NATURE

THURSDAY, NOVEMBER 18, 1920.

Editorial and Publishing Offices:
MACMILLAN & CO., LTD.,
ST. MARTIN'S STREET, LONDON, W.C.2.

Advertisements and business letters should be addressed to the Publishers.

Editorial communications to the Editor.

Telegraphic Address: PHUSIS, LONDON.
Telephone Number: GERRARD 8830.

Science and the Cenotaph.

THE second anniversary of the Armistice of November 11, 1918, has come and gone, and the whole nation, united in a common impulse of pious and grateful remembrance, has done solemn homage to the memory of the glorious dead. King and people, leaders and comrades, have paid reverence to the remains of that unknown hero who has been laid to rest in our national shrine, and who typifies the humble and silent sacrifice of those many thousands to whom we owe the survival of civilisation.

To the soldiers of science, to whom duty and self-sacrifice are, or ought to be, ever-present ideals, the ceremony of last Thursday should have made a special appeal. In the great struggle which terminated two years ago they were not backward in taking their places in the fighting organisation of the nation. With very few exceptions they put their special gifts and training at the service of the State. The devotion and fearless courage of the medical branch of the scientific profession have earned universal recognition. Thousands of the younger students in all faculties, who had, before the war, patriotically joined the Officers Training Corps, came forward in 1914 as one man and filled the gap in the supply of officers until the new armies were ready. Of the older men of science a great number joined fighting units and shared with the rest the hardships and dangers of the trenches. Many valuable lives were thus sacrificed which a wiser distribution might have spent to better advantage: one remembers a mathematician of great ability who served as an infantry officer and was killed by the explosion of a bomb store, and the tragedy of Moseley, who fell at Gallipoli. Others, again, debarred from active service in the trenches, took up work behind the lines or in the technical services—work not without its perils, as is shown by the fate of Keith Lucas and Bertram Hopkinson, two distinguished fellows of the Royal Society, both killed in aeroplane accidents, who died a soldier's death as truly as if they had fallen in action. Another well-known scientific researcher spent weeks experimenting in a submarine in a highly dangerous zone. Such examples might be multiplied a hundredfold. In gas warfare, sound ranging, air work, submarine detection, etc., a vast number of men of science were to be found, and gave their labours and their lives unstintingly. Many made the supreme sacrifice, and, on the whole, men of science proved themselves to be capable leaders and efficient organisers and administrators even in fields widely separated from those of their peace-time activities.

Scientific workers may thus join in the universal homage to the fallen with a pure heart and the consciousness of duty done. They, at all events, are free from the reproach of having in any way profited by the general suffering, or of having exploited the war for selfish ends. Whilst the cost of living still soars, and salaries and wages, in industry, commerce, and administration, try to keep pace with it, the remuneration of scientific workers, poor already before 1914, is gradually being brought down to the starvation limit, the small nominal increase given in some cases being very far indeed from making up for the decreased purchasing power of the pound.

The question not unnaturally suggests itself: How many among those silent crowds that stood bareheaded last Thursday have given any effective help even to one of the millions of returned soldiers who, in the present jostle of selfish appetites, are asking for work and bread from those whose businesses and wages they have saved? And, in particular, how many have given a thought to those struggling scientific toilers who have put away their uniforms and strive vainly to exist on inadequate salaries, under crushing taxation and to meet an ever-rising cost of living? Yet the brains of these men were no mean factor in winning the war, and it should be increasingly obvious that the salvation of a modern State, both in peace and war, must depend nowadays upon trained observation and intelli-

gence—that is, upon science. Only impartial observation and study, such as a scientifically trained mind alone can give, will bring us nearer to the solution of the tremendous problems in sociology and economics which confront this generation. Only science can find new sources of energy for an industrial system which is largely wasting its resources in coal and oil, and, for that reason alone, is doomed to bankruptcy: a strike of miners may be settled, but what politician will settle a strike of the coal itself? How is that new and marvellous roadway of the air to be opened up and made commercially available for future generations without not merely routine technical knowledge, but also that insight of genius which is the rare gift of selected souls? And how can the heritage preserved for us by the glorious dead be defended against the dangers which all history tells us are certain to arise again if the nation has not a reserve of trained and inventive intelligence at its service?

In those days, of which the memory now seems to be fading so quickly, when the whole Empire stood thrilled and tense it was commonly repeated that we had at last become conscious of the value of science, that the old mistakes would not recur, the old neglect would be a thing of the past. We look in vain in the public Press for a repetition of such statements nowadays. We have heard of a "land fit for heroes"—but perhaps the true meaning of the phrase may have been that it would take a hero to exist in the new world. Possibly the phrases about the nation's recognition of science may have been mere words, but human beings cannot live upon such diet. The multiplication of Government Departments supposed to foster research, or of highly paid research administrators (with or without scientific qualifications), will not really recruit the ranks of true scientific workers unless something is done, and done quickly, to make the existence of such workers tolerable. That these ranks are being depleted at the present time there is ample evidence; it is becoming increasingly difficult to find suitable candidates to fill university posts, and the more responsible the posts the more difficult it is to fill them. It is clear that the better brains are being gradually squeezed out of the scientific careers. If this process goes on much longer the nation will awake one day to find that it has effectually killed the goose which laid the golden eggs.

Most of us receive daily appeals for war memorials of various kinds. Would not the best, and, in the end, the cheapest, war memorial be a growing and efficient body of brain-workers, able and willing to solve the problems which the war has left in its train, and to help the nation in its hour of need? For leaders both in peace and war we must find and train men who will be competent to use the national resources in the most effective manner. Scientific workers are naturally marked out by their progressive instincts and severe training to serve not merely in an advisory capacity in the councils of the nation, but also as executive officers. Moseley and others of his type will not have died in vain if the Cenotaph reminds us that men of science must take an active part in the affairs of State, in guiding the development and thought of the nation, and in seeing that the bitter lessons learnt during the last six years are not forgotten.

This end will not be attained by service on committees, whether for chemical warfare or any other subject. If the War Office seeks to be scientific it should establish within itself, as the Admiralty has done, a research department with distinguished men of science as permanent members of the staff to suggest and supervise work on methods of modern warfare. It would be the business of such officers to make use of science for purposes of national security, and workers in university or other laboratories could please themselves whether they co-operated or not in particular researches or experiments. We can understand the objections offered by Prof. Soddy and others against men of science associating themselves as a body with problems of this type, but until human nature reaches a higher ethical plane than it occupies at present we must have a War Office, and an essential part of it should be an able scientific staff, the members of which would be responsible for making us strong enough to meet any crises which the future might bring. No committee of sixty or more associate members can do this, and none would be necessary if the War Office ranked a scientific service with the General Staff, as it should do, instead of inviting scientific workers to devote their time and knowledge to "offensive and defensive aspects of chemical warfare" for little more than out-of-pocket expenses.

We claim for science a much more responsible position, and a far higher appreciation of its worth, than our war leaders offer to it even now; and we do so because we remember that thousands of young lives were lost through its neglect. When we bow our heads before the Cenotaph we

think of the highly trained men of science who were killed at Gallipoli or drowned in the mud of Flanders while Ministers turned for advice to alchemists and circle-squarers, or confused great chemists with dispensers of drugs, and we wonder whether even now anyone in power realises what civilisation has lost through the sacrifice of creators of knowledge. While we mourn their loss, let us work and pray for the scientific enlightenment of the leaders into whose hands the destinies of the nation are entrusted, so that we may be assured of strong and effective guidance whatever is before us.

The Newer Spiritualism.

Phenomena of Materialisation: A Contribution to the Investigation of Mediumistic Teleplastics. By Baron von Schrenck-Notzing. Translated by Dr. E. E. Fournier d'Albe. Pp. xii + 340. (London: Kegan Paul, Trench, Trubner, and Co., Ltd.; New York: E. P. Dutton and Co., 1920.) Price 35*s*. net.

"OF making many books" on spiritualism "there is no end," and study thereof "is a weariness of the flesh." Certainly such is the effect of reading a ponderous and repellent volume of 200,000 words conveying the story of séances the details of which are as like one another as peas in a pod. The author describes it as "really a monograph on materialisations," since it deals, in the main, not so much with communications from the dead as with exudations from the living. These, in pseudo-scientific jargon, are defined as "ideoplastic" or "teleplastic," taking the shape of fluidic threads or psychic discharges from the mouth, armpits, and other parts of the body, sometimes returning thereto, and often accompanied by blood. Both the author and translator agree in assigning them to "a new, or, rather, a hitherto unexplored, function of certain human organisms" which have "a spiritistic interpretation" as "conductors of psychic impulses."

The book made a considerable stir in Germany on its publication in 1913; here, it was the subject of a damaging review by Miss Verrall in the Proceedings of the Society for Psychical Research, July, 1914. The translation before us was made by Dr. Fournier d'Albe in consultation with Mme. Bisson, in whose house the medium lived, and whose reports on the sittings make up the substance of the book. It is to her that the medium has "lent her remarkable powers" in return for board and residence. The real name of the medium, whose pseudonym is "Eva C.," is said to be Marthe Béraud; and while Baron von Schrenck-Notzing says that he "is not justified in publishing details concerning her personal and family affairs," he withholds nothing in respect of detail about herself, both physically and mentally. As to the latter, she is described as abnormally emotional, subject to violent outbursts of anger, very amenable to influences, and nursing illusions that her charms lead the male sex easy captives. The numerous photographs of her which are sandwiched between faked spirit photographs show that physical beauty forms no part of her attractiveness. She is, in brief, a confirmed erotic and neurotic woman, who, according to information from an independent source, nurses the belief that she is an incarnation of Thaïs.

As already said, the record of the sittings, which extended from June, 1909, to July, 1913 (they were held chiefly in Paris), has a dreary uniformity. Mme. Bisson was always present; her watchful care over "Eva C." suggests more than friendship, and awakens suspicions as to collaboration in "materialisations." The appointments were as usual; the medium sat in a dark cabinet, Mme. Bisson hopping in and out, and then joining the other sitters, rarely more than three or four, in a room dimly lighted by a red lamp; a white light, as all spiritualists agree, "acting destructively on the pseudopods or psychic projections from the medium's body." Apart from M. Richet, a somewhat credulous savant, no prominent man of science was at the sittings, save one Dr. Specht, who, after three attendances, said that he had been "shown materialisations which do not exist." Baron von Schrenck-Notzing naïvely adds: "On account of this negative attitude, Dr. Specht was not invited to further sittings." Difficulty met attempts to secure teleplasma; "Eva C." was backed by Mme. Bisson in her objections, but of the two samples which Baron von Schrenck-Notzing secured one was recognisable as human skin, and the other, under microscopic examination, a mucus-like substance, showed "cell detritis, numerous microbes, and some wool (from dress)." Convinced as he is that the teleplasmic phenomena have a "spiritual interpretation," it is to the credit of Baron von Schrenck-Notzing that he admits explanations, if only to controvert them, such as are supplied by the facts of hysterical rumination, when the patients bring up matter which they have swallowed, and of excretions due to excitation.

The reviewer can deal only with such statements as fill this book at their face value. The *onus probandi* lies on those who make them. As Faraday said in a lecture delivered before the

Royal Institution in 1854: "I am not bound to explain how a table tilts any more than to indicate how, under the conjurer's hands, a pudding appears in a hat." Baron von Schrenck-Notzing and Dr. Fournier d'Albe have a clear course before them. Let them bring "Eva C." to London to exhibit her "materialisations" before a committee of which Sir Ray Lankester, Sir Bryan Donkin, and Mr. Nevil Maskelyne should be members. Then the matter would be put beyond doubt whether the so-called evidence, thus judicially sifted, is or is not based upon the collusive action of mediums and upon the bad, because prejudiced, observation of the sitters. The need to keep in mind what Hume says about occult phenomena was never more urgent than it is to-day. "As finite added to finite never approaches a hair's breadth nearer to infinite, so a fact [statement?] incredible in itself acquires not the smallest accession of probability by the accumulation of testimony."

Boltzmann's Lectures.

Ludwig Boltzmanns Vorlesungen über die Prinzipe der Mechanik. Dritter Teil. Elastizitätstheorie und Hydromechanik. Edited by Prof. Hugo Buchholz. Pp. xiii + 608–820. (Leipzig: Johann Ambrosius Barth, 1920.) Price 21.60 marks.

THE name of Ludwig Boltzmann will live on account of his great creative work, the study of which has happily been facilitated by the publication of his collected "Wissenschaftliche Abhandlungen" (3 vols., 1909, Barth), through the co-operation of the Academies of Berlin, Göttingen, Leipzig, Munich, and Vienna. But he was distinguished also as a teacher, and his power of exposition is shown in several volumes of lectures which have appeared in print. Perhaps the best of these are his "Vorlesungen über Gastheorie" (2 vols., 1895), based chiefly on Maxwell's and his own fundamental researches on the subject. Less well known are his lectures on Maxwell's theory of electricity and light, and those on the principles of mechanics, each occupying two volumes.

The book now under review comes from the same Leipzig press, and forms a third and final volume of the lectures on mechanics. Unlike the preceding volumes, it does not come direct from Boltzmann himself; it is written, on the basis of his lectures, by one of his pupils, Buchholz, to whom Boltzmann, and afterwards his widow, allotted the work of editorship. It first appeared in 1916 as an appendix to a larger volume of Boltzmann's lectures, also edited by Buchholz, entitled "Applied Mathematics: the Mechanical Potential and its Application to the Determination of the Figure of the Earth (Higher Geodesy)." It contains the theory of elasticity and hydrodynamics which was a necessary adjunct to the geodetic part of that treatise; but its separate publication as a third volume of the principles of mechanics fulfils Boltzmann's intentions regarding the latter course of lectures, and renders it readily available to those who do not wish to study the larger work from which it is reprinted.

Boltzmann's lectures on mathematical physics formed a "cycle" unified by his use of the conception of the potential—the mechanical, electrical, and electrodynamic potentials, as in the lectures previously published, and, in the present volume, the elastic and hydrodynamic potentials. One further set of lectures remains unpublished—namely, that on the general mechanical theory of heat; in this course the thermodynamic potential is introduced and illustrated by three important examples of its application, of which Gibbs's theory of chemical equilibrium is the chief. This final instalment is at present held up owing to financial difficulties; it is much to be hoped that these may be overcome, in order to complete Boltzmann's representation of mathematical physics and in view especially of the close relation of these lectures to his work on gas theory.

Although beyond a certain point the theories of elasticity and hydrodynamics diverge widely, their kinematical foundations are almost identical, while the theory of the stress ellipsoid is as necessary to hydrodynamics as it is to elasticity when the viscosity of liquids is taken into account (though in the present volume the latter is not done). It is therefore illuminating to consider the two subjects together, and their treatment in these lectures is admirable. The explanations of the kinematical and mechanical principles are simple and detailed, and the elastic potential is then introduced and applied to a few important general problems—in particular, to the proof of the Hamiltonian principle for elastic potential energy, to the determination of the potential for various forms of crystal, and to the propagation of waves of compression and distortion in an elastic solid. This is all done in comparatively little compass—a hundred pages—and a general grasp of the subject is rendered easy by the avoidance of individual problems, such as the theory of bending in beams, or the vibrations of rods, strings, and membranes, in which the potential plays no prominent part.

