THURSDAY, JANUARY 31, 1918.

SOME CHEMICAL MANUALS.

(1) *Treatise on Applied Analytical Chemistry: Methods and Standards for the Chemical Analysis of the Principal Industrial and Food Products.* By Prof. V. Villavecchia and others. Translated by Thomas H. Pope. Vol. i. Pp. xvi+475. (London: J. and A. Churchill, 1918.) Price 21*s.* net.

(2) *Trattato di Chimica Generale ed Applicata all' Industria.* By Prof. E. Molinari. Vol. i., *Chimica Inorganica.* Parte Prima. Quarta edizione, riveduta ed ampliata Pp. xiv+560. (Milano: Ulrico Hoepli, 1918.) Price 12.50 lire.

(3) *Notions Fondamentales de Chimie Organique.* By Prof. C. Moureu. Cinquième édition, revue et considérablement augmentée. Pp. vi+548. (Paris: Gauthier-Villars et Cie, 1917.) Price 20 francs.

(4) *Reagents and Reactions.* By Prof. E. Tognoli. Translated from the Italian by C. Ainsworth Mitchell. Pp. viii+228. (London: J. and A. Churchill, 1918.) Price 6*s.* net.

(1) PROF. VILLAVECCHIA, the director of the chemical laboratories of the Italian Customs, has compiled this useful treatise for the purpose of facilitating the examination of industrial and alimentary products, and of the raw materials of their manufacture. It would seem to be especially designed for the exact characterisation and valuation of commercial products by experts and inspectors appointed to enforce contractual conditions in connection with the purchases and supplies of the State. It is, in fact, such a book as might be put together by the head of our own Government laboratory for the use of the members of his department. It covers, however, a far wider range of analytical work than usually falls to the lot of a Government chemist in this country, who is seldom called upon to make many of the very specialised analyses which are treated of in this book, as they have no direct connection, as a rule, with the requirements of the State. In the few exceptional cases in which such examinations are needed special arrangements are made. The Government departments in this country have probably much larger and wider facilities for enlisting the services of specialist analytical experts than is the case in Italy, which may account, therefore, for the comprehensive scope of Prof. Villavecchia's work, which was primarily designed for use in his own department.

The book treats of the analysis of potable waters and water for industrial purposes; of the examination of a great variety of chemical products, inorganic and organic, such as the common acids, alcohols, esters, salts, mordants, sulphur, etc.; of the more important fertilisers; of cement materials; metals and alloys; fuels; mineral oils and their derivatives; fatty substances; and a variety of industrial products obtained by the treatment of fatty matters, such as stearine, soap, glycerin, hydrogenised oils, etc.

The methods, as a rule, are judiciously selected with special attention to the particular point to be ascertained, and with due regard to the limitations of time imposed on official work of the kind, where it often happens, as in tender samples, that large numbers have to be dealt with as quickly as possible. At the same time the analytical processes are scientifically sound, and capable of affording a satisfactory degree of accuracy. Most of them have been repeatedly tried in the laboratories under the author's direction, and in cases where the methods yield results which are only relative to the procedure employed, the conditions needed to ensure strictly comparable results have been carefully studied. Mr. Pope, the translator, has made some additions and modifications in order to render the work more applicable to conditions in this country, but the departures from the Italian text are few and comparatively unimportant. We can confidently recommend the book to all analysts who are concerned with the analytical examination of the various classes of material of which it treats.

(2) Dr. E. Molinari is professor of chemical technology in the Milan Polytechnic. His work under review, now in its fourth edition, was first published in 1904. The fact that it has passed through so many editions in such a comparatively short time is a sufficient indication of its success in meeting the demand in Italy for a comprehensive treatise on chemistry, both general and physical, applicable to the arts and manufactures. The present volume is concerned with the inorganic (non-metallic) division of the science. It has been carefully revised and brought up to date, and is fairly well illustrated. It contains, for example, an excellent account of modern methods of making sulphuric acid, with special reference to the various contact processes in use in Germany and England, with diagrammatic representations of the plant as shown in the patent specifications. The methods of liquefying air and the fractional separation of its main components, as practised on the large scale, are well described and illustrated, as are the methods for the utilisation of atmospheric nitrogen, so far as these have been made public. The book is admirably printed in excellent type on good paper, and is a thoroughly sound and eminently readable treatise.

(3) Prof. Moureu's "Notions Fondamentales de Chimie Organique," now in its fifth edition, is too well known to need any detailed account. The present volume is, of course, necessarily enlarged in order to do justice to the growth of knowledge since its first issue in 1902, but in its general plan and arrangement it differs in no essential particulars from its predecessors. The author has added some pages on new developments of the atomic theory, with special reference to valency, and the article on stereochemistry has been recast. Special attention has been paid to the treatment of the connection between physical properties and chemical constitution, and some account is given of the mechanism of chemical change. The book already enjoys the distinction of being one of the most generally preferred text-books on its subject

in the French universities, and is by no means unknown in the chemical schools of other countries. The care which is evidently taken in revising it, and the frequency of its reappearance in the form of new editions, will tend to ensure a continuance of its popularity.

(4) Prof. Tognoli's little book on "Reagents and Reactions," translated from the Italian by Mr. C. Ainsworth Mitchell, supplies an omission and serves a very useful purpose. As the translator points out, it is a common practice to refer to a reaction by the name of the chemist who first devised it. Indeed, in many cases there is no other convenient method of designating it. Thus we speak of the Marsh and the Reinsch tests for arsenic, the Nessler test for ammonia, the Baudouin test for sesame oil—to confine oneself to well-known examples. But some examples which might be quoted are far from well known—many are obsolete and some are wholly forgotten. Physiological chemists, and medical men who dabble in physiological chemistry, are especially prone to associate their names with minor qualitative tests for pathological and similar products, such as albumin, biliary pigments, gastric juice, urine, *et hoc genus omne*. Most of these tests find no permanent place in chemical literature, but reference to them may occasionally be made in special papers with no mention of their exact character. On the other hand, there are, of course, others which have been found of great value and are in constant use.

The author has gathered together a list of the more important reagents commonly employed in such testing, arranging them in alphabetical order and indicating the means of ascertaining their purity. He then gives a more or less detailed account of reactions arranged in the alphabetical order of the names of their discoverers or of those persons with whose name the test is commonly associated—which is not in all cases the same thing. Condensed as the descriptions of the tests are, the list extends to nearly 140 pages. It is probably sufficiently complete, and we may be reasonably certain that no important chemical reaction of the kind has been omitted; the book therefore adequately fulfils the intention of the author. In a collective index at the end of the volume the various names are gathered together in connection with the substances for which the tests were devised, arranged in alphabetical order. Thus we have thirty-two names in connection with albumin, fifty-two in connection with alkaloids, fifty in connection with dextrose (mostly in urine), and no fewer than 126 in connection with that particular fluid itself. A useful feature in the book is a description of various test-papers for acids and bases; others for special tests, such as for ozone, nitrites, oxygen, hydrogen peroxide, carbohydrates, oxidising and reducing substances, etc. There is also a short list of test-papers found useful in clinical tests, *e.g.* the tropæolin paper of Boas-Lücke for detecting the acids of the gastric juice; Geissler's potassium mercury iodide and citric acid paper for detecting albumin in urine; Olliver's indigo-carmine and sodium carbonate paper for the recognition of dextrose in urine, etc. There are also tables, by recognised authorities, showing the specific gravities of aqueous solutions of ammonia, caustic potash and soda, potassium and sodium carbonates, the common mineral acids, and of methyl and ethyl alcohols, glycerin, and dextrose, with the corresponding values, in certain cases on the hydrometers in common use.

The book is conveniently arranged, and will be found useful for purposes of reference by analytical and physiological chemists.

THE WORLD'S WHEAT SUPPLY.

The Wheat Problem. By Sir William Crookes. Third edition. With Preface and additional chapter bringing the Statistical Information up to date, and a chapter on Future Wheat Supplies, by Sir R. H. Rew. With an Introduction by Lord Rhondda. Pp. xvi+100. (London: Longmans, Green, and Co., 1917.) Price 3*s.* 6*d.* net.

IT is now nearly twenty years since Sir William Crookes discussed the world's wheat supply in his presidential address to the Bristol meeting of the British Association in 1898. His address, issued afterwards in book form, has already passed through two editions. This third and revised edition, for the publication of which Lord Rhondda appears to be responsible, could not have appeared at a more opportune moment. No one at the present time can fail to appreciate the gravity of the problem which the author presents. The recent enactment of the Corn Production Bill shows that even politicians recognise its urgency and have taken steps to secure the production of a greater area of wheat.

But it is not to legislative aid that Sir William Crookes trusts for increased corn production. His hope—to quote his own words—is that "starvation may be averted through the laboratory." The argument is briefly as follows:—

A large and progressively increasing proportion of the world's inhabitants feed upon wheat, and the world's demand for wheat continuously increases. The possibility of increasing wheat production by extension of area is shown to be approaching finality. The time must, therefore, arrive in the near future when the world's wheat production will not meet the world's demand, and famine must necessarily follow. This can be averted only by increasing the yield of wheat per acre, which can be most readily achieved by the increased use of nitrogenous manures.

But the world's requirements for nitrogenous manures for this purpose would rapidly exhaust all possible existing supplies—sulphate of ammonia, nitrate of soda, and guano. It is claimed that the fixation of atmospheric nitrogen by a chemical process provides the only practical safeguard against a rapidly approaching world's wheat shortage.

It is further stated that the fixation of atmospheric nitrogen on a commercial scale is a practicable proposition, for its development has pro-

vided combined nitrogen for manure and explosives in sufficient amounts to enable Germany to continue the war.

A last chapter, written for this edition by Sir Henry Rew, gives a somewhat more optimistic forecast, based on more recent and detailed statistics, of the possibility of extending the world's wheat supply without the introduction of any new factor, such as cheap nitrogenous manure made from the atmosphere.

Of the vital interest and importance of the problem at the present time there can be no two opinions. The book should be read by everyone. For some years the world's wheat crop has barely sufficed for the world's consumption. With the restriction of labour, manures, etc., by the war, a world's wheat shortage may confidently be expected. What this would mean to us is shown by the fact that wheat provides more than 30 per cent. of the energy of the national food budget, and as much as 60 per cent. in certain classes. Every possible effort should, therefore, be made to increase wheat production.

The Corn Production Act will no doubt increase the area. To increase the crop per acre is, as Sir William Crookes suggests, a problem for the laboratory. But there are many possibilities beyond the synthesis of cheap nitrogenous manures. In the first place, the amount of farmyard manure produced annually in the United Kingdom is probably not far from 50 million tons, containing about 250,000 tons of nitrogen. Half of this is certainly lost through the imperfect methods of making and storing in common use. If the loss could be reduced by only 10 per cent. the saving of nitrogen would be equivalent to a normal dressing of sulphate of ammonia over the whole wheat area of the United Kingdom.

But manurial nitrogen is by no means the only factor which limits wheat production. It has been estimated that fungoid diseases on the average depress the world's wheat crop by about 30 per cent. Biffen's work on the inheritance of immunity to rust has opened the door for improvement in this direction. Experience gained with the first rust-immune variety to get into general cultivation—"Little Joss"—suggests that immunity to rust in this country is able to increase the yield by about 10 per cent. In other countries immunity to other diseases would probably be still more effective.

Beaven has shown, too, that even when the total crop is limited it is possible to select varieties which give an abnormally high proportion of grain to straw. This method of selection, which has so far been applied only to barley, appears likely to increase grain production by at least 10 per cent. without increasing the drain upon the soil.

Notwithstanding these and possibly other factors which may increase yield per acre, there is no doubt that in the main a cheap and plentiful supply of nitrogenous manure, combined with the spread of knowledge as to its proper use, would do more than anything else to increase the world's wheat production. With this in mind perhaps it is not too much to hope that Lord Rhondda will use his power as capitalist and organiser to ensure that the fixation of atmospheric nitrogen shall have a fair chance of succeeding both commercially and scientifically. T. B. W.

THE PROBLEM OF HUMAN INSTINCT.

(1) *The Psychology of War.* By Dr. John T. MacCurdy. Pp. xi+68. (London: William Heinemann, 1917.) Price 2*s.* 6*d.* net.

(2) *Instinct in Man: A Contribution to the Psychology of Education.* By Dr. J. Drever. Pp. x+281. (Cambridge: At the University Press, 1917.) Price 9*s.* net.

THE study of instinct as a factor in human nature is a modern, even a contemporary, development. The philosophers of the seventeenth and eighteenth centuries wrote much about the passions and the inclinations and the appetites, by which they meant the irrational impulses which form the baser animal nature, upon which, as they thought, the rational nature is superposed as a spiritual endowment. The modern treatment of the problem, however, is the outcome of the enormous advance of the biological sciences in the latter half of the nineteenth century in the work of Darwin and his successors. Particular attention is being focussed on the study to-day. The great world-war, with the deliberate destruction of accumulated wealth on a gigantic scale, and the devotion to death and mutilation of a whole generation, is so manifestly irrational that we are driven, perforce, to seek the meaning and cause of war in instinct as opposed to reason, in a primitive nature consisting of impulses and cravings imperfectly controlled by intellect.

(1) The two books before us deal with this problem of instinct in man from very different points of view. The small book of Dr. MacCurdy is of the nature of an exhortation called forth by the special circumstances of the day. The idea that underlies it is that there is a striking analogy between abnormal psychology, which reveals the havoc wrought in the individual mind by the loss of control over repressed complexes, and the psychology of nations at war. The suggestion is that there may be a psychiatry for social, as there is for individual, disintegration of personality.

