to theory, it was to be expected, both here and abroad, that England's wheat supply, so far as it depends on the eastern counties, would be at its lowest at and about the present time. G. H. BRYAN.

PROF. BRYAN'S reminder of my work of twelve years ago upon the yield of wheat in the eastern counties of England comes at an opportune moment. It may be of interest to recall how the "theory," to which he refers, arose. In considering the figures for the yield of wheat for England in the twenty-one years 1884 to 1904, I had noted that they were so closely related to the rainfall of the "principal wheat-producing districts" (approximately the part of Britain east of a line from Portland to Inverness) for the previous autumn that one might almost rely upon losing a bushel and a quarter per acre from the crop for every inch of rain recorded for the region in the previous autumn. There were some exceptional years, and in the hope of getting something still more amenable to rule I restricted the area to the counties of the meteorological district "England East," and took out the figures for wheat from the returns of the Board of Agriculture and for rainfall from the Weekly Weather Report. From these it appeared that every inch of rain in the autumn meant a loss of 2·2 bushels of wheat per acre for the eastern counties, but the occasional exceptions were not less pronounced than for the wider area, but more so.

Trying to circumvent these vexatious exceptions to an obviously useful general rule, I was working with a graph of the twenty yields 1885 to 1904, and discovered accidentally that it was reversible with reference to the epoch 1895–96. The individual values varied from 25·2 to 36·3, but the means for the pairs of years 1895–96, 1894–97, 1893–98, and so on, were nearly identical; the means of any other set of pairs not so. The only explanation of a reversibility of that kind that I could imagine was the combination (possibly fortuitous or occasional) of a series of periodic variations of any periods whatever which happened to be concurrent in a node in 1895–96. By a crude process of trial and error I was led to the conclusion that the best representation of the actual figures on that basis was to be got by combining a sine-curve of eleven years period with five of its harmonics of selected amplitude, each with a node at 1895–96; five of the nodes were ascending, one descending. This is a different matter from taking any graph between zero values eleven years apart and finding the harmonic components that will give the best fit, because the graph that I was working with crosses the zero line twelve times in twenty years. There is little or nothing suggestive of an interval of eleven years, but it followed from my analysis that the figures must repeat themselves after eleven years, a conclusion which I had not previously conjectured, but which turned out to be verified in an astonishing number of cases, and led to a most accurate prediction of the yield for 1905, which was then unknown.

There were thus two "theories" in the field, one that the yield of wheat depended (negatively) upon the rainfall of the previous autumn, the other that the figures repeated themselves after eleven years in consequence of the periodic changes with a fundamental interval of which "eleven years" was the nearest whole number. A curious point was that the years which were exceptional as regards the rainfall-rule did not appear as exceptions to the rule of reversal with regard to 1895–96. Thus the year 1903 is 6·2 bushels in defect of the rainfall-rule, but it compensates the yield for 1888 quite properly; on the other hand, 1904 gives a yield 4 bushels too small to compensate the yield of 1887, but it agrees quite well with the rainfall, while 1887 itself does not. In fact, if 1887 had agreed with the rainfall the repetition in 1898 and compensation in 1904 would have been quite good.

Thus there is a good deal of tantalising attraction about either "theory," and the relation of the one to the other. Mr. R. H. Hooker took the matter up, and discussed the yields of the various crops in relation to the weather conditions of different parts of the year in a well-known paper published by the Royal Statistical Society. He gave his opinion in favour of autumn rainfall as against "eleven years," in spite of the triumphant success of the latter's first prediction, that for 1905, which gave 32·8 bushels per acre to compare with an actual 32·0, whereas autumn rainfall would have given 37·6.

I have not looked into the matter critically since 1906, although the question is obviously one of immense practical importance, particularly at the present time, when the extension of the wheat area is being urged. To some of my friends the period of eleven years, which in this case could not be evaded or concealed, is anathema, and to others all such imagined periods and apparent relations are more likely to turn out will-o'-the-wisps than beacon-lights. So I thought it best to let the question rest until another eleven years had expired. That time has now arrived, and the question certainly deserves further investigation.

But there are certain pitfalls in the way of the continuance of the investigation. "Autumn rainfall" is a conventional expression, so is "eastern counties" in regard to the yield of wheat. One is apt to get off the line of continuity if one tries to deal with the matter amid the press of other things. And even with the additional figures properly computed we shall not necessarily secure the continuity which the investigation requires. The years that have elapsed have been memorable for the progress that has been made in the successful breeding of wheat, and success in breeding

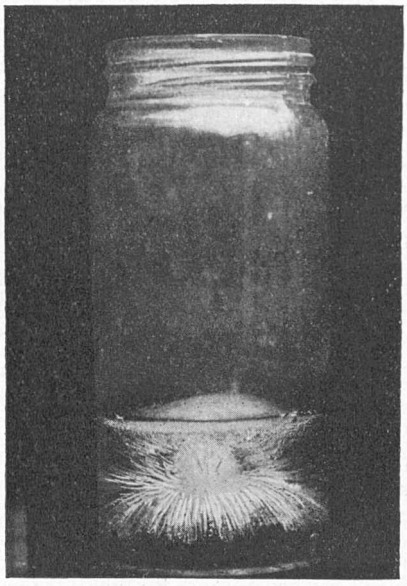
means improving the crop by choosing wheat that is immune from the effects of incidental causes which are part of the natural order and used to be instrumental in depressing the market yield. Moreover, when wheat was cheap there was a disposition only to sow it in the most favourable land, to withdraw the rest from wheat-cultivation, and thus to raise artificially the average yield per acre.

Considering all the circumstances, even as they were in 1906, it is surprising that any suggestion of law should come out of the figures at all. Improved knowledge among farmers may easily now have introduced variations which will form a systematic error in the comparison of facts with the calculations of either "theory"; consequently the investigation means rather more than comparing figures. The mere repetition of the process that was good enough for 1904 may be illusory in 1917, for causes which were not inherent in the original figures. NAPIER SHAW.

A Frost Thistle: A Beautiful Effect of Freezing.

THE frost flower here photographed was entirely the result of a chance experiment, but it was so beautiful that it would be well worth repetition and detailed study.

So far as I can see, the sole factors necessary for the production of such an effect are a small amount of garden mould left standing in a little water (about



an inch in depth) in a small glass jar, and frosty weather. In this particular case the vessel was left out of doors on a window-sill during a recent frosty night in a state of tranquillity save for the occasional shakings caused by vehicles passing over the bridge below.

In the morning the water was frozen solid; the glass was intact, the ice having expanded upwards, doming the surface. Within the ice cylinder was a wonderfully perfect representation of a thistle flower, most delicately fashioned in gleaming threads of silvery whiteness and of exquisite beauty, all emanating from a fluffy-looking, opaque, central, domed nucleus.

In reality the threads were fine curved threads of gas (? air) radiating through the clear ice. As shown in the figure, those below curved downwards, those above upwards, for all the world like lines of force round a magnetic pole, but demonstrated by capillary tubes in ice. On closer examination I was, I believe, able to discover another essential feature in the phenomenon in the form of tiny specks of mud, one at the peripheral end of each gas-tube.

I submit the following explanation of the frost thistle.

It must be assumed that as freezing proceeds from without inwards, the gas-tubes also grew centripetally. The tiny particles of earth we believe to have determined the points of origin of minute gas bubbles. When the first shell of ice was formed, these bubbles would naturally, by the expansion of the ice, tend to be squeezed and compelled to elongate, and then to move in the direction of least resistance—*i.e.* inwards and towards the centre of the vessel. In other words, these silvery threads, curving, as they do, upwards from the bottom and downwards from the top, are graphs which indicate the progress of the congelation.

When the congelation had reached to about one-third of the radial distance to the centre, some change appears to have occurred, for the central ice-mass was no longer clear, but of a milky opaqueness, within which the gas-tubes could be no longer followed by the eye. This we attribute to the sudden solidification of a confined residual volume of liquid of enhanced salinity, which, at the moment of its change of state, yielded up its dissolved gases in countless bubbles of the minutest size. These, probably uniformly distributed throughout the central ice, produced its cloudiness.

May I add that this example of natural magic grew within a few yards of the site of Roger Bacon's study on Folly Bridge at Oxford? R. T. GUNTHER.

NATIONAL RECONSTRUCTION.

IT is not too much to say that of all the subjects which claim careful consideration at the present time of discussion as to Imperial reconstruction, none is more important than education. It is true that the consequences of any change for the better or worse in educational matters will affect more directly the next generation than the present, but the clarification of men's minds and the settlement of a course of action in this direction are urgently desirable. For it is evident that opinion is still much divided as to the aims which ought to be kept in view, and until such divisions are practically healed the present wasteful conflict will go on.

The discussion which has been carried on during so many years by the partisans of classical studies on one hand, and the supporters of science on the other, is an indication that there is still much misunderstanding and exaggeration on both sides. The extremists on one side contend that Greek is an essential element in a liberal education, and talk of physical science as "gross materialism," while some of the extreme opponents of classical studies are not content with dropping Latin and Greek, but would turn schoolboys into technical chemists. It is to be hoped that the people with more moderate views, who fortunately seem to form the majority, will arrive before long at a generally acceptable compromise whereby the interests of a truly liberal education may be secured.

The advocates of the classical system have shown in recent utterances a moderation which

may be taken as indicating a politic submission to the force of that part of public opinion which is against them. An example occurred at the meeting of the Hellenic Society on November 14, Dr. Walter Leaf, president, being in the chair. The president opened the proceedings with some remarks about compulsory Greek in the entrance examinations at Oxford and Cambridge for which he would receive the cordial thanks of any friends of physical science who may have listened to him. As he justly pointed out, the study of Greek must stand or fall on its own merits, and he denounced the retention of Greek as a compulsory subject in terms as vigorous as could be desired both by those who care nothing for classical learning and by those who have the interests of Hellenic studies at heart. For there can be no doubt that the number of young people who enjoy the gifts which enable them to push on beyond the difficulties of the language itself, so as to be in a position to imbibe and to enjoy something of the beauty of Greek poetry, drama, and philosophy, is, and must always remain, relatively small; while the forcing of hundreds of young men to undergo the drudgery of getting up an imperfect knowledge of Greek grammar and some small portion of a Greek author is deliberately to create a crowd of people who in after life hate and despise the system which has compelled them to waste so much time.

Dr. Leaf made a mistake in his reference to what he described as the present tendency to exalt materialistic science. Everyone knows that the circumstances of the time compel a concentration of attention on inventions which have arisen out of scientific discovery, and to the unthinking the production of dyes and explosives, of big guns and aeroplanes, may appear to be the chief aim and purpose of scientific research. But this is not all that science has to offer, nor is it the purpose towards which instruction in scientific principles, methods, and results as an element in a liberal education should be directed. Such products of scientific activity belong mainly to the technical school and the workshop, and though a good deal of illumination for the mind may be derived from a study of such things, the primary purpose in the use of physical science in education is in training the powers of observation, the application of the inductive method to the results and the acquisition of such a knowledge of the external world as is necessary to the intellectual life of the modern civilised man. Surely no man brought up under the classical system at school and university can pretend that he is indifferent to the discoveries in electricity, chemistry, and biology in the last half-century. Present knowledge about the constitution of the chemical elements and the application of the principles of evolution have so changed all ideas about the world in which we live and the nature of man himself that such changes can be ignored by no one who claims to be called an educated man.