The second hundred pages are devoted, on similar lines, to the general equations of hydrodynamics, the velocity potential, and the theory

of wave-motion and vortex-motion. Both water- and sound-waves are discussed, including the change of form of progressive waves on water. The analogies with other branches of science are pointed out from time to time, such as, for example, that between the magnetic field of an electric current and the irrotational motion round a vortex filament. The book should be valuable both to readers approaching electricity and hydrodynamics for the first time, and to those who have studied either alone in detail. S. C.

The Surveyor's Art.

Geodesy: Including Astronomical Observations, Gravity Measurements, and Method of Least Squares. By Prof. G. L. Hosmer. Pp. xi+368. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1919.) Price 18*s.* 6*d.* net.

PROF. HOSMER'S text-books on surveying and allied subjects are well known, and any further contribution from his pen is sure of a welcome from all those either actually engaged upon, or interested in, the art of mapping the earth. We here use the word "mapping" in its complete sense—namely, as including everything requisite to the most minute delineation of the earth's surface, and of such physical quantities dependent upon its interior constitution as can be determined by surface observations.

The present book, based upon the practice and researches of the United States Coast and Geodetic Survey, is designed as a text-book for students of the higher branches of the art. We can only lament that no such volume has yet appeared based upon British surveying practice, a deficiency due partly to the fact that the great survey work of a geodetic character recently in progress in the British Empire has been that carried out by the Indian Survey Department, a body which has always trained its own staff and never summarised its methods in a text-book, and partly to the complete non-existence of any school of geodesy in this country. Should such a school ever be established, and should we ever recognise that, taking the lowest point of view, it would pay us to put the survey of our African territories upon a scientific and permanent basis, and to discontinue the present fragmentary, haphazard, and unscientific methods, the experience gained by the United States Coast and Geodetic Survey, the system it has evolved, and the body of practice it has formulated will be worthy of the closest study. On some points of detail surveyors trained in other countries would doubtless depart from the American practice, while the latter would, in other points, possibly require supplementing; there has been, for example, little occasion to develop any procedure specially applicable to very dense forest country; but on the whole the experience and skill of the American surveyors may be safely taken as guides for any future work.

We do not quite follow Prof. Hosmer in his apparent support of the now rather out-of-date search for the "figure of the earth" in the form of the spheroid which most closely fits the true surface. For convenience of calculation some spheroid must be assumed, but, provided that this is approximately true, such an approximation as is furnished by any of the well-known figures, the exact spheroid selected is unimportant. The shape of the geoid, the ultimate objective of the surveyor, can be as well represented in relation to one spheroid as to another. Great practical convenience, however, accrues if all survey systems—in any case those which have, or possibly could have in the future, a land connection—are reduced to the same conventional figure. All the North American surveys from Canada to Mexico have now adopted the Clarke (1866) figure and no further knowledge of the earth's true shape will compel them to abandon this as the basis for their reductions.

As regards the system of levels we are doubtful whether the convention adopted in the United States of applying an orthometric correction and thus defining level so that two points on an undisturbed lake are at different levels is, on the whole, the best. We should prefer to treat any points on the same equipotential surface as being at the same level, and re-define height to mean the distance of the equipotential from the geoid at a selected latitude. This is a subject which might with propriety engage the attention of the International Geodetic Congress when that body is summoned. E. H. H.

Ronald Poulton.

The Life of Ronald Poulton. By his Father, Edward Bagnall Poulton. Pp. xi+410. (London: Sidgwick and Jackson, Ltd., 1919.) Price 16*s.* net.

NOT only those who were the intimate companions of Ronald Poulton, but likewise the rest—and they were legion—who admiringly witnessed his deeds of prowess in the field, were able to realise that behind all the brilliant qualities of

the outer man, the vigour and sportsmanship and grace and sheer physical beauty, there lay as the inward source of all these things a beautiful nature. One of his friends has described his personality as "radiant," and perhaps no word is better suited to convey the secret of his shining manliness. He touched nothing that he did not strike fire from, and this was because something clean and strong, like fire, burned within him.

The story of his life is written with a simple directness that enables the unfolding of his character to be observed, as it were, objectively and in the light of the accessory conditions. Enough is said to reveal a happy and populous home as the most fundamental of such formative influences. Next we see him as one of that band of "dragons" who grow up at Oxford under the genial and wisely tolerant rule of Dr. C. C. Lynam, and note that his talent for games had already been discerned by sympathetic experts. Then he goes to Rugby. If life in the English public school needs sometimes to be painted in darker colours, it is at least certain that, wherever Ronald Poulton was, vice could not show its face. He found at Rugby what the normal healthy-minded boy may surely expect to find in any of our great schools—the opportunity for an education in which the physical, mental, and moral sides of young humanity are cultivated together. The threefold result is seen in his increasing skill as an athlete; in the winning of a science scholarship at Balliol; and in a capacity for helping others that at the university, in his various boy-clubs, in business at the factory, and finally in the Army, was destined to render him, unassuming as he was, a supreme leader of men. His subsequent career, from his Balliol days onwards, shows a steady maturing of many-sided powers of social usefulness that the word "leadership" serves best of all to sum up; and, indeed, the interest that one is led to take in this aspect of his development quite overshadows the stirring tale of his football, sketched as it is by Mr. A. C. M. Croome with many fine touches. One wonders how much he might have done for England had he been spared to give the full support not merely of his wealth, which was to be great, but of his lucid intellect and nobility of soul, to the public cause which he had most at heart—the provision of a liberal education for the masses.

Of a loss that touches so many it is hard to speak fittingly, but perhaps the following passage, taken from a story by Mr. G. F. Bradby, will seem not wholly beside the point: "We say to each other, and do, no doubt, in part believe, that it is not length of days, but service, that gives to life its value, and that to die cheerfully in a great cause is perhaps the noblest use to which any man can put the life that has been given him. And all the time we are conscious of the great blank that has fallen on our own."

R. R. MARETT.

Our Bookshelf.

An Ethno-geographical Analysis of the Material Culture of Two Indian Tribes in the Gran Chaco. By Erland Nordenskiöld. Pp. xi + 295. *The Changes in the Material Culture of Two Indian Tribes under the Influence of New Surroundings.* By Erland Nordenskiöld. Pp. xvi + 245. (Comparative Ethnographical Studies, Nos. 1 and 2.) (London: Humphrey Milford, Oxford University Press, n.d.) Price 20*s.* net two vols.

CONSUL-GENERAL AXEL JOHNSON, of Stockholm, managing director of the Johnson Line to South America, supports in every way Swedish exploration of that continent, recognising the advantages which are sure to result from purposely conducted commercial and scientific interchange between the peoples of the respective countries. In other words, systematically gained knowledge will benefit trade. Mr. Erland Nordenskiöld is by no means the first Swedish pioneer. The first volume comprises a sifting of the present economic conditions of two still primitive tribes, the Choroti and Ashluslay of the Gran Chaco. The second volume deals in a similar way with the Chiriguans of the great Guarani group, and with the Guaranised Arawaks, both on the border between Bolivia and Argentina. Many other tribes had also to be considered as the many implements, customs, games, etc., have been traced, sometimes all over the continent, their distribution being well shown by sixty maps. The more sporadic a certain tool, the older it is, and its discontinuous occurrence is generally caused by whole tribes having died out.

The less civilised tribes copy from the richer and more advanced, not *vice versa*. The very common practice of the rape of women is one of the main influences upon the adaptation and spreading of implements and industries, since the women naturally cling to what they have been brought up with.

The chapters on the influence of the whites contain some remarkable conclusions. The positive, advantageous effect of the white culture is greater where the Indians live far away from the whites—for instance, domestic animals and things connected with them. Direct contact brings loss of independence, which ultimately spells irretrievable poverty. There is an apparently exhaustive and critically consulted bibliography. An index may be forthcoming in the contemplated third volume.

Principles and Practice of Aerial Navigation. By Lieut. J. E. Dumbleton. Pp. vii + 172 + v plates. (London: Crosby Lockwood and Son, 1920.) Price 12*s.* 6*d.* net.

ORDINARY navigation may be broadly divided into two kinds: coastal navigation, in which, shaping his course by compass, the mariner verifies his position by cross-bearings of two terrestrial objects, by two objects in transit and the bearing of a third object, and by various other methods; and navigation of the open sea, with no lights or headlands available, so that he has to depend wholly upon celestial observations. With regard to long voyages of the second type, but little progress has been made in air matters, difficulties as to obtaining a satisfactory horizon having so far proved insuperable. It is upon the development of directional wireless that the hopes of the airmen are fixed in connection with long-distance aviation in the immediate future.

It is therefore to navigation of the coastal type that the airman has given special attention, and here it is evident that not only has he availed himself fully of methods already in use, but has also not failed to improve upon these processes.

On p. 90 we have an example of this in the course and distance indicator, an instrument which from a given course and an air speed calculates the course to steer and the ground speed. So also, on p. 64, we have a most useful problem, not to be found in navigation books, for finding by three bearings of the same object the course made over the ground. As presented in the book, to be done by protraction it would seem a little complicated for use in a heavier-than-air machine, but, reduced to the form of a table, it should be of very great utility by sea or air.

The book is clearly written and altogether a highly creditable production, and should prove attractive not only to airmen and seamen, but also to all who take an intelligent interest in the development of aviation on the scientific side.

Roses: Their History, Development, and Cultivation. By the Rev. Joseph H. Pemberton. Second edition. Pp. xxiv + 334 + 9 plates. (London: Longmans, Green, and Co., 1920.) Price 15*s.* net.

THE demand for a second edition of the Rev. J. H. Pemberton's useful book on roses is a welcome sign that there are still a considerable number of keen gardeners who are interested in the genus, not so much on account of its horticultural merits, but rather because of its botanical interest. The various species of the genus Rosa, unspoilt by the hybridiser and "improver," are well worthy of cultivation, and it is to be hoped that this book will turn many to the study of the wild species, as well as to the interesting hybrids that have been derived from them.

In garden catalogues of a hundred years ago the "old-fashioned" roses were the pride of the collections, and one would like to see such collections revived, difficult as it may be now to procure some of the earlier forms.

Few people to-day have seen *Rosa hemisphaerica* in all its glory, nor do they know the beauty of the various forms of the Scotch rose, or of *R. damascena* or *R. indica*. To most, probably, the charming little rose de Meaux (*R. centifolia Pomponia*), given in the list of grandmother's roses, is scarcely known, and the same may be said of the greater number given in this interesting list of old garden favourites.

This second edition does not differ on general lines from its excellent predecessor, but a good deal has been added on the perpetual flowering musk roses, which the author himself has done so much to popularise; and on the hybrid *lutea* roses. Some useful additions have been made to the section dealing with fungus pests and to the chapters on soils and manures.

The appendix, giving a list of selected roses, has been revised, and forms a valuable guide to those who wish to grow the best types of garden roses.

Pyrometry: A Practical Treatise on the Measurement of High Temperatures. By Chas. R. Darling. Second edition, revised and enlarged. Pp. xii + 224. (London: E. and F. N. Spon, Ltd.; New York: Spon and Chamberlain, 1920.) Price 10*s.* 6*d.* net.

THE publication of the first edition of Mr. Darling's book on pyrometry in 1911 filled a want in English technical literature at a time when the value of a more exact measurement of temperature in industrial operations was being appreciated. Mr. Darling points out in his preface to the new edition that since his book was first issued there has been a great extension in the use of pyrometers in industrial processes and laboratory work, and there can be little doubt that his book has contributed in no small measure to this desirable development. He further refers to the invaluable uses of pyrometers during the war, and it is pleasing to have his testimony that British makers were fully able to meet the demand for instruments. In his revision Mr. Darling has described several instruments of the more recent pattern, and added new material, bringing the book thoroughly up to date. The bulk of the new matter is to be found in the chapter dealing with thermo-electric pyrometry, and valuable and suggestive additions have been made, particularly on the use of base-metal junctions and on protecting sheaths for couples. In the chapter on optical pyrometers there has been considerable extension, especially of the section on colour extinction instruments, the simplicity of which is a strong point.

Co-education and its Part in a Complete Education. By J. H. Badley. Pp. 39. (Cambridge: W. Heffer and Sons, Ltd., 1920.) Price 2*s.* net.

THIS is an address delivered at Cambridge on February 22 of this year to a meeting of the "Socratic" Society by the headmaster of the well-known Bedales School, with the addition of some notes, which appear at length in the appendix,

bearing upon points concerning which fuller information was desired. The address takes the form of a general survey of the present position and outlook of education in this country, and of the part that co-education may be expected to play in its development.

The author defines education as the training of life, for life, by life. We must think of the child as a living organism with immense and varied possibilities. The purpose is to give these possibilities the fullest opportunity of development quite irrespective of the child's future vocation, and concerned only with the point of view of his position as an actual and potential member of the community. Mr. Badley's contention is, as a result of twenty years' experience at the Bedales residential school for both sexes, that the full value of education in its widest aspect cannot be attained for either sex unless both be taught together during the whole period of school and student life with such differentiation as physical and psychical conditions demand. It is a carefully reasoned statement worthy of the serious attention of all educators. We are face to face with the making of a new world, in the fashioning of which men and women will share equally, and in the common educational training of both sexes the problem will find its most effective solution. Such is the view of the author of this most inspiring address.

A Text-book of Electrical Engineering. Translated from the German of Dr. Adolf Thomälen. By Prof. George W. O. Howe. Fifth English edition. Pp. xi+482. (London: Edward Arnold, 1920.) Price 28*s.* net.

A NUMBER of minor alterations which have been introduced into this edition increase its value. For instance, the symbols have been modified, when necessary, so as to bring them into line with the recommendations of the International Electrotechnical Commission, and descriptions of obsolete machines have been omitted. The theory of the single-phase commutator motor has been extended, and students will find the theorems given simple and instructive. We can recommend the book to those who want a general survey of the whole elementary theory of electrical machinery.

It is assumed throughout that the alternating-current waves follow the harmonic law; this greatly simplifies the analysis. We should like the author to have laid greater stress on the limitations of the theory due to the assumptions which have been made. Owing to hysteresis, for instance, the waves do not follow the harmonic law, and although the error introduced by the assumption may be small, it makes it difficult—if not impossible—to judge of the relative merits of some of the alternative diagrams given, as they are all affected to varying extents.

We notice that the translator defines the slip of an induction motor as the difference between the number of revolutions per second of the stator magnetic field and of the rotor. It is more customary now to define it as the ratio of this difference to the revolutions per second of the stator field. Defined in this way, the slip is a pure number, and the mathematical equations of the induction motor are simplified.

Governors and the Governing of Prime Movers. By Prof. W. Trinks. Pp. xviii+236. (London: Constable and Co., Ltd., 1920.) Price 22*s.* 6*d.* net.

THIS book is probably the only one in the English language which deals exclusively with governing, the subject being usually dealt with in text-books on prime movers. The author's aim has been to produce a book of essentials and principles, put in a form which will enable the reader to judge existing and future types of governors; there are no catalogue pictures. The author does not pretend to have covered the whole field of governing; thus the mathematical side has been restricted to the usual undergraduate standard; and he projects a further volume for the use of engineers who have to make governing a life study.

Among the other subjects treated in the volume will be found discussions on the governor as a motor and as a measuring instrument, promptness and traversing time, adjustment of equilibrium speed, shaft governors, natural period of vibration of governors, interaction of the governor and the prime mover, rate-of-flow, pressure and relay governors, governor troubles and remedies. There is also a very useful chapter on discarded types of governors. In all these the treatment is clear, and there is a large number of line drawings, which will be of assistance to the student. Since there are no makers' illustrations, the book is equally suitable for British and American students, and we can recommend it with confidence.