(2) Dr. Drever's main interest is the application of the theory of human instinct to educational theory and practice. The modern problem of instinct is threefold—philosophical, psychological, and biological. The philosophical problem concerns the cognitive aspect of instinct, and centres round the theory of Bergson. Instinct, in Bergson's view, is a mode of knowing, intuitive in character, different in kind, and divergent in orientation from the mode of knowing which we name intelligence. Dr. Drever, without definitely rejecting this view, thinks that the problem can be solved by the adoption of a very simple formula. This is that instinct is knowledge at the perceptual level, intelligence being conceptual. But, useful as such a distinction may be for provisional

description, it will carry us only a very little way towards a solution of the problem. No one, indeed, who has learnt the lesson of Kant can imagine that percepts devoid of concepts satisfy the conditions which make experience possible.

The psychological problem of human instinct emphasises the affective rather than the cognitive aspect. Its inception was McDougall's theory in "Social Psychology." The human instincts in this view are innate dispositions to act under definite stimulation. They are distinct, and may be enumerated, but each primary instinct is correlated with a specific emotion. This relation of the instinct to a specific emotion was challenged by Shand in "The Foundations of Character." Dr. Drever puts forward an interesting theory of emotion, which deserves particular notice. Emotion he holds to be the "tension" due to the checking of an impulse.

The biological problem of instinct lays stress on the conative aspect, and is mainly a genetic, as opposed to an analytic, study. It is the genetic problem which is emphasised in the experimental work of Lloyd Morgan. Dr. Drever expounds the view that the essential phenomenon in instinctive behaviour is "primary meaning," which in experience acquires "significance." This at once indicates the practical relation of theory of instinct to education. H. W. C.

OUR BOOKSHELF.

The Fishing Village and Other Writings (*Literary and Scientific*). By W. Omer-Cooper. Introduction by George A. B. Dewar. (Bournemouth: Horace G. Commin, 1917.) Price 3*s*. 6*d*. net.

THIS little volume, from the patriotic point of view, records the ready and eager devotion of a young life, the self-sacrifice so nobly shared with thousands of other men, including even actual boys. To a scientific journal its appeal is different. Though falling in battle before he was twenty-two, Wilfrid Omer-Cooper had already made his mark as a naturalist by ardour in research, acuteness in observing, and a highly useful facility of expression. Evidence of this zeal and capacity led to his becoming a fellow of the Linnean Society at the earliest possible date, as was the case with Sir William Hooker and his son, Sir Joseph Hooker, though with how different a tenure, one of fewer weeks than they had years.

The general reader can scarcely fail to be moved by the quaintness of Mr. Omer-Cooper's almost lover-like letters to his mother, who in earlier years may well have felt no little anxiety from her son's George-Borrow-like fondness for visiting gipsy encampments.

The chapters on lizards and serpents are of popular interest without giving scope for any special originality. It is among marine invertebrates and terrestrial isopods that the young naturalist found an opening for advancing research and encouraging scientific pursuits. In regard to the latter group the name of Alexander Patience should have been included in the list of recent authorities. There is rather too sharp a touch in the notice of "The British Woodlice," by Webb and Sillem, since scarcely any compendious work on any subject is free from "inaccuracies." Even in this small volume slugs are referred to as insects (p. 118); the generic name Metoponorthus is used instead of Porcellionides (p. 141), and the genus Paragnathia, instituted in the *Zoologist* for January, 1916, by the author and his brother Joseph, is referred in consecutive lines to two different families (p. 153). The strange differences in the sexes of the Gnathiidæ are well described, and altogether "The Fishing Village," with its youthful poetry, solemn philosophy, well-considered science, and other features, makes a very readable book.

Cape Peninsula List of Serials. Second edition. Pp. 95+iv. (Cape Town: Printed for the Trustees of the South African Public Library, 1917.)

THIS is a list of about 1300 scientific periodicals which are available for reference to readers in the Cape of Good Hope, the special feature being the indication of the library or libraries in which each periodical may be found.

The compilation has been made by Mr. A. C. G. Lloyd, who has had the advice and assistance of Sir Thomas Muir and Mr. Pilling.

A notice of the first edition of this useful index appeared in NATURE in 1912 (vol. xc., p. 434). The work was then printed in seven columns, the first column giving the name of the periodical, the remaining columns being allotted to the libraries indexed.

In the new edition great care has been taken, in dealing with incomplete sets, not only to state that the set or volume is incomplete, but to give detailed lists of the missing parts. The space required for these details has been obtained by giving up the arrangement in parallel columns. These exact details as to missing parts and volumes will no doubt induce the authorities of the libraries in which they occur to take steps to fill the gaps wherever that is possible. Indeed, it is stated that since the publication of the first edition of this list of serials gaps in thirty-one sets have been wholly or partially filled up.

Lists of serials which enable the scientific worker to ascertain where a particular volume can be consulted are always welcome. In the present case consultation is made very easy by the simple arrangement of the material.

Chemistry for Beginners and Schoolboys. By C. T. Kingzett. Second edition. Pp. viii+150. (London: Baillière, Tindall, and Cox, 1918.) Price 2*s*. 6*d*. net.

THE first edition of Mr. Kingzett's little book was reviewed in our issue of July 26 last (vol. xcix., p. 422). It is sufficient to say of the present edition that some rearrangement of matter has been made, and the book has been carefully revised and considerably enlarged by the incorporation of some additional information.

LETTERS TO THE EDITOR.

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

The East and West Asymmetry of Solar Prominences.

IT has attracted the attention of astronomers for some time that solar prominences appear to be more numerous on the east, or advancing, side of the sun than on the west, or receding, side, and systematic observations have been instituted to test this unexpected result. The current Kodaikanal Bulletin (lvii., August, 1917) seems to establish it definitely by a very complete analysis of the observations for the first half of 1917. Of prominences projected on the solar disc as absorption markings, 52·9 per cent. as regards area, and 53·4 per cent. as regards number, were on the eastern side of the central meridian. Of reversals and displacements (largely preponderant towards the red) of hydrogen lines on the disc, there was a like excess on the eastern side. But of the bright prominences directly observed on the limb there was no excess as regards number, and only a slight excess as regards area.

The solar disturbances must presumably be uniformly distributed all round the sun's equator; it would seem to be extremely unlikely, as is generally recognised, that the side which happens to be presented to the earth or any other planet should exhibit special features. But it has doubtless not been overlooked that a more probable mode of explanation is open. Although the character of the prominences can scarcely be affected by any influence of the earth, yet their appearance may be considerably affected by their own configuration with respect to the line of sight of the observer. The outer regions of the solar atmosphere are rotating more rapidly than the parts below; if then a prominence pushed up from below into the atmosphere sloped forwards in the direction of the sun's rotation instead of being on the average perpendicular to the surface, it would present a different aspect and different depth in the line of sight to the observer, according as it is on the advancing or receding side of the sun. The darkness of the absorption markings on the disc would depend on the depth of material through which the light had to penetrate to the observer, and perhaps also in consequence the number of shadings that would be counted as markings would be affected. The amount and direction of this influence it may be hazardous to guess at, but it might just be possible to detect some slight difference in the general appearance of the markings east and west. To the bright prominences on the limb these considerations would apply in a smaller degree, if at all. J. L.

Cambridge, January 26.

Carnotite Ores and the Supply of Radium.

IN NATURE for October 25, 1917, there appeared a review of Dr. P. E. Browning's book, "Introduction to the Rarer Elements." A special chapter devoted to the radio-elements was contributed by me, and in commenting on this section the reviewer takes exception to a statement that "the chief source of radium has been the minerals containing a higher proportion of uranium, principally carnotite, and the present supply has been largely obtained from the carnotite ores of south-western Colorado." Since the comments of the reviewer suggest the possibility of an even more widespread misconception of the true conditions, I am taking the liberty of mentioning some of the facts upon which the above statement is based.

The *minerals* containing a *higher* proportion of uranium are the several varieties of uraninite (including pitchblende, cleveite, thorianite, etc.), autunite, carnotite, gummite, uranophane, and a number of others which occur only in comparatively small quantities. The *ores* of uranium from which the supply of radium in commerce has been obtained consist of mixtures of relatively small proportions of these minerals with large proportions of valueless mineral matter, chiefly silica. Thus in the carnotite ores from Colorado the uranium mineral constituent is carnotite containing sometimes as much as 55 per cent. of uranium, while the actual content of uranium in the *ore* is in most cases scarcely more than 2 per cent. Carefully selected specimens of pitchblende from St. Joachimsthal may occasionally run as high as 70 per cent. uranium, but the *ores* from this mine, even after concentration, seldom contain more than about 10 per cent. of uranium. Although no trustworthy information on this topic has ever, to my knowledge, been made public, I am strongly inclined to the opinion that the average Cornwall ores (containing pitchblende as the chief uranium mineral constituent) seldom contain more than 5 per cent. of uranium, and I have direct knowledge that some shipments from this locality have fallen considerably below this figure. Other examples might be given, but the above will suffice to justify the statement that "the chief source of radium has been the *minerals* containing a higher proportion of uranium." It is clear that the uranium content of the *ore* is seldom indicative of the proportion of uranium contained in the uranium mineral which carries the radium.

In regard to the proportion of the world's supply of radium salts contributed by the Colorado carnotite ores, I may perhaps state that the greater proportion of the radium salts furnished during the years 1903–12 by the De Haen Company, of Hanover, and the Brunswick Quinine Factory was extracted from these ores. The chief source of the radium prepared by the Armet de Lisle and other French factories has been the Colorado ores, and large shipments have also been made to Great Britain from this country. The National Radium Institute and the Standard Chemical Company have separated relatively large amounts of radium salts from the Colorado carnotite ores exclusively. It has been conservatively estimated by those familiar with the subject that prior to 1913 at least one-half of the world's supply of radium salts had been extracted from Colorado carnotite, and the proportion supplied by the Colorado ores since that year has been very much larger. Additional information can be obtained by those who desire it from the publications of the U.S. Bureau of Mines (*not* Bureau of Standards), the special papers of Dr. C. L. Parsons, chief of the Division of Mineral Technology, U.S. Bureau of Mines, and the records of the "Hearing on Radium" before the U.S. Senate and House of Representatives (Public Documents, S. 4405, and H. J. Res. 185 and 186).

BERTRAM B. BOLTWOOD.

Yale University, New Haven, Conn., U.S.A., November 30.

I AM afraid that Prof. Boltwood does not quite see the reason why I hesitated to endorse the statement in question: it was necessary to quote the whole paragraph as it appears in the article, but my difficulty was confined to the words "principally carnotite." It is, of course, obvious that the chief source of radium is the minerals containing a higher percentage of uranium, and it was for that reason only that I hesi-

tated to place carnotite, which at most carries 60 per cent. of uranium, before the pure uránium mineral pitchblende, of which considerable deposits are known to exist both at St. Joachimsthal and in Cornwall, as well as in other countries.

Doubtless the bulk of the present supply of radium has been won from Colorado carnotite ores, but the discovery of radium, all the pioneer work on its separation, and the whole of our first supplies of the salts came from pitchblende. When the present abnormal conditions due to the war have passed, work upon uraninite, both in Bohemia and Cornwall, now practically suspended, will probably become considerable.

J. H. GARDINER.

The Growth of Conifers.

My friend, Mr. D. M. Andrews, has communicated to me an observation which seems to deserve comment. At the Government nursery near Monument, Colorado, at an altitude of 7000 ft., there are two beds of two-year-old seedlings of Engelmann spruce (*Picea Engelmanni*), a common tree of the Rocky Mountains. Each lot is shown to be hardy in the locality, having passed a winter in the open, protected only by a covering of oak branches. The seedlings in one bed, raised from seed gathered in the Pike's Peak, Colorado, region, were, when examined, about 2½ in. high, and had matured their buds and ceased growing for the year in the latter part of August. The seedlings in the other bed, from Arizona seed planted at the same time, were about 4 in. high, and had not yet completed their growth for the year. The Arizona seedlings were green, those from Colorado strongly bluish. Seeking an explanation for this difference, it appears probable that the Colorado trees became adapted to a more severe climate during the waning of the last glacial period, and have not yet lost the physiological characters appropriate to past conditions. The Arizona trees, the ancestors of which lived in a milder, more southern region, did not develop such adaptations, and now that our climate has changed they are actually better fitted for Colorado conditions than trees of Colorado ancestry.

T. D. A. COCKERELL.

University of Colorado, Boulder, Colorado,
December 29, 1917.

THE OUTLOOK IN FRENCH AGRICULTURE.

THE *Revue Scientifique* for September 22 contains a report on the position and prospects of French agriculture presented by M. Louis Mangin, of the Académie des Sciences, to the National Council of the Ligue Française on behalf of the Committee on Economic Organisation of that body. The position revealed is far from reassuring. Wheat production has fallen to barely 70 per cent. of the pre-war crop, potatoes to 80 per cent., wine to 65 per cent., and sugar-beet to little more than 30 per cent. The situation as regards live stock shows the same disquieting features. Practically 20 per cent. of the pre-war head of cattle fell into the hands of the enemy, and ill-devised measures taken to secure the meat supply in the early days of the war further seriously accentuated the shrinkage. Although the cattle position from the point of view of numbers has since been substantially improved, the proportion of young stock is so great that substantial relief of the meat stringency cannot be expected from home resources for a considerable time. The decline in numbers of sheep which had set in long before the war has been greatly accentuated. Pigs also show a decline of 38 per cent. since the end of 1913. No reference is made to the position as regards milk production. A survey of the forest area completes the tale of depleted resources, something like one-eighth of this area having been already denuded, with but little provision for its replacement.