It may be asked whether it would not be an advantage even to the classical scholar that he should be in a position not only to learn from the newspapers that discoveries have been made, but also to understand something of the nature of the evidence on which they are assumed to be established. It appears, however, that there are people who still think otherwise, and, as governors of schools and universities or Civil Service Commissioners, do not hesitate to place all kinds of obstacles in the way of the new learning and to draw or drive away from the fields of science many of the best brains in the country. Protests have already been raised over and over again at meetings of the British Association, at the British Science Guild, in addresses by presidents of the Royal Society, and at the gathering organised by the Neglect of Science Committee in May last. A fresh and vigorous denunciation of this kind of obstruction was uttered by Prof. Soddy in November last at a meeting of the University Scientific Society at Aberdeen. His subject was "The Future of Science and What Bars the Way," and he began by addressing himself to the consideration of the latter question because he believes that active opposition has still to be overcome before science can take its rightful place in the Scottish universities. He repeats with emphasis what has been asserted already often enough, namely, that some of the older institutions have lost whatever capacity they may once have had for intellectual leadership, and by the inherent qualities of their system they perpetuate a type of man who is out of harmony with the present age, who remains in a world of medieval obscurantism, and is an obstacle in the way of future national reconstruction. A claim is set up for the older studies to an elevating spiritual influence which the present state of the world shows to have failed. In the meantime science has put at the disposal of man physical powers which, in the hands of the barbarian uninfluenced by the humanist, threaten to wreck the world.

The conservatism and exclusiveness of which Prof. Soddy complains are not confined to the Scottish universities. They pervade the schools throughout the kingdom, dominated as most of them are by the classical stronghold of Oxford; and in the public service of the country the statesman, the headmaster, and the divine remain largely blind and deaf to the signs and warnings of the time. They claim not merely to preserve a sanctuary for the memory of departed glories, but their decadent humanism continues to monopolise the avenues to preferment, to positions of influence, opportunity, and honour.

But what will be likely in the address to attract most attention in Aberdeen, and perhaps elsewhere, is the charge which is brought against the University Court of financial jugglery to the disadvantage of science and medicine. Mr. Carnegie in 1901 gave two millions sterling to the Scottish universities for the purposes of scientific study and research as well as payment of the fees of deserving students. Prof. Soddy asserts that owing to the form in which the accounts are pub-

lished, it becomes possible to divert the money to a large extent from the objects for which it was intended, and that this operation has been applied to the departments of chemistry and geology. Obviously these are matters which will have to be looked into.

In the conflict which is going on there can be no doubt that, assisted as it is by the prominence of the many practical problems, of which the dyes are the most notorious example, science will utimately win the day. The purely classical people will have to give way, and there is evidence that all over the country some progress has been made in the quality of the science teaching in the schools. It is to be hoped that in the triumph of the practical the interests of the liberal will be duly safeguarded. We can no more afford to let go ancient literature and history than modern physics and chemistry. All that the representatives of science ask for is that the new may be admitted to an equal place alongside the old, where both may stand in mutual honour and esteem.

The indifference to the value of science appears to be almost attributable to a natural conservatism inherent in the British character. It certainly has pervaded a large part of the business world up to quite recent times, when the pressure of war-work has served as a wholesome stimulant. The newspapers are full of discussions as to what is to happen when the war ceases, but for the most part they have rather a specialist character. A series of articles appeared in the *Times* of July and August last in which "The Elements of Reconstruction," in reference to the Empire, were discussed in an unusually broad and thoughtful spirit. They have been reprinted with an introduction by Lord Milner,[1] and both articles and introduction deserve to be read carefully and digested by all thoughtful men. The keynote of the whole may be said to be *co-operation*. This means that, in the view of the writers, the methods of business will have to be changed completely; there must be among manufacturers mutual support and confidence instead of suspicion and rivalry; and in the interests of the State many small businesses in competition with one another must be united. There must be national scientific education, and the men who control the industries must be fully qualified by education, liberal as well as special, not only to understand fully their own processes, but to deal in an enlightened spirit with all the problems connected with labour.

Whether the doctrine that food production, fuel, and transport are not to be left under the control of private ownership, but transferred to public administration, will within our time be put into practical operation is a question. The author's opinion is that such a development can be realised, not by the Socialist panacea of "expropriation," but "by amalgamation, by co-ordination and co-operation, by bringing the State into partnership, and an increasing partnership, in the big businesses that result from these amalgamations, by developing the crude beginnings of the 'controlled establishment,' by the *quid pro quo* of profit-sharing and control in the national interest in exchange for the national credit and a helpful tariff."

Labour and trade-unions provide another text which needs much careful thought. A temper must be cultivated free from class hostility and the use of aggressive phraseology. The war has doubtless done some little to clear away jealousy and suspicion between employer and employed, to so large an extent the fruit of traditional misunderstandings. "The efficacy of ignorance," to use an expression of Dr. Johnson's, has been tried long enough, and that is why at the outset the prime importance of education was assumed. It is interesting to notice that in the opinion of the authors of "Eclipse or Empire?" reviewed in NATURE of November 9, the falling-off which they claim to have observed in inventions is due to our defective system of education. Here there are evidently two distinct propositions, of which the former is open to question. If the former is established, there will not be much difficulty in accepting the latter.

The lack of clear thinking is one of the evil influences of the past, and as labour continues to make its voice heard, sometimes above other voices, it is imperatively necessary that the broadening of the higher education in school and university shall be accompanied by a lengthening and deepening of the course in the elementary schools.

[1] Nisbet and Co., Ltd. 1s. net.

ACCESSORY FACTORS, OR "VITAMINES," IN DIET.

IT was known to Captain Cook that fresh food, especially green vegetables, contained something which was absent from the preserved food used by him in his voyages, but was necessary to maintain health. Stepp showed, a few years ago, that bread and milk, if extracted with alcohol, did not suffice for the growth of rats, but that addition of the residue from the alcohol extract restored the adequacy of the diet. Hopkins then found that rats are unable to grow on a diet, otherwise complete, composed only of pure protein, fat, carbohydrate and salts, although this diet can be rendered perfectly adequate by the addition of a minute amount of milk. Further research by Osborne and Mendel and others in the United States confirmed these results.

There are, therefore, certain necessary constituents of food the presence of which is not obvious to chemical examination, owing to the very small amount contained. For these substances the name "vitamines" was suggested by Funk, on the basis of chemical work which was afterwards found by him to be incorrect. Unfortunately the word has come into use. Since we are, as yet, ignorant of their chemical nature, which is probably of several kinds, it is preferable to use the longer name, "accessory factors."

An interesting account of some of the aspects of the problem, especially those of practical interest,

was given in a lecture by Prof. Carl Voegtlin to the Washington Academy of Sciences, and published in the Journal of the Academy for October 4. After directing attention to such diseases as scurvy and beri-beri, due to deficiency in certain constituents of food, Prof. Voegtlin discussed the chemical nature of "vitamines." They are somewhat readily destroyed by temperatures above 100° C., especially in alkaline reaction. The acidity of lime-juice thus preserves the anti-scorbutic properties of the fresh fruit. They are removed from solution by adsorption on the surfaces of various inert powders, such as kaolin, charcoal, and mastic, a property which will probably be of value in obtaining them in a concentrated form. The lecturer makes a slip, however, when he states that it is necessary that a substance should be in the colloidal state in order that it may be adsorbed. It is merely necessary that its deposition shall reduce the surface energy of the adsorbent; amyl alcohol, for example, is largely adsorbed by powders. According to McCollum there are two kinds of accessory factors which it is necessary to add to polished rice in order to make it effective for growth, neither being sufficient alone. One of these is contained in butter, the other in wheat germ; this latter appears to be insoluble in fat, although soluble in alcohol and in water.

Vitamines are not manufactured by the animal organism, but they do not readily disappear from it when once supplied. It seems that they do not suffer loss by chemical change. This fact suggests that their action is of a catalytic nature, somewhat like that of traces of zinc in the growth of Aspergillus, shown by Raulin. Or they may be related to the hormones of internal secretion.

The remainder of the address is devoted to the consideration of the relative content of various foodstuffs in these substances. It is pointed out that ordinary mixed diets contain a liberal supply, but that tinned foods may be deficient. An exclusive diet of highly prepared cereals, such as polished rice, is dangerous. Owing to the value of fresh vegetables in this respect, we may note the importance of not restricting the import of such fruit as oranges, which are apt to be the only vegetable consumed in the poorer districts of London.

It appears that, although phosphorus is not known to be a constituent of vitamines, yet a fairly accurate index of the vitamine content of cereals may be given by their phosphorus content. With regard to bread, attention is directed to the use of sodium bicarbonate in its manufacture. This is converted on baking into the carbonate, and the resulting alkalinity tends to destroy the vitamines. If acid substances, such as butter-milk or cream of tartar, are also added, the effect is obviated.

Owing to the small quantities of these essential factors which are present in foods, the difficulty of investigation is great. But the problem is being attacked by many workers and valuable results are being obtained.

W. M. BAYLISS.

SIR E. B. TYLOR, F.R.S.

AFTER a period of twilight of seven or eight years and a few days' illness, Emeritus Prof. Sir E. B. Tylor peacefully passed away on the night of January 2, and with his death closes a memorable chapter in the history of anthropology in England.

Edward Burnett Tylor was born at Camberwell on October 2, 1832, and was educated at Grove House School, Tottenham, belonging to the Society of Friends. At an early age he entered his father's business, but his health soon broke down, and he travelled abroad for several years. In 1856 he visited Mexico in company with the ethnologist, Henry Christy, who doubtless stimulated his interest in ethnology. The observations made during this tour were published in his first book, "Anahuac; or, Mexico and the Mexicans" (1861). Thenceforth he led the strenuous, uneventful life of a student. In 1858 he married Miss Anna Fox, of Wellington, with which town he was closely associated until the day of his death.

Tylor never had a university training, but several universities honoured themselves by conferring on him an honorary degree. For many years he was keeper of the University Museum at Oxford, and he took great delight in and did much to improve the Pitt Rivers Museum. He was reader in anthropology in the University of Oxford from 1884 to 1895, when a professorship of anthropology was instituted for him; he became emeritus professor at the close of 1909. The Royal Society elected him to a fellowship in 1871. He had the distinction of being invited to be the first lecturer under the Gifford Trust at Aberdeen, but his lectures, given in 1889–91, have, unfortunately, never been published. The honour of knighthood was conferred on him in 1912. Many other distinctions by learned societies marked the high appreciation in which he was universally held. Tylor was a tall man of imposing appearance, and his friendly, modest courtesy will never be forgotten by those who had the privilege of knowing him.