Portraits of Scientists. 11 in. by 14 in.+margin. (The Class-room Portrait Gallery, 7 Queen Square, W.C.1.) Price 6*s.* 6*d.* each, or 30*s.* the set of five.

THESE collotype portraits have been produced with the view of meeting the need for instructive decoration in classrooms, lecture halls, and laboratories. The publishers hope that, while helping to create an atmosphere of culture, the portraits will also supply a background for much solid instruction woven around the lives of great men.

The difficulties met with, at present, in the choice and provision of artistic, decorative, and educational pictures for secondary schools and other institutions are such that any attempt at improvement in this direction is welcome. However, the paper of the present issue and the artistic effect of the portraits leave much to be desired. The series includes Galileo, Sir Isaac Newton, Michael Faraday, J. Clerk-Maxwell, and Lord Kelvin; and it is proposed to prepare a further series, incuding chemists and other men of science of to-day.

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.]*

Einstein's Shift of Spectral Lines.

REFERRING to my suggestion from Gullane on p. 280 in NATURE of October 28, Lord Rayleigh has recalled my attention to Prof. Eddington's admirable report on "The Relativity Theory of Gravitation," whereby I have been reminded that the predicted shift depends not on gravitational intensity, but on gravitational potential. This makes my revolving disc quite inefficient; it would seem that bodies of astronomical size are necessary for the test.

But since the shift is proportional to the square of peripheral velocity, instead of to the acceleration, it occurs to Lord Rayleigh that the high speed of positive rays curved in a magnetic field might facilitate its detection; for, as he points out, if their speed were 10^8 c.g.s., their radiation shift would be comparable to a fortieth of an Ångström unit.

But this same proportionality to u^2/c^2 raises the question whether, after all, the shift expected is anything more than the natural consequence of self-inductive increase of inertia due to speed. If a satellite suddenly gained a spurious inertia not subject to attractive force, its orbit would enlarge and its period lengthen. So it may be with electrons in a violently projected Bohr atom.

I appreciate Dr. Chree's friendly experimental caution in your issue of November 11.

November 12. OLIVER LODGE.

The British Association.

WE have been asked by the executive of the National Union of Scientific Workers to send a contribution to the discussion in NATURE on the cause of "the apathy of local people of the educated classes to the presence of the Association" in the centres where it meets.

The majority of those who have taken part in the discussion appear to assume that this apathy is due to the failure of the Association to interest the general public in the utilitarian applications of science and their contributions to the material benefits of civilised life. Only one or two writers seem to have attempted to follow up the lead given in your editorial of September 16, which attributes the public apathy to "the neglect of national bodies like the British Association to adjust themselves to changing national needs. . . . The Association makes little endeavour to show the bearing of scientific methods and principles upon most subjects of vital importance in national polity and industrial affairs."

Prof. Soddy strikes the same note in NATURE of September 23, where he says "the vast body of the general public, disillusioned by the war, looks to them [scientific men] to provide a way of escape from the evils that threaten our civilisation." He points out that "scientific synthesis and the direction of the unique mental attitude, induced only by the actual discovery of new knowledge, to the conduct of public affairs are the real and peculiar functions of the Association if it is to regain its national position."

The executive of the union would like to endorse these views, and to suggest that it is not necessary to invoke the outstanding genius of Huxley and his contemporaries and to hold them up in invidious comparison with the men of the present day in order to explain the apathy of the public. The explanation lies rather in the message which Huxley and his contemporaries had to give to the lay public. Their appeal was not based upon holding up to public admiration the utilitarian benefits offered by science, important as these undoubtedly are. Their message appealed to the deep-seated complex of ideas, experiences, beliefs, and emotions which conditions every man's outlook on life. It challenged the static view of man's relation to his environment which was the heritage of dogmatic theology, and offered in its place a dynamic view, which revealed man as himself a part of the great stream of natural causation. As such it tore old prejudices up by the roots, roused fierce resentment in those who could not free themselves from such prejudices, and an equally fierce exultation in others who were smarting under repressions imposed by the authority of theological dogma.

Science (or, we should rather say, the bulk of the institutions and men who claim to represent science) has no such message at the present day. As is shown by the Rev. A. L. Cortie in his letter in NATURE of September 30, the sections which discussed questions such as the constitution of the atom and relativity drew good and numerous attendances; we suggest this was because these subjects touch on ideas of the nature of matter, space, and time—ideas which find a place, however vague, in the philosophy of life of a large number of people.

We believe that if the British Association and other bodies representing organised science are to regain the place in the public estimation which they held in the latter half of last century they will have to come out with a new message which, like that of Huxley and his contemporaries, challenges old-established points of view. Where the Association is to find a field ripe for such a message is suggested in your editorial and amplified by Prof. Soddy. While Huxley's message forced people to revise their old-established ideas and prejudices as to man in his relations to his *natural* environment, the public is now ripe for a lead from science in the direction of a fundamental revision of that part of its outlook on life which concerns the relations of man to the *social and economic* environment which he has created.

JOHN W. EVANS,
President.
H. LYSTER JAMESON,
Member of Executive.
A. G. CHURCH,
Secretary.

National Union of Scientific Workers,
25 Victoria Street, Westminster,
London, S.W.1, November 12.

FROM the correspondence that has recently appeared in NATURE it is evident that there is a healthy determination on the part of scientific men in Great Britain that the British Association shall not be allowed to stagnate, but must exhibit progressive evolution as well as the solid dignity implied in its full title. One point that I have recently noticed in your columns with great satisfaction is that in future representatives from similar associations in other countries will be invited to attend each meeting. We who work in parts of the British Empire remote from its centre, and are content to do so, although perhaps our scientific atmosphere is not so rarefied as some maintain, are undoubtedly apt to get out of touch, if not out of sympathy, with the work of our colleagues at home, while they are equally apt to view our en-

deavours as something distinct from their own, on a different, if not precisely a lower, plane, or—shall I say?—on a stage such as that on which the dogs danced for Dr. Johnson's admiration. Such misconceptions are good for no one. They ignore two fundamental facts: that science is universal, and that, nevertheless, scientific work may be undertaken on different lines, and even in a somewhat different spirit, under different conditions.

I am convinced that the British Association might do a great deal to dispel the mirage by making a feature of discussions (of course, on quite general lines) on overseas work in different branches. There are always members present at the meetings from many parts of the Empire as well as from various foreign countries, but they are too often silent members from whom expression of opinion is neither encouraged nor invited. In zoology, at any rate, what we want nowadays is not so much isolated fragments of research, however accurate the observation may be, as syntheses of results. Zoology, indeed, and perhaps other branches of biology also, are in danger of destruction by the toxins produced in their own vital processes, such, for example, as nomenclature and purely museum taxonomy. Yet comparatively few of the subjects discussed at meetings of the British Association, to judge from reports, rise much above this level. What is wanted, so far as the scientific man from overseas is concerned, is more informal discussion on fundamental subjects, more expression of reasoned opinion and well-thought-out aims as opposed to details of observation, and less of the specialist atmosphere. At any rate, that is what *I* want on the rare occasions on which I am able to attend a meeting of the British Association.

N. ANNANDALE.

Indian Museum, Calcutta, October 19.

Chemical Warfare and Scientific Workers.

PROF. SODDY has directed the attention of readers of NATURE (November 4, p. 310) to the issue on the part of the War Office of a letter in which the active co-operation of men of science is invited towards the intensive development of chemical warfare. The list of ordinary associate members embraces more than sixty names of chemists, physicists, and medical men —a list apparently drawn up without consultation with the various members concerned. On receipt of the letter referred to, I replied at once with the request that my name should be removed from the list of associate members, and in this refusal to serve I was actuated by the following considerations:

The use of poisonous gases in warfare was a nefarious novelty introduced by the Germans in violation of the conventions prescribed for civilised belligerents, and the Entente Powers had no option but to undertake methods of retaliation. During the later period of the war I acted as an associate member of the Chemical Warfare Committee, and, like many other chemists, did all in my power to assist by scientific investigation the progress of gas warfare on the offensive side. At that time my services were given most willingly. But the position has entirely altered now that the war is over. My present point of view is that I do not think it right that men of science should, two years after the armistice, be approached with the request to undertake work on a method of conducting warfare which has not yet been recognised as legitimate.

If gas warfare is to be adopted in the future, one result follows of necessity: every nation will be compelled in self-defence to cultivate this form of devilry. Yet we have just listened to the earnest appeal of the Prime Minister for more goodwill amongst nations, amongst people, amongst the classes! The recognition of chemical warfare even on the basis of a peace organisation must certainly engender an atmosphere of suspicion. It will, however, be the hope of many that if nations will by mutual consent unite in the abolition of an instrument which adds so much to the horrors of war, they will also have the strength and the determination to make their decision effective.

The successful development of chemical warfare will obviously be dependent on scientific work, and it is easily understood that the authorities should look to the universities to give them some assistance in its prosecution. University teachers should be on their guard before they bind themselves to a policy in the framing of which their opinion as a body has never been taken. Surely the universities ought to have been asked their views. Why should a professor of chemistry by joining the Chemical Warfare Committee pledge his university to a course of action of which the university may not approve?

ALEX. MCKENZIE.

PROF. SODDY (NATURE, November 4, p. 310) seems to have overlooked some arguments. Lack of preparation for war is no guarantee against an aggressive policy. Recent British history shows a close correlation between Jingoism and military inefficiency. In this country Jingoes are seldom intelligent enough to provide against the risks they incur.

Again, the more scientific war becomes, the more difficult it will be to wage it without the consent of scientific workers. If they really desire a saner state of international relations, scientific workers should seek so to develop the engines of war that they alone can use them.

Lastly, if Prof. Soddy really wishes to stop the application of science to warlike purposes, he should surely welcome with open arms the War Office Committee. Can he suggest any means for discouraging the application of scientific study to war (or to any other problem) so entirely efficient as the placing of the matter in the hands of a large Governmental Committee composed exclusively of eminent persons?

NORMAN R. CAMPBELL.

November 9.

British Laboratory and Scientific Glassware.

PROF. BAYLISS in his letter published in NATURE of November 4 appears to attribute the breakage of British laboratory glassware, when exposed to changes of temperature, to inadequate annealing, citing table glassware as an example of a commercially well-annealed article.

I have at different times examined many hundreds of pieces of table glass under the polariscope, and have never yet found one entirely free from strain. On the other hand, I have often found laboratory beakers, taken at random from average samples, in which no strain whatever can be detected. When strain does occur in beakers and flasks it is generally at the lip, and is caused by the flanging operation. In this connection it is interesting to note that beakers which contain bad striæ, and are, consequently, in a state of strain which cannot be removed by annealing, give figures for thermal endurance as high as those obtained from beakers free from striæ.

The difference in thermal endurance between German and English laboratory glassware is inherent in the composition of the glasses selected for their manufacture. The predominant factor controlling the variations in thermal endurance is the coefficient of expansion of the glass, since this property changes

far more rapidly with a change of composition than do the other properties, diffusivity, tensile strength, and Young's modulus, which make up the thermal endurance of the glass. The coefficient of expansion of German laboratory glassware is something more than 10 per cent. lower than that of English, and this fact alone would account for the breakage of the English glass with drastic heat treatment.

There is no particular difficulty attached to the manufacture of glass having a low coefficient of expansion and high thermal endurance, and we may take it that the English manufacturers have decided that the maximum resistance to attack by reagents is to be desired, and have, accordingly, sacrificed thermal endurance to a small extent in order to obtain the encouraging results outlined in Mr. Jenkinson's letter in NATURE of October 28.

The whole question is largely one of general policy. If the chemists of this country prefer to use a glass of higher thermal endurance but with less resistance to reagents, then I have little doubt that the British makers would supply it. E. A. COAD PRYOR.

Milford, Park Road, Teddington, November 8.

The Separation of the Element Chlorine into Normal Chlorine and Meta-Chlorine, and the Positive Electron.

IN commenting on a letter under the above heading from Prof. Harkins in NATURE of April 22 last, I remarked that his assumption that "the hydrogen nucleus or the positive electron has, according to these papers, a weight, and presumably a mass, of 1·000, on the basis of oxygen as 16·000," was contradicted by experiment.

Prof. Harkins has pointed out to me that this assumption was made with the reservation "whenever the positive electron is combined in a complex atom," which I was careless enough to overlook. I wish, therefore, to apologise for my remark and withdraw it unreservedly.

I very much regret that this apology comes so late, but the delay is due to the fact that Prof. Harkins led me to understand that he was himself publishing a statement on the matter in NATURE, to which I could reply. He now tells me he has decided not to do so. F. W. ASTON.

Trinity College, Cambridge, November 9.

The Stereoscopic Appearance of Certain Pictures.

IN going round a picture gallery it will be noticed that in certain pictures the objects delineated appear to stand out in a similar manner to those seen with a stereoscope. A picture of this kind has the effect of making those surrounding it appear very flat by comparison. This appearance is not the characteristic of a particular artist, because in an exhibition, all the paintings being by one man, only one or two may be found which have this stereoscopic appearance.

The majority of the pictures will be correct in drawing, perspective, light and shade, but it will be noticed that this will be correct only for one eye—that is to say, the picture is quite correct for either eye when the other is closed. Those pictures, however, which have a stereoscopic appearance are painted so that the representation is as nearly as possible a delineation as seen by the combined retinæ, any disturbing element which would do away with this illusion being eliminated. For instance, a revolver pointed straight at a person so that the centre of the barrel is pointing directly between the two eyes will be seen quite differently with the two eyes. When the right eye is closed the left-hand side of the barrel will be seen, the right-hand side being invisible. When the left eye is closed the right-hand side is seen, and the left-hand side of the barrel is invisible. When, therefore, the barrel of the revolver is foreshortened and both sides are visible, the muzzle being pointed directly at the observer, the appearance is such as could be seen only with both eyes. The stereoscopic appearance is then very striking, and the revolver appears to follow the observer and to be pointed directly at him, no matter what position he takes up with regard to the picture. In all the pictures or portions of them which present this stereoscopic appearance it will be noticed that the appearance as seen by both eyes is represented, the left-hand side of the picture being represented as seen by the left eye, the right-hand side as seen by the right eye.

In a demonstration which I gave before the Physiological Society (*Journal of Physiology*, vol. xlviii., 1914) I showed that the perception of binocular relief is independent of double images and the stimulation of disparate points, provided that the object presents images to the two retinæ similar to those which are presented by an object in the field of vision. This can be shown by taking a pair of stereoscopic photographs in which the point of sight is at the centre of each and cutting them vertically in two, and then, having pasted the left half of the left photograph on the left side and the right half of the right photograph on the right side on white or black cardboard at an appropriate distance, so that there is no overlapping when placed in the stereoscope, a picture in striking relief is obtained when combined together in the stereoscope. In this case it will be noticed that there is no portion common to both fields of view. In each case the overlapping portion is combined with white. It seems probable that this is how binocular vision takes place in ordinary circumstances. If an object in high relief—as, for instance, a vase or the face of a person—be viewed at a short distance and one particular point fixated, it will be noticed that the right eye dominates the right side of the field of vision and the left eye the left side. The image seen is almost entirely that of the right eye for the right side and that of the left eye for the left side, as may be proved by noticing the relation of surrounding objects, and closing first one eye and then the other alternately. F. W. EDRIDGE-GREEN.

The Energy of Cyclones.