Many suggestions are put forward for the relief of the present situation and for the future restoration and strengthening of French agriculture. The claims of rice as a diluent of wheaten flour are strongly urged in view of the large supplies available in the Asiatic colonies. To overcome the difficulties of shortage of manual labour on the land, the organisation of supplies of African and yellow labour is suggested, whilst further relief could be obtained by a more active policy with reference to the production and use of motor tractors and farm machinery in general. The example of England in placing this manufacture under the same control as that of munitions of war is warmly commended. Consolidation of estates is urgently necessary and should be accompanied by a revision of the register of lands. The price of corn should be left sufficiently free to rise to encourage production, whilst at the same time the rise in the price of bread should be restricted by all appropriate means. It is suggested that these two apparently irreconcilable objects can be effectively attained through the establishment of municipal bread bureaux, which should subsidise or tax the bakers according to the fluctuations in the price of corn. This expedient was successfully resorted to during the Crimean War.

It is urged that the home production of manures should be fostered by using every measure to increase the output of sulphate of ammonia, by developing the synthetic manufacture of nitrates and ammonia from the atmosphere, and by increasing the production of superphosphate, all of which industries, it is urged, should have the same privileges as munition factories. To secure increased crops arrangements should be made for free distribution of manures to small cultivators.

Measures must be taken for restoring the head of live stock. To this end restrictions must be placed upon slaughter of home stock; the colonial resources of Madagascar and Africa must be drawn upon for meat, to be prepared there in frozen or otherwise preserved condition in order to reduce costs of transport. For the same reason abattoirs and refrigerating plants should be established in the home meat-producing districts, whereby cheaper production and reduction in the number of middlemen would be secured. The strong prejudice of the people against refrigerated or preserved meat must be broken down, and much could be done in this direction by the use of such products throughout the Army and Navy.

SIR JOHN WOLFE BARRY, K.C.B., F.R.S.

SIR JOHN WOLFE BARRY, the eminent civil engineer, died on January 22, in his eighty-second year. The youngest son of Sir Charles Barry, R.A., the architect of the Houses of Parliament, he was educated at Trinity College, Glenalmond, and at King's College, London. He was a pupil of Sir John Hawkshaw, and afterwards for him assistant resident engineer on the Charing Cross and Cannon Street Railway. In 1867 he started in private practice.

Sir John Wolfe Barry devoted himself largely to the construction of bridges, railways, and docks, and by his ability, wide experience, and energy acquired a position of leadership in the engineering profession. He gave ungrudging assistance to all public undertakings and inquiries involving engineering considerations, and had great influence in many ways in promoting the industrial and commercial prosperity of the country. He took great interest in efforts to raise the scientific qualifications of engineers and in the investigation of engineering problems. A member of the Institution of Civil Engineers for fifty years, on its council for thirty-four years, and its president in 1896–97, his authority and the value of his services to it can scarcely be overrated. He became F.R.S. in 1895, K.C.B. in 1897, and was chairman of council of the Royal Society of Arts in 1898–99.

There is not space here to enumerate the numerous undertakings on which Sir John Wolfe Barry was engaged in an executive or consultative capacity. Amongst them were the Lewes and East Grinstead Railway, the Inner Circle extension from the Mansion House to Whitechapel—a work of great difficulty—the Blackfriars arched railway bridge, the Tower Bridge (in association with the late Sir Horace Jones), the King Edward VII. Bridge at Kew, the Barry docks and railways, the Grangemouth dock, and the entrance lock and graving dock at Immingham; also dock and railway works in Buenos Ayres, Natal, and India. Sir John took an interest in the introduction of electricity on railways. With the late Sir Charles Hartley, he represented this country on the Suez Canal International Commission; with Sir E. Fry and Sir Hugh Owen, he was a member of the Court of Arbitration for the purchase of the London Water Companies, and was a member of the Royal Commission on London Traffic in 1903–5.

Perhaps the greatest service rendered by Sir John Wolfe Barry to engineering industries was the part he took in founding and directing the activities of the Engineering Standards Committee. It was due mainly to his insight and influence that representatives of Government departments, engineers, manufacturers, shipbuilders, and others were brought together, and have freely given their time and experience in dealing with the complex details of standardisation, a work of the greatest national importance. Sir John, in 1917, gave an account of the work of the Standards Committee, during sixteen years, in a lecture to the Institution of Civil Engineers on "The Standardisation of Engineering Materials and its Influence on the Prosperity of the Country." Started in a tentative way, with the object of reducing the wholly unnecessary number of rolled sections of steel bars and rails, produced by manufacturers who had to meet the wishes of different engineers and architects, it was soon found necessary to draw up complete specifications of quality and of the tests to which material should be subjected. The work of the committee then extended to other departments of industry, especially to the various branches of the electrical industry. The main committee now consists of twenty-two members, and there are sixty-four sectional and sub-committees, having in the aggregate more than 500 members. Practically all persons interested are represented and have a consultative voice in all proposals for standardisation. The specifications adopted are published, and when necessary revised annually.

Sir John Wolfe Barry pointed out in his lecture that it was difficult to estimate exactly the beneficial results of standardisation, but that he was justified in saying that they have been immense in facilitating production and in cheapening output, while ensuring excellence in the scientific composition of materials and in accuracy of workmanship. Thus, in the case of Portland cement, whereas formerly different specifications were imposed by different users, involving modifications in manufacture, practically now the whole output is made to one standard specification.

In the case of rolled sections for construction, for shipbuilding, and for railway and tramway rails, the annual output before the war was 3,700,000 tons, valued at 25,000,000*l*. Of this at least 85 per cent., and in some cases 95 per cent., were rolled to standard specifications.

The war has raised serious problems as to the security in the future of our foreign trade. Under Sir John Wolfe Barry's guidance, the Standards Committee has undertaken the laborious work of translating the standard specifications into French, Spanish, and Russian, converting British into metric measures, and issuing them in a much cheaper form. It also contemplates the establishment, in twelve important foreign trading centres, of local committees in touch with the London organisation, and concerned with the promotion of trade.

Sir John took an active interest in the foundation of the National Physical Laboratory, having been a member of its Executive Committee, and greatly assisted it in obtaining such funds as it has secured for carrying on its work and in making it the expert authority in scientific questions arising in connection with standardisation. He exerted great influence in the improvement of technical education. He was chairman of the Executive Committee of the City and Guilds of London Institute, and took much interest in the development of the Central Technical College. Since the reorganisation of the London University, he was

for a time a member of the Senate, and up to the date of his death was chairman of the delegacy which governs the City and Guilds Engineering College. It was at his instance that the Institution of Civil Engineers adopted an examination scheme so that candidates for admission to membership must now pass an educational test as well as an investigation of their experience in constructional work.

At the memorial service held at St. Margaret's Church, Westminster, on Saturday, January 26, there were present, in a large and distinguished congregation, representatives of many scientific societies and other bodies with which Sir J. Wolfe Barry was connected, including the following:—British Science Guild (Sir Robert Hadfield and Sir Alex. Pedler); City and Guilds Engineering College (Profs. W. E. Dalby, A. R. Forsyth, and T. Mather); Imperial College of Science and Technology (Sir Alfred Keogh and Mr. Alexander Gow); Institute of Municipal and County Engineers (Mr. Thomas Cole); Institution of Civil Engineers (Mr. Harry Jones and Dr. J. H. T. Tudsbery); Institution of Electrical Engineers (Mr. R. Elliott-Cooper and Mr. Alexander Ross); Institution of Naval Architects (Sir Henry J. Oram and Mr. Robert W. Dana); King's College, London (Mr. W. Smith); National Physical Laboratory (Sir Richard Glazebrook); Royal Institution (Sir W. Phipson Beale and Hon. R. C. Parsons); Royal Society (Sir J. J. Thomson and Sir Richard Glazebrook); Royal Society of Arts (Mr. A. A. Campbell Swinton and Mr. G. K. Menzies); and Surveyors' Institution (Mr. Alexander Goddard).

DR. WILLIAM GREENWELL, F.R.S.

THE distinguished archæologist, Dr. William Greenwell, of Durham, died on January 27 in his ninety-eighth year. He was affectionately referred to by everybody as Canon Greenwell, on the strength of a minor canonry of Durham, which was the highest promotion the Church found for him, and which he adorned for more than sixty years. For all that time he was the guide, philosopher, and friend of two generations of archæologists. What he was to the Church in Durham may be indicated by his preservation of the windows of Lanchester Church and by other work in ecclesiastical antiquity.

Dr. Greenwell became the local secretary for Durham of the Society of Antiquaries in 1866, and was elected a fellow in 1868. He did not attend to be admitted until 1875, but in the meantime made several communications to the society. His contributions to *Archaeologia* were six, made between 1889 and 1909. The majority of the papers read and exhibits made by him to the society during his fifty-two years' association with it related to prehistoric archæology, on which he wrote with high authority; but he was equally at home in describing a ring of Alfred the Great's sister, which he had added to his collections, or a portrait of Mary Tudor, belonging to the Dean and Chapter. He was an indefatigable explorer and a discriminating collector. Before 1880 he had accumulated objects from 234 barrows, and these he presented to the British Museum. No sooner had he given away or sold one collection than he began to make another. This happened more than once. The latest instance is that of the fine collection of remains of the Bronze age which was acquired for the British Museum a few years ago by the munificence of a lamented American millionaire. We are much mistaken if, since then, another collection has not been well begun. He lectured at the Royal Institution in 1867 on the Yorkshire barrows.

Dr. Greenwell joined the Ethnological Society in 1868, was forthwith elected on its council, and contributed to it in 1870 an account of the opening of Grimes Graves near Brandon, in Norfolk. He was elected a fellow of the Royal Society in 1878. He addressed the Royal Archæological Institute at Durham in 1908 with "extraordinary knowledge and lucidity" on the development of the spear and dagger during the Bronze age.

Of his published works, besides his papers in the Transactions of these and many other societies, and several ancient records edited by him for the Surtees Society, the principal is that on British barrows, in which the late Prof. Rolleston collaborated.

Dr. Greenwell was honorary D.C.L. of Durham, a man of versatile accomplishments and much learning. He was an adept in the sport of fly-fishing, which he practised almost to the last. Genial and witty, warm-hearted and enthusiastic, he lived every day of his long life.

MISS ETHEL SARGANT.

BY the death of Miss Ethel Sargant, which occurred on January 16, after a brief illness, at the age of fifty-four, botanical science has sustained a severe loss. Miss Sargant was educated at the North London Collegiate School and at Girton College, Cambridge; she took the two parts of the Natural Sciences Tripos in 1884 and 1885. In 1913 she was elected to an honorary fellowship of Girton College. She was a fellow of the Linnean Society, and was the first woman to serve on its council. At the time of her death she was president of the Federation of University Women.

Miss Sargant spent a year at Kew (1892–93), working at the Jodrell Laboratory under Dr. D. H. Scott; she always spoke with gratitude and enthusiasm of the training in the methods and spirit of research which she received at his hands. A paper written in collaboration with Dr. Scott appeared in the *Annals of Botany* in 1893. All Miss Sargant's later research was carried out privately, for some years in a laboratory built in the grounds of her mother's house at Reigate, and eventually at her own home in Girton village, Cambridge. Her earlier work, after leaving Kew, was cytological, and dealt with the formation of the sexual nuclei in *Lilium martagon*. Her attention to the structure of the embryo-sac bore further fruit at a later date in an interesting theory regarding the meaning of "double fertilisation" in Angiosperms, which she developed in the *Annals of Botany* for 1900.

But Miss Sargant's principal work lay in the direction of anatomy and morphology: she possessed the "morphological sense" to a most remarkable degree, and the anatomy of seedlings became a subject which she made peculiarly her own. She formed a unique collection of microscopical preparations illustrating the vascular anatomy of monocotyledonous seedlings. She was the first botanist to apply microtome technique to the elucidation of the problems presented by the anatomical transition from stem to root; owing to the extreme shortness of the hypocotyl in many monocotyledonous seedlings, it is often quite impossible to demonstrate their structure by means of hand sections alone. In a series of papers, the great majority of which appeared in the *Annals of Botany*, she developed her well-known theory of the origin of monocotyledons, based upon the results of her researches into seedling structure. In 1913 she was president of Section K (Botany) at the Birmingham meeting of the British Association, being the first woman chosen to preside over a section. She took for the subject of her address "The Development of Botanical Embryology since 1870," and gave a masterly review of a difficult and controversial field, in which she had herself broken much new ground.

NOTES.

THE gold medal of the Royal Astronomical Society has been awarded by the council of the society to Mr. John Evershed for his investigations of radial motion in sun-spots and other contributions to astrophysics. The Hannah Jackson (*née* Gwilt) gift has been awarded to the Rev. T. E. R. Phillips for his observations of planets, double stars, and variable stars. The awards will be presented at the annual general meeting to be held on Friday, February 8.

THE scheme for the reconstitution of the Labour Party, to which we referred last week (p. 404), providing for representation of producers "by brain" as well as "by hand," was submitted by Mr. Henderson on behalf of the executive to the conference at Nottingham on January 23. After discussion it was decided that the draft scheme should be referred to the affiliated societies, and that another conference should be called in a month's time to consider it.

THE proposed formation of a British Association of Chemists will be discussed at the meeting of the London Section of the Society of Chemical Industry to be held at the Royal Society of Arts on Monday, February 4, at 7.30 p.m.

THE death has occurred, in his sixty-seventh year, of Mr. Louis P. Gratacap, curator in mineralogy in the American Museum of Natural History since 1900. For the previous nine years he had held the post of assistant curator. His publications included a standard "Guide to Mineral Collections," "Popular Mineralogy," and "Geology of the City of New York."

THE death is announced, at the early age of forty-five, of Dr. T. C. Janeway, who occupied, at Johns Hopkins University, the chair of medicine formerly filled by Sir William Osler. He was a member of the Board of Scientific Directors of the Rockefeller Institute for Medical Research, and secretary of the Russell Sage Institute of Pathology. Prof. Janeway was the author of "The Clinical Study of Blood Pressure."