The publication of his masterly work, "Researches into the Early History of Mankind and the Development of Civilization" (1865), at once brought Tylor to the forefront as an ethnologist. In some respects it was pioneer work, as in it he assembled multitudinous facts culled from a wide range of reading, and so grouped them as to bring out new conclusions. His reputation as a thinker and as an exponent of "ye beastlie devices of ye heathen" was further enhanced by the publication in 1871 of "Primitive Culture: Researches into the Development of Mythology, Philosophy, Religion, Language, Art, and Custom" (2 vols.). His great erudition was presented with such a charming literary style and flashes of quiet humour that the book was read with delight by people of very varied interests. It speedily became a "classic," and such it will always remain. As Andrew Lang said in the "Anthropological Essays presented

to Edward Burnett Tylor in honour of his 75th Birthday, October 2, 1907": "The extent of his reading, his critical acumen, his accuracy, his power of exposition, his open mind, and his scientific caution make this book no passing essay, but a possession for ever."

Ten years later Tylor published a most excellent little book, "Anthropology: an Introduction to the Study of Man and Civilization" (1881), which still remains a valuable and suggestive guide for those who desire to know the significance of what Max Müller termed "Mr. Tylor's science."

On looking through the compendious bibliography of Tylor from 1861 to 1907 compiled by Miss Freire-Marreco for the above-mentioned Essays, it is obvious that, apart from his four books, his activity largely manifested itself in lectures, reviews, and addresses. His papers, even when descriptive, were always marked by a breadth of view and an endeavour to drive home the lessons to be garnered from the facts. The most important of these papers is that "On a Method of Investigating the Development of Institutions, applied to Laws of Marriage and Descent," in which it was his "aim to show that the development of institutions may be investigated on a basis of tabulation and classification." In order to indicate the wide range of his studies, the following are some of the subjects of his papers: Games, Australian marriage laws, the origin of the plough and wheel-carriage, the Asiatic relations of Polynesian culture, the winged figures of the Assyrian and other ancient monuments, charms and amulets, the Tasmanians as representatives of Palæolithic man, and totemism. Indeed, there were few aspects of anthropology which he had not investigated, and he enriched all those with which he dealt.

Although Tylor illustrated his theses with a wealth of references, he never permitted himself to be swamped by them. He will always be regarded as the first and foremost exponent of the comparative method in this country, and though, as was natural for a contemporary of Darwin and Huxley, he was imbued with the principle of development, yet he was fully alive to the borrowing of culture and to cultural drifts; thus, ever since 1874 he repeatedly drew attention to the direct cultural influence of Asia on the higher civilisations of the New World and the spread thence of certain elements of that culture among more barbarous tribes. Tylor was always interested in method, and it was mainly by his efforts in this direction that ethnology can now claim to be a science. A. C. HADDON.

CAPT. F. C. SELOUS.

THE late Capt. Frederick Courteney Selous, whose death in action against the remaining German forces in East Africa has just come as a painful shock to his many friends in the two hemispheres, was born in London on the last day of 1851. His surname—pronounced in the French manner—indicated his French ancestry on the father's side, but his main composition was English and Scottish, and his appearance almost Scandinavian in his blondness and his Nordic violet eyes—perhaps the most striking feature in a very charming face. As a young man he was exceedingly good-looking, and always reminded me—after I had been to South Africa—of a not uncommon type of Boer (which, indeed, is a very common type in Holland), similarly blond and with the like violet-grey eyes. I first met him in the early 'eighties at the house of his near relatives, the Garrods, of Harley Street. The great comparative anatomist, Alfred Garrod, was his cousin, and similarly of Huguenot-French origin.

Selous was educated first at Rugby and afterwards in French Switzerland and in Rhenish Germany, so that he entered on his African explorations with a well-filled mind and a trained power of observation. I rather fancy his decided bent for natural history and the pursuit of big game must have arisen from his Garrod connections and the consequent deep interest he took in the Zoological Gardens (Prof. Garrod was prosector there).

He was an African pioneer of the very best type. Always a total abstainer, there was never anything rowdy about him, yet he won the respect and frank liking of the roughest types of men of all races. He was greatly esteemed in the United States. Only three days before the announcement of his death I received a note from the secretary of the New York Zoological Society, recounting a talk with Prof. H. F. Osborn and Colonel Roosevelt about the war, winding up with the question: "*Have* you any news about Selous? We are all so anxious about him."

Selous was not a systematist in zoology, but he was a close and accurate observer of the life-habits of birds and beasts, and in his branch of natural history he contributed much valuable lore to science. If all his contributions were removed from the galleries and drawers of the British Museum, our examples of the African fauna—especially its spectacular fauna—would indeed be poor. Moreover, he added very greatly to our knowledge of birds' eggs, especially the eggs and nests of Palæarctic (and Mediterranean) birds.

His loss will be a source of grief to many, not only here and in the United States, but also in Africa. I should think he was one of those few notable and active men who never made an enemy, not even when he took a strong, almost vehement, line in the matter of the protection of birds from the ravages of the plumage trade, on which subject he made terse and most effective speeches.

H. H. JOHNSTON.

NOTES.

THE question of closer co-ordination between scientific research and practical design in aeronautics has been mentioned more than once in these columns, and it now appears that such co-ordination will be one of the good results following the reorganisation of the Air Board. The inclusion of two representatives of the Ministry of Munitions and of a technical director

should ensure the full use of the available scientific data in the design of machines, especially as the name of Dr. T. E. Stanton has been mentioned in connection with the latter appointment. As is well known, Dr. Stanton has been superintendent of the engineering and aeronautical departments of the National Physical Laboratory for many years, and is therefore in possession of all the necessary scientific knowledge in both the aerodynamical and purely engineering branches of the subject. The proposed housing of the various departments of the Board under one roof, and consequent free exchange of ideas between technical experts of both Services, should do much to advance the scientific design of machines. Another excellent feature of the reorganisation is the possibility of standardising component parts of machines and engines for both Services, and thereby improving the rapidity of construction. If we are to maintain our air supremacy, it is necessary that we should have an ample supply of machines of existing proved types, as well as that we should proceed to new designs, and the centralisation of supply and design should assure both these necessities in the future.

In a series of recommendations made by the Federation of British Industries for the development of Government service for the promotion of British trade in foreign countries, it is suggested that foreign trade should be under a single department operating under Foreign Affairs. The proposed department would undertake the promotion and protection of British trade in foreign countries and the collection and distribution of information relating thereto, support British efforts to secure contracts abroad, and, when possible, make it a condition that goods purchased by loans to foreign countries should be obtained mainly from British sources. Similar functions in regard to Home and Colonial trade should be discharged by the Board of Trade, a Ministry of Commerce, or other appropriate department. With respect to the Diplomatic Service, it is suggested that the staff should be increased with the view of enabling officials to pay more attention to commercial affairs, and that an officer of high rank designated Commercial Counsellor with appropriate assistance should be added. Suggestions are also made for the improved remuneration and training of the members of the Consular Service, promotion to be by merit under the supervision of a Promotions Board. Candidates for the service should be required to pass a general course in economics and commercial methods, and should be conversant with two or more foreign languages. Facilities for such training should be provided at the universities. Officers should also be granted facilities to visit the leading industrial centres at frequent intervals. A staff of experts is also needed to procure detailed information on particular trades, industries, and markets. Finally, the urgency of this reform is pointed out. Steps should be taken immediately in order to be prepared for conditions after the cessation of war.

"Microbes and the War," with comments on the national neglect of natural science, is the title of a pamphlet by Prof. Ernest Glynn, of the University of Liverpool. The author first describes, in popular language, the various microbial diseases which attack armies in the field, and comments on the measures that have been taken to combat them, which are the outcome of scientific research as to their nature and prevention. Notable instances of these are typhoid fever and anti-typhoid inoculation, cholera and anti-cholera inoculation, Mediterranean fever and its spread by goats' milk, and, among animals, glanders and its recognition by the mallein test. By an appreciation of the vast importance of bacteriological science in the present war, our armies "have won great, though silent and bloodless, victories." Prof. Glynn then proceeds to discuss the general neglect of science by the nation and its disastrous consequences in the present war—our dependence upon the foreigner for dyes, chemicals and synthetic drugs, glassware and optical glass, for example. A Cabinet Minister excused the importation of fat into Germany by the statement that it had only *recently* been discovered that glycerin could be obtained from lard; Woolwich Arsenal advertised for university-trained research chemists at wages of 2*l.* 0*s.* 6*d.* per week! Prof. Glynn ascribes the national neglect of science as being largely due to the dominance of vested interests in classics. At Eton, of eighty assistant-masters but five teach science, and the same disproportion holds good for the majority of public schools. The argument is supported by quotations from numerous sources that have appeared during the last two years. The pamphlet is issued by Messrs. Tinling and Co. at the modest price of 3*d.*, and should be widely circulated.

The death is announced, at eighty-nine years of age, of M. J. B. A. Chauveau, member of the section of rural economy of the Paris Academy of Sciences.

Prof. W. Kolle, of the Institute of Hygiene and Bacteriology at Berne, has been appointed successor to Prof. Paul Ehrlich in the directorship of the Frankfort Institute for Experimental Therapy.

The Order of the Nile, Second Class, has been conferred by the Sultan of Egypt upon Mr. S. H. Wells, Director-General of the Department of Technical, Industrial, and Commercial Education in Egypt, and formerly principal of the Battersea Polytechnic.

Mr. F. A. Stockdale, Director of Agriculture, Mauritius, has been appointed by the Secretary of State for the Colonies Director of Agriculture, Ceylon, and Dr. H. A. Tempany, Government Chemist and Superintendent of Agriculture for the Leeward Islands, has been appointed to succeed Mr. F. A. Stockdale as Director of Agriculture, Mauritius.

Close upon the news of the depredations of the blister rust in the American white-pine forests comes a report from the Department of Agriculture directing attention to the fact that the poplars of the United States are seriously threatened by an outbreak of the European poplar-canker. The States affected include New Hampshire, Massachusetts, Rhode Island, Connecticut, New Jersey, Pennsylvania, Delaware, Maryland, Ohio, and Nebraska. The disease attacks the twigs, limbs, and trunks of the black and Lombardy poplars, and of the Carolina poplars or cottonwoods.

Dr. Frank M. Chapman, curator of ornithology at the American Museum of Natural History, New York, has recently returned from a journey taken largely in order to establish friendly relations with the museums of South America. He has arranged with the directors of several of these museums for regular exchanges of specimens. Many of the directors have also consented to act as local representatives of the New York institution, and to give assistance in the work of exploration. Dr. Ribero, for instance, at Rio de Janeiro, helped Dr. Chapman's party to find favourable spots for collecting in the mountains near that city. Dr. Chapman's report on Colombia is already in type, and reports are in preparation respecting the exploration of Ecuador, Peru, and Bolivia. It is hoped that there may eventually be completed—though not, perhaps, for several generations—a biological survey of the whole of South America, for which the American Museum of Natural History, with the co-operation of the local museums, will be responsible.