IT does not seem to me as though any really satisfactory theory has yet been put forward to explain the genesis and maintenance of cyclones; I fully agree with Mr. Deeley (November 11, p. 345) that they are not due to contiguous masses of air at different temperatures, but, on the other hand, I do not see how they can originate in an inert and stable region like the stratosphere.

Were storms produced by contrasts of temperature—or, in other words, by the so-called polar front—surely they would be most violent where the contrast was most marked. The stormiest parts of the world are the great belt of the southern ocean from 40° to 60° S. lat. and that part of the Atlantic which lies north-west of Scotland, and neither of these regions shows any exceptionally steep gradient of temperature.

Observations in the upper air have shown a remarkable uniformity in the mean temperature (mean with regard to height) from 0 to 20 km. in every place where they have been obtained, and it follows as a corollary that there is a very uniform pressure at 20 km. height over the globe, for the pressure at 20 km. is almost independent of the surface pressure.

Observations over Europe, the only part of the world where they are numerous enough for the purpose, have also shown a most extraordinarily close correlation between the temperature and pressure of the air in the upper part of the troposphere, many of the coefficients exceeding 0·90. These facts must be reckoned with in any theory about the formation of cyclones.

My own belief is that pressure differences originate in the upper half of the troposphere from variations in the strength of the surrounding winds. Being given the means of originating and maintaining a difference of pressure at about the height of 9 km., the rest of the phenomena follow readily. The distribution of temperature, the high positive correlation below and the negative correlation above, and the rise and fall of the tropopause between cyclone and anticyclone are all explained by the vertical motion of the air that would naturally follow from the distribution of pressure. W. H. DINES.

Benson, November 12.

Physiological Method as a Key to the Causation of Isle of Wight Disease in Bees.

IN the summer of 1918, while working with Prof. L. Hill and Mr. T. A. Webster on gas research, I advised Dr. John Rennie, of the natural history department of the University of Aberdeen, that a physiological study of metabolism in healthy bees and in bees known to be suffering from symptoms of Isle of Wight disease should be undertaken, making use of oxygen and carbon dioxide determinations. As a corollary, an investigation into the temperature of bees, healthy and unhealthy, was also indicated.

In the summer of 1919 it was found that apparently bees infected with Isle of Wight disease consumed in a given time much less oxygen than healthy controls. This observation was not reported to me until July, 1920, when I was able at once to draw the conclusion that the symptoms of Isle of Wight disease were due to blocking of tracheal tubes and anoxæmia. Loss of the power of flight was to be expected, as the co-ordinating nervous mechanism and the musculature involved were deprived of their proper oxygen supply.

Had I been made acquainted with the results of a research I had advised, or had the investigator been able to draw a very simple physiological conclusion from the data, whether the data were correct or erroneous, the discovery of a parasite as the blocking agent or disturbing factor in tracheal tubes would have been the natural consequence.

In 1920 this parasite was discovered by anatomical study, and its presence as the agent causing the disease is announced in the Press as the outcome of the researches of Dr. John Rennie, Mr. P. Bruce White, and Miss Elsie J. Harvey.

It will be noted that the physiological method of investigation could have led equally surely to the discovery of the parasite and to the interpretation of the symptoms. JAMES M. MCQUEEN.

Halesowen, November 5.

Luminosity by Attrition.

I AM very glad that Sir Ray Lankester has again directed attention to this phenomenon. By a slip of the pen he says (November 4, p. 310) "quartz pebbles" in his first paragraph and in the heading. My object in writing is to say that these pebbles may be found on any shingle beach, and may be known by their translucent appearance under a "rotten" (or pitted) exterior. They are *pale* brown, and, when dry, look like lumps of derelict toffee. But on the shingle beaches of South Devon (notably the "Budleigh Salterton Pebbles"), the Chesil Beach, and the Suffolk coast (notably at Aldeburgh) practically every pebble on the beach will "flash."

It is much to be desired that some mineralogist should take up the intensive study of flint, chert, and quartzite. I may mention that for many years I have stored every "peculiar" flint pebble I have come across, and my entire collection is at the service (as a gift) of any museum worker who cares to undertake the study. EDWARD HERON-ALLEN.

Large Acres, Selsey Bill, Sussex,
November 12.

THE recent letters in NATURE from Lieut.-Comdr. Damant and Sir E. Ray Lankester recall some observations made in 1916 in collaboration with my friend and former headmaster, the late Mr. W. P. Workman, who first directed my attention to this interesting phenomenon. Specimens of translucent quartz from a quarry about three miles from Tintagel, North Cornwall, give the characteristic orange-coloured light in broad daylight and the peculiar smell. This *triboluminescence* of quartz was observed by Du Fay in 1735, and about 1748 Delius mentioned the sulphurous smell which accompanies the glow when quartz is rubbed against quartz (Kayser, Bd. iv., pp. 614, 617; Winkelmann, Bd. vi., p. 809).

The following observations present, I believe, some points of novelty: (1) Luminescence is produced when quartz is rubbed by any material, such as topaz or sapphire, which is harder than itself. Dr. Gordon, head of the geological department of King's College, London, kindly lent a number of minerals for the purpose of this test. Ordinary steel, which falls below quartz in the scale of hardness, does not cause the glow. (2) Fused quartz, as supplied by the Silica Syndicate, gives a very fine effect. I have on several occasions shown this as a lecture experiment by rubbing together two tubes of transparent fused silica. In this connection the observation of Lord Rayleigh (NATURE, vol. civ., p. 153, 1919) that "silica glass" possesses a remarkable crystalline or quasi-crystalline structure is of special interest. (3) The tubes of fused quartz when rubbed together give the same peculiar odour as ordinary quartz pebbles.

It should, therefore, be possible to carry out an experiment of the kind suggested by Sir E. Ray Lankester by grinding the interior of a quartz vessel which might be highly evacuated or contain suitable liquid or gaseous reagents. According to Lord Rayleigh's experiments (Royal Society, February 27, 1919), the clearest and whitest quartz has some power of scattering light, though much less than that of glass or liquids. This small scattering is considered to be due to inclusions, as in the case of visibly smoky or yellow quartz. May not the presence of minute diffused metallic particles, or perhaps particles of silicon itself, be the cause of the various phenomena under discussion? H. S. ALLEN.

The University, Edinburgh.

Contractile Vacuoles.

THERE is no doubt that the explanation of the production of these vacuoles as given in NATURE of November 11 by Prof. Henry H. Dixon is the correct one. It may perhaps be of interest to Prof. Dixon to refer to a paper by W. Stempell published in 1914 in *Zoolog. Jahrb., Abt. allg. Zool. u. Physiol. der Tiere* (Bd. 34, iii., p. 437), where the same view is put forward. I believe that this journal is not very accessible—a fact which doubtless accounts for its having been overlooked. I may say that it is my custom to teach this view, and a brief account will be found on p. 162 of my "Principles of General Physiology." W. M. BAYLISS.

Notes.

THE KING has been pleased to approve of the following awards this year by the president and council of the Royal Society:—A Royal medal to Mr. W. Bateson, for his contributions to biological science, especially his studies in genetics; and a Royal medal to Prof. G. H. Hardy, for his researches in pure mathematics, particularly in the analytic theory of numbers and allied subjects. The following awards have also been made by the president and council:—The Copley medal to Mr. H. T. Brown, for his work on the chemistry of carbohydrates, on the assimilation of atmospheric carbon dioxide by leaves, and on gaseous diffusion through small apertures; the Rumford medal to Lord Rayleigh, for researches into the properties of gases at high vacua; the Davy medal to Mr. C. T. Heycock, for his work in physical chemistry, especially on the composition and constitution of alloys; the Darwin medal to Prof. R. H. Biffen, for his work on scientific principles applied to the breeding of plants; and the Hughes medal to Prof. O. W. Richardson, for his work in experimental physics, especially thermionics.

DR. H. DESLANDRES, president of the Paris Academy of Sciences, gave, at the meeting on October 4, an eloquent *éloge* on Sir Norman Lockyer, who was a correspondant of the Academy in the section of astronomy. He referred to Sir Norman as one of the founders of physical astronomy who approached science along untrodden paths and with whose name great discoveries are associated. Among the researches and conclusions to which Dr. Deslandres directed particular attention were those of the observation of solar prominences in broad daylight, the discovery of helium, the effect of variation of pressure on the width of hydrogen lines in prominences, the application of the Doppler-Fizeau principle to the spectroscopic determination of velocities in prominences, dissociation of chemical elements, the temperature relations of long, short, and enhanced lines in spectra, the correlation between solar and terrestrial meteorology, and stellar classification on an ascending as well as on a descending temperature scale as described in "The Meteoritic Hypothesis" and "Inorganic Evolution." Reference was also made to the Hill Observatory, Sidmouth, as "already one of the best provided in England," and Dr. Deslandres concluded his appreciative address with the words: "Dans son ensemble, l'œuvre est considérable et touche aux plus hautes questions de la Science. Sir Norman Lockyer est assurément un des plus grands savants de l'Angleterre, et un des plus grands astronomes de tous les temps. L'Académie s'honore de l'avoir compté parmi ses membres; elle adresse à sa veuve et à ses enfants ses plus vives condoléances."

A MEETING of the International Commission for Weather Telegraphy, which was appointed by the International Meteorological Conference at Paris in October, 1919, will be held at the Air Ministry during the week November 22–27. The following delegates are expected to attend the meeting:—Lt.-Col. E. Gold (president), Meteorological Office, Air Ministry; M. A. Angot, Bureau Central Météorologique, Paris; Col. L. F. Blandy, Controller of Communications, Air Ministry; Dr. van Bemmelen, Meteorological Observatory, Batavia; Col. Delcambre, Service Météorologique Militaire, Paris; Prof. F. Eredia, Ufficio Central di Meteorologia, Rome; Prof. E. van Everdingen, Meteorologisch Instituut, De Bilt, Holland; Gen. Ferrié, Ministère de la Guerre, Paris; Capt. Franck, Service de la Navigation Aérienne, Paris; Señor José Galbis, Servicio Meteorologico Español, Madrid; Lieut. H. D. Grant, Meteorological Office, Air Ministry; Dr. Hesselberg, Meteorologiske Institut, Christiania; Col. Matteuzzi, Servizio Aerologico, Rome; Prof. A. de Quervain, Central Meteorological Office, Zurich; M. Rey, Ministère de l'Agriculture, Paris; Capt. C. Ryder, Meteorologische Institut, Copenhagen; Mr. T. Thorkelsson, Meteorological Service, Reykjavik; and Dr. A. Wallén, Meteorologiske Hydrografiske Anstalt, Stockholm. Since the war much progress has been made in different countries in the development of codes for telegraphic reports of the meteorological information which experience in the war and the needs of aerial navigation indicated as necessary. The main object of the Commission is to co-ordinate these developments in the revision and extension of the codes prepared at the last meeting of the Commission, which was held in London in September, 1912.

THE Nobel prize for physics for 1920 has been awarded to Dr. C. E. Guillaume, director of the International Bureau of Weights and Measures at Sèvres. The prize for 1919 has been reserved.

THE Chadwick Trustees announce that a public lecture will be given by Prof. J. B. Farmer, entitled "Some Biological Aspects of Disease," on Thursday, November 25, at 5.15 p.m. The lecture will be delivered in the lecture hall of the Medical Society of London, 11 Chandos Street, W.1.

THE Woburn Fruit Farm, which was carried on from 1894 to 1918 by the Duke of Bedford, and since then by means of a grant from the Development Fund administered by the Committee of the Rothamsted Experimental Station, is to be closed at Christmas owing to the continued ill-health of Mr. Spencer U. Pickering, which renders him unable to continue his experimental work there.

THE gold medal of the Institution of Mining and Metallurgy, the highest distinction in the power of the council to bestow, has been awarded to Sir Thomas Kirke Rose "in recognition of his eminent services in the advancement of metallurgical science, with special reference to the metallurgy of gold." The Consolidated Gold Fields of South Africa, Ltd., gold medal and premium of forty guineas have been awarded to Mr. H. Livingstone Sulman for his paper entitled "A Contribution to the Study of Flotation" (Transactions, vol. xxix., 1919–20).

AT the anniversary meeting of the Mineralogical Society held on November 9 the following officers and

members of council were elected:—*President:* Sir William P. Beale, Bart. *Vice-Presidents:* Prof. H. L. Bowman and Mr. A. Hutchinson. *Treasurer:* Dr. J. W. Evans. *General Secretary:* Dr. G. T. Prior. *Foreign Secretary:* Prof. W. W. Watts. *Editor of the Journal:* Mr. L. J. Spencer. *Ordinary Members of Council:* Dr. A. Holmes, Miss M. W. Porter, Mr. R. H. Rastall, Sir J. J. H. Teall, Mr. A. F. Hallimond, Dr. F. H. Hatch, Mr. J. A. Howe, Lt.-Col. W. Campbell Smith, Mr. T. V. Barker, Prof. C. G. Cullis, Mr. W. A. Richardson, and Dr. A. Scott.

MR. J. HARGREAVES presided over the annual meeting of the Chaldæan Society held at the Great Northern Hotel on November 13. Reports of astronomical work and progress were received from the local sections established at Luton and Tottenham, and the formation of new sections for Warwickshire and Hertfordshire was announced. Special attention was directed to the encouraging work of the society in the observation of the zodiacal light, variable stars, sun-spots, the moon, and photographic work. The secretary, Mr. S. S. Clerk-Maxwell, King's College, Cambridge, expressed a hope for further development and for the formation of local sections south of the Thames. *The Chaldaean* is now published for the society by Messrs. Geo. Philip and Son, Ltd., 32 Fleet Street, E.C.4.

A JOINT meeting of the Physical and Optical Societies for the discussion of "The Making of Reflecting Surfaces" will be held on Friday, November 26, at 7 p.m., at the Imperial College of Science and Technology, South Kensington, S.W.7. The programme will be divided into two parts: (*a*) Technical methods and processes, and (*b*) properties of reflecting surfaces (reflecting powers, etc.). Some demonstrations of actual processes will also be given. Mr. R. Kanthack is making a complete bibliography and *résumé* of previously published work on this subject, and will contribute a description of the results of his investigation to the discussion. Papers have been promised by representatives from manufacturing firms, astronomical observatories, and other scientific institutions. A complete programme will be issued during the week. Tickets may be obtained from the secretary of the Physical Society (Imperial College of Science) or of the Optical Society (39 Victoria Street, Westminster, S.W.1).

REPLYING to a question in the House of Commons on November 15, Mr. Lloyd George said: "The whole subject of chemical warfare has been under careful consideration by the Cabinet during the past year. It was decided on March 4 that the question should be raised at the Council of the League of Nations. It is, I am sure, obvious to the House that this is a question on which our action must depend on that of other nations. It was realised, therefore, that, as other countries have been continuing to develop this method of warfare, the safety of our fighting Services would be seriously jeopardised by lack of similar development in this country, and it was decided on May 12 that, pending a pronouncement on the subject by the League, the fighting Services should continue their researches and experiments. The War Office Committee has been constituted as part of the organisation necessary for the continuation of these studies. The whole subject will, of course, have to be reconsidered when the Council of the League of Nations has made its pronouncement."

REPRESENTATIVES of countries included in the League of Nations and of America met in Paris on October 17–21 for the purpose of forming an International Union against Tuberculosis, which would continue the work carried on by the old international association, the last conference of which was held in October, 1913, at Berlin. Great Britain's representatives were Sir Robert Philip, of the National Association for the Prevention of Tuberculosis and the Ministry of Pensions; Dr. Nathan Raw, also from the National Association; and Dr. Halliday Sutherland, of the Ministry of Pensions. The conference was presided over by M. Léon Bourgeois, and the principal subject raised was the necessity for the early diagnosis of tuberculosis and the methods which could be used for this purpose. The headquarters of the International Union against Tuberculosis will be at Geneva, and the next conference will be held in London in 1921.