THE Research Defence Society and the Association for the Advancement of Medicine by Research have been united into one society, which will retain the name and official address of the Research Defence Society. All such communications as used to be made to the association should, therefore, now be made to the honorary secretary of the Research Defence Society, 21 Ladbroke Square, London, W.11.

IN consequence of a statement from F. I. Faltz-Fein directing attention to the dangers which, in the present circumstances, threaten the existence of the famous zoological park and horse-breeding station on his estate at Ascania Nova, the council of the All-Russian Horse-breeders' Congress brought the matter to the notice of the Petrograd Academy of Sciences, with the earnest request that immediate and energetic measures be taken for the protection of an establishment which is of very great scientific value, and justly considered the pride of Russia. It is announced in the December Bulletin of the Academy that, in response to this appeal, the Government has instructed Maj.-Gen. P. K. Kozlov to take the necessary measures.

ACCORDING to reports in the French Press, a "General Congress of Civil Engineering" will be held in Paris on March 18–23 next. The objects of the conference, as recently explained to the French Minister of Commerce and Industry, are to awaken the French nation to the need for increased industrial enterprise and the attainment of industrial agreement. The Minister expressed the hope that the conference would give very close attention to such questions as the saving of fuel and the thorough utilisation of intellectual and mechanical effort; wage war on waste of all kinds; and advocate the systematic utilisation of by-products, and the adoption of improved scientific mechanical methods of production—in short, give that place to applied knowledge that it now merits.

THE Minister of Reconstruction has appointed the following committee of manufacturers and business men to consider the provision of new industries for the engineering trades:—The Hon. H. D. McLaren (chairman), Mr. C. Bennion, Sir George Bullough, Bart., Mr. F. H. Crittall, Mr. R. Dumas, Mr. W. B. Lang, Mr. C. A. Lister, Mr. P. J. Pybus, Mr. G. H. Sankey, Sir Percy Stothert, Mr. J. Taylor, Mr. W. Taylor, Mr. W. Thom, and Sir W. Rowan Thomson. The duties of the new committee will be to compile a list of the articles suitable for manufacture by British engineers which were either not made in the United Kingdom or made in insufficient quantities, and for which there is likely to be a demand after the war. The need for such a list of articles and for some organised effort to make them at home has been amply shown by the war, which has revealed our dependence on many—even the enemy—countries for articles vital to our industries, and even to our war equipment.

BY the death of Lieut. E. J. Woodhouse in France on December 18 last, from wounds received early in the month, the Indian Agricultural Service has lost a capable organiser and adviser. Educated at Marlborough, Lieut. Woodhouse entered Trinity College, Cambridge, in 1903. In 1906 he graduated with honours in the Natural Sciences Tripos, and the following year obtained the University diploma in agriculture. He then proceeded to India to take up the post of economic botanist to the Government of Bengal. Three years later he was appointed principal of the Agricultural

College of Bihar and Orissa, but still retained his post as economic botanist. His chief work was on problems connected with economic botany, but he also undertook some work on economic entomology, and successfully demonstrated a method of reducing the attacks of surface caterpillars on a very large scale and of reducing the attacks of potato moths in Bengal. At the outbreak of the war he was a captain in the Bihar Light Horse, and in February, 1915, joined the Indian Army Reserve of Officers. In July of that year he went to France, where he carried on with his usual energy. Lieut. Woodhouse was a capable worker, and won the good opinion of all who came in contact with him.

IT is with regret that we have to record the passing of another veteran from the ranks of the great engineers of the Victorian era. Sir Alexander Meadows Rendel has just died at the ripe age of eighty-eight. His death recalls the construction, rather more than sixty years ago, of the Royal Victoria Dock and of the Shadwell Basin, London Docks, when he acted as engineer to the London Dock Company. Sir Alexander had then just succeeded to the practice of his father, Mr. James M. Rendel, F.R.S. The family was, in fact, devoted to engineering work, both by tradition and natural inclination. All four of Mr. Rendel's sons attained distinction and repute, three of them, including Lord Rendel, in connection with the great firm at Elswick, of which Lord Armstrong was the head. It was fitting, therefore, and almost inevitable, that, on the completion of his academic training at Cambridge, where he was a scholar of Trinity, the eldest son should pass into the office of his father. In addition to the docks mentioned above, Sir Alexander was responsible for the Albert and Edinburgh Docks at Leith. But it is principally in connection with India that his name will be remembered. He was consulting engineer to the India Office and to many of the Indian railway companies. He designed and constructed a very large number of bridges, of which the most important were the Lansdowne Bridge over the Indus at Sukkur, opened in 1889, and the Hardinge Bridge, over the Ganges at Sara, completed in 1915. He paid a number of visits to India, and so close was his association with Indian affairs that it is not too much to say that over a period dating from days before the Indian Mutiny he exercised a very considerable influence, not only in strictly engineering matters, but on the general policy and administration of the Indian railway system.

THE death, about three months ago, of Dr. Maryan Smoluchowski de Smolan, professor of physics at the University of Cracow, Poland, at forty-five years of age, deprives the scientific world of a pioneer in the field of modern thermodynamics and the kinetic theory of matter. Smoluchowski's chief investigations, already crowned with notable success and full of promise for the future, centred round the problems of the so-called fluctuations about the average, normal state of statistical equilibrium. The most prominent example of his researches of this kind is his famous explanation of the opalescence of gases at or near the critical state. Most of Smoluchowski's papers were published in the Transactions and the Bulletin of the Academy of Sciences of Cracow. A good summary of his own work and of the problems that most interested him will be found in his report in the *Physikalische Zeitschrift*, vol. xiii. (1912), p. 1069. The non-specialist will find an easily accessible description of some of his researches in Perrin's attractive book "Les Atomes." Smoluchowski's scientific attitude and tendencies, however, are best characterised in his address given at the University of Göttingen, "On the Limits of Validity of the Second Law of Heat Theory" (*cf.* "Vorträge üb. d. kinet. Theorie d. Materie u. d. Elektrizität von Planck, Debye, Nernst, Smoluchowski, Sommerfeld u. Lorentz"; Leipzig: Teubner, 1914, pp. 89–121). This admirable lecture will be found to contain not only a clear explanation of the famous difficulties connected with Boltzmann's H-theorem, but also a fascinating description of the *rôle* of fluctuations as restrictors of the validity of the second law of thermodynamics, increasing at the same time the true value of that law, and presenting it in an interesting light.

VERY soon after the commencement of the war the Government of this country was made to realise that the services of chemists, as distinguished from pharmacists, are really of essential national importance. The special position as regards recruiting for the Army, into which chemists of high qualification were placed, is evidence of this recognition. Even yet, however, a large proportion of the general public is unaware of the importance of the chemist in industry, one of the causes of this being the fact that, unlike the French and the Germans, we do not in general distinguish between "chemists" and "pharmacists"; in fact, the term "chemist" is legally confined to compounders and vendors of medicine. Recognition by public opinion of the importance of the chemist is necessary in order to secure his adequate remuneration, and until this is secured there will be an insufficiency of chemists, and therefore no chemical industry worthy of the name. Recently, however, signs have not been wanting that the condition of the chemical industry and the position of the chemist are beginning, and likely to continue, to improve. The latest sign is the alteration in character of the Journal of the Society of Chemical Industry, upon which we venture to congratulate both the society and the review editor. The Journal has always been an exceedingly valuable one, but until recently it was rather machine-like, and the human element was chiefly conspicuous by its absence. In it one sought the abstracts under the heading of particular interest to oneself, and glanced at the titles of the papers to discover one of interest—and that was all. Now, however, that there is a review section, including articles of general interest, trade reports, Parliamentary and legal news, signed reviews of chemical books, reports of meetings of the different sections, and of those of other societies, almost every chemist will be able to pick up the Journal with the practical certainty of finding something of interest. Further, the Journal now has a better chance of appealing to those who are not chemists, and so helping to educate the public as to what a chemist really is.

WE regret to see the announcement of the death, on January 23, of the veteran alienist, Dr. Henry Maudsley. He was born near Settle, in Yorkshire, in 1835, and he graduated from University College Hospital as M.D. of London in 1857. Through a busy professional life as superintendent of Manchester Asylum, physician at the West London Hospital, professor of medical jurisprudence at University College, and so on, he kept up a strong interest in psychological and philosophical problems, and he was for many years editor of the *Journal of Mental Science*. A keen intellectual combatant, absolutely sincere and fearless, he played a notable part among notable men at a time of great scientific activity—the last quarter of the nineteenth century. It was apparently under the influence of Herbert Spencer that Dr. Maudsley was early in the field in applying evolutionist conceptions to psychology. His "Responsibility in Mental Disease" appeared in 1874, and was the first of many works, such as "Physiology of Mind," "Pathology of Mind," "Body and Will," which did useful service to

psychological science in emphasising the intimate way in which physiological factors are bound up with psychical factors in the unified life of the creature. Central to his whole thinking was the idea of the unity of the organism in which mental and motor activities are closely correlated, and he never wavered from this position, which was vigorously expounded in his "Organic to Human," published less than a couple of years ago. Dr. Maudsley was essentially "tough-minded," and his pre-occupation with mental diseases probably exaggerated his distrust of "over-strained idealism of any sort." Deepest in his life, perhaps, was the desire to further by his investigations and thinking a scientific systematisation which would make for the relief of man's estate. Towards that end, ten years ago, he generously contributed 30,000*l.* to the London County Council for developing the treatment of mental diseases. What we venture to call his mood of scientific meliorism, sometimes shadowed, was expressed in the fine sentence: "By large and close and faithful converse with Nature and human nature in all their moods, aspects, and relations is the solid basis of fruitful ideals and the soundest mental development laid."

In a recent number of *West Africa* (January 19) Mr. R. E. Dennett suggests the formation of a Union for the study of the British West African Colonies and the advancement of their interests in this country. Mr. Dennett begins by pointing out how necessary it is that British West Africa should have a showroom in one of the principal London thoroughfares, where produce and pictures of typical West African scenes could be displayed. The foundation of such a showroom might, he suggests, be the first step towards the formation of a union to co-ordinate work for British West Africa. There would be scope for talent of every kind in this union, since the activities of its sections would range over such diverse subjects as superstitions and mythology, sanitation, forms of government, banking, utilisation of produce, transport, hospitality to distinguished West Africans, and the care of West African students. Much work for West Africa is already being done, as Mr. Dennett admits, by the Imperial Institute, the Royal Colonial Institute, Kew Gardens, and various learned and other societies, and though he disclaims any intention of competing with existing institutions, the details of his scheme include suggestions for some work which is already being done. What is really needed at present is a union the main business of which would be to stimulate the organisations already at work for West Africa, including the Government, instead of trying to do any part of the work itself. It is well known, for example, that the quality of much West African produce needs improvement, that the agricultural and forest departments in these territories need larger staffs and more funds, and that further means of transport are required. A union competent to speak for West Africa would be usefully employed in directing public attention to these and other equally important matters, and in taking action through the proper channels to get them remedied. If such a union had existed it could scarcely have remained quiet when last month a great part of the exhibition galleries of the Imperial Institute, including the only exhibit of West African produce in London, was closed to the public by the Office of Works to accommodate a branch of the Ministry of Food.

Lord Leverhulme discusses, in *Science Progress* for January, the question of the abolition of slums. The slum problem is, he observes, merely a case of bad "packing," because, while most towns have slums, the majority of them possess within their boundaries a sufficient area of land to accommodate three times their present population. Lord Leverhulme's suggestion is that each municipality should acquire, as occasion offers, the fringe of land on its suburbs, and that the municipality could afford to give this land to persons ready to build houses thereon. With the general adoption of the Town Planning Act the present scandalous condition of things might be removed.

Sir C. H. Read describes, in *Man* for January, two bronzes acquired from a Parsi in Bombay, who stated that his family had possessed them from time immemorial, and that they had been brought by one of his ancestors from Persia, where they had been attached to the gate of the city whence the Parsi family had come. They are castings by the wax process, known as *cire perdue*, and represent animals which at once recall the bull-like monsters of Assyria; but, at the same time, there are differences that may be of some significance. The Assyrian bulls are human-headed, and these also have human heads, but while the modelling of the bodies suggests a bull, the horns are unquestionably those of a sheep. This sheep has been identified by Lord Rothschild as *Ovis orientalis gmelini*, the wild sheep of Asia Minor and Armenia. It is possible that these bronzes were ultimately derived from Assyria, and as the relations between Assyria, Persia, and Armenia were intimate, the story of the Parsi may be correct. But many questions regarding the style and use of these bronzes, which will ultimately pass to the British Museum, await further investigation.

It was stated in one of the morning papers a few days ago that "there have recently arrived in England evidences of the most important zoological discovery that has come to light since the finding of that strange beast, the okapi. . . . This discovery proves very completely the existence of a new and hitherto unknown species of elephant, a real dwarf elephant." All that has really happened is that two skeletons have just arrived in this country of a "dwarf" race of elephant described in the *Revue Zoologique Africaine* in 1913. Thus the announcement of this "discovery" is somewhat belated. The specimens just received are stated to be fully adult examples, but this is not yet certain, and will be determined by Dr. C. W. Andrews, of the British Museum of Natural History, to whom they have been submitted. But we have known of the existence of dwarf elephants in Africa since 1906, when the first of its kind was discovered. This came into the possession of Hagenbeck, the German dealer in live animals, who sold it to the Zoological Society of New York, in the gardens of which it is still living. This animal forms the type of the species *Elephas africanus pumilio*. The species referred to in 1913 was described under the name *Elephas africanus frennseni*. The specimen obtained by Hagenbeck now stands about 5 ft. high, but whether this is its maximum height is open to question, since its growth may have been checked by a troublesome skin disease from which it has long suffered. The specimens described in 1913, from Lake Leopold II., measured some 6 ft. in height, which is stated to be the height of the taller of the two animals the skeletons of which have just been received. These may not prove to be adult, so that the precise amount of dwarfness of these "dwarf" elephants has still to be determined, but it seems certain that they are far smaller than the typical African elephant, though they are giants compared with the extinct dwarf elephant of Malta.