AT the annual general meeting of the Faraday Society held on December 18, 1916, the following officers and council were elected:—*President*, Sir Robert Hadfield; *Vice-Presidents*, Prof. K. Birkeland, W. R. Bousfield, Prof. F. G. Donnan, Dr. Eugene Haanel, Prof. A. K. Huntington, and Dr. T. Martin Lowry; *Treasurer*, Dr. F. Mollwo Perkin; *Council*, W. R. Cooper, Dr. C. H. Desch, Dr. J. A. Harker, Emil Hatschek, Cosmo Johns, Prof. A. W. Porter, E. H. Rayner, A. Gordon Salamon, Dr. George Senter, and Cav. Magg. E. Stassano. A general discussion, to be opened by Sir George Beilby, F.R.S., will shortly be held on "The Training and Work of the Chemical Engineer." Later in the session general discussions will probably be arranged to deal with "Osmotic Pressure" and "The Setting of Cements and Plasters."

DR. J. WALTER TEWKES has issued a pamphlet reporting the progress made in the excavation and repair of the Sun Temple at Mesa Verde National Park. The monument was discovered by Dr. Tewkes in 1909, and since then work has steadily gone on in order to excavate and repair this interesting building. The pamphlet issued by Dr. Tewkes contains a full account of the building, with a ground plan, measurements, and photographs, which make it now possible to understand the character and purpose of this remarkable structure.

UNDER the title, "Some Forest Insects in Aberdeenshire," Mr. Walter Ritchie, in the *Scottish Naturalist* for December, cites a remarkable case of a beetle which, in different areas of its range, selects different food-plants, though there is no apparent need for this change in diet. The species in question is *Cryptorhynchus Lapathi*, which, in Central Europe, is a destructive enemy of the alder, but on the Dee, near Aboyne, it feeds on the willow. Though alder trees of various ages were growing in abundance among the willows not a single alder was attacked.

"THE Evolution of Provincial Museums and the Obstacles They Have to Surmount" formed the subject of an admirable address by Mr. F. Woolnough at the Ipswich Conference of the Museums Association of 1916. He complains much, in the *Museum Journal* for December, wherein this address is printed, of the lack of interest taken by the State in the work of museums, hence the want of funds and the restricted usefulness of such institutions. Every museum, he contends, should be provided with a well-equipped lecture-room, wherein the various aspects of this or that section of the collections can be enlarged upon before or after a visit to the actual specimens in the galleries. This provision is not likely to be made in the immediate future, having regard to our depleted exchequer, but nevertheless it is sadly needed.

WE note with regret that the Bill for the introduction of protective measures designed to save some of the more interesting birds of Malta from extermination has been shelved, at least temporarily, as the result of an opposition which depended for success on ability to distort facts, in the supposed interests of local sportsmen and those who gain an easy living by exploiting the bird-life of the island. From the report of the debate in the *Daily Malta Chronicle*, which has been sent us, we learn that the Lieutenant-Governor and the Crown Advocate paid a just tribute to the efforts of Dr. Giuseppe Despott to place this Bill upon the Statute-book. Though the Crown Advocate, in the course of an able and learned speech, showed that the leader of the Opposition was himself but recently urging the very measures he now so strongly opposed, and though he directed a running fire of scathing criticism against the manifold absurdities of the arguments advanced, the Bill was suspended for six months in order that further evidence might be obtained. In the interests of the islanders themselves and of economic ornithology beyond the sphere of operations of this Bill, it is to be hoped that it will presently find a place on the Statute-book.

WITH the November number of the *Quarterly Journal of Microscopical Science* (vol. lxii., part 1) is issued an Index to vols. xxix.–lxi. (inclusive). The preface is signed by Mrs. H. L. M. Pixell-Goodrich, who is presumably responsible for its compilation on the plan adopted by Dr. G. H. Fowler for the index to vols. i.–xxviii. It is an index of both authors and subjects, and will be an invaluable aid to zoologists, who have so frequently to consult this important periodical. Incidentally, also, it constitutes a very interesting record of contributions made, chiefly by British zoologists, to what we may perhaps be allowed to term the more academic branches of zoological science during the past twenty-eight years, a record with which the editor of the journal, Sir E. Ray Lankester, has every reason to be satisfied.

THE caterpillars of that destructive insect, the large larch saw-fly, *Nematus erichsonii*, have been found, and for the first time, in Aberdeenshire. They were met with in considerable numbers during the months of August and September by Mr. Walter Ritchie, who gives a brief account of his discovery in the *Scottish Naturalist* for December, 1916. He found that the area over which these caterpillars were dispersed measured about eight square miles, and this being so, it is well that the discovery has been made now, in order that immediate steps may be taken to check or suppress its extension. The damage, he remarks, caused by this species in England led to its being placed among the insects scheduled under the Destructive Insect Pests Order. By this Order the presence of the insect in any plantation must be reported at once to the Board of Agriculture.

A FURTHER important contribution to the science of animal nutrition in its application to farm animals is furnished by Armsby, Fries, and Braman in their determinations of the net energy values for cattle of red clover hay and maize meal, which are recorded in vol. vii., No. 9, of the *Journal of Agricultural Research*. Results in close agreement with previous determinations were obtained, the general average indicating a net energy value per kilogram of dry matter consumed of 981 Cal. in the case of clover hay, and 1913 Cal. for maize, the total metabolisable energy being 3522 Cal. and 3755 Cal. respectively.

FOR the guidance of farmers the Board of Agriculture has issued a leaflet (Special Leaflet No. 64) on ground-nut cake, a feeding-stuff to which much attention has been given since the outbreak of war. As an important product of British tropical possessions the ground-nut (*Arachis hypogaea*) has an obvious interest, and in view of the high value of its oil for edible purposes and the richness in protein (45 to 50 per cent.) of the press residue, or cake, all efforts to secure its wider use in this country are warmly to be commended. As in the case of palm kernels, the successful development of the industry is largely dependent upon the creation and maintenance of a large and stable home market for the cake, and the Board's leaflet should contribute usefully towards this end.

THE general concern about rising food prices lends a wider interest than it would normally claim to the recently issued Report on Prices and Supplies of Corn, Live Stock, and other Agricultural Produce in England and Wales in 1915 (Agricultural Statistics, 1915, vol. I., part iii.), presented to the Board of Agriculture and

Fisheries by Sir R. H. Rew in October last. Basing his comparison upon the average for the three years 1906–8, he arrives at the general index number of 138 for the year 1915, as compared with 111 in 1914. As compared with the latter year, the greatest increases were in wool (190 as against 133), barley (166 as against 113), and hops (140 as against 92). As compared with the average prices of 1906–8, the highest levels were attained by wool (190), barley (166), and oats (163). A notable exception to the general high rate of increase was fruit, which was only 5 per cent. above the standard selected.

THE cereal harvests of Argentina and Australia are now sufficiently advanced to enable the International Institute of Agriculture to issue from Rome its annual survey of the world's supply of cereals available until next year's harvest. From this survey the crops of enemy countries are necessarily excluded, but otherwise all significant grain-producing countries are included. In the case of wheat, the estimate shows a decline of no less than 25·3 per cent. from last year's figure, or 8·8 per cent. below the average for the period 1909–13. An important factor in this decline is the lamentable decrease in the Argentine crop, which is estimated at little more than one-half (52 per cent.) of the average for the above period. In marked contrast the Australian crop is estimated to be 4 per cent. higher than last year, and 64 per cent. above the five-year average. For sixteen countries in the northern hemisphere the crop harvested is 9·1 per cent. below the five-year average. Barley, oats, and rye show increases above the five-year average of 1·1, 2·3, and 12 per cent. respectively. For maize, data for the northern hemisphere only are yet available, and show a diminution of 5·3 per cent. below the five-year average. In every case the contrast with the excellent crops of 1915 is very marked.

AT a recent meeting of the National Academy of Sciences, Washington, U.S.A., Prof. W. M. Davis brought forward a proposal for the exploration of the North Pacific Ocean. Some details of the scheme are given in *La Nature* for December 16. Prof. Davis's proposal entails a thorough exploration of vast areas of the ocean in which there are at present few, if any, soundings, not by a single ship, even on the scale of the *Challenger* Expedition, but by methodical, long-continued efforts, presumably by several vessels, and including work in oceanography, biology, geology, and meteorology, as well as in the anthropology of many little-known islands. He suggests that the United States should undertake the work and be responsible for its cost.

A MEMORIAL to Sir Francis Drake was erected last summer on the shores of Drake's Bay, on the coast of California. According to the *Geographical Review* for November, 1916 (vol. ii., No. 5), the memorial takes the form of a redwood post bearing a brass plate inscribed with the date of Drake's landing, June 17, 1579, and is, so far as practicable, a replica of the post set up by Drake himself before leaving the bay. The memorial was erected by the Sir Francis Drake Association, a body of persons interested in commemorating Drake's voyage as a milestone in the history of California. There seems to be little doubt that it was in the bay now named after him, and not in San Francisco Bay, that Drake landed in 1579 on his voyage from Panama.

AN article on the climate of Salonica which appears in the *Bolletino* of the Royal Italian Geographical Society for December (vol. v., No. 12) is of particular importance at present. The article is based on the data obtained from the two observatories founded in 1891 and 1893 respectively, and published in Vienna and Sofia. From the numerous tables which are given it would appear that in January, the coldest month, the mean temperature is 5·4° C., with an absolute minimum of −7·2° C.; July, the warmest month, has a mean of 26·6° C. The mean annual rainfall is 546 mm., with a marked maximum in late autumn and again in May. July, with a mean of 25 mm., appears to be the driest month. Snow falls on an average of six days in winter. The prevailing winds are south-westerly in summer and northerly in winter.

THE *Scientific American* for December 2, 1916, contains an illustrated article on the telescopic rifle-sight of the United States Army. The telescope is of the reflecting prism type, and magnifies six diameters. It is made as nearly as possible dust- and water-proof, and is furnished with a rubber eyepiece to protect the eye of the marksman from the recoil of the rifle. A dovetailed slot on the telescope slides on to a corresponding piece on the service rifle. When detached it is carried in a leather pouch. In sighting, the object is brought on to the point of intersection of the cross lines of the telescope, which is adjusted for ranges up to 3000 yards by means of a milled and graduated screw-head on the left-hand side, and for direction by a smaller screw-head. As in the case of the majority of soldiers the accuracy of sighting with the ordinary sight exceeds the ability to hold the rifle steady enough to secure a hit, it is not intended to issue a telescope sight to every soldier, but only to those who have shown by their skill as marksmen that they have the requisite steadiness of aim to profit by it.