MR. E. W. SHANN referred in his letter in NATURE of November 11 to the statement in the leading article in our issue of October 28 that there was "little or no evidence" that the museums of our public schools "are used in school teaching." This statement was based not only on the Report of the British Association Committee, but also on the confessions of public-school science masters in annual conference in 1916, and on personal inquiries from boys and masters while the article was being written. Oundle is a marked exception to the prevailing apathy, yet Mr. Shann in his long and interesting letter devotes only ten lines to the use of the museum in class-work. Such small evidence as there is, in addition to that from Oundle, comes, as in Mr. Shann's case, from the biological and geological sides. This is not because the subject or the material is more suited to the museum method, but because the teachers have had a scientific training and have some appreciation of a museum's usefulness. More might be done even here, but it is in the teaching of history, ancient and modern, and in the elucidation of ancient or foreign authors, that so much more use might be made of school museums.

IN a brochure entitled "A Proposal to Increase the Purchasing Power of the Penny" Mr. Harry Allcock puts forward the view that the value of the penny as 1/240th of the pound sterling has proved too low for post-war requirements, and that, in consequence, penny prices have been advanced by 50 per cent. in many cases where a smaller increase would have satisfied the seller had a single coin been available intermediate in value between 1*d.* and 1½*d.* As a result, two coins are now needed in millions of daily transactions where formerly only one was used, and this has led to a shortage of copper coins and much inconvenience to the public. The provision of either additional copper coins or new nickel coins would involve national expenditure, to obviate which Mr. Allcock

suggests that the Government should now increase the token value of the penny by 20 per cent., thus making it represent one-tenth instead of one-twelfth of the shilling and increasing its purchasing power proportionately. The present value of the pound sterling and of all existing notes and silver coins relative to the pound would be unchanged, but the shilling would be divided into ten pence. The consequent loss to the Mint when the copper coins already in circulation became so worn as to need withdrawal would be insignificant, and the risk of the public hoarding copper coins in anticipation of the change could be avoided by imposing this without notice; while holders of large stocks of copper coins for business purposes might be called upon to surrender to the State the amount by which their holdings were increased in value.

THERE can be no doubt that scientific progress in relation to agriculture has been seriously hampered in the past by the poor material prospects offered to the scientific worker, and the Ministry of Agriculture, in recognising the fact and in attempting to remove the defect, has shown a spirit of enlightened goodwill which is of hopeful augury. The provision of a grant earmarked to cover the salaries of workers in universities and in institutions such as the Rothamsted Experimental Station, in addition to, and separate from, a grant for laboratory and general research expenses, is a real effort to ensure that the workers shall have some security of tenure and some prospect of a settled career in the prosecution of research. The principle is sound, but the practical application is as yet not entirely successful. A system of grading the workers is perhaps inevitable, and the salaries allotted to the different grades are in some respects not unreasonable. But the annual increments are too small, especially during the years when the average worker is marrying and his expenses are increasing, and there is not sufficient range between the extremes of the scale, *e.g.* a worker recently graduated and beginning his career receives 450*l.*; the same man ten years later, with a wife, two or more children, and a position to maintain, receives only twice that amount, and is actually worse off than before. The total number of graded posts is much too small even to cover only those already working in agricultural research. That will, no doubt, be improved as time goes on, but meanwhile it leads to stagnant promotion and invidious selection. There must be something seriously at fault when (to take only one particular instance) a worker of more than thirteen years' experience in research, of acknowledged eminence and authority in an important subject, should be offered, and have in the meantime to accept, a post in the third grade (called "junior assistants"), and be classed along with those at the start of their career with no record of solid achievement behind them.

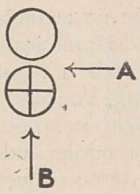
THE authorities of the New York Zoological Society are justly proud of the fact that a chimpanzee was born in the Gardens of the society on July 14. A very welcome account of this event is given in the Zoological Bulletin of the society for September (vol. xxiii., No. 5) by Mr. W. Reid Blair. The mother of this infant is about ten years old, and was taken in West Africa; the father is about eight years old, and was taken in what was German East Africa. The offspring of these two animals at birth weighed about 3 lb., and measured 16 in. in length. The body was but sparsely clothed with hair, save on the head, back, and arms. In its less prognathous jaws and in the great relative size and form of the ears it differs conspicuously from the adult chimpanzee. Unfortunately, the mother was unable to nurse it properly, so that it lived but a few days. During this time, however, some interesting observations were made upon the behaviour of the mother in regard to her treatment of her infant. Only once before has the chimpanzee bred in confinement. This was in Cuba in 1915.

IN Report No. 9 of the Industrial Fatigue Research Board Mr. P. M. Elton describes his investigations on output in the weaving-sheds of two silk mills. The observations lasted for a continuous period of fifteen weeks, and represent the output of forty-seven experienced weavers. At each mill it was found that the output steadily improved during the course of the experimental period. This was due mainly to the diminishing need of artificial light. In the latter half of February and the first week of March, when no artificial lighting whatever was necessary, the output during the first and last hours of the working day was 11 per cent. greater than at the same hours in January, when lighting was required, though the output in the middle hours of the day (when no artificial light was required in either instance) was practically the same. It might be thought that such a result argued inadequacy of the artificial lighting, but photometric measurements showed that the light was quite good. Another factor which influenced output was the temperature of the weaving-sheds. It was found that a rise of temperature from 59° F. to 65° F. caused a 10 per cent. improvement in output, but no definite relationship between output and humidity could be traced. The practical importance of Mr. Elton's investigations needs no comment. It is only by careful and accurate observations such as he has described that the conditions necessary for maximum efficiency can be ascertained.

IN Memoir No. 6 of the Entomological Series of the Agricultural Department of India, Ramachandra Rao gives a lengthy report of an inquiry into the efficiency of indigenous insect pests as a check on the spread of Lantana in India. This plant is a noxious weed in most parts of India and Burma; various other plants which have been introduced for ornamental purposes have also got, or are getting, out of hand, and are likely to prove sources of future trouble. A native of South and Central America, it has been introduced by man into many tropical countries, and in all suitable localities it is a scourge, displacing the native vegetation and often seriously interfering with the natural regeneration in forests. In the Hawaian islands an Agromyzid fly introduced from Mexico, the larvæ of which live in the fruits of Lantana, has proved a valuable check, though it has not by any means exterminated the plant. In work of this

nature it has to be considered whether the introduced species is likely to turn to plants of economic value and thus do more harm than good. It is necessary, therefore, to make quite sure of this vital point before introducing the Agromyzid into India. The author of this memoir has brought to light a number of insects attacking Lantana in India. The most efficient of these appears to be a small plume moth (*Platyptilia pusillidactyla*), the caterpillar of which feeds on the flower-heads and considerably reduces the number of seeds produced. Its efficiency, however, would be much greater were it not so subject to the attacks of Hymenopterous parasites. No insect is likely to do more than act as a check upon the reproductive capacity of the plant, and until such insects can be satisfactorily brought into operation, the eradication of the plant in (at present) lightly infested districts by cultural methods seems to be the only feasible course.

RECENT investigation into the irregularities of the heart illustrates the great value of researches which apparently have no practical application. The electrical phenomena of muscle and nerve were thought to be of merely academic interest, but after the perfection of the Einthoven galvanometer these electrical reactions became of great use in the study of the action of the heart. By placing pairs of electrodes on the surface of a muscle, as shown by the two circles of the accompanying diagram, it is found that a wave of excitation travelling in the direction of arrow A will reach both electrodes at the same time and the electrical response will be insignificant, but a wave of excitation travelling in the direction of arrow B will reach the electrode, marked with a cross, first, so that an appreciable electrical response will result, and the direction of the electrical current will indicate the direction in which the wave is travelling; the commencement of the electrical response shows the time at which the wave of excitation reaches the electrode. By this method Dr. T. Lewis and his co-workers have followed the path of the excitation in the disorder known as auricular fibrillation (see *Heart*, August, 1920, vol. vii., No. 4). The normal heart-beat starts at a locality known as the sino-auricular node, and spreads in all directions over the auricle. When the wave of excitation reaches the extremities of the auricle it cannot pass back because it is dammed by the refractory period of the contracting auricle. In auricular flutter the wave of excitation passes down one side and up the other, so that it reaches the starting point after the muscle has relaxed. Thus the wave can follow in the same direction and a "circus" movement becomes established. The result is that the auricle beats at a rate of more than 300 contractions per minute. It is not known why the auricle allows the wave of excitation to pass in one direction only, but once it is started it continues because the auricular muscle relaxes just before the wave of excitation reaches it, and the wave of excitation does not catch up to the refractory period of the contracting muscle.



DR. J. RUNNSTRÖM, of the Zootomical Institute, Stockholm, has long been occupied with experiments on Echinoderm larvæ. Among others, he has cut away portions of the larvæ and observed the further development either in those portions or in the individuals from which they have been removed. In *Bergens Museums Aarbok*, 1917–18 (1920), he tells us how he has removed from the larva of a sea-urchin (*Parechinus miliaris*) the sunken area that would in the normal course of metamorphosis produce the young urchin. This did not prevent the formation of a new sinking or infolded sac of similar character, though, owing to the regeneration of the hydrocœl (whence the characteristic water-vascular system develops), the formation of an actual echinoid did not proceed. Even a fragment removed from the same side (the left) of the larva displayed a like infolding, so that a single larva might thus be induced to form three sacs. These results show that in this case the laying down of an organ does not, as Driesch has supposed, limit the faculty of the remaining cells to form a corresponding organ, or perhaps one should say "of the neighbouring cells," for fragments removed from the right side of the larva produce, not an echinoid sac, but an infolding that seems to represent the formation of a new larval gut. In larvæ from which the echinoid rudiment has been removed further deviations from the normal process occur and resemble changes observed in some abnormal holothurian larvæ—an observation of much theoretical importance.

IN recent years dried blood has appeared frequently on the market as an animal food, and, considering the large quantities of this material which are available daily from the abattoirs of Great Britain and the increasing difficulties of obtaining nitrogenous food for animals, an inquiry was started as to the value and safety of utilising dried blood as a nitrogen-supplying food. Blood collected in small quantities and stored before drying is useful only as a manure, but blood which is dried immediately after collection may be used as animal food. Mr. L. F. Newman, in the *Journal of the Ministry of Agriculture* for June last, contributes the results of some feeding experiments with dried blood. He concludes that the addition of blood to an ordinary farm ration of wheat offals may cause considerable gain in weight compared with the results from a diet of offals only, while the addition of blood to plain maize-meal may give an increase equal to the results obtained from feeding offals only. Another material which has been suggested as animal food is the bracken rhizome, and a paper by Prof. James Hendrick on "Bracken Rhizomes and their Food Value" appears in the Transactions of the Highland and Agricultural Society of Scotland (1919). Prof. Hendrick carried out preliminary feeding experiments which indicated that bracken rhizomes are not rich enough in the more valuable food constituents to be of much use for anything but maintenance purposes, and even here their usefulness is limited because they are not palatable to certain classes of stock. During the last forty or fifty years, however, considerable damage

has been caused by the spreading of bracken on good pasture lands, and it is possible that by utilising the rhizomes for animal food the infested areas can be cleared without incurring much loss.

THE October issue of the Journal of the American Chemical Society contains a long paper by Mr. W. D. Harkins on the structure of atoms. Evidence is given for the statement that atoms in which the ratio of negative to positive electrons in the nucleus is high are rare, both in meteorites and on the earth. Suggested constitutions are assigned to the nuclei of the more abundant light atoms. The constituents of atoms are regarded as α-particles, positive electrons (hydrogen nuclei), electrons, particles of mass 3 (ν-particles), and secondary structures of positive and negative electrons (μ-particles).

Engineering for November 5 contains an illustrated account of a large depôt to be used for the storage of wool, now approaching completion at Hull. This building is being constructed for the Ministry of Munitions by Messrs. Nissens, Ltd., of Birmingham, and is a development of the well-known Nissen hut, which proved its practical utility on a wide scale so successfully during the war. The area covered is approximately 10 acres, and construction was commenced only on June 16 last. The depôt consists of eighteen buildings of the Nissen type, each 552 ft. long by 40 ft. wide, all communicating. Each semicircular rib is made up of five segments joined by fish-plates; the ribs are held together by wood purlins. The buildings are double-skinned, with an air-space of 7 in. between the inner and outer linings of galvanised corrugated sheet, and are thus damp-proof and not affected by condensation. Only forty men, on piecework, have been employed, and the rate of building has been approximately one bay of 552 ft. completed per week. The form of construction has several advantages, and is suitable for many purposes. Buildings of practically any length can be made; they are absolutely weather-proof, are capable of erection by unskilled labour, and if lined with 2-in. plaster slabs will be found as cool as brick buildings.

Our Astronomical Column.

THE ECLIPSE OF 1922 IN AUSTRALIA.—Further details concerning this eclipse have come to hand. Mr. W. E. Cooke, the Government Astronomer of New South Wales, has visited various points on the Queensland railway within the totality track, and sends a pamphlet containing his experiences. The inhabitants of the villages are willing to give all possible help to observers. The weather prospects are distinctly hopeful, though the altitude of the sun in this region will not be great (26° at most). The most easterly and most accessible station is Stanthorpe, on the Dividing Range, 2656 ft. high, a favourite summer resort, having several good hotels. Those undertaking observations of a delicate nature should go further inland, to Coongoola or Goondiwindi. As there is a branch of the British Astronomical Association in New South Wales, there is reason to hope that all these stations will be occupied. The west coast of Australia in the neighbourhood of Condon or Wallal is favourable as regards height of sun and probability of a clear sky. Mr. H. A. Hunt, the Commonwealth Meteorologist, notes that Wallal, which is a telegraph station, might be reached from Port Hedland, 150 miles to the west-south-west by pearling lugger; a steamer visits Port Hedland about once a month. Mr. Hunt considers the weather prospects much more hopeful here than in Christmas Island. Another possible locality is in Central Australia, near the telegraph station of Charlotte Waters, which is 110 miles from the head of the railway at Codnadatta.

JUPITER'S SATELLITES.—Mr. R. T. A. Innes has carried out a regular series of observations of the eclipses of these satellites, especially of I. and II., since 1908; he gives the main results in Union Obs. Circ. No. 50. On comparing the observed duration of eclipse with the tabular value, there is a regular wave in the residuals with a six-year period, from which it is inferred that the tabular inclination of Jupiter's equator to its orbit needs a positive correction; it is indicated with less certainty that the node of the equator on the orbit needs a negative correction. The tabular values of mean longitude at epoch need the following corrections: I., −0·080°; II., −0·031°; and III., −0·006°. These results are of interest, and they show that the idea, so generally held, that ordinary visual observations of these eclipses are no longer of use, is not correct.

Mr. Innes appeals to all observers to unite in observing the eclipses with special care for the period 1920 December 9 to 1921 May 31. The month February 18 to March 18 may be omitted, as eclipses then take place very near the primary. The disappearance of the last speck of light and the re-appearance of the first speck are the phenomena to which attention should be specially directed. The aperture and condition of seeing should be noted. Mr. Innes points out that observations of satellite I. afford a delicate test of the constancy or otherwise of the earth's rotation.