IN the *Australian Zoologist* (vol. i., part 4, Sydney, October 8, 1917) there is an interesting article by Mr. Charles Hedley, director of the Australian Museum, on the economics of *Trochus niloticus*. This handsome shell was mistaken for a product of the Nile by Aldrovandus, who, in 1606, was the first writer in Europe to describe it. Mr. Hedley tells us that it is found on coral-reefs from Ceylon to Samoa, and as far north as Japan. The natives of various islands make use of the animal as food, and the periphery of the shell has been cut out and worn as a bracelet by the Papuans. But among civilised people it was only known to shell fanciers until a few years ago. "Exhaustion of former supplies of pearl shell and the increasing demand of recent years have promoted search for new sources of mother-of-pearl. Thus *Trochus niloticus*, or trocas, as it is sometimes called, having dense firm nacre, which proved good material for buttons, came to be exploited by manufacturers. During the past six years an active request for Trochus by button-makers has sprung up, advancing from 20*l*. to 30*l*. a ton." The Great Barrier Reef is being fished for Trochus, from Torres Straits southwards to Port Mackay. The export of Trochus from Queensland in 1915 was 544 tons, worth 12,000*l*., and in 1916 was 950 tons, worth 23,000*l*. The Philippine Islands export about 320 tons annually. From Western Australia the exports of Trochus were:—For 1912, 52 tons; for 1913, 66 tons; for 1914, 19 tons; for 1915, 73 tons; for 1916, 26 tons. There are also large fisheries in New Guinea, the Solomon Islands, and Fiji. Some Japanese fishermen carefully save both meat and shell. From ten tons of shell a ton of meat is obtainable, worth, in China, 20*l*. a ton. Mr. Hedley considers that the annual Australian crop of Trochus is likely soon to deteriorate under the present active fishery.

THE annual report of the Department of Agriculture, Nyasaland, for the year ending March 31, 1917, contains much interesting matter. The exports of tobacco, tea, and cotton constitute a record for the Protectorate, and the past year has been particularly favourable for agriculture generally, despite the difficulties arising out of the war and the absence of many planters on military service. The increased demand for tobacco is a direct result of the privileged admission of British-grown tobacco into the United Kingdom, and, despite high prices for freight, the industry is very prosperous, and has now established itself in the home market. Nearly 1000 more bales (400 lb.) of cotton were exported than in the previous year, and the acreage under European cultivation is now 29,580. Tobacco first appeared as an article of export in 1899, and, despite freight charges, has managed to establish itself against American competition. Tea to the extent of 420,685 lb. was exported, whilst in the previous year the amount was 288,341 lb. The great difficulty with regard to Nyasaland products is that of freight and transport, and much damage to cotton and tobacco results during the difficult journey to the coast. There is also the drawback that owing to delays the planter can seldom realise on his crops within one year of the date of shipment, thus necessitating double capital, or planting on advance rates, which eat deeply into profits. Until direct railway communication with the coast can be established this promising land will remain very severely handicapped.

THE *Scientific American*, in its issue of December 22 last, directs attention to the low efficiency of massed rifle fire at ranges less than 500 yards. It appears that the best results ever obtained were by the Boers at Colenso, when in full daylight and from a sheltered position they succeeded in making one hit in 600 shots fired against an enemy thoroughly exposed in the open. This lack of success of the rifle at close ranges leads to its being regarded rather as a handle for a bayonet than as an effective weapon itself. It seems that no amount of preliminary training or of adjustment of sights can eradicate the tendency of the rifleman to shoot too high when under mental stress. To overcome this difficulty Col. Ely, of the American Army, has invented an attachment weighing only 2 oz. which, when adjusted, prevents the rifle being discharged when its angle of elevation exceeds a given value. The records obtained with the device are about twenty-four times as good as the Colenso results, but it does not appear to have been adopted by the American military authorities.

THE importance of modern methods of welding in enabling repairs to be executed quickly has been brought out by a recent account in *Engineering* (January 11) of the methods adopted for making good the damage done by the Germans on vessels interned in U.S. ports. The principle of electric welding has been applied to fifteen ships in the port of New York, and all these are now in commission and probably ready for service. Bulletin No. 98 of the University of Illinois Engineering Experiment Station is also of interest, and gives an account of tests of oxyacetylene welded joints in steel plates. The plates employed varied in thickness from No. 10 gauge to 1 in., and were subjected to various heat treatments. The tests include static loads, repeated loads, and impact. The welds were made by skilled workmen. For joints with no further treatment after welding, the joint efficiency for static tension was found to be about 100 per cent. for plates up to $\frac{1}{2}$ in. thick, and to decrease for thicker plates; these joints show an efficiency not greater than 75 per cent. for the material in the joints, but were strengthened by working the metal after welding and weakened by annealing at 800° C. Repeated stress tests followed in a general way the results of the static tests. Hammering or drawing the weld while hot increases the strength. The impact tests show that oxyacetylene welded joints are decidedly weaker under shock than is the original material; for joints welded with no subsequent treatment, the strength under impact seems to be about half that of the material. If the welded joint is worked while hot, the impact-resisting qualities are slightly improved. Annealing from 800° C. seems to have very little effect on the impact-resisting qualities.

MESSRS. H. K. LEWIS AND CO., LTD., hope to publish in the course of the next few weeks vol. i. of "Regional Surgery," a work by American and British authors, in three volumes, edited by Dr. J. F. Binnie, Gould's "Pocket Medical Dictionary," Stitt's "Tropical Diseases," and Stitt's "Practical Bacteriology." The first consignment of these books was lost at sea by a gale.

THE twentieth issue of "The Scientist's Reference Book and Diary"—that for 1918—has now been published by Messrs. Jas. Woolley, Sons, and Co., Ltd., of Manchester, at the price of 2*s*. 6*d*. As usual, it consists of two parts: the first is a storehouse of physical and chemical constants, definitions, and important scientific facts; and the second is a conveniently arranged diary and memorandum book. The two are bound together in a leather case suitable for carrying in the pocket.

THE following books are announced for publication during February by Messrs. Chapman and Hall, Ltd.:—"The Chemistry of Colloids," by Prof. R. Zsigmondy, translated by Prof. E. B. Spear, part ii.,

Industrial Colloidal Chemistry, by Prof. E. B. Spear, and a chapter on Colloidal Chemistry and Sanitation by Prof. J. F. Norton; "An Introduction to Theoretical and Applied Colloid Chemistry," by Dr. W. Ostwald, translated by Prof. M. H. Fischer; "Biochemical Catalysts in Life and Industry: Proteolytic Enzymes," by Prof. J. Effront, translated by Prof. S. C. Prescott and C. S. Venable; "Practical Pyrometry," by E. S. Ferry, G. A. Shook, and J. R. Collins; "Hand Grenades," by Major G. M. Ainslie; "Ordnance and Gunnery," by Lt.-Col. W. H. Tschappat; "Hydro-Electric Power-Stations," by E. A. Lof and D. B. Rushmore; "A Practice Book in Elementary Metallurgy," by Prof. E. E. Thum; "Testing for the Flotation Process," by A. W. Fahrenwald; an enlarged edition of "Practical Instructions in the Search for, and the Determination of, the Useful Minerals, including the Rare Ores," by A. McLeod; "The Development of Forest Law in America," by J. P. Kinney; and reprints of "Scientific and Applied Pharmacognosy," by Prof. H. Kraemer, and "Applied and Economic Botany," by Prof. H. Kraemer.

OUR ASTRONOMICAL COLUMN.

THE PLANET SATURN.—This beautiful telescopic object will be in opposition to the sun on January 31, and will be very favourably placed for telescopic scrutiny during the ensuing few months. There is evidence to show that much the same phenomena occur on Saturn as on Jupiter, and that occasionally disturbances on a considerable scale occur in the atmosphere of the former object. Yet it has not been very successfully observed when we compare the results with those obtained with regard to Mars and Jupiter. The far greater distance of Saturn and the less conspicuous character of the markings are no doubt in part responsible for this, but sometimes, as in 1903, the spots and irregularities in the belts are very plain and numerous.

The rotation period of Saturn requires redetermination, for the markings in different latitudes exhibit proper motions. Prof. Hall's white equatorial spot of 1876–77 gave a period of 10h. 14m., whereas the dark and light markings which were visible in the north temperate region in 1903 indicated a period of about 10h. 38m., or twenty-four minutes longer.

UNIT OF STELLAR DISTANCE.—As a step towards the extension of the decimal system to celestial measurements, and the unification of units in the statement of stellar distances, it is suggested by M. de Rey Pailhade that a convenient unit would be 10^{10} kilometres (*L'Astronomie*, December, 1917). A light-year is equivalent to 946 of such units, or approximately 1000, which is a number easily remembered. The parsec, which corresponds to 3·25 light-years, is very closely 3000 units, and the distance of 61 Cygni would be expressed by 5865. On the same system, the mean distance of the earth from the sun is 0·015, and that of Neptune 0·450. The symbol suggested for the new unit is Us (*unité stellaire*), but this does not seem to be well adapted for countries other than France.

RELATIVITY AND SHIFTS OF FRAUNHOFER LINES.—According to Einstein's theory of relativity, the lines in solar and stellar spectra should be displaced towards the red by an amount depending upon the difference in gravitational potential between the gravitational field in which the lines originate and the terrestrial field where the radiation is received. In the case of the sun the theoretical displacement is equivalent to the Doppler displacement due to a radial velocity of 0·634 km. per sec., and at λ 5000 amounts to 0·010 A. With the powerful instruments now in use in solar observations such a shift of the lines should be easily measurable. The question has been taken up at Mt. Wilson by Dr. St. John, who has selected some of the band lines of cyanogen as the most suitable for the purpose, in consequence of their freedom from displacements due to pressure (*Astrophysical Journal*, vol. xlvi., p. 249). The mean sun *minus* arc displacement at the centre of the sun for the forty-three band lines measured was zero, while for thirty-five lines at the limb it was only +0·0018 A. It cannot be assumed, therefore, that the Einstein effect is annulled at the centre by an outward radial motion of the solar vapours, as the effect of such a motion would vanish at the limb and the gravitational effect should appear. The observations accordingly give no evidence of a displacement of the lines of the order of magnitude required by the principle of relativity.

THE "ANNUAIRE ASTRONOMIQUE" FOR 1918.—The current issue of this useful publication maintains the high standard reached in former years. Besides the usual tables relating to the sun, moon, and planets, it includes a series of charts showing the aspect of the heavens in each month, and interesting notes on a great variety of astronomical subjects. A general review of progress in the various departments of astronomy and meteorology is a valuable feature. The Annuaire is published at 3 francs by the Librairie Ernest Flammarion, Paris.

PARIS ACADEMY OF SCIENCES.

PRIZES PROPOSED FOR THE YEAR 1919.

Mathematics.—Francœur prize (1000 francs), for discoveries or works useful to the progress of pure or applied mathematics.

Mechanics.—Montyon prize (700 francs), for the invention or improvement of instruments useful to the progress of agriculture, the mechanical arts, and the practical and speculative sciences; Poncelet prize (2000 francs), for work useful to the progress of mechanics.

Astronomy.—The Lalande prize (540 francs), for the most interesting observation in, or memoir most useful to the progress of, astronomy; Benjamin Valz prize (460 francs), for work on astronomy under similar conditions to those of the Lalande prize; G. de Pontécoulant prize (700 francs), for the encouragement of work in celestial mechanics.

Geography.—Gay prize (1500 francs). The question proposed for 1919 is the study of the physical geography of North Africa, and principally Mauritania; Tchihatchef foundation (3000 francs), for recompense or assistance to naturalists distinguished in the exploration of the lesser-known parts of Asia, excluding British India, Siberia, Asia Minor, and Syria.

Navigation.—The prize of 6000 francs, for work increasing the efficiency of the French naval forces; Plumey prize (4000 francs), for improvements in steam engines or any other invention contributing to the progress of steam navigation.

Physics.—Kastner-Boursault prize (2000 francs), for the best work on the various applications of electricity in the arts, industry, and commerce; Gaston Planté prize (3000 francs), to the author of a discovery, invention, or work important in the field of electricity; Hébert prize (1000 francs), for the best treatise or most useful discovery for the popularisation and practical use of electricity; Henri de Parville prize (1500 francs), for original work in physics; Hughes prize (2500 francs), for an original discovery in the physical sciences, especially electricity and magnetism and their applications; Pierson-Perrin prize (5000 francs), for a discovery in physics.

Chemistry.—Montyon prize (unhealthy trades) (one

prize of 2500 francs and one mention of 1500 francs), for the discovery of a means of rendering some mechanical art less unhealthy; Jecker prize (10,000 francs), for the author of the work most useful to organic chemistry; Cahours prize (3000 francs), for the encouragement of young men already known to have done good work, more particularly by researches in chemistry; Houzeau prize (700 francs), for a young chemist of merit.

Mineralogy and Geology.—Delesse prize (1400 francs), for work in geology, or, alternatively, in mineralogy. It may be divided. Joseph Labbé prize (1000 francs), for geological work or researches with reference to the mineral wealth of France, its colonies or protectorates, or, in default, to recompense the author of any work made in the general interest.

Botany.—Desmazières prize (1600 francs), for the best work on cryptogams published during the preceding year; Montagne prize (1500 francs), to the author or authors of important discoveries or works on the cellular plants; Jean Thore prize (200 francs), for the best memoir on the fluviatile or marine algæ of Europe, or on mosses, lichens, or European fungi; de la Fons Mélicocq prize (960 francs), for the best work on the botany of the North of France; de Coincy prize (900 francs), for a work on phanerogams; Jean de Rufz de Lavison prize (500 francs), for work in plant physiology.