BULLETIN No. 147 of the Institution of Mining and Metallurgy contains an account of a discussion on standardisation and the metric system at a recent meeting of the institution. The desirability of employing discretion in the adoption of the principle of standardisation was insisted upon, and it was pointed out that the articles in which standardisation had been successfully achieved by the Engineering Standards Committee are, in general, parts common to all kinds of machinery, such as nuts, bolt-heads, and wires, and not of a complicated character. In the case of plant that cannot be standardised down to details it may be possible to lay down the broad outlines, such as leading dimensions, speeds, and powers. As examples of mining plant which can be standardised completely were instanced the Californian stamp, amalgamating plates, rock crushers, iron or steel trams for underground use, tramway gauges, skips and skip-ways. An important question is whether standardisation should be adopted in terms of our present system of weights and measures, or in terms of the metric system. As regards universality, the metric system has a particular claim to consideration, as it is a system which is continually obtaining official recognition in other countries, while our own system is not. In the immediate future competition in trade will be more strenuous than it has ever been before, and in adhering to our present weights and measures we shall be seriously handicapped; it is therefore necessary to decide at once whether the question of internal convenience shall continue to override all other considerations. There is no doubt that the adoption of the metric system in this country is inevitable sooner or later, and the present time appears to be exceptionally suitable for introducing the reform.

MR. H. C. BRILL is the author of two papers of considerable biochemical interest in the March number of the *Philippine Journal of Science* (*Section A.*). The first deals with the so-called

"false" chaulmoogra oil, which is expressed from the seeds of *Hydnocarpus venenata*, Gaertner. Considerable uncertainty exists as to the origin of true chaulmoogra oil, but it is probably obtained from the seeds of *Taraktogenos kurzii*, King. Since the latter oil is admittedly the most promising remedy for the treatment of leprosy, it is highly important to determine whether oils from the seeds of other plants of the same family, such as *H. venenata*, can be substituted for it, thus largely increasing the quantity of the remedy available. The author finds that the oils from *T. kurzii*, *H. wightiana*, *H. anthelminticus*, and *H. venenata* are chemically similar, but differ from the oil of *Gynocardia odorata*. It is therefore to be expected that the physiological action of the former oils would be similar, and the outcome of the author's further work on their physiological properties will be awaited with interest. The second paper establishes the fact that certain edible beans, particularly varieties of the soy bean, contain a substance which, like the "maltol" discovered by Brand in caramel malt, gives a reaction with ferric chloride similar to that given by salicylic acid. Of thirty-two varieties of Japanese, Chinese, and American beans, eight breakfast foods, six coffee substitutes, and four flours, twenty-one of the bean samples, one breakfast food, and four of the coffee substitutes gave positive results when tested by the ferric chloride reaction; but only the four coffee substitutes gave positive results when tested by Jorissen's reaction. In testing for the presence of salicylic acid in beans, it is therefore advisable to use Jorissen's reagent.

MR. J. H. LAVENDER gives some interesting notes in *Engineering* for December 29 on the hardening of screw gauges. From a number of preliminary experiments on different brands of cast steel, one having a high percentage of manganese was selected. The reasons for this selection are as follows:—(*a*) The manganese content of the steel appeared to affect the volume changes in the steel; (*b*) this particular brand of steel could be quenched in oil, and a better surface finish obtained than from one quenched in water. The analysis of the steel gave the following percentages:—C, 0·96; Si, 0·19; Mn, 1·20; S, 0·03; P, 0·02. The furnace used for heating the gauges need not be of any particular kind, so long as the metal is not heated too rapidly and uniformity during heating is obtained. A small Richmond gas furnace is very suitable for the work. From the results given by the pyrometric curves, it was decided to harden gauges from a temperature of 749° C. Gauges quenched from this temperature are quite hard, and the temperature is sufficiently high to provide a fair margin for the hardener. Undue oxidation is prevented by providing a reducing atmosphere in the furnace by means of excess of gas, and by having the quenching tank as near as possible to the furnace. Gauges are tempered in oil at 260° C., sufficient time being given for obtaining uniform temperature throughout the metal. Whale oil is used for cooling purposes. The strain produced by sudden quenching is got rid of during the tempering process, and a trustworthy man, by following the procedure outlined, can produce work which comes within the National Physical Laboratory's requirements.

"THE Wellcome Photographic Exposure Record and Diary" for the new year is issued by Messrs. Burroughs Wellcome and Co., a little volume for the pocket that many photographers would be very sorry to be without. It includes, as in past years, not only what the title indicates, but many tables, formulæ, and other information that photographers need, and the well-known "Exposure Calculator" that has stood the test of many years. The formulæ are, of course, in terms of "tabloids," but as the content of each is given, the user of them knows what he is doing. The price of the diary is one shilling, and special editions are issued for the southern hemisphere and U.S.A.

AN early publication of the Cambridge University Press will be Dr. J. Y. Buchanan's "Comptes Rendus of Observation and Reasoning." It will contain, among others, the following papers:—Recent Antarctic exploration; chemical and physical notes; on ice and brines; on steam and brines; the size of the ice-grain in glaciers; ice and its natural history; Beobachtungen über die Einwirkung der Strahlung auf das Gletchereis; in and around the Morteratsch Glacier; a study in the natural history of ice; the use of the globe in the study of crystallography; on a solar calorimeter used in Egypt at the total solar eclipse in 1882; solar radiation; the total eclipse of August 30, 1905; eclipse predictions; the solar eclipse of April 17, 1912; the publication of scientific papers; the Royal Society; nomenclature and notation in calorimetry; thermometric scales for meteorological use; and the metrical system.

MESSRS. SOTHERAN'S new catalogue (No. 767) of second-hand books in zoology, including big-game hunting, and comprising many works relating to ornithology, should be seen by all in search of bargains in these branches of science, most of the works being priced at a great reduction. We note that the list directs attention to a complete set to 1912 of the Abstracts of the papers printed in the Philosophical Transactions and the Proceedings of the Royal Society; also of the Philosophical Transactions from 1665 to 1910. Messrs. Sotheran announce the continuation, by Mr. W. L. Sclater, of Shelley's "The Birds of Africa." It is hoped to complete the work by the publication of four or five additional volumes.

WE have received from Mr. Humphrey Milford a copy of the general catalogue of the Oxford University Press, issued in November last. It contains 574 pages describing the six sections—one of which is concerned with natural science and medicine—into which the catalogue is divided. An exhaustive alphabetical index of authors, editors, and some titles makes it easy to discover particulars of individual books. The section dealing with natural science runs to thirty-five pages, and describes works on the history and methods of the sciences and on the following, among other subjects:—Mathematics, physics and chemistry, astronomy, geology, biology, and medicine. The illustrations scattered throughout the different sections add to the attractiveness of the catalogue.

THE spring announcements of Messrs. Macmillan and Co., Ltd., include:—"A Text-Book of Thermo-Chemistry and Thermo-Dynamics," Prof. O. Sackur, translated and revised by Dr. G. E. Gibson; "Human Physiology," Prof. L. Luciani, translated by Frances A. Welby, with a preface by Prof. J. N. Langley, illustrated, in five vols., vol. iv., edited by Dr. G. M. Holmes; "Community: A Sociological Study, being an attempt to set out the Nature and Fundamental Laws of Social Life," Dr. R. M. Maciver; "The Origin and Development of the Moral Ideas," Dr. E. Westermarck, vol. ii., second edition; "The Economic Annals of the Nineteenth Century," the late Prof. W. Smart, vol. ii., 1821–1830; "Higher Education and the War," Prof. J. Burnet; "Highways and Byways in Wiltshire," E. Hutton, illustrated by Nelly Erichsen.

OUR ASTRONOMICAL COLUMN.

LARGE METEOR ON JANUARY 4.—This brilliant object was observed at about 10.20 p.m. at the Royal Observatory, Greenwich; by Mrs. F. Wilson, Totteridge; by the Rev. Canon Grensted, Liverpool; and by the Rev. H. C. Bender, Chelsea, S.W. As viewed from the metropolitan district the meteor traversed the region of Pisces, while, as seen from Liverpool, the path lay amongst the stars in the western part of Canis Major.

Mr. Denning writes us that the data already to hand indicate that the object was very low in the atmosphere, its height being approximately from forty-four to eighteen miles above the earth's surface from a point six miles E.N.E. of Salisbury to four miles S.E. of Tetbury. Had the meteor survived during another twenty-five miles of flight it would have fallen to the ground in the locality about ten miles S.E. of Ross, or twelve miles E. of Monmouth, and this may have actually occurred, though the descent was not observed. The fallen mass may, however, yet be discovered. In the case of the meteorite of October 13, 1914, though the light and detonation were noticed over a considerable area, the fall of the object was not witnessed, but it was accidentally discovered, embedded in the soil, on the following day.

EXTRA-FOCAL PHOTOMETRY.—Among the many methods employed in photographic photometry, the extra-focal method developed by Parkhurst has the great advantage that only a simple equipment is required. The plate being exposed in the camera beyond the focus, the resulting images have relative densities varying with the brightnesses of the stars, and, by means of a Hartmann microphotometer, these can be compared with artificial star discs of known relative magnitudes. At the Laws Observatory, University of Missouri, investigations of the method have lately been made by R. H. Baker and Edith E. Cummings, using a 5-in. photographic doublet, attached to a 7½-in. refractor as guiding telescope (Bulletin No. 24). The greatest known source of error is sky-fog, the effect of which is greatest for the fainter stars. This and other possible sources of error have been fully investigated, and means of overcoming them have been found. Tests of the accuracy attainable were made on eight plates containing double exposures of selected circumpolar regions, on which 196 stars were suitable for measurement. The star images ranged from 0·3 to 0·5 mm. in diameter, and it is shown that the advantage of such small images in reducing overlapping and exposure time does not involve any loss of accuracy. The probable error of a single observation was about one-twentieth of a magnitude, so that the extra-focal method compares favourably with other methods. Twelve eclipsing variables are under investigation.

HYDERABAD OBSERVATORY.—From the annual report of the director of the Nizamiah Observatory, Hyderabad, for the year ending October 5, 1916, we learn that, although serious inconveniences have been caused by the war, substantial progress has been made with the work for the Astrographic Catalogue. Besides the investigation of proper motions by measurement of plates taken at Oxford, Mr. Pocock reports that 134 plates were taken and measured during the year. In zone −17°, 143 plates, containing 56,302 stars, have now been completely reduced and the results partly printed, while in zone −18° copy for press has been prepared for 102 plates, containing 42,545 stars. Much work has also been done in connection with the magnitude scales of the various catalogues used in connection with the astrographic work.

EDUCATIONAL POSITION AND OUTLOOK.

AFTER-WAR problems dominated the various sectional meetings of the Conference of Educational Associations held last week, and the two schemes of reform suggested by the Education Reform Council and the Workers' Educational Association were frequently in evidence. Three main lines of thought could be noted. One took up the burden of the Master of Balliol's inaugural address in his insistence upon the need for an educated democracy. Thus Principal Maxwell Garnett, of the Manchester School of Technology, speaking on the vocational outlook before the Child Study Association, urged that primitively interest was aroused by things to be done; thus permanent neurographic records were formed, and from these neurograms interest systems were created which tended always to grow. Hence it was wise to develop a single wide interest and a power of concentrated attention, and such interest systems, developing in adolescence, if centred round one's vocation, would produce a body of workers who would be at once more effective and more contented. At the same time, there was need to reserve from all classes those who would become prophets and thinkers. This last was the note of Prof. Snelley's address before the Teachers' Guild; a healthy democracy must evolve an aristocracy whilst at the same time fostering the forces that would destroy it, and always there must be a selection of the most vigorous personalities who would express the ideals and aspirations of the age. This involved, as Principal Garnett also insisted, some other method than the crude intellectual test of selecting those who should proceed by scholarships to higher centres of learning. Prof. Gilbert Murray had pointed out at the previous meeting the corollary to this, that there should be secured to the youth of all classes the best education for which each was intellectually fitted.