THE ORIGIN OF SPECTRA.—Dr. H. H. Plaskett contributes an interesting article on spectra to the Journal of the Royal Astronomical Society of Canada (vol. xiv., p. 7). The paper summarises Nicholson's work on the atom and that of Planck and Einstein on the quantum theory of light. It is pointed out that there are some serious difficulties in the quantum theory. "Interference can be obtained with a path-difference of more than a million wave-lengths. This seems to require that the quantum must have this length (several feet) in space. Further, the experimental fact that a 3-ft. O.G. has a higher resolving power than a 3-in. can only be interpreted as meaning that the quantum has a 3-ft. cross-section. It is difficult to see how a quantum of such dimensions is indivisible, and if it is, how any light gets into a 3-in. telescope." It is suggested that the facts seem to require some compromise between the undulatory and quantum theories; in fact, the author considers a satisfactory theory of radiation as the first desideratum of future progress, the second being a solution of the three-body problem as applied to the more complex atoms.

Dr. Silberstein's suggestion that the atomic nucleus may not be a homogeneous sphere of positive electricity, but a collection of point charges, is shown to remove some difficulties, but to create others, which have not yet been solved.

The Bulawayo Meeting of the South African Association.

THE eighteenth annual session of the South African Association for the Advancement of Science was held in Bulawayo, Southern Rhodesia, on July 14–17, with Dr. I. B. Pole Evans as president. There were the usual receptions and functions, together with visits to the Khami ruins, the Matoppos, the Victoria Falls, and Livingstone. A party, after the conclusion of the official meeting, visited the Great Zimbabwe.

More than sixty papers were read in the various Sections, and the attendance was a large one, more than 130 members proceeding by special train from the Transvaal, as well as some from the Cape Peninsula and Natal.

The president, Dr. I. B. Pole Evans, Chief of the Division of Botany and Director of the Botanical Survey of the Union, gave a most interesting address on "The Veld: Its Resources and Dangers," the address being illustrated by a series of beautiful lantern-slides. He reviewed recent progress in botanical knowledge, and outlined the notable advance that had been made by the members of the Botanical Survey in respect to systematic ecology, indigenous grasses, fungi, and poisonous plants. By "veld" is meant the natural vegetation of the country. The botanical regions correspond to a large extent with the geological formations, and nineteen types of veld, each with its own characteristic flora, can be identified. An outline was given of the geographical and geological features, climatic conditions, predominant flora, and plants of economic importance of each region. The grasses, poisonous plants, and those yielding drugs, fibres, oil, rubber, timber, and tanning materials, were noted. The need for co-operation among workers in different fields of research was strongly urged, and was illustrated by reference to the co-operation of botanists and veterinarians in the elucidation of certain stock diseases due to poisonous plants. The need for the closer association of the botanist and chemist for the investigation of various problems in animal nutrition was indicated. In conclusion, the president stated: "The investigation of such questions is of enormous importance from an economic point of view, and when such problems are scientifically and systematically attacked the veld will yield a hundredfold its present resources, and its dangers will correspondingly decrease and diminish."

Mr. H. E. Wood, of the Union Observatory, Johannesburg, as president of Section A, gave an address on "Recent Progress in Astronomy," noting that the present year was the centenary of the foundation of the Royal Observatory at the Cape. A very interesting comparison of the astronomical knowledge of a hundred years ago with that of the present day was given. The problem of the measurement of the distance of the stars by various methods was outlined, and the rapid progress due to the use of the blink microscope described. An account of the helium stars, of the behaviour of the variable stars, and of the important results accruing from the combined investigation of their absolute magnitude and spectroscopic constitution was given.

"Geology in Relation to Mining" was the subject of the presidential address to Section B, given by Mr. F. P. Mennell, who has seen all the later developments in the mining industry of Rhodesia. A detailed account was given of the ways in which the economic geologist could aid countries like the Union of South Africa and Rhodesia by showing that their internal resources were sufficient in kind and amount to form the basis of essential industries without overseas aid. Gold, chromite, coal, zinc, iron, and copper are present, and in the production of chromite Rhodesia leads the world. The structure of the Rhodesian gold-bearing rocks and its influence on the development of such reefs industrially were set forth. In conclusion, it was pointed out that the mining industry led to the manufacture of such products as pipes, wire, and chemicals on the spot, and so to the establishment of local industries.

Dr. T. R. Sim, late Government Forester in Natal, delivered the presidential address to Section C on "Causes Leading towards Progressive Evolution of the Flora of South Africa." He showed that change in the flora was continuously going on, and that there was an interaction between flora and climate. These interactions cause a definite trend, not necessarily in the direction of new species, but in the gradual disappearance of what were climax types. The influence of cultivation, bush-cutting, and climatology on flora was considered, while sun-spot cycles and rainfall cycles were described in considerable detail By the prevention of grass-burning, by forest maintenance, and by increasing the area under exotic trees the amount of moisture retained and reprecipitated could be vastly increased; thereby a more temperate method of rainfall would result, and consequently less erosion of the soil occur.

In Section D the presidential address was delivered by Mr. C. W. Mally, Cape Entomologist, whose subject was "Some Zoological Factors in the Economic Development of South Africa." The need for a zoological survey of the Union was mentioned, and the problem of the blending of white and coloured races was discussed and disapproved. The problem of "big game" was considered. Entomological research in relation to human and animal diseases and to agriculture was outlined, and the insect pests of maize, wheat, and olives were described. Fluctuations in the relative abundance of insects over various periods appeared to be more or less inexplicable. An account was given of some results achieved in combating insect pests of crops by the use of insecticides and natural enemies. A plea for adequately trained men for scientific research in South Africa concluded the address.

The Rev. H. A. Junod, president of Section E, gave a most interesting address on "The Magic Conception of Nature among Bantus." He outlined the peculiar difficulties in connection with the mentality of natives, and showed the necessity for a proper knowledge of their laws and customs by the dominant race. The Bantu mind does not concern itself with causes, but believes that any abnormal phenomena such as drought or disease are produced by spiritual agents who possess the power of witchcraft. Numerous interesting examples of the reasoning by analogy of the Bantu were given, and a demonstration of the native magic practice of "bone-throwing," together with a most interesting explanation of the symbolism, was presented. This ingrained magic conception was the stumbling-block to Bantu progress.

"Labour Conditions in South Africa" was the subject of Prof. R. Lehfeldt's presidential address to Section F. The problem is complicated by the presence of many natives. The sharp barrier between the races leads to the production of the "poor white" class, who become destitute and lazy while clinging to the remains of racial pride. The same condition prevents the more intelligent members of the native races from rising. Rural colonies failed for various

reasons, and the great majority of the destitute cannot become independent farmers, but must work for wages. Native labour is cheap, and so forms an obstacle. A policy of segregation of the races in different parts of South Africa is almost impossible economically. The address closed with an aphorism: "A country will, in the end, belong to the people who do its work."

An evening lecture was delivered by Prof. J. A. Wilkinson on "The Nitrogen Problem." The South Africa medal and grant were awarded to Prof. E. Warren.

It is only possible to notice briefly a few of the many papers read before the various Sections, but most of them will be printed in the Journal of the Association.

In Section A, Prof. P. G. Gundry read an interesting paper on the effect of high temperature and the elevation of aerodromes in the taking-off of aeroplanes. Prof. W. N. Roseveare contributed a short note on Einstein's planetary equation. Father Goetz wrote on rainfall and barometric variation in Bulawayo.

Messrs. A. M. Macgregor, H. B. Maufe, and A. J. C. Molyneux contributed papers on the geology of Southern Rhodesia to Section B. Mr. G. N. Blackshaw investigated magnesia-impregnated soils, and concluded that the most economical treatment for them was liberal dressings of kraal manure. Such soils occur in the Great Dyke of Southern Rhodesia. Mr. E. V. Flack has analysed samples of bat guano deposits in Rhodesia. They vary in composition, but often the addition of sulphate of potash or nitrate of soda or superphosphate greatly adds to their value as fertilisers.

Dr. P. van der Bijl contributed a monograph on the Polyporeæ of South Africa to Section C. Prof. D. Thoday described the ericoid leaves of the Maquis of the Cape Peninsula, and Mrs. Thoday gave an account of the seed of *Gnetum gnemon*. Dr. E. Marion Delf discussed the distribution of accessory food-factors in plants, and Dr. T. R. Sim read a paper on South African ferns. Mr. A. O. D. Mogg described an interesting method of veld estimation by counting plants in transects, while Prof. S. Schonland discussed certain Crassulaceæ found in Rhodesia.

Papers on the causation of "lamziekte" were contributed to Section D by Sir Arnold Theiler, and from another point of view by Dr. E. R. Hartig. The former has found that bone-meal satisfies the abnormal craving exhibited by cattle suffering from the disease, and farmers in "lamziekte" areas, such as around Vryburg, are being advised to add bone-meal to the rations of their infected cattle. Dr. Annie Porter described the life-history of the African sheep and cattle fluke, *Fasciola gigantica*, and exhibited specimens. She has proved experimentally that the intermediate host is the snail, *Limnaea natalensis*, in which the young stage, *Cercaria pigmentosa*, occurs. Prof. H. B. Fantham gave an account of his continued observations on various parasitic protozoa found in South Africa. He has shown that there is a seasonal variation in the occurrence of the spores of *Sarcocystis tenella*. Mr. J. Sandground contributed an interesting paper on the economic importance of a study of Nematodes, mentioning his researches on *Heterodera radicicola*. Mr. S. H. Skaife described a Tachinid parasite of the honey-bee.

In Section E, Mr. N. H. Wilson, of the Rhodesian Native Affairs Department, gave a paper on the future of the native races there, and considers that it is necessary to allow both white and black to make full economic use of their abilities with the white man as a directing and predominant partner. The Rev. H. A. Junod, in describing some features in the religion of the Ba-Venda, mentioned that they have two sets of religious institutions, ancestor worship and a vague monotheistic notion. The Rev. W. A. Norton described some of his ethnological and linguistic studies in Bechuanaland.

A paper on agricultural economics by Prof. R. A. Lehfeldt, and one on geographical method by Mr. J. Hutcheon, were contributed to Section F.

Johannesburg is now the seat of the headquarters of the Association, and the next meeting will be held at Durban in July, 1921. H. B. F.

Geography at the British Association.

AFTER the presidential address by Mr. J. Macfarlane the proceedings of Section E began with a paper by Mr. D. Lleufer Thomas on some geographical aspects of the distribution of population on the South Wales coalfield. The main coalfield of South Wales comprises about 780 square miles. It is chiefly an elevated plateau with an average altitude of 1000 ft., rising in North Glamorganshire to some 2000 ft., and is deeply scored by narrow, declivitous valleys. These valleys open by narrow gaps to the coastal plain. The result of these conditions is that the population, which is mainly dependent on the coal outcrops, is pent up in the valleys and somewhat removed from the outer world. Another determining factor in the location of population was the occurrence near the coal of raw materials valuable in manufactures, such as iron, or sites offering special facilities for the assembling and treatment of imported materials, such as Swansea, which attracted the copper of Cornwall. Until nearly the middle of the nineteenth century coal-mining was entirely subsidiary to iron-making, and the development of the coalfield was therefore confined to its outer fringes, leaving the whole of the interior as sparsely populated as in the pastoral age. Development gradually spread southwards from the iron centres down the valleys. The present congestion of population is of comparatively recent date. The population is recruited mainly from the West Midland Counties, especially the British district, and to a less extent from the south-western counties. As a result, Monmouthshire and, to a less degree, East Glamorganshire have been anglicised in speech. In the discussion following the paper Mr. H. J. Randall emphasised the transitory nature of the population referred to and its complete dependence on coal production and demand.

Dr. A. E. Trueman read a paper on the iron industry of South Wales. The distribution of the industry was determined by the working of ironstone nodules, which are richest in the eastern part of the coalfield. Local hæmatitic ores have had little effect on the industry. The ironstone nodules were originally collected in stream-beds and worked chiefly along the northern outcrops, where the dip is less steep than in the south. With the deforestation of the country smelting declined, but revived in the nineteenth century with the use of coal. The phosphatic nature of the nodules rendered them unsuitable for the manufacture of steel by early processes, and the output of local ore gradually decreased. At present it is only

a few thousand tons a year, most of which is sent to Staffordshire for smelting. The South Wales iron industry is now dependent on imported ores, chiefly hæmatite from Spain. While it persists in the north-eastern part of the coalfield, where it originated, there is some tendency to move the industry to the coast in order to save transport.

Mr. A. E. L. Hudson directed attention to an interesting scheme initiated by the Welsh Department of the Board of Education for the collection of rural lore by the schools of Wales. The scheme affords at the same time an excellent opportunity for the collection of regional survey material, and so introduces this important aspect of geographical teaching into the school curriculum.

Lt.-Col. W. J. Johnston described the methods employed for the production of small-scale Ordnance Survey maps. The introduction of colour in the one-inch maps in 1894 caused a decreased demand for the engraved form. Printing from copper plates is a slow process, and with the large editions necessitated nowadays is practically out of the question. At the best about 20 copies an hour can be printed in one colour from a copper plate, while a modern rotary machine can produce 2000 copies in the same time. Lithography is therefore superseding copper-plate printing in this and other countries. Col. Johnston discussed at length the various methods and showed numerous specimen sheets. He dwelt on the advantages of drawing on paper and then making direct zinc plates by means of photo-zincography. This is not only the quickest method and allows of rotary printing, but it also admits of fresh fundamental plates being made in a few hours without any risk of the subsidiary plates being out of register. For all practical purposes the glass negative is a permanent record, and has the advantage that corrections in detail can easily be made on it.

Capt. H. Allan Lloyd discussed the essentials of maps for aviators. Speaking from much experience on the Western Front, he considered that in order to be of value aerial maps must incorporate details of the outstanding features of town-planning and the nature and characteristics of the ground as seen from the aerial viewpoint. Opinion was far from unanimous as to the amount of detail necessary, but aviators were agreed that the topographical map made for land travel was not suited for their purposes. Natural and artificial features which attract the eye must be emphasised, and detail which is not distinctive, as well as most of the names, must be omitted. Capt. Lloyd believed that aerial maps should show the distinctive plan of each town exaggerated beyond the scale of the map in order that such prominent landmarks as towns might be recognisable by a fleeting glance through a rift in the clouds. Aerial maps of the future, in order to be widely useful, must meet the needs of the man half-trained or practically untrained in map-reading. Capt. Lloyd proposed also to distinguish between certain types of terrain, each characterised by shapes of fields, density of buildings, or other features, and to indicate these on the map, adding illustrations of the types in the margins.

The Section met jointly with Section L (Education) to hear Prof. W. L. Myres open a discussion on the place of geography in a reformed classical course. Recent decisions regarding "compulsory Greek" compel drastic revision of classical teaching. With the postponement and restriction of language courses the aim must be earlier acquaintance with ancient conduct and thought through a closer co-ordination between history, literature, and geography. The Mediterranean region forms a natural supplement to homeland geography, and is a unity bound together by the sea. A study of Mediterranean geography, with its emphasis on outdoor life, the outcome of its climate, and its dependence on woodland in place of grassland, is invaluable in giving a sense of proportion to the study of the geography of the British Isles. Prof. Myres regretted the lack of a good account of Mediterranean geography in English. The discussion was continued by Sir Robert Blair, Mr. G. G. Chisholm, Mr. H. O. Beckit, and the Rev. W. J. Barton. Mr. Beckit insisted that the study of geography saves history from becoming an abstraction and gives it reality. Mr. Chisholm pointed out the need for correlating history, geography, and literature with the adequate study of economics.