Anatomy and Zoology.—Cuvier prize (1500 francs), for work in anatomy and zoology; Savigny foundation (1500 francs), for the assistance of young travelling zoologists, not receiving a Government grant, who specially occupy themselves with the invertebrates of Egypt and Syria.

Medicine and Surgery.—Montyon prize (three prizes of 2500 francs, three honourable mentions of 1500 francs, citations), for discoveries or improvements during the year in medicine or surgery; Barbier prize (2000 francs), for a discovery valuable in surgery, medicine, pharmacy, or in botany having a relation to the art of healing; Bréant prize (100,000 francs), the capital sum is offered to anyone discovering a specific cure for Asiatic cholera or for the discovery of the causes of this terrible scourge; Godard prize (1000 francs), for the best memoir on the anatomy, physiology, and pathology of the urino-genitary organs; Chaussier prize (10,000 francs), for the best book or memoir showing an advance in legal or practical medicine; Mège prize (10,000 francs), to the author who continues or completes the essay of Dr. Mège on the causes which have retarded or favoured the progress of medicine from antiquity to the present day; Bellion prize (1400 francs), for works or discoveries especially profitable to the health of man or the amelioration of the human species; Baron Larrey prize (750 francs), to a doctor or surgeon belonging to the Army or Navy for the best work presented to the Academy in the course of the year dealing with military hygiene, surgery, or medicine; Argut prize (1200 francs), for a discovery allowing the cure, by medicine, of a disease up to the present only capable of being dealt with surgically.

Physiology.—Montyon prize (750 francs), for the most useful work in experimental physiology; Lallemand prize (1800 francs), for work relating to the nervous system in the fullest sense of these words; Philipeaux prize (900 francs), for experimental physiology; Fanny Emden prize (3000 francs), for the best work treating of hypnotism, suggestion, and generally of physiological action exerted at a distance from the animal organism.

Statistics.—Montyon prize (one prize of 1000 francs, two mentions of 500 francs), for statistical researches of any nature.

History and Philosophy of the Sciences.—Binoux prize (2000 francs).

Medals.—Arago medal, awarded by the Academy at any time that a discovery, work, or service rendered to science appears worthy of this testimony of high esteem; Lavoisier medal, awarded under conditions applying to the Arago medal, for services rendered to chemistry; Berthelot medal, to holders each year of the prizes in chemistry.

General Prizes.—Prize founded by the State (3000 francs), question for 1919: researches on the geographical and bathymetric migrations of fishes and on the conditions which govern them; Bordin prize (3000 francs), question for 1919: in the theory of integrals of total differentials of the third species and double integrals relating to an algebraic function of two independent variables, the existence of certain numbers (*nombres entiers*) has been demonstrated, of which it is difficult to obtain the value, and may depend on the arithmetical nature of the coefficients of the equation of the surface corresponding with the function. The Academy requires a profound study of these numbers in particular cases. Vaillant prize (4000 francs), question for 1919: to discover a photographic layer, without visible grain, and as sensitive as the gelatino-bromide at present in use; Petit D'Ormoy prize: two prizes of 10,000 francs each, one for pure or applied mathematics, the other for natural science; Jean Jacques Berger prize (15,000 francs), for work relating to the city of Paris; Saintour prize (3000 francs), for work in the mathematical sciences; Henri de Parville prize (1500 francs), for a book on original science, or popularisation of science; Lonchampt prize (4000 francs), for the author of the best memoir on the diseases of man, animals, or plants from the special point of view of the introduction of mineral substances in excess as the cause of the disease; Henry Wilde prize (one of 4000 francs, or two of 2000 francs), for a discovery or work on astronomy, physics, chemistry, mineralogy, geology, or experimental mechanics; Gustave Roux prize (1000 francs); Thorlet prize (1600 francs).

Special Foundations.—The Lannelongue foundation (2000 francs), for one or two persons at most, in reduced circumstances, belonging themselves, or by their marriage, or parents, to the scientific world, with preference to medicine. Laplace prize, for the pupil leaving the Ecole Polytechnique holding the first place. L. E. Rivot prize (2500 francs), divided between the four pupils leaving the Ecole Polytechnique each year with the first and second places in the divisions of *mines* and *ponts et chaussées*. Normal School prize (2000 francs) will be awarded after the conclusion of the war to an old pupil, killed or wounded in the field, in recompense or in view of scientific work.

Funds for Scientific Research.—Trémont foundation (1000 francs); Gegner foundation (4000 francs); Jérome Ponti foundation (3500 francs); Henri Becquerel foundation (3000 francs); Bonaparte foundation (50,000 francs); Loutreuil foundation (125,000 francs); Charles Bouchard foundation (5000 francs).

GLASS TECHNOLOGY.

WE have now before us Nos. 1 to 3 of the Journal of the Society of Glass Technology. The first of these has already been noticed in these columns (NATURE, July 26, 1917). The two additional numbers now available indicate the healthy progress of this new society, and augur well for the renewed vitality of the glass industry in this country. The papers which appear in this journal cover a wide range of subjects and vary very considerably in size and

value; they may, perhaps, be regarded as somewhat minor contributions to a great subject, but that is as much as can be expected at a time when all our best energies are devoted to "doing" rather than to writing or talking about what has been and is being done. Thus, Sir Herbert Jackson's address, "Some General Observations on Glass," is interesting and suggestive, but obviously deals only with some of the fringes of the great work on which its author is known to be engaged.

Two subjects of very great immediate interest and importance are, however, dealt with in these Journals. The first of these relates to refractories. The papers by Fearnsides, Davidson, Rosenhain, and Cosmo Johns form part of a special discussion on refractories for the glass industry held by the society in Sheffield as a supplement or extension of the discussion on this subject inaugurated by the Faraday Society. On the basis of these papers the Society of Glass Technology was able to formulate the requirements of the glass industry in regard to refractories and to submit these to a conference on refractories afterwards held in London. This activity is of very considerable importance, because it is hoped that as the result of these conferences a "Refractories Research Association" may shortly be formed, for the purpose, in the first place, of furnishing fresh support and co-ordination for the various researches on refractories already in progress at various centres, such as the pottery laboratories at Stoke-on-Trent and at the National Physical Laboratory, and also of initiating much-needed additional researches both at those institutions and, possibly, elsewhere. The interests of the glass industry are most intimately concerned with this whole question of refractories—indeed, it is probably not too much to say that progress in glass manufacture depends almost entirely on progress in refractories. It may be hoped, therefore, that the Society of Glass Technology will give its best efforts to support this movement for research on refractories. Above all, it is to be hoped that no spirit of local or provincial jealousy will be allowed to interfere with the proper distribution and development of this work, whether at Sheffield, Stoke, or Teddington.

The second subject of great and immediate scientific and industrial interest touched upon in this journal is the question of the behaviour of glass in contact with chemical reagents and the correlated question of the testing of chemical laboratory glassware. This is a subject which, before 1914, had received very considerable attention in Germany, and there was a natural tendency to look to the work of the "Reichsanstalt" for guidance in these matters. The necessity for producing satisfactory laboratory glass in this country has led to a new and independent attack on the whole subject, and it has wisely come to be recognised that if the laboratory glass industry is to flourish in England after the war, it must be reinforced by an adequate system of testing by some recognised institution which will afford to the buyer and user of the ware an adequate guarantee of its good quality. The institution and organisation for dealing with a system of testing of this kind are, fortunately, already in existence at the National Physical Laboratory, and only need the provision of additional accommodation and staff to allow of their immediate application to the whole industry.

The question of the precise nature of the tests to be applied, however, is more difficult. Here, as in all cases where the power of prolonged endurance of an article or a material is to be tested, it is necessary to devise some accelerated test which shall—in a few hours or, at most, days—furnish an indication of the probable behaviour of the article in ordinary use over a period of months or years. In such cases it is difficult, if not impossible, to retain similarity or proportionality in the tests in such a way that the article giving the best test shall also be that which gives the best actual wear in use. In the case of glassware, in which resistance to hot water and to acids and alkalis and to such vigorous reagents as ammonium chloride and ammonium sulphide is demanded, as well as resistance to sudden changes of temperature and adequate mechanical strength, the problem is particularly complex—thus a variety of glass specially resistant to hot water may not be so resistant to hydrochloric acid, while a glass having a high degree of thermal endurance may not be adequately resistant to water.

The whole question of the tests to be applied has now been systematically studied for a considerable time, both at the National Physical Laboratory and by a special committee of the Institute of Chemistry, while two papers, by Messrs. Westwood, Cauwood, and Turner, and Messrs. Cauwood, English, and Turner respectively, in the present journal, furnish an interesting and important contribution to the subject. It may be hoped that agreement on this matter, sufficient to arrive at a working specification for routine testing, may soon be arrived at, and that the National Testing Bureau for Glass may commence its beneficent work for the British glass industry at no distant date.

X-RAYS AND THE WAR.[1]

IT was close on two years before the first formal meeting of the Röntgen Society, just twenty years ago, that Röntgen had stumbled, so to speak, across a new type of radiation, the wonderful properties of which excited the whole civilised world.

Since then the art of radiography has gradually extended into fields once never dreamt of. A present-day development, very typical of the times, is the detection of contraband metals, the examination of autogenous welds, and the scrutinising of steel and other metal castings and plates for faults and blow-holes. Such work demands high voltages and the heaviest outputs. Already steel plates more than 1 in. thick have been successfully examined.

But the all-important use of the X-rays is their medical application. Every hospital of any size now has its X-ray department, and there are many thousands of radiologists—both medical and laymen—devoting their lives to the work. X-ray technique has improved so vastly as to give the diagnostic methods of physician and surgeon a facility and exactitude never deemed possible at one time.

In the large military hospitals the great majority of wounded soldiers are X-rayed. The examination of wounds and injuries by X-rays has, in fact, become routine practice, whether in the field, by the use of the ingenious and cleverly designed motor-lorry outfits, or in the base hospitals. The X-ray has become as indispensable as the dressing or the splint, and it is an essential adjunct in prescribing and directing, as well as avoiding, operations. Even sprains are radiographed to find whether there is any slight bone fracture—as there very often is.

The X-ray detection of embedded bullet and shell fragments is now so certain as to be commonplace. Bullets and shrapnel are found and removed from any part of the body, even from the lung and brain or in the region of the heart. Precise instruments for localisation in the actual operating theatre are now in use, and even during the operation itself the surgeon's instrument may be guided to the foreign body. Stereoscopic fluoroscopy is possible, and if a practical apparatus could be produced it would be of incalculable

[1] Abridged from the Presidential Address delivered to the Röntgen Society on November 6, 1917, by Capt. G. W. C. Kaye.

value to the surgeon and radiologist in their combined efforts.

Unless there is a suspicion of septic poisoning a bullet is generally best left alone, but shell fragments are usually dirty, and the nature of the damage they inflict along their course makes it important that their exact position should be known. It is in such cases that X-ray stereoscopy attains its fullest delicacy. For example, the location of small foreign bodies near the eye, or actually in the eyeball, can be carried out to the hundredth of an inch.

In the case of a fracture the stereoscopic radiograph reveals the direction of the fracture and the disposition of the broken bone, and so assists the surgeon in deciding on the method of reparation. After the bone has been set, the progress of the recovery can be clearly followed in the subsequent photographs—whether the parts are joining up, whether new material is forming. The sequence of radiographs is included in the record of each case. The total number of photographs already taken at the various hospitals since the war commenced amount to many hundreds of thousands. Very valuable data will be obtained when time allows the radiologist to go carefully over all the accumuated records of cases.

The value of the X-rays in diagnosing chest complaints has been established again and again in this war. This is the case particularly with incipient tuberculosis, where early diagnosis is of great importance. Not only the diagnosis, but the treatment of tubercular glands has been attended with considerable success. Great attention has been paid in this war to the soldier's teeth, and very rightly. Here, again, the X-rays are playing their part and dental radiology has become an important subject. No more than mention can be made of the splendid work of "opacity" radiology, which can diagnose with routine certainty diseases of all parts of the alimentary canal. This has been of great service in examining Army recruits of doubtful medical fitness.

A word should be said as to the invaluable results obtained from single-flash exposures, especially in heart and lung conditions. Another war development of radiology is its employment by the orthopædic surgeon in his efforts to restore damaged limbs.

But the beneficent effects of the X-rays do not end with radiography. They have achieved wonderful results, not only in the diagnosis, but also in the repair of wounds. Amongst the minor tragedies of the war, few are more pathetic than the ghastly mutilations and disfigurements caused by shell wounds of the face and head. Many of our soldiers would seem to be doomed to a life of perpetual misery and humiliation, but by the wonderful plastic operations of the surgeon they can be restored to at least a semblance of their former selves. The radiologist's part in such work is to render scar-tissues pliant, to depilate hair from the scalp and skin surfaces concerned, to render the transferred flaps of skin pliant and more adaptable to their new positions, and to stimulate generally the healing process in both flaps and bone. For these purposes he employs radiation treatment, either X-rays or radium rays.

In the treatment of septic wounds and persistent sinuses, the most extraordinary success has resulted from a combination of X-rays and ultra-violet rays. Hyperthyroidism, or "soldier's heart," has been successfully treated by X-rays and radium rays.

The electro-therapeutist has also been prominent in war work. Countless electrical departments have been established in military hospitals throughout the country for the treatment of war injuries. Quite one-half, if not more, are gunshot wounds of the nerves with paralysis of the muscles. These cases are sent for electrical examination of the injured nerves and subsequent electrical treatment. Many cases of war wounds, more particularly those of the uncomplicated but inert type which refuse to heal, are treated electrically. Simple application of a direct current stimulates the process of repair, and sluggish wounds at once commence to heal. "Trench feet," which occurred in large numbers last winter, receive benefit by electrical treatment. Cases of shell-shock and neurasthenia and other functional disorders of the nervous system, some of which are seldom or never seen in times of peace, are now being cured in large numbers by electrical means.