A second main line of thought had to do with the classics-science controversy, with science in favour. Thus Sir Alfred Keogh, presiding at the Education Reform Council meeting, urged that the lack of knowledge of elementary facts of science and Nature shown by Ministers and administrators was a national misfortune, and that every boy destined for public life should have a very liberal education both in science and classics. The other side was given at the Association for the Reform of Latin Teaching, where, however, Dr. Rouse deplored the almost complete failure of the reformers to influence the teachers of classics. On the question of the teaching of science in secondary schools, an interesting point was raised by Prof. Nunn, in the discussion on women's work in boys' schools, before the Froebel Society. He thought that whilst the biological sciences were safe in their hands, the physical sciences were not. Such practical developments of mathematics and the physical sciences as engineering were nearer to men's interests, and if women were to treat these in any but an academic manner they must be brought into direct contact with such practical developments.

A third main line of thought was that of the position, prestige, and salaries of teachers. At no previous conference has this point been so frequently emphasised by chairmen and lecturers, and in reference to all grades and classes. Greater culture and efficiency and a wider training were constantly in demand, and to attract the right men and women to the profession a more generous recognition and remuneration were needed—and the teachers were not those who insisted; they only applauded.

The annual meeting of the Geographical Association was held at the London Day Training College on January 5–6, with Sir Thomas Holdich, president, in

the chair. The position of geography as the bridge subject between the humanistic and the purely scientific studies was well brought out in the papers and discussions. Mr. H. J. Mackinder, M.P., in opening a discussion on the resolutions drawn up by the Five Associations, quoted a statement issued by the council of the Geographical Association with regard to the teaching of geography. In this document the object of teaching geography in schools is said to be to train future citizens to imagine accurately the interaction of human activities and their topographical conditions. It is pointed out that as these conditions have been established partly by natural forces and partly by human effort, any discussion of the correlation of the various conditions must be both scientific and humanistic. The case is summed up thus:—"The unity of geography, for school purposes at any rate, is essentially humanistic, and on one side related closely to history, but the assembling of the physical data is a very important part of geographical teaching and cannot be left to the teacher of other subjects."

Two other papers brought out the relationships of geography, and at the same time curiously emphasised the fact that geography is a subject in itself. Prof. Fleure read a paper on "Regions in Human Geography," which was saturated with humanism, and was marked by a strong historical flavour, and yet was in no sense history. "Correlation of various conditions" within a region is essentially geography, whatever is or is not. "Though essentially humanistic" and "related to history," geography has a unity of its own. Prof. Nunn read a paper to a joint meeting of the association and the Mathematical Association on "Map Projections." The relationship of geography to science was taken for granted in the meeting, just as the joint meeting last year with the Historical Association took the humanistic relation for granted. What was perhaps more striking with regard to the paper was the different point of view of the geographer from that of the mathematician, even a most sympathetic mathematician, in regard to this almost purely mathematical subject. It was quite evident that while both geography and mathematics gain immensely by correlation, yet there is very distinct work for each. The danger of leaving projections for geographical work entirely to the mathematical teacher, or, indeed, for mathematical training to be left to the geographical teacher, was unmistakable. Again, to quote the statement, "the assembling of the physical data . . . cannot be left to the teachers of other subjects." The last sentence of the statement stands true: "Experience has shown that the art of geographical correlation depends on specially trained habits of thought."

The Mathematical Association held its annual meeting on January 5, under the presidency of Prof. Whitehead. After the business meeting—at which Prof. T. P. Nunn was elected president for 1917–18—Prof. Nunn read an important paper on "The School Course in Geometry," illustrated by many interesting models and practical devices. He urged that geometry should be closely connected with the facts of life and that the pupils should approach it through practical work of various kinds; that many topics which have hitherto been postponed to a late stage or omitted altogether—*e.g.* certain facts of solid geometry and the simpler properties of the conic sections—should be introduced at a comparatively early stage; and that the reasoning, while of a nature suitable to the stage reached, should throughout be careful and rigid. In this connection he distinguished three stages: the first that of simple intuitional reasoning in connection with direct experience; the second that of deductions based upon the assumption of certain fundamental truths; and the third that of constructing a system of geometrical truths on the smallest possible basis of assumptions.

The afternoon session opened with an inspiring address from Prof. Whitehead on "Technical Education." His main thesis was that a liberal education should in all cases be in close touch with the activities of life; and it should include in varying proportions the literary, scientific, and technical elements. These should be closely connected; technical education needs the enlightenment of science, intellectual education lacking some relation to handwork is barren, while the literary element supplies that wider contact with other life and thought which is essential to healthy mental life. Only so can we reach the ideal in which "work is play and play is life," and nothing but harm can come of the assumption that the practical world is one in which high ideals can have no place.

Later in the afternoon Mr. P. Abbott opened a discussion on "The Place of Mathematics in Educational Reconstruction," dealing chiefly with the mathematics suitable for continuation schools. Other speakers dealt with other aspects of the subject.

The twenty-fifth annual general meeting of the Incorporated Association of Headmasters was held at the Guildhall, London, on January 8. The Rev. J. R. Wynne-Edwards (Leeds Grammar School), in his presidential address, said that in science teaching in schools two chief objects are in view—first, the acquisition of facts that "every educated man ought to know," the laws of Nature, the constitution of our planet and its atmosphere, the chief properties of light, heat, and electricity, and their bearing on daily life; and secondly, the investigator's respect for truth, his determination to observe phenomena irrespective of preconceived ideas, and to reason on observed facts without being hampered by preconceived theories. Of these two objects the second is by far the more important. It is agreed that the time has come to improve our system of science teaching and to bring science to bear more fully on the problems of our daily life; but difficulties present themselves the solution of which will tax all the ingenuity of the nation. At present there is not an adequate supply of teachers, and it is absolutely essential that a solution of this difficulty should be found. Another difficulty is to adapt science teaching to the need of industry without taking away its power as an intellectual stimulus, and to persuade the manufacturers of the country that it is to their interest to have the very best advice that science can give them and to pay for it accordingly. One still hears of graduates serving in Government munition works as science experts at 2*l.* a week, which they are prepared to accept in their anxiety "to do their bit" for their country, while workmen in the same works may be earning their 5*l.* or 6*l.* per week. There are, however, signs of a change, and the great demand and very limited supply of expert science men is giving rise to abnormal conditions.

The following resolution was carried by 70 votes to 15:—"That it is of the highest importance to the welfare of this country that the decimal system of weights and measures be adopted, and that this association approves of the policy and aims of the Decimal Association, and invites its members to support the proposals."

PRIZE AWARDS OF THE PARIS ACADEMY OF SCIENCES FOR 1916.

MATHEMATICS.—The Grand Prize of the mathematical sciences. No memoir was received dealing with the question proposed, but a prize of 2000 francs was awarded to N. E. Nörlund, professor at the University of Lund, for his work on the linear equations

in finite differences. The Bordin prize, Georges Darmois and Bertrand Gambier each an honourable mention (1000 francs); the Poncelet prize to Charles de la Vallée Poussin, for the whole of his contributions to mathematics; the Francœur prize to (the late) René Eugène Gateaux, for his work on the functional calculus.

Mechanics.—The Montyon prize to E. Mérigeault, for his work on the theory of ventilators and centrifugal pumps and on internal-combustion motors. No memoir was received on the subject proposed for the Fourneyron prize. The H. de Parville prize to Leonardo Torres y Quevedo, for his researches on calculating machines and other mechanical inventions.

Astronomy.—The Lalande prize (increased to 1000 francs) to Jérôme Eugène Coggia, for his astronomical work as a whole; the Valz prize to Giovanni Boccardi, for his researches on the variation of latitude; the Janssen prize to MM. Ch. Fabry, Henri Buisson, and Henry Bourget, for their researches on the determination of the temperature, and evaluation of the atomic weights of the unknown gases in the nebula of Orion; the Pierre Guzman prize was not awarded.

Geography.—The Delalande-Guérineau prize to Sir Ernest Shackleton, for his explorations in the Antarctic continent; the Gay prize to Henri Vallot, for his topographical studies in the French Alps; the Tchihatchef prize was not awarded; the Binoux prize to Eugène Prévot, for his work in geodesy and topography.

Navigation.—The prize of 6000 francs between M. Marbec (3000 francs), for his rapid adaptation of the vessel *Gharb* as a water-carrier to Gallipoli, P. Dumanois (2000 francs), for his work relating to the installation of Diesel motors on submarines, and M. Le Matelot (1000 francs), for his practical method of determination of position near the coast; the Plumey prize (2000 francs) to Louis Barbillion, for his researches on governing motors used in connection with dynamos.

Physics.—The La Caze prize is not awarded; the Kastner-Boursault prize to (the late) Eric Gerard; the Hébert prize to Jules Lemoine, for his work on the optical effects of electricity; the Hughes prize to (the late) L. Chaumont, for his memoir on Kerr's phenomenon.

Chemistry.—The Montyon prize (unhealthy trades) to (the late) Alexandre Hébert, for his researches relating to the hygiene of workshops; honourable mentions (1500 francs each) to Charles Samuel Banzet, for his work on respiratory masks for use against noxious gases either at the front or in works, and to Paul Langlais, for his apparatus designed to protect workpeople against fumes at shell works; the Jecker prize to (the late) Paul Lemoult, for the whole of his chemical work; the La Caze prize is not awarded; the Cahours foundation: the arrears to (the late) Jacques Bongrand; the Houzeau prize to (the late) Edouard Bauer.

Mineralogy and Geology.—The Victor Raulin prize to J. de Lapparent, for his work on eruptive rocks.

Botany.—The Desmazières prize to F. Renault and J. Cardot, for their work on the mosses of Madagascar; the de Coincy prize to R. Souèges, for his researches on the embryogeny of the Ranunculaceæ and Cruciferæ; the Montagne and de la Fons Mélicocq prizes are not awarded.

Anatomy and Zoology.—The Cuvier prize to Edouard Chevreux, for his work on the Amphipods; the Savigny prize to Ed. Lamy, for his malacological studies; the Thore prize is not awarded.