The Rev. W. J. Barton read a paper on the oases and shotts of Southern Tunis, and Dr. E. C. Jee contributed a paper on the movements of the sea to a joint meeting of Sections D and E. Dr. R. N. Rudmose Brown directed attention to the urgent scientific needs of the exploration of the oceans on a large scale with modern equipment and methods. In this connection the Section supported the movement initiated by Section D, urging the Government to undertake an oceanographical expedition at least comparable in scale with that of the *Challenger*.

Prof. E. H. L. Schwarz lectured on the Kalahari and the possibilities of its irrigation. In the 300,000 square miles which comprise the Kalahari Desert there are three great depressions which formerly held water. These are the Ovamboland, Etosha, and Great Ngami depressions. Prof. Schwarz outlined his scheme for a weir on the Kunene, by which the waters of that river could be turned into Ovamboland and restore the country to fertility, the surplus water finding its way to the Etosha. By weiring the Chobe its waters would be prevented from passing to the Zambezi, and could be made to flow to Ngami.

Dr. Vaughan Cornish, in a lecture on Imperial capitals, discussed the positions of the great capitals of ancient and modern times, particularly in reference to strategic considerations. Imperial capitals, as a rule, have not been, and are not, in the centre of their dominions, but in a position between this and the most important frontier. Such a position combines the best site for the administration of domestic affairs, which is the natural crossways of routes nearest to the centre, with the most suitable place for military headquarters and foreign relations, which is towards the principal frontier.

Dr. T. Ashby read a paper on the water-supply of ancient Rome He dealt mainly with the four important aqueducts, the Anio Vetus and Anio Novus, which drew their supply from the Anio River, and the Aqua Marcia and Aqua Claudia, which made use of springs in the Anio Valley. These still form the most important source of supply for the modern city.

The work of the Section concluded with a paper by Principal E. H. Griffiths and Major E. O. Henrici on the urgent need for the creation within the Empire of a central institution for training and research in the science of surveying, hydrography, and geodesy. The work of such an institution would be to train surveyors by the most modern and exact methods and to turn out men suitable for the various Survey Departments of the Empire; to keep surveyors in touch with the activities and progress in all parts of the world; to give instruction in hydrographic surveying; and to conduct research in problems concerning the tides, terrestrial magnetism, and geophysics generally, particularly in the higher branches.

During the meeting of the Association a collection of maps illustrating various aspects of the geography of South Wales, arranged by the Cardiff branch of the Geographical Association, was exhibited in the reception-room in the City Hall.

National Union of Scientific Workers.

THE annual meeting of the council of the National Union of Scientific Workers was held at King's College on November 13. In his address Dr. J. W. Evans, the retiring president, dealt with the subject of "Research at the Universities." Dr. Evans paid a tribute to the achievements of scientific workers during the war, and pointed out that the task ahead of them was of even greater consequence and allowed of no relaxation of effort. After summarising the activities of the Department of Scientific and Industrial Research, he expressed dissatisfaction with the present attitude of this Department towards the scientific and technical faculties of our universities. Since the publication of its first report the Department appeared to have abandoned the more fruitful policy of encouraging to the utmost the research workers at the universities. The restrictive character of the present grants to individual workers at such institutions tended to divorce research from teaching. In his opinion this was a fundamental error, since the best results in research could be achieved only by those who devoted some time to teaching. Apparently the Department looked to the universities and technical colleges to maintain a supply of competent research workers for the State-aided research associations rather than to undertake industrial research for themselves. He considered that a teaching staff engaged in research work, both in pure science and in its applications to industry, was in a more favourable position to discover and develop new principles than research workers isolated and restricted in the laboratories of research associations or even Government research institutions. In conclusion, Dr. Evans urged the importance of universities including in any course in science some training in research methods. This he embodied in a resolution which was supported by Prof. Soddy, who stated that Prof. Perkin had already applied this principle to the chemistry courses at Oxford University. Chemistry students there had shown by their enthusiasm how much the change was appreciated.

Continuing, Prof. Soddy said that since the president had prepared his address there had been a complication brought about by a request from the War Office that the universities should undertake research into the development to the utmost extent of chemical warfare research for offensive and defensive purposes. He expressed the view that it was a matter that must inevitably be considered, sooner or later, by the union. It ought to be considered before rather than after the occasion arose. He was glad that the executive of the union had already decided to appoint a committee to go into the whole question.

The resolution disapproving of the policy of the Department of Scientific and Industrial Research, in establishing and financing research associations, which hands over to the private use of profit-seeking monopolies valuable knowledge obtained at the expense of the whole community, and places the research associations in a position to exploit the scientific workers of the country for their own benefit, was carried unanimously. Prof. Soddy stated that the Government had capitulated to the big business interests in politics and departed altogether from its original intentions. There was no greater example of unfair competition than in the chemical industries.

Mr. A. A. Griffith, in moving a resolution that for the present Advisory Council of the Department should be substituted a council elected on different principles, pointed out that there could be little effective criticism of the Department under the existing arrangement whereby the Government practically appointed its own critics. It was certain that a council part of which was elected by democratically constituted scientific organisations would result in more careful scrutiny and criticism of the acts of the Department.

A resolution by Mr. F. A. Potts to the effect that scientific workers employed as whole-time officials in Government Departments should enjoy status and pay not less than those enjoyed by the administrative class of Civil Servants was carried unanimously.

Prof. Leonard Bairstow was elected president for the ensuing year.

University College of Swansea.

THE University College of Swansea, which was incorporated in January of this year and made a constituent college of the University of Wales by a new University charter sealed as recently as August 13, opened its first session on October 5. The court of governors of the college held its annual meeting on Monday, November 15, and at the conclusion of the meeting the principal, Dr. T. Franklin Sibly, delivered an inaugural address.

After paying a tribute to the pioneers of the university movement in Wales, the principal recalled the fact that the local initiative and private benefactions which brought the college into being had their mainspring in the demand for scientific teaching and research which should benefit the great industries of the district. But no time was being lost in making provision for a faculty of arts, in willing response to the insistent local demand which arose from the conviction that a one-sided institution could possess no full title to university rank. It was, however, in the domain of science that the college would always discharge a large part of its mission; and Dr. Sibly laid emphasis upon the true humanity of the man of science and the nobility of the scientific ideals of a search for truth and of a disinterested co-operation with other workers.

The college was situated in the industrial heart of Wales. The leaders of local industry, headed by the president of the college, Mr. F. W. Gilbertson, were displaying a unique degree of enlightenment and generosity in their support of the college. To the original endowment fund of some 70,000*l.* they had already added donations amounting to more than 4000*l.* and subscriptions which totalled more than 6000*l.* per annum. The subscriptions, having been promised for a period of five years, were expected to earn an equivalent annual grant from the State. Dr. Sibly believed that the workpeople of the district would prove no less staunch as supporters.

The Municipality of Swansea, which had promoted the college, had already given a magnificent site of forty-five acres in Singleton Park, offered the use of Singleton House, and promised further support. The college set the highest store on all grounds by its close association with the town.

There were, however, some serious material disadvantages. The adverse factors of inflated prices and depreciated currency were all the more serious in view of the relatively heavy cost of staffing and equipping technological departments. The measure of State aid in sight was quite inadequate.

Outlining the range of their activities and the spirit in which they entered upon them, the principal laid stress upon their work in applied science on one hand, and upon the extra-mural field open to them on the other. They possessed the means of building up a great school of metallurgy which would work in the closest co-operation with industries at its very doors. A strong department of mining and fuel technology

would be essential to the future development of the college, but the funds needed for its inception were not yet forthcoming. They realised the vital importance of research in these fields as in others. Adult education was one of the greatest problems of the modern universities, and they sought to take the university to the people in the fullest possible measure.

It was a duty and an essential of success to associate themselves as closely as possible with local needs and national aspirations, but they had also to play their part in the world-mission of the universities. They were laying the foundations of a great institution which would exist and work in order to enrich the life of the people.

University and Educational Intelligence.

BIRMINGHAM.—The Huxley lecture is to be delivered in the Mason College on Friday, November 26, by Prof. C. S. Sherrington, who has chosen as his subject "The Gateways of Sense." The lecture is open to all members and friends of the University.

EDINBURGH.—Dr. John Stephenson, until recently professor of zoology in Government College, Lahore, has been appointed lecturer in zoology in the University.

OXFORD.—On November 16 Convocation passed a cordial vote of thanks to Prof. James Mark Baldwin for his offer to pay for the present, in honour of his friend, Prof. Poulton, an annual sum of 100*l.* into a fund to be called "The Edward Bagnall Poulton Fund," to be applied at the discretion of the Hope professor of zoology for the time being in the promotion of the study of evolution, organic and social. Prof. Baldwin has also announced his intention of leaving by will moneys for the sustentation of such a fund.

The nomination by the Council of the Royal Society of Prof. C. S. Sherrington, Waynflete professor of physiology, to the presidency of the society has given great satisfaction throughout the University.

MR. G. S. ROBERTSON has been appointed lecturer on agricultural chemistry in the newly founded department of agriculture of the Queen's University of Belfast.

LORD ATHOLSTAN has given 100,000 dollars (more than 25,000*l.* at the current rate of exchange) to the special fund now being raised by McGill University, Montreal.

THE Toronto correspondent of the *Times*, in illustration of the liberal attitude of the Quebec Government towards education, states that the Legislature will be asked to vote 1,000,000 dollars (approximately 250,000*l.*) to McGill University.

COL. S. L. CUMMINS, who in 1912 succeeded Sir William Leishman as professor of pathology of the Royal Army Medical College, Millbank, has been appointed to the new chair of tuberculosis at the Welsh National Medical School, founded by Major David Davies, M.P.

WE learn from the *Times* that the Government of Burma has decided to establish a university at Rangoon. The administration will be in the hands of a council, with an executive committee, comprising representatives of such bodies as the Burma Chamber of Commerce and the Rangoon Trades Association, while matters connected with teaching will be in charge of a Senate composed almost exclusively of professors and lecturers.

DR. RUSSELL WELLS, Vice-Chancellor of the University, was entertained at a house dinner at the University of London Club on November 10. Lord Moulton, who presided, paid a high tribute to Dr. Wells's work for the University, referring particularly to his success in raising 300,000*l.* for degrees in commerce, mainly from men of business. Work of this kind tended, he said, to break down the isolation which was so frequently the bane of universities. Dr. Wells said that their object was to make the University of London in the educational world what the City of London was in the world of commerce.

THE first Congress of Universities, which was held in London in 1912, was a conspicuous success. All the universities of the Empire, to the number of fifty-three, were represented, in most cases by their executive heads, together with several of their professors. The report of the proceedings, an imposing volume of some 460 pages, is a valuable contribution to the politics of education. The Universities Bureau was an outcome of this congress. To it was entrusted the summoning of future congresses at intervals of five years. The war prevented this intention from being carried into effect, and, since hostilities ceased, the great pressure under which the universities have been working has made it impossible for their representatives to gather from the four corners of the Empire earlier than next summer. It has now been arranged that the second congress shall be held in 1921. Dr. Alex Hill, who organised the first congress and has acted as secretary to the Bureau since its institution, is engaged in its promotion. The number of universities in the Empire has now increased to fifty-eight. It is hoped and anticipated that all will make a point of sending delegates to this great council on higher education. With great generosity the University of Oxford has invited all members of the congress to be its guests on July 5–8. The Chancellor of the University, Lord Curzon, will preside over the morning session on July 5, and Mr. A. J. Balfour, Chancellor of the University of Cambridge, will preside in the afternoon. On the preceding day the congress will assemble in London for certain ceremonial functions and entertainments, of which the programme will be announced at a later date. During the fortnight preceding the meeting of the congress members from overseas will visit the various universities of the United Kingdom in turn, in order that they may become acquainted with their methods and resources.

Societies and Academies.

LONDON.

Royal Society, November 11.—Sir J. J. Thomson, president, in the chair.—Dr. W. G. **Ridewood**: The calcification of the vertebral centra in sharks and rays. In the course of the inquiry 150 sharks and rays, belonging to 68 species and 44 genera, were examined. The investigation largely resolved itself into ascertaining the limits of the three component cartilages of the definitive centrum, namely, the sheath-cartilage, the arch-cartilage, and the perichondrially produced cartilage, and studying the relations of the calcified lamellæ to these parts. Similarity in pattern of the calcified lamellæ is shown in certain cases to be homoplastic, the lamellæ being developed in sheath-cartilage in some genera and in perichondrial cartilage in others. In some cases the similarity may be accounted for by convergent degeneration from ancestral types which there is reason to believe were themselves dif-

ferent in their mode of calcification. The distribution and proportions of the three kinds of cartilage composing the centrum are of greater morphological importance than the disposition of the calcified lamellæ in them, and the difference between chorda-centra and arco-centra is relative rather than absolute. In some cases (Lamnidæ) the centra possess so little sheath-cartilage that they approach the arco-centra of Esox and Amia.—Dr. A. **Compton**: Studies in the mechanism of enzyme action. I.: *Rôle* of the reaction of the medium in fixing the optimum temperature of a ferment.—C. H. **Kellaway**: The effect of certain dietary deficiencies on the suprarenal glands. Changes in the size and adrenalin content of the suprarenal glands of pigeons were found constantly when the diet consisted of polished rice alone, or when an adequate ration of protein or of fat was added to the dietary, and were associated with the appearance of polyneuritis. The daily administration of a sufficient amount of "Marmite" to the diet of polished rice prevented these changes from occurring. An attempt was made to explain the enlargement of the adrenals as being due partly to congestion and œdema of the gland-tissues, and partly to the storage in the cortex of the gland of lipoids set free by the breaking down of body-tissues. The investigation of the cholesterol content of the adrenals of normal and polyneuritic birds did not support this theory of lipoid storage. The increased residual content of adrenalin was attributed to diminished output of adrenalin, as a result of the greatly lowered metabolism in birds fed on deficiency dietaries. The histological appearances of the glands suggested obstruction of the venous outflow from the medulla by cortical hypertropy as an additional cause. Œdema in birds fed on deficient diets was of infrequent occurrence, and could not be produced by the daily administration of large doses of adrenalin. It does not appear to be causally related to an increased output of adrenalin.—E. J. **Collins**: The genetics of sex in *Funaria hygrometrica*. Cultures of *F. hygrometrica* from spores reproduced the normal monœcious plants; vegetative cultures derived from the antheridia and the surrounding "perigonial" leaves of the male "inflorescence" produced male plants only, pointing to the probability that a separation takes place such that the element upon which the monœcious condition depends is dropped out of those cells from which the male organ with its surrounding leaves is formed. Vegetative cultures from the archegonium and the surrounding "perichætial" leaves have been made, and have produced typical monœcious plants. The conclusion is that up to the point of the formation of the female organ the cells of the haploid gametophytic phase retain the power to produce monœcious plants, whereas the leaves surrounding the male organ have lost this power. Sex-segregation here occurs in a haploid tissue.