And so the story goes on. The radiologist and the radio-therapeutist have found their reward in the gratitude of many men to whom they have once more made life endurable.

The outbreak of war found the X-ray manufacturers, like everybody else, quite unprepared. The greatest credit is due to them for the splendid way they threw themselves into the breach and turned out, in record time, unprecedented numbers of outfits for the Army. The X-ray bulb manufacturer was at once confronted with the absence of the glass, which Germany had hitherto supplied. The English glass manufacturer had to face the task of producing a uniformly good glass which would stand up, without puncturing, to the high voltages which obtain in practice. The problem was very difficult, but it is gradually being surmounted by State aid. In the meantime our American and French friends came to the rescue.

It is remarkable how slight have been the changes in design experienced by the target tube. He would be a bold man, nevertheless, who would assert that the present design has approached finality. All X-ray tubes are, in fact, extraordinarily inefficient things. Under favourable conditions they make use of rather less than one part in one thousand of the energy imparted to the cathode rays.

The Coolidge tube, first introduced nearly four years ago, has been considerably improved in detail, and now claims pride of place among X-ray tubes. It is not entirely free from defect, and its rays are no more homogeneous than those from an ordinary bulb, but its elasticity, precision, ease of control, long life, and relative freedom from inverse current make it an invaluable addition to the radiologist's equipment. Some wonderful output figures have been obtained by Coolidge on experimental water-cooled models. One tube was run continuously for many hours at 200 milliamperes and 70,000 volts, the power input being 14 kilowatts, *i.e.* about 19 h.p. It is anticipated that this figure will be shortly increased to 50 kilowatts.

It was hoped on its introduction that the Coolidge tube would be the means whereby X-rays approximating to the hardest γ rays from radium would be obtainable. Such anticipations have not been realised. In some recently published work Sir E. Rutherford describes measurements on the very hardest rays emitted by a Coolidge tube excited by close on 200,000 volts. In order to filter out the hardest rays present he passed them through 1 cm. of lead, the reduction in intensity being more than a millionfold. The residual rays proved to have a wave-length of about 0·06 Å.U., which may be compared with Rutherford's latest estimate of the wave-length of the hardest γ rays from radium C—between 0·02 and 0·007 Å.U. In other words, the Ra γ rays in question corresponded with X-rays generated by voltages between 600,000 and 2,000,000—figures to which no X-ray tube of present-day design could possibly stand up, even if we had the means to produce such voltages on a practical scale.

As to the composition of the X-rays generated by an X-ray bulb, we know now that the rays consist in general of two groups:—

(*a*) A continuous spectrum of rays with a sharply

defined boundary on the side of the shorter wave-lengths, the position of such boundary depending on the voltage on the tube.

(*b*) One or more characteristic radiations (of the ... J, K, L, M, ... series), each approximately homogeneous and characteristic of the metal of the anticathode. The higher the atomic weight the more penetrating the radiation in the same series.

The proportions of (*a*) and (*b*) depend entirely on the conditions. With very soft tubes a large proportion of the radiation may be wholly characteristic.

With reference to the spectrum of general rays, it has recently been shown that the maximum frequency of X-ray which a tube can yield can be readily calculated by a simple extension of Planck's quantum theory. The relation in question (due to Einstein) is $Ve=h\nu$, where V is the voltage on the tube, e the elementary charge on each cathode ray, ν the frequency of the hardest X-ray produced, h is Planck's constant. e and h are known with considerable exactness, so that we have the means of calculating very readily the voltage necessary to generate a particular X-ray. Inserting Millikan's latest values of these constants, we have

$$\text{Wave-length in Å.U.} = \frac{12{,}400}{\text{voltage}}.$$

The accuracy of this simple relation has been confirmed experimentally over a wide range of voltages in America. It will be noticed that the result is independent of the material of the anticathode.

With reference to the characteristic radiations, each consists of a number of spectral lines. For these, Einstein's simple law does not hold, a greater voltage being required. Webster noticed that the various spectral lines of a series all spring into being together as the voltage is increased through the critical value.

Through the medium of the X-rays we have unveiled a few of the secrets of the structure of the atom. The biggest development has resulted from the discovery of the wave-like character of the X-rays. It was Laue and his pupils in 1913 who first demonstrated the diffraction of X-rays by crystals, but it was in this country that the first real insight into the problem came. The Braggs showed how the crystal reflection of X-rays could be utilised to separate out different waves in a fashion exactly analogous to the production of interference colours by thin plates. The X-ray spectrometer revealed both the atomic spacings of a large number of crystals and the absolute wave-lengths of a variety of monochromatic X-rays.

The work of Moseley stands out pre-eminently here. Moseley photographed many characteristic X-ray spectra, and measured the wave-lengths of the principal lines. He was able at once to obtain the very remarkable and simple relation now associated with his name, namely, that the frequency of a characteristic X-ray from any element is proportional to the square of the atomic number of the element. This atomic number must be distinguished from the atomic weight. It denotes merely the order in which the elements come when arranged according to their atomic weights. Thus the atomic number of hydrogen is 1, of helium 2, of lithium 3, and so on. The atomic numbers follow the order of atomic weights except in three instances: argon and potassium, cobalt and nickel, iodine and tellurium are interchanged.

The X-ray spectra are revealed as an extreme type of light-ray spectra, and are even more characteristic of the parent atom. Later work has shown that X-ray spectra contain many lines and are much more complicated than was first believed.

Moseley's work has been extended by others, notably by Siegbahn and Friman. We now know the atomic numbers of all the known elements, beginning with hydrogen and ending with uranium—with an atomic number of 92. Each of the atomic numbers is represented by an element, with the exception of numbers 43, 61, 75, 85, and 87, which stand for five elements waiting to be discovered. It by no means follows, however, that there are only five missing elements; five is a lower limit, for we now know that several elements may have the same atomic number. Such isotopes, as Soddy has called them, cannot be distinguished one from another by ordinary chemical or physical tests. They are grouped together under the one atomic number in the periodic classification of the elements, but, nevertheless, they may, and do, possess atomic weights differing by several units. It is apparent that the atomic number is something more than a mere integer; it undoubtedly represents some fundamental attribute of the atom, and as the work of Rutherford and others has shown, the atomic number equals the excess number of positive charges in the nucleus of the atom.

The boundaries of the known spectrum have been considerably extended since the war broke out. In the ultra-violet Lyman has extended the region first investigated by Schumann to a wave-length of about 500 Ångström units, and Richardson and Bazzoni have very recently further extended this to 420 Å.U. The longest X-ray so far measured by Siegbahn has a wave-length of 12 Å.U. Rutherford has recently given evidence for believing that the wave-length of the hardest γ rays from Ra-C is in the region of 1/100 Å.U. We are thus now familiar with a range of more than ten octaves of X- and γ rays without a break—not at all a bad record for so young a subject. There still remain about five octaves to be explored in the region between X- and ultra-violet rays, a region which contains the characteristic X-rays of the light elements from hydrogen to neon.

And now to turn to quite a different topic. At the moment we are all reproaching ourselves for our past neglect of science in this country. We are paying the penalty of our indifference, despite the wonderful adaptability and resource which this war has shown we possess as a nation. The country is slowly learning its lesson. Willy-nilly, we are being led to see at last that our system of education misdirects much genius into unproductive channels, and we are awakening to the importance of research, both pure and applied.

The value of applied science to industry is now accepted throughout the country, and British industry should begin to feel the benefit, especially now that the principle of State-aided research is established.

But we must not forget that it is the pure academic research, unrestricted and unprescribed, which has been the prime cause of all the radical changes in industrial methods. Research in pure science is rarely appreciated by the general public or manufacturer, for it cannot be done to order. One must put faith in the research worker that he may continue to have faith in himself. Much of what he will do will be discontinuous and abortive, but he must not be hampered by utilitarian notions being continually rammed down his throat. If he does not solve the original problem he will probably solve some other which has sprung from it, and one successful discovery may outweigh by far all his failures.

The equal importance of the applied research worker, who is responsible for turning to account the discoveries of the pure investigator, must not be lost sight of for a moment. There is no line of demarcation between the two divisions of research. Each involves study, hard work, and thought. The methods of both branches are questioning and searching; the common end is knowledge, to which there is no heaven-sent road.

What has been the reward of the research worker

in the past? It is the shameful truth that the man of science, with few exceptions, has received little or no recognition by the mass of the people of this country, who, unknowing and uncaring, have been perfectly content to allow him the status, both social and financial, which he himself has modestly sought for his everyday life and wants. But the country, in its hour of need, has turned to its scientific sons for help in its war problems, and has not turned in vain. The war is bringing home to the nation the dependence of its very existence on science, and a little good may come out of a very great evil if public opinion can be brought to realise that the statement is as true in peace as in war, and that a nation's administrators should always include among them suitable men of the highest technical and scientific standing, not merely to advise, but also to initiate and direct.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

BIRMINGHAM.—At a special Degree Congregation held on Thursday, January 24, the Vice-Chancellor (Col. Gilbert Barling, C.B.) conferred the honorary degree of Doctor of Laws on Lord Morris, late Premier of Newfoundland.

LONDON.—The following doctorate has been conferred by the Senate:—*D.Sc. in Statistics:* Miss Kirstine Smith, an internal student, of University College, for a thesis entitled "On the standard deviations of adjusted and interpolated values of an observed polynomial function and its constants, and the guidance they give towards a proper choice of the distribution of observations."

WE learn from the *Times* that in reply to an inquiry as to whether Mr. Andrew Carnegie would make good the damage to the science building at Dalhousie University, Halifax, N.S., which was originally his gift, the reply received from the trustees of the Carnegie Corporation, New York, was that they would "consider it a privilege to pay for repairing the damage."

NEW scales of salaries, necessitated partly by the increase in the cost of living, have been, or are being, drawn up for teachers in primary and secondary schools, but so far nothing has been done in London towards improving the salaries of technical teachers, salaries which even before the war were already too low. Failure to do this is, in part, due to the fact that no "Fisher grants" similar to those given for elementary and secondary education have been available for technical education. A meeting to consider the matter has been arranged by the Association of Teachers in Technical Institutions to be held at the Polytechnic, Regent Street, W.1, on Saturday, February 2, at 3 p.m. All teachers in technical institutions, junior technical schools, and trade schools (whether members of the association or not) are invited to attend.

WE have received the annual report of the committee of the Aberdeen Public Library for the year 1916–17. The committee realises that public libraries should prepare for the coming period of reconstruction by providing their readers with the most authoritative books in pure and applied science. It is felt that people in all departments of industry are beginning to see more clearly the value of a thorough scientific knowledge of their craft, and that they will therefore ask for books which contain the most recent information instead of being content with books which are now out of date. Acting upon the advice of a special sub-committee, under the convenership of Prof. J. Arthur Thomson, the committee has discarded a large number of obsolete scientific books in order to make room for up-to-date works, including technical books on every handicraft known to be followed in Aberdeen. In the Reference Department of the Aberdeen Library the trade and technical periodicals, dictionaries and encyclopædias, business directories, gazetteers and atlases form a "commercial library" similar to those which have been established in Glasgow and Liverpool. The purpose of such commercial libraries is to make immediately available the best and most recent information as to all matters affecting trade and commerce. We congratulate the Aberdeen Library Committee upon the steps it is taking to increase the efficiency of the library and to make it a centre for the spread of accurate knowledge in all branches of industry and commerce.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Microscopical Society, January 16.—Mr. E. Heron-Allen, president, in the chair.—Presidential address: The Royal Microscopical Society during the great war and after. The president gave a review of the war conditions under which the society has met since August, 1914, and of such part of the work of the society as is ripe for publication in connection with the war. He gave an analysis of the work of the society's abstractors during the periods 1901–13 and 1914–17, and adumbrated a contraction and specialisation of the activities of the society in the future, in the direction of the technical optics of the microscope and its application to all branches of industry and research.

Linnean Society, January 17.—Sir David Prain, president, in the chair.—E. S. **Goodrich**: The restoration of the superficial bones of the head of the fossil fish Osteolepis. Having shown the restorations of Pander, Gregory, and Watson, which differ considerably from each other, Mr. Goodrich described his own restoration of the bones and lateral-line canal system, and directed attention to the importance of an accurate knowledge of the structure of such an early and primitive form as Osteolepis, from the Lower Devonian strata, for a correct interpretation of the homologies of the cranial bones in the higher fishes and in the land vertebrates.—J. **Britten**: Some early Cape botanists.—C. E. **Salmon**: A hybrid Stachys. The plant originated in the author's garden, where previously only *Stachys germanica* and *S. alpina* were cultivated; it was identical with *S. intermedia* [Solander in] Ait. Hort. Kew, ii., 301 (1789).

MANCHESTER.

Literary and Philosophical Society, December 11, 1917.—Mr. T. A. Coward, vice-president, in the chair.—W. **Thomson**: Somatose. Somatose is a substance prepared by dissolving the refuse from meat which has been extracted with water with the view of producing meat extract. In South America this refuse material was thrown into the sea. A German chemist found that he could dissolve part of this refuse fibrin by heating it with water under a pressure of 90 lb. to the square inch—that is, at a temperature of 320° F. By filtering and evaporating this solution to dryness he obtained a horny grey mass, which, on being powdered, constituted somatose. It was held by some that the value of somatose as a food could be determined by the amount of nitrogen it contained, and that the nitrogen equivalent in somatose was equal to the nitrogen equivalent in lean beef. With the view of determining this, the author considered that it could be done only by feeding animals with food containing lean beef on one hand and somatose on the other

He made these experiments by feeding tame mice, and found that, whilst the mice throve upon a mixture of oats and lean beef, they did not thrive upon a mixture of oats and somatose, and whilst the one set increased in weight the other fluctuated more or less largely below their original weight, and he came to the conclusion that somatose should be classed more appropriately as a poison than as a food.