Medicine and Surgery.—Montyon prizes to Octave Laurent (2500 francs), for the whole of his work in surgery; Edmond Sergent and Henri Foley (2500 francs), for their works on recurring fever; Maurice Letulle (2500 francs), for his book on pleuro-pulmonary tuberculosis; mentions to Jules Glover (1500 francs), R. J. Weissenbach (1500 francs), and Henri Stassano (1500 francs); the Barbier prize to G. Moussu, for his researches on the local reactions to tuberculin in domestic animals; the Bréant prize (arrears of interest) to J. Havet (2000 francs), for his work on the nervous system of invertebrates; Mme. Marie Phisalix (2000 francs), for her researches on the poison apparatus and poisons of lizards and snakes; Frédéric Bordas and S. Bruère (1000 francs), for their work on the accelerating action of farm manure on the rapid destruction of dead bodies; the Godard and Mège prizes are not awarded; the Bellion prize to (the late) Richard Millant, for his work on opium poisoning; the Baron Larrey prize to Dr. Lasnet, for his essay on the organisation and working of the medical service in Colonial expeditions, A. Tournade receiving a very honourable mention for his work entitled "The Organisation and Working of No. 13 Temporary Hospital of Verdun."

Physiology.—The Montyon prize to M. Couvreur, for the whole of his work in experimental physiology; the Lallemand prize, divided equally between Aldo Massaglia, for his researches on glycosuria, and L. Launoy, for his work on the thyroid, parathyroid, and thymus glands; the La Caze prize is not awarded; the Pourat prize to MM. Mayer and Schaeffer, for their contributions to the physico-chemical properties of the cell and its tissues; the Martin-Damourette prize is not awarded; the Philipeaux prize to Antoine Magnan, for the whole of his work relating to the influences of the medium, movement, and feeding on organisms.

Statistics.—The Montyon prize to Charles Perrier, for his memoir on the criminal skull.

History and Philosophy of Science.—The Binoux prize between Joaquim Bensaude (1000 francs), for his book on nautical astronomy in Portugal at the period of the great discoveries, and (the late) Louis Couturat (1000 francs); a mention (500 francs) to E. Doublet, for his works relating to the history of astronomy and meteorology.

Medals.—The Berthelot medal to Paul Lemoult, Alexandre Hébert, and Edouard Bauer.

General Prizes.—The Bordin prize is not awarded; the Jean Reynaud prize to the late Henri Amagat, for the whole of his work; the Baron de Joest prize to Ernest Esclangon, for his researches on the sound phenomena produced by cannon and projectiles; the Houllevigue prize to Edmond Bordage, for his studies on the fauna and flora of Réunion; the Saintour prize is not awarded: the Henri de Parville prize to Auguste Barbey (1000 francs), Louis Raveneau (500 francs), Daniel Bellet (500 francs), and E. Montoriol (500 francs); the Lonchampt prize to Mlle. Thérèse Robert (2500 francs), for her researches on the function of calcium salts on the growth of plants, and H. Busquet (1500 francs), for his physiological and pharmacodynamical researches; the Wilde prize to M. Mansuy (2000 francs) and F. Garrigou (2000 francs), for the whole of their work; the Caméré prize to M. Freyssinet, for his novel applications of reinforced concrete; the Gustave Roux prize to (the late) Michel Longchambon (2000 francs), for his geological and petrographical work; the Thorlet prize to Adolphe Richard; the Lannelongue foundation between Mmes. Cusco and Rück; the Laplace and Rivot prize is not awarded; the Trémont foundation (1000 francs) to Charles Frément, for his work on the deformations of metals submitted to stresses; the Gegner foundation to A. Claude (2000 francs) and Mlle. I. Iotevko (2000 francs); the Jérôme Ponti foundation to MM. Battandier and Trabut, for their botanical work in northern Africa; the Henri Becquerel foundation is not awarded.

BONAPARTE FOUNDATION.

The committee has had to examine thirteen requests for grants from the Bonaparte Fund. The following grants are recommended:—(1) Charles Alluard (4000 francs), for continuing the publication, in conjunction with R. Jeannel, of the scientific results of three expeditions in eastern Africa (1903 to 1912).

(2) M. Bondroit (2000 francs), for collecting the material in France necessary for the constitution of a fauna of French ants.

(3) Pierre Lesage (2500 francs), for the continuation of his experiments on the plants of the coast zone, and in particular his researches on the transmissibility of the characters acquired by plants watered with salt water.

(4) The Touring Club de France (3000 francs), to contribute to the establishment of the new botanic garden at Lautarel (Hautes-Alpes).

(5) Camille Sauvageau (3000 francs), for extending to the species of Laminaria of the Mediterranean and the Channel the remarkable discoveries of the author on the development of a single species which grows in the Bay of Biscay.

(6) Em. Vigouroux (2000 francs), to contribute to the purchase of apparatus useful for the continuation of his interesting researches on the state of silicon dissolved in metals.

(7) Raoul Bayeux (2000 francs), to aid him in continuing his researches on the physiological effects and the therapeutics of hypodermic injections of gaseous oxygen. The author proposes to study experimentally the action of hypodermic oxygenation on the defensive reactions of the organism against asphyxia and against infections.

(8) Joseph Laïs, as a contribution to the expense of photogravures relating to the photographic chart of the heavens, the copper-plates to become the property of the Paris Observatory.

The committee has in reserve, after payment of these grants, 55,000 francs.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

THE fifth election to Beit Fellowships for Scientific Research will take place on or about July 15. Not more than three fellowships will be awarded. Applications must be received on or before April 16. Forms of application and all information may be obtained, by letter only, addressed to the Rector, Imperial College, South Kensington, London, S.W.

DR. W. H. HADOW, Principal of Armstrong College, Newcastle, and Vice-Chancellor of Durham University, has been appointed a member of the committee to consider and report on the scheme of examination for Class I. of the Home Civil Service in lieu of Mr. H. A. L. Fisher, who has found it necessary to resign membership of the committee on assuming the duties of the President of the Board of Education.

"EDUCATION in the Universities after the War" is the subject of a lecture to be delivered by the Master of Balliol next Tuesday evening, at 5 o'clock, at the meeting-room of the Society of Antiquaries, Burlington House, Piccadilly. Mr. Fisher, Minister of Education, will preside. The lecture will be one of a series on "Reconstruction," to be given every Tuesday during January and February. Applications for reserved seats may be made to the hon. secretary, United Workers, 175 Piccadilly, W.

ON December 15 last the degree of Doctor of Medicine *honoris causa* was conferred by Malta University on Col. Ch. A. Ballance, C.B., M.V.O., Col. Wm. Thorburn, C.B., Col. Arch. E. Garrod, C.M.G., F.R.S., and Col. Howard H. Tooth, C.M.G. Lord Methuen, the Governor of Malta, presided, and a Latin address was delivered by Prof. A. Bartoli, and a speech made by the rector, Prof. E. Magro. In his concluding remarks Lord Methuen said Col. Ballance had been in Malta from the time the hospitals were started, Col. Thorburn arrived shortly after, and, together with Col. Garrod and Col. Tooth, they had rendered services to the patients that could not be over-estimated.

THE shortage of colour sensitisers for photographic plates, and the difficulties thereby incurred in the colour-printing trade, are affording another example of the fact that when the requisite stimulus is applied the chemical resources of the country are quite able to meet industrial needs. The Leeds Education Committee, through its Technical School, having become aware of the situation in the colour-printing trade, approached the Leeds University, and the work of supplying the necessary sensitisers has been taken in hand under a joint scheme of research. A preliminary report gives a full description of the preparation of two dyes, formocyanine and tolucyanine, which are stated to be identical in their sensitising powers with those of the German products hitherto used. The work is being continued.

THE School of Oriental Studies at the London Institution is, we learn from the *Times*, to be formally opened by the King near the end of next month, but classes will begin on January 18. A preliminary announcement which has been circulated states that at the outset teaching will be provided in seven groups of languages, comprising twenty different tongues; but it is hoped at an early date to extend the scope of the school. Courses on the history, religion, and customs of Oriental and African countries will form a special feature in the teaching of the school. The Senate of the University of London has assented to the transfer to the school of the teachers in the Oriental departments at University and King's Colleges, excluding certain subjects, such as Egyptology, Assyriology, and Hebrew. The Oriental staffs have accordingly been transferred to the school, but since the teaching at the colleges has been on a restricted scale numerous additional appointments have been made. The school is intended to provide London with a centre for Oriental teaching adequate to the needs of the metropolis and of the Empire, and one that will remove the reproach that London has hitherto been without an Oriental School comparable with those of Paris, Petrograd, and Berlin.

UNDER the will of the late Miss A. F. Yule, the daughter of the late Sir Henry Yule, the house and grounds of Tarradale, or Taradale, in the county of Ross and Cromarty, where Sir Roderick Murchison was born in 1792, are left in trust "to be preserved for ever to the use and enjoyment of my countrymen under the style and title of the Murchison of Taradale Memorial." The executors are left a wide discretion in interpreting the objects of the testatrix, but the idea expressed is that the house, with all its contents, including a library extending to more than 20,000 volumes, should form "a place of rest and refreshment for poor scholars or other students, preferentially, but not exclusively, those no longer young," and preferably also of Scottish birth or descent. If funds do not permit otherwise, the house may only be kept open for three or four months in the year. The desire is also expressed that the grounds of Tarradale House should form a sanctuary or reserve for the preservation of the wild life of the Highlands, more especially for wild birds, and the trustees are given power to lend the house and grounds to any one or more of the Scottish universities, for a limited period, for purposes of scientific research, exclusive of experiments

on living animals. The whole residue of the estate, apart from a few small legacies to servants and others, is left to the trustees for the purposes of the trust to form a maintenance fund for carrying out the objects named. Should there be any funds in excess of the requirements of the original scheme, the trustees are directed to utilise them for the establishment of "Murchison of Taradale Memorial Bursaries" at any of the Scottish universities or places of secondary education in Scotland or elsewhere, for the assistance of young natives of Ross-shire of either sex of any age between fourteen and twenty-four, preferably those able to speak and write the Gaelic language.

SOCIETIES AND ACADEMIES.

LONDON.

Faraday Society, December 18, 1916.—Sir Robert Hadfield, president, and later Prof. A. W. Porter, in the chair.—Ezer **Griffiths** and E. A. **Griffiths**: A carbon tube furnace for testing the softening points and compressive strengths of refractories. The paper describes a carbon tube furnace designed for the testing of refractory materials under definite load. The specimens are cut from the brick and ground up into the form of short cylinders. Pressure is applied by means of springs suitably connected to carbon rods which carry the specimen under test. Two simple forms of electrode construction are described. In one of them the current is carried by two copper tubes bent into a zigzag form, and cast into two blocks of white bearing metal. The faces of the blocks are cast to the form of the carbon tube to which they are clamped. The copper tubes also serve for water cooling. The temperature of the specimen is directly observed by means of a polarising type of optical pyrometer.—Prof. E. D. **Campbell**: Do equiatomic solutions in iron possess equal resistances? The conception of steel as a solid solution has long suggested a relationship between its chemical composition and resistance. Benedicks, in 1902, laid down the general law that equiatomic solid solutions in iron possess equal resistances. The experimental work of Arnold has shown the assumptions underlying Benedicks's law to be untenable, and the object of the author's experimental work was to seek a more satisfactory hypothesis. The experiments, which are fully described in the paper, were carried out on seven steels of varying composition, and their specific resistances were measured in both the hardened and annealed states. The deviations from the calculated values cannot be explained on Benedicks's assumption, but they suggest that it is the *molecular* concentration of the *carbides* in solid solution, and not the *atomic* concentration of the *carbon*, which determines the influence on the specific resistance exerted by such solutes.—R. H. **Sherry**: Grain-growth in deformed and annealed low-carbon steel. Coarse crystallisation or grain-growth in pure iron and low-carbon steels permanently deformed and annealed has from time to time caused no little difficulty to workers in sheet, wire, cold-drawn bar, and pressings of these materials. The present paper, based on an extended investigation, explains the conditions under which grain-growth occurs.—R. G. **Parker** and A. J. **Dalladay**: The union of glass in optical contact by heat treatment (see NATURE, December 21, 1916, p. 317).—Prof. W. C. McCullagh **Lewis**: The effect of pressure on the equilibrium constant of a reaction in a dilute solution: A simple proof of the expression. The paper indicates a simple mode of deducing the effect of external pressure on the equilibrium constant of a reaction in dilute solution. The method, which involves the simple concept of maximum work, may be found to be of use by teachers of physical chemistry, as students generally find the method of Planck somewhat difficult.

Geological Society, December 20, 1916.—Dr. Alfred Harker, president, in the chair.—Dr. Marie C. **Stopes**: Recent researches on Mesozoic "Cycads" (Bennettitales). The paper dealt particularly with recently discovered petrified remains which reveal their cellular tissues in microscopic preparations. The distribution of a few of the most interesting representatives of the Bennettitales (including the cohorts Bennettiteæ and Williamsoneæ) was shown in a table. The group is by far the most characteristic of all the plants of the Jurassic and Lower Cretaceous, during which periods its distribution was almost world-wide. It was locally, if not universally, dominant, and was the most highly evolved plant-group of the epoch of which we are cognisant. Three chief points of interest are noted in the geological distribution of these plants:—(*a*) That the most numerous highly specialised trunks reach their maximum in the Jurassic and Lower Cretaceous periods, when their distribution was practically world-wide; (*b*) that the oldest and therefore presumably the most primitive type, Wielandiella, is externally less like the living Cycads than the commoner later forms, while these latter are utterly unlike the living genera in their fructifications; (*c*) that the geologically youngest cone is the largest yet discovered, occurring in the Gault when the extinction of the group appears already to have set in. Contrary to what might have been anticipated from their external likeness to the living Cycads, coupled with their great geological age, the fossil "Cycads" are much more complex and on a higher level of evolution than the living group. It seems to the author to be extremely unlikely that the fossil and the living forms have any direct phylogenetic connection nearer than a remote, unknown, common ancestor. The mooted connection between the fossil "Cycads" and the Angiosperms is highly suggestive, but lacks data for its establishment.

Royal Microscopical Society, December 20, 1916.—Mr. E. Heron-Allen, president, in the chair.—A. **Bacot**: Note on the relation between the hatching and development of the larva of the yellow-fever mosquito (*Stegomyia fasciata*) and the presence of bacteria and yeasts. In sterile water or in "killed" cultures of various bacteria and yeasts, the author found that the proportion of mosquito eggs unhatched within a normal period was much larger than when a living culture or stagnant water teeming with organic life was employed. Of the "refractory" eggs first mentioned a large proportion hatched out at once on the addition of a small quantity of brewer's yeast, or other living micro-organisms, to the previously sterile fluid.—Prof. S. J. **Hickson**: Certain sessile forms of Foraminifera. After discussing the observations of Schultze and Carpenter, the author gave his reasons for regarding the foraminifer described by the former as identical with *Polytrema miniaceum*, but that studied by the latter as being a different organism, for which he now proposed the new generic name of Homotrema; and then detailed the differential diagnosis of the two forms. The author next dealt with the form known as *P. cylindricum*, Carter, which he regarded as the type of a new genus, Sporadotrema; all these forms he regarded as having secondarily acquired the sedentary habit after a previous free existence, in contrast with the genus Gypsina, which he considered had always been sedentary and encrusting in its habit.—E. J. **Sheppard**: Note on an exhibit showing migration of nuclear material into an adjacent cell. A slide of the "pollen mother-cells" of *Lilium candidum* was exhibited showing migration of nuclear material (chromatin) from one cell nucleus into the cytoplasm of an adjacent cell, the migration chromatin being preceded and almost surrounded by a liquefaction or absorption zone of the cytoplasm. So far no fusion of the

chromatin with that of its "receptor cell" had been observed, and no explanation of the phenomenon was offered.

PETROGRAD.

Imperial Academy of Sciences, October 19, 1916.—M. D. **Zalésskij**: The carbon flora discovered by V. N. Robinson and I. I. Nikšič in the N. Caucasus.—A. A. **Čuprov**: The mathematical expectancy of the coefficient of dispersion.—V. V. **Zalenskij**: The fate of the spermatozoa and the segmentation of the ovum of *Salpa africana*.—I. A. **Balanovskij**: The new variable in Hercules.—L. S. **Kolovrat-Červinskij**: The disengagement of the emanation from solid or fused radium salts.—P. A. **Zemiatčenskij**: Deposits of fireproof clay in the neighbourhood of Latna, on the Kiev-Voronež Railway, Lepecka (Tambov Government), and Čirikov, on the Griaze-Orlov Railway (Voronež Government).—V. V. **Redikorcev**: New pseudo-scorpions.—V. A. **Lindholm**: Contributions to the malacological fauna of the Government of Nižnij Novgorod.—N. S. **Kurnakov**: The discovery in Russia of potassium chloride or sylvine.

November 2, 1916.—N. Ja. **Cinger**: The most useful species of conic projections.—S. I. **Metalnikov**: The problem of the immortality of unicellular protozoa.—N. A. **Bush**: Valuable trees of the Caucasus.—N. V. **Nasonov**: Supplementary notes on *Ovis orientalis*, Gmel.—A. **Martynov**: Supplementary note on the Trichoptera fauna of the Crimea.

SECTION OF HISTORICAL SCIENCE AND PHILOLOGY, October 26, 1916.—N. Ja. **Marr**: The date of the Mosoch migration from Armenia to Svania.

November 9, 1916.—K. A. **Inostrancev**: The Charput inscription (561 H.).

BOOKS RECEIVED.

The High Price of Sugar and How to Reduce It. By H. H. Smith. Pp. iv+54. (London: John Bale, Ltd.) 1*s.* net.

Atoms. By Prof. J. Perrin. Translated by D. Ll. Hammick. Pp. xiv+211. (London: Constable and Co., Ltd.) 6*s.* net.

Laboratory Manual of General Chemistry, with Exercises in the Preparation of Inorganic Substances. By A. B. Lamb. Pp. vi+160+pp. for Notes. (Cambridge, Mass.: Harvard University Press.)

Australia. By Prof. J. W. Gregory. Pp. 156. (Cambridge: At the University Press.) 1*s.* 3*d.* net.

The Classics of International Law:—Synopsis Juris Gentium. By Prof. J. Wolfgang Textor. Edited by Prof. L. von Bar. Vol. i., A Reproduction of the First Edition. Vol. ii., A Translation of the Text. By J. P. Bate. (Washington: Carnegie Institution.)

The Interferometry of Reversed and Non-reversed Spectra. By Prof. C. Barus. Pp. 158. (Washington: Carnegie Institution.)

Sissano: Movements of Migrations Within and Through Melanesia. By W. Churchill. Pp. 181. (Washington: Carnegie Institution.)

A Naturalist in Borneo. By the late R. W. C. Shelford. Edited, with a biographical introduction, by Prof. E. B. Poulton. Pp. xxvii+331+plates xxxii. (London: T. Fisher Unwin, Ltd.) 15*s.* net.

DIARY OF SOCIETIES.

THURSDAY, JANUARY 11.

ROYAL GEOGRAPHICAL SOCIETY, at 5.30.—The Amazon River and Unexplored South America: J. Campbell Besley.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Principles Involved in Computing the Depreciation of Plant: F. Gill and W. W. Cook.

FRIDAY, JANUARY 12.

ROYAL ASTRONOMICAL SOCIETY, at 5.—Probable Motions in the Spiral Nebula M 51 (Canes Venatici) found with the Stere-Comparator.—S. Kostinsky.—A Determination of the Constant of Aberration: S. S. Hough.—(1) The Part played by Rotation in Cosmic Evolution: (2) Note on the Action of Viscosity on Gaseous and Nebular Masses: J. H. Jeans.—Observations made at Adelaide during the Annular Eclipse of the Sun, July 30, 1916: Adelaide Observatory.

MALACOLOGICAL SOCIETY, at 8.—*Patella vulgata*, L., and its so-called Variety, *P. depressa*, Penn.: Rev. Dr. A. H. Cooke.—The Occurrence of Manganese in Mollusca: Dr. A. E. Boycott.—Note on the Holotype of *Crioceratites bowerbanki*: J. de C. Sowerby and G. C. Crick.

MONDAY, JANUARY 15.

VICTORIA INSTITUTE, at 4.30.—Christian Mysticism: Very Rev. Dean Inge.

TUESDAY, JANUARY 16.

ROYAL INSTITUTION, at 3.—The Old Brain and the New Brain, and their Meaning: Prof. C. S. Sherrington.

ROYAL STATISTICAL SOCIETY, at 5.15.

MINERALOGICAL SOCIETY, at 5.30.—Tapiolite in the Pilbara Goldfield, Western Australia: E. S. Simpson.—Palæophysiology; the Organic Origin of some Minerals occurring in Sedimentary Rocks: J. V. Samojloff.—The Simondium Meteorite: Dr. G. T. Prior.

WEDNESDAY, JANUARY 17.

ROYAL MICROSCOPICAL SOCIETY, at 8.—Presidential Address: Alcide d'Orbigny, his Life and his Work: E. Heron-Allen.

ROYAL METEOROLOGICAL SOCIETY, at 5.—Annual General Meeting.—Presidential Address: The Winds of North Africa: Major H. G. Lyons.

ENTOMOLOGICAL SOCIETY, at 8.—Annual Meeting.

THURSDAY, JANUARY 18.

LINNEAN SOCIETY, at 5.—The Comparative Morphology of the Sorus of Ferns: Prof. F. O. Bower.

MATHEMATICAL SOCIETY at 5.30.

ROYAL SOCIETY OF ARTS, at 4.30.—Between the Tigris and the Indus. The Ben-i-Israel: Sir T. H. Holdich.

CHEMICAL SOCIETY, at 8.—Alloys of Copper and Tin, Aluminium and Gold: Col. C. T. Heycock.

FRIDAY, JANUARY 19.

ROYAL INSTITUTION, at 5.30.—Soap Bubbles of Long Duration: Sir James Dewar.

INSTITUTION OF MECHANICAL ENGINEERS, at 6.

SATURDAY, JANUARY 20.

ROYAL INSTITUTION, at 3.—The Lakes and Mountains of Central Africa: A. R. Hinks.

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