PARIS.

Academy of Sciences, January 7.—M. Paul Painlevé in the chair.—P. **Appell**: Oblique aerial movements of light spheres possessing weight.—G. **Giraud**: Hyperabelian functions.—S. **Lattès**: The iteration of rational substitutions and the functions of Poincaré.—J. **Chokhate**: Some properties of the polynomials of Tchebicheff.—A. **Denjoy**: A general property of analytical functions.—A. **Guillet**: The experimental determination of a moment of the form, $X\frac{d\theta}{dt}$, and of an apparent inertia arising from the viscosity of a fluid.—A. **Mailhe**: A new method of preparation of the nitriles by catalysis. Ammonia and methyl benzoate vapour are passed together over thoria at 450°–470° C.; benzonitrile, C_6H_5CN, is the main product. The reaction is similar when ethyl benzoate is employed. Ortho- and para-toluonitriles and phenylacetonitrile can be made by the same method.—A. **Pictet** and J. **Sarasin**: The distillation of cellulose and starch in a vacuum. Under a pressure of 12 mm. to 15 mm. cellulose gives a little water, and then, between 200° and 300°, a heavy yellow oil, which sets to a semi-crystalline mass. About 10 per cent. of charcoal remains in the retort. The pasty mass is about 45 per cent. of the cellulose taken, and, after purification, forms white, tabular crystals, identical in all respects with Tanret's lævoglucosane. Starch on distillation gives the same product with the same yield.—S. **Menteath**: The defile of Navarre. The tectonic of this defile is a continuation across the Pyrenees of the structure of the layers of Dax, Bastennes, and Salies-de-Béarn; it cannot be taken as typical of the structure of the Pyrenees chain.—L. **Gentil** and L. **Joleaud**: Geology of the region of Tunis.—L. **Dunoyer**: Diurnal variations of the wind in altitude. A theory is developed which affords an explanation of the results of observations described in an earlier paper (*C.R.*, 1917, p. 1068).—J. **Peyriguey**: Two water-spouts observed at Rabat, December 18, 1917.—R. **Souèges**: Embryogeny of the Alismaceæ. Differentiation of the radicular extremity in *Sagittaria sagittaefolia*.—J. **Silhol**: The use of kapok for dressings. A description of the properties of kapok compared with those of cottonwool, especially from the point of view of materials for dressing wounds. Kapok exerts selective absorptive properties, removing micro-organisms from pus.—M. **Adrian**: The use of certain marine algæ as food for horses. An account of feeding experiments in which a treated seaweed was used in place of oats for feeding horses, with marked success. The seaweed was accepted, digested, and assimilated by the animals. The laminaria utilised are abundant on the Breton coast.

WASHINGTON, D.C.

National Academy of Sciences, September, 1917 (Proceedings, vol. iii., No. 9).—J. **Loeb**: Heliotropic animals as photometers on the basis of the validity of the Bunsen-Roscoe law for heliotropic reactions. New quantitative experiments proving that the "instinctive" motions of animals to light are phenomena of automatic orientation and a function of the light intensity, the function being the Bunsen-Roscoe law of photochemical action.—H. G. **May**: The appearance of reverse mutations in the bar-eyed race of Drosophila under experimental control. Such a phenomenon is not difficult of explanation on the theory that it is produced by a chemical change in the constitution of some substance.—L. R. **Cary**: The part played by Alcyonaria in the formation of some Pacific coral reefs. On certain of the Pacific reefs the Alcyonaria are important coral-forming agents; their relative importance can be determined only after borings have been made through some reefs to determine the history of the reefs.—A. G. **Mayer**: Observations upon the alkalinity of the surface water of the tropical Pacific.—H. H. **Plough**: The effect of temperature on linkage in the second chromosome of Drosophila. Both high and low temperatures produce an increase in the percentage of crossing over. The crossing over appears to take place in the stage when the chromosomes are known to be finely drawn-out threads, not in the early oogonial divisions or in the late thick thread stage.—A. H. **Sturtevant**: Genetic factors affecting the strength of linkage in Drosophila.—H. **Seares**: Further evidence on the concentration of the stars towards the galaxy.—C. **Barus**: Theoretical relations in the interferometry of small angles.—J. A. **Harris**: Interperiodic correlation in the egg production of the domestic fowl. The results make possible the selection of groups of birds of high annual egg production from the trap-nest records of individual months.—E. W. **Washburn**: Two laws governing the ionisation of strong electrolytes in dilute solutions and a new rule for determining equivalent conductance at infinite dilution derived from conductivity measurements with extremely diluted solutions of potassium chlorite. In sufficiently dilute solution all uni-univalent salts of strong acids and bases obey the mass-action law, and all have the same ionisation constant; the values of the mass-action expression for all such salts are identical, the identity persisting up to higher concentrations the more nearly the salts resemble each other.—E. C. **MacDowell** and E. M. **Vicari**: The growth and fecundity of alcoholised rats. Both growth and the fecundity of the alcoholised are subnormal as compared with non-alcoholics.

October, 1917 (Proceedings, vol. iii., No. 10).—G. M. **Green**: The general theory of curved surfaces and rectilinear congruences. Preliminary announcement of the number of theorems in a field which seems to be promising.—J. P. **Iddings** and E. W. **Morley**: A contribution to the petrography of southern Celebes. Twelve analyses of lavas from Celebes.—A. G. **Mayer**: The non-existence of nervous shell-shock in fishes and marine invertebrates. Corroboration of the conclusion that war-shock is predominantly a psychic phenomenon and, being hysteria, can be cured by hypnotic suggestion.—A. R. **Moore**: Chemical differentiation of the central nervous system in invertebrates. In the cephalopod, caffein brings about hyper-irritability of the cerebral ganglia, while camphor affects the stellar ganglia in the same sense. Atropin causes spasms in the squid, but inhibits the activity of the chromatophores. Camphor shows a selective action in the shrimp, paralysing the elements, controlling backward swimming, and exciting those controlling forward motion.—W. E. **Garrey**: Proof of the muscle-tension theory of heliotropism. Experiments show that the motion of animals to or from a source of light are due to an influence of the light on the tension of muscles of different sides of the body.—W. H. **Longley**: Changeable coloration in Brachyura. The colours of crabs and their capacity to change them vary from species to species, according to the same general rule that appears to prevail among fishes.—J. F. **McClendon**: The equilibrium of Tortugas sea-water with calcite and aragonite. The surface water

of the sea is the supersaturated solution of $CaCO_3$, and it is only necessary to introduce calcite crystals in order to cause precipitation of this substance.—H. J. **Muller**: An Œnothera-like case in Drosophila. Report of an extended series of experiments showing that it will not do to accept evidence apparently in favour of factor inconstancy without the support of highly rigorous factorial analysis.—A. G. **Mayer**: Is death from high temperature due to the accumulation of acid in the tissues? Death is probably due to the formation of acid rather than to coagulation of proteid substances.

VICTORIA.

Royal Society, November 8, 1917.—Prof. W. A. Osborne, president, in the chair.—R. S. **Rogers**: *Chiloglottis pescottiana*, sp. nov. The species was found at Tallangatta, and is distinguished from others of the genus in the distribution of the calli and the form of the labellum.—Miss N. C. B. **Allen**: Magnetic deflection of rays; tabulation of v against RH, assuming Laurentz theory.—F. **Chapman**: The occurrence of Acrotreta in Lower Palæozoic (Lancefieldian and Heathcotian) shales. The discovery of this genus in Victoria further supports the conclusion as to the Upper Cambrian age of the Heathcotian and associated beds. The new species is related to *A. belti* from the Lower Tremadoc of North Wales and to *A. transversalis* of the St. John Group, New Brunswick.—F. **Chapman**: An apparently new type of Cetacean tooth from the Tertiary of Tasmania. *Scaptodon lodderi* is represented by a flattened conical tooth with a small bevelled crown, which is otherwise allied to teeth of the Physeter type.

BOOKS RECEIVED.

Solectrics: A Theory explaining the Causes of Tempests, Seismic and Volcanic Disturbances, and other Natural Phenomena: How to Calculate their Time and Place. By A. J. Cooper. Pp. 213. (London: J. D. Potter.) 6*s*.

Ambulance de l'Océan. La Panne la Prothèse du Membre Inférieur. By Dr. F. Martin. Pp. viii+107. (Paris: Masson et Cie.) 5 francs.

The Philosophy of Benedetto Croce. The Problem of Art and History. By Dr. H. Wildon Carr. Pp. x+213. (London: Macmillan and Co., Ltd.) 7*s*. 6*d*. net.

Notions d'Acoustique. Instruments de Musique; le Telharmonium. By J. Rodet. Pp. 96. (Paris: Gauthier-Villars et Cie.) 3.50 francs.

The Scientist's Reference Book and Diary, 1918. (Manchester: J. Woolley, Sons, and Co., Ltd.) 2*s*. 6*d*.

Carnegie United Kingdom Trust. Report on the Physical Welfare of Mothers and Children. Scotland. Vol. iii. Pp. xxviii+625+illustrations. (Dunfermline: Carnegie U.K. Trust.)

Third Melbourne General Catalogue of 3068 Stars for the Equinox 1890, from Observations made at Melbourne Observatory during the Period 1884–87 to 1894–1900. Pp. viii+77. (Melbourne: A. J. Mullett.)

DIARY OF SOCIETIES.

THURSDAY, JANUARY 31.

ROYAL SOCIETY, at 4.30.—The Growth of Trees: A. Mallock.—Action of Light Rays on Organic Compounds, and the Photosynthesis of Organic from Inorganic Compounds in Presence of Inorganic Colloids: Prof. B. Moore and T. A. Webster.—The Isolation and Serological Differentiation of *Bacillus tetani*: Capt. W. J. Tulloch.—An Investigation into the Periodicity of Measles Epidemics in the Different Districts of London for the years 1890–1912: Dr. J. Brownlee.

ROYAL INSTITUTION, at 3.—Revolving Fluid and the Weather Map: Sir Napier Shaw.

FRIDAY, FEBRUARY 1.

ROYAL INSTITUTION, at 5.30.—Gravitation and the Principle of Relativity: Prof. A. S. Eddington.

SATURDAY, FEBRUARY 2.

ROYAL INSTITUTION, at 3.—The Ethics of the War: P. H. Loyson.

MONDAY, FEBRUARY 4.

ROYAL SOCIETY OF ARTS, at 4.30.—High-temperature Processes and Products: C. R. Darling.

ARISTOTELIAN SOCIETY, at 8.—The Theory of a Limited Deity: Bishop of Down.

TUESDAY, FEBRUARY 5.

ROYAL INSTITUTION, at 3.—The Problems of British Anthropology: Prof. A. Keith.

ROYAL SOCIETY OF ARTS, at 4.30.—The Industrial Resources of South Africa: C. du P. Chiappini.

INSTITUTION OF CIVIL ENGINEERS, at 5.30.—The West Quay of Madras Harbour: The Hon. Sir Francis J. E. Spring and Hugh H. G. Mitchell.

RÖNTGEN SOCIETY, at 8.15.—A Simple Means of Obtaining "Static Currents" from an Induction Coil: Dr. G. B. Batten.—A Mobile Snook Apparatus: E. E. Burnside.

ZOOLOGICAL SOCIETY, at 5.30.—Notes on the Dingo in Australia: T. E. Whitehead.—Notes on the Skull of *Rana tigrina*: Prof. B. L. Bhatia and Baini Prashad.—Description of a New Snake of the Genus Oligodon, from Upper Burma: G. A. Boulenger.—A New and a Rare Species of the Golden Mole (Bematiscus): Dr. B. Broom.

WEDNESDAY, FEBRUARY 6.

ROYAL SOCIETY OF ARTS, at 4.30.—The Development of the Mineral Resources of the Empire: Prof. W. Frecheville.

SOCIETY OF PUBLIC ANALYSTS, at 5.—Annual General Meeting.—A Modified Acetic Acid Reagent for Valenta Tests: A. E. Parkes.—Oiticica Oil—a New Drying Oil: E. Richards Bolton and Cecil Revis.

GEOLOGICAL SOCIETY, at 5.30.

ENTOMOLOGICAL SOCIETY, at 8.

THURSDAY, FEBRUARY 7.

ROYAL SOCIETY, at 4.30.—*Probable Papers:* The Photo-Electric Action of X-rays: Prof. O. W. Richardson.—The Parent of Actinium: F. Soddy and J. A. Cranston.—The Absorption of the Radiation Emitted by a Palladium Anticathode in Rhodium, Palladium, and Silver: E. A. Owen.

ROYAL INSTITUTION, at 3.—Illusions of the Atmosphere: The Travelling Vortex and the Cyclonic Depression: Sir Napier Shaw.

INSTITUTION OF ELECTRICAL ENGINEERS, at 6.—Ninth Kelvin Lecture: Kelvin as a Teacher: Prof. M. Maclean.

LINNEAN SOCIETY, at 5.—Two Bibliographical Rarities of the Society's Library: (*a*) Cupani, F., "Panphyton siculum," 1713; (*b*) Du Gort, J. and P., "L'Histoire et Pourtrait des Plantes," Lyon, 1561: The General Secretary.—Plant Distribution from the Standpoint of an Idealist: H. P. Guppy.

FRIDAY, FEBRUARY 8.

ROYAL INSTITUTION, at 5.30.—Science and Ethics: Principal E. H. Griffiths.

ROYAL ASTRONOMICAL SOCIETY, at 5.—Anniversary Meeting.

SATURDAY, FEBRUARY 9.

ROYAL INSTITUTION, at 3.—The Ethics of the War: P. H. Loyson.

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