Geological Society, November 3.—Mr. R. D. Oldham, president, in the chair.—Miss M. E. J. **Chandler**: The Arctic flora of the Cam Valley at Barnwell, Cambridge. The Pleistocene loams and gravels at Barnwell, Cambridge, contain peat-seams showing variations in character which are probably dependent on the ordinary laws of transport by water. These seams have added numerous new plants to the small flora previously known to occur therein, so that the floral list now includes about eighty-nine species. The plants identified were grouped as follows: (1) The Arctic element. (2) The plants of wider distribution. (3) The southern element. (4) The calcareous-soil element. (5) The estuarine element. Attention is directed to the complexity of the flora because of its bearing on the whole question of peat deposits in river-gravels. The Arctic floras of the Lea and Cam Valley differ in the occurrence, to a great extent, of different plants and plant-families in the two cases, and in the more pronounced Arctic character, exotic element, and calcareous-soil element in the Barnwell flora. If the floras lived during different cold periods, their discrepancies could be explained by an appeal to the interval of time which separated them; if, as seems more probable from stratigraphical evidence, they lived during the same cold period and were approximately contemporary, the gradual oncoming or decline of the cold, together with the respective geographical situations in the two cases, would probably be a sufficient explanation of their points of dissimilarity.

Aristotelian Society, November 8.—The Very Rev. W. R. Inge, Dean of St. Paul's, president, in the chair.—W. R. **Inge**: Inaugural presidential address on "Is the Time Series Reversible?" The kinematograph has illustrated the possibility of observing events in a reversed time order; is it possible that we might actually move through time in a reversed order so that effects would be thought of as causes? If the positions of earlier and later and of past and future belong to appearance, and not to reality, the real order will be a series, but a series without change and without time. The psychological theory of the "specious present" was criticised, and also the scientific concept of cause. In regard to the first, it was suggested that our consciousness of the present is our point of contact with supra-temporal existence, and that our tendency to identify this experience with the moving line which divides past from future is an error. Immediacy belongs only to a supra-temporal mode of intuition. With regard to the conception of causation, it had been almost driven out of natural science, and it would be a good thing if it were driven out of philosophy too. Time-succession seems to belong to a half-real world and to share its self-contradictions. We are partly in this half-real world and partly out of it. We are enough out of it to know that we are blind on one side, which we should never know if time were real, and we inside it.

CAMBRIDGE.

Philosophical Society, October 25.—Mr. C. T. R. Wilson, president, in the chair.—K. **Tamaki** and W. J. **Harrison**: The stability of the steady motion of viscous liquid contained between two rotating co-axial circular cylinders. It is shown that the steady motion is unstable for one particular type of disturbance, and that a considerable degree of viscosity is needed to give stability in the case of some other modes of disturbance. It is not possible to discriminate on a theoretical basis between the relative stabilities when the inner cylinder is rotating and the outer fixed, and *vice versa*. A criterion suggested by Prof. Lamb is discussed. Further, an explanation is given of the apparent discrepancy between the conclusion of Reynolds that a certain degree of viscosity is necessary for stability and the conclusion of Lord Rayleigh that certain steady motions of an inviscid liquid are stable, without making the assumption that there is a finite difference in behaviour between a viscous and a non-viscous liquid.—M. M. **Riesz** and Prof. G. H. **Hardy**: Le principe de Phragmén-Lindelöf.—G. P. **Thomson**: A note on the nature of the carriers of the anode rays.—M. H. **Cramér**: The distribution of primes.—Prof. G. H. **Hardy**: Note on Ramanujan's trigonometrical function $c_q(n)$, and certain series of arithmetical functions.—L. J. **Mordell**: The representation of an algebraic number as a sum of four squares.—Major P. A. **MacMahon**: The parity of the number which enumerates the partitions of a number.

MANCHESTER.

Literary and Philosophical Society, October 19.—Sir Henry A. Miers, president, in the chair.—C. E. **Stromeyer**: An attempt to explain the real nature of time, space, and other dimensions. The author said that in the remote past doubts seem to have been entertained about the reality of time and space, and of matter it seems always to have been believed that it could be made to appear and disappear. Kant and Schopenhauer were converts to the new belief in the indestructibility of matter, but asserted of time and space that they were functions of the brain. They may, therefore, be looked upon as being the innocent originators of the modern idea that the world is mind and matter. In their days energy and its conservation or indestructibility had not been discovered, but they suspected that besides matter there was another reality which they respectively called "das Ding an sich"—the real thing—and "der Wille zum Leben"—the will to live. They did not explain what they meant by reality, and the author pointed out that they should have said that time and space were relatively unreal to matter and to the "real thing," in the same way that length, breadth, and depth are relatively unreal to space, if this be taken as the standard of reality. The author then said that dimensions, using the term in its widest sense so as to include time, space, velocity, work, pressure, and all the electric, thermometric, and chemical dimensions, were unquestionably factors of energy. Energy always appears as a product of these factors, never as a factor. It stands in marked contrast to every one of its factors in being indivisible quantitatively until it has been divided qualitatively. It cannot be located in the same sense that length may be said to be located in space or a volt in an ampere. Energy, in contrast to its factors or dimensions, seems to be the only "real thing"; all its factors, our world, are relatively unreal, but amongst each other they appear relatively real. Thus, contrary to Kant's and Schopenhauer's views, matter is both as real and as unreal as are time and space. The author also dealt with the fourth dimension, and showed that it was not a real one.

EDINBURGH.

Royal Society, October 25.—Prof. F. O. Bower, president, in the chair.—The president delivered an address on "Size: A Neglected Factor in Stelar Morphology." The purpose of the address was the application of the principle of similar structures to certain internal tissues of plants. The principle had been used by zoologists to explain certain peculiarities of the animal body, both external and internal. Botanists had been slower to use it in relation to plants, though it had been pointed out that the limit of size of trees is imposed by the fact that the strength of the trunk increases only as the square, while the weight increases as the cube, of the dimensions. The same relation holds for the limiting surface of internal tissues in proportion to their bulk; as the size increases the surface varies as the square, while the bulk of the tissues enclosed varies as the cube. If, then, interchange of soluble substances through the limiting surface be proportional to its area, as the size is increased there will come a limit beyond which further increase is impossible unless the form be altered. This general position was used to explain the very complicated vascular system in certain plants, especially the ferns. The breaking up of their vascular tracts into curiously elaborate masses was held to be a necessary consequence of the need for increased proportion of surface to bulk in the larger forms. It was also exemplified in certain roots of palms and other plants. The reason why the difficulty did not arise in ordinary tree-trunks was that after the early stages the strict limitation of the conducting tracks was broken down. But in fern-stems and palm-roots it was strictly maintained in the adult, and this was what raised the difficulty and accounted for the peculiar structure which they showed.

PARIS.

Academy of Sciences, October 26.—M. Henri Deslandres in the chair.—P. **Appell**: The ellipsoidal oscillations of a liquid sphere.—P. **Termier** and W. **Kilian**: The tectonic signification of the fragments of mica schists, various crystalline rocks, and green rocks which crop out here and there near Briançon in or at the surface of strata of Briançon facies.—C. **Nicolle** and E. **Conseil**: The preventive vaccination of man against Mediterranean fever. Experiments on human subjects showed that it is easy to vaccinate preventively by subcutaneous inoculations of dead cultures. The duration of the immunity has yet to be determined.—R. **Birkeland**: Resolution of the trinomial algebraical equation by higher hypergeometrical functions.—M. **Zervos**: Some transformations of partial differential equations of the second order.—C. **Camichel**, D. **Eydoux**, and A. **Foch**: The transmission of energy by vibrations of liquids in pipes. M. Constantinescu has recently described his researches on the transmission of energy by means of vibratory waves in a pipe full of liquid. As the methods of calculation have not been published, the author develops the theoretical side of the question by the general method given by Allievi.—A. **Buhl**: The symmetries of the gravific field and the Lorentzian extension of Hamilton's principle.—E. **Jouguet**: The variation of entropy in waves of shock of elastic bodies. The variation of entropy is of the third order at least, and hence for small discontinuities the dynamic adiabatic law of Hugoniot is very near the ordinary adiabatic law.—P. **Dejean**: The Ar_3 point of steels and of martensite. In a recent paper by L. Guillet a diagram by M. Chevenard was given relating to iron-nickel alloys practically free from carbon. For alloys between 0 and 25 per cent. of nickel the curve of the Ar_3 points showed no discontinuity, and this appeared to contradict some earlier results of the authors on the critical points of nickel steels containing 0·2 per cent. of carbon. In the present communication it is proved that the two series of results are not contradictory.—M. **Barlot**: Combinations of the halogen derivatives of lead and thallium. A study of the electrical conductivity of aqueous centinormal solutions of $PbCl_2$ and TlCl indicated the existence of a compound $TlCl.PbCl_2$, and this was isolated by cooling a boiling aqueous solution containing the two chlorides in equimolecular proportions. The crystals separating are of a definite form, but after keeping for some time at the boiling point in presence of a quantity of water insufficient to dissolve it, they decompose into the two constituents, readily identifiable under the microscope. Similarly constituted double bromides and iodides were also prepared.—M. **Godchot**: The systematic degradation of dibasic saturated acids of high molecular weight. The method of Bouvet has been successfully extended to suberic, azelaic, and sebacic acids.—A. **Damiens**: The estimation of traces of bromine in organic materials.—G. **Denigès**: An extremely sensitive colour reaction for phosphates and arsenates: its applications. Traces of phosphates treated with an acid solution of ammonium molybdate and a little stannous chloride develop a blue coloration. Arsenates behave similarly.—M. **Marion**: The action of hydrogen peroxide on flour. Solutions of hydrogen peroxide allowed to react with flour under definite conditions (concentration of

hydrogen, peroxide, temperature, and acidity) give off oxygen, and this can serve as a measure of the grade of the flour.—J. **Savornin**: The continental Aquitanian in South Morocco.—P. **Bonnet**: The structure of the Caucasian isthmus and its relations with the oil-fields.—S. **Stefanescu**: The phylogeny of *Elephas meridionalis*.—A. **Danjon** and G. **Rougier**: The spectrum and theory of the green ray. Photographs of the spectrum of the green ray show that the theory of anomalous dispersion is untenable; the results are clearly in favour of the theory of normal dispersion, with absorption of the orange by the moisture in the atmosphere.—C. **Dufraisse** and J. C. **Bongrand**: The measurement of the tear-producing power of irritating substances by the *méthode du seuil*. The "*concentration de seuil*" is the lowest concentration which can be detected by its action on the eye in 30 seconds. This concentration for benzyl bromide is taken as unity in the measurements, and, although observers differ in sensibility, the comparative results expressed in this manner are independent of the observer. Figures are given for the principal lacrymogenic substances utilised in the war.—R. **Wurmser**: The action of radiations of different wave-lengths on the chlorophyll assimilation.—L. **Destouches**: Physiological observations on *Convoluta roscoffensis*.—A. **Krempf**: The larval development of *Coeloplana gonoctena*.—P. **Wintrebert**: The embryonic functions of the apparatus of relation in the anamniotic vertebrates.

NAPLES.

R. Accademia delle Scienze fisiche e matematiche, April 3.—Prof. Monticelli, president, in the chair.—G. **d'Erasmo**: Miocene ichthyolites from Syracuse. A description of four species of Teleostomi new to the fossil fish fauna of the calcareous Miocene deposits of the province of Syracuse, of which one (*Pagellus siracusanus*) is new to science, and also one representative of the Elasmobranchi of the genus Carcharias. The paper is accompanied by a plate of *Sparnodus vulgaris, Pagellus siracusanus,* and *Callipterix spinosus*.—M. **Picone**: Riemann's integral and its relation to that of Lebesgue.—E. **Pantanelli**: Elective absorption of ions in equilibrated solutions. This is a sequel to the author's investigations on the absorption of ions by plants, in which he employs new experimental methods to elucidate the complex process of absorption of ions in equilibrated solutions, whether modified by the addition of salts with the object of maintaining the same osmotic pressure as that of solutions in which marine or terrestrial plants live, or in experiments with pure salt solutions.

April 10.—M. **Cipolla**: Hardy's criterion of convergence, ii.

SYDNEY.

Royal Society of New South Wales, September 1.—Mr. J. Nangle, president, in the chair.—G. D. **Osborne**: The volcanic neck at the basin, Nepean River. The general geological features of the neck are discussed and a detailed account of the petrology of the rocks occurring there is given. The neck, which breaks through the Triassic rocks at its surface outcrop, is filled with a fine-grained breccia which is intruded by basalt dykes and plugs. The formation of the neck with the production of a long, narrow vent has been effected by explosive action concentrated upon a weak fissure structure lying transverse to the monoclinal fold in that locality. It has played an important part in the physiographic history of the Warragamba and Nepean river systems in Cainozoic times, the present junction of these two rivers being within it. In the breccia there occur fragments of the peridotites cognate with the basalt, and foreign xenoliths of rhyolite, gneissic granite, and sandy limestone. The basalt contains only cognate inclusions of norites, hyperite, harzburgites, lherzolites, dunites, pyroxenites, and troctolite, the last-named recorded for the first time in New South Wales. The cognate inclusions represent fragments of a differentiate which solidified under plutonic conditions. The rhyolite inclusions may have come from the southward extension of the Kuttung series, the granitic rocks from ancient terrains and the calcareous clastic rocks from a now denuded roof of Upper Wianamatta rocks. Chief among petrographical features are the occurrences of two mineral intergrowths, a granophyric one of pleonaste and diopside and a graphic intergrowth of augite and picotite.—R. H. **Cambage**: Acacia seedlings, part vi. The seedlings of seven Acacia species are described. The author stated that one seed-pod of *Acacia farnesiana* had floated in sea-water for more than eleven weeks and another for more than twelve weeks, and as he had previously demonstrated that a seed of that species would germinate after having been immersed in sea-water for three and three-quarter years, he considered the likelihood of the distribution of this species being sometimes effected by ocean currents was strengthened. The twinning of seedlings of *Acacia asparagoides* was recorded, several seeds having produced twin plants.—J. H. **Maiden**: A box-tree from New South Wales and Queensland. This tree, which is described as a new species, seems to deserve the name of "narrow-leaved box" better than all the boxes, its juvenile leaves being narrow-lanceolate and its mature foliage almost as narrow. The fruits are small and the timber pale brown. It is one of the trees known as "mallee box." It differs from *Eucalyptus bicolor*, which has narrow juvenile foliage, in the red timber and thick bark of the latter, and is widely different from *E. Woollsiana*, R. T. Baker, which has broad juvenile foliage. It has been collected from Gilgandra, New South Wales, to Southern Queensland, and is particularly abundant in the Pilliga scrub. The type comes from Narrabri, New South Wales.

Books Received.

A Naturalist in Himalaya. By Capt. R. W. G. Hingston. Pp. xii+300+plates. (London: H. F. and G. Witherby.) 18*s.* net.

Orographical, Regional, Economic Atlas. Part 2, Europe. Pp. 32. (Edinburgh: W. and A. K. Johnston, Ltd.; London: Macmillan and Co., Ltd.) 1*s.* 6*d.* net.

Wild Friends at Home. By E. Chivers Davies. Pp. 64. (London: G. G. Harrap and Co., Ltd.) 6*s.* net.

A First Trigonometry. By Winifred Waddell and Prof. D. K. Picken. Pp. vii+78. (Melbourne: Melville and Mullen Pty., Ltd.)

A Critical Revision of the Genus Eucalyptus. By J. H. Maiden. Vol. iv., parts 31–40. (Index.) Vol. v., part 2. Pp. 23–70+4 plates. (Sydney: W. Gullick.) 2*s.* 6*d.*

Lehrbuch der Mineralogie. By Prof. P. Niggli. Pp. xii+694. (Berlin: Gebrüder Borntraeger.) 80 marks.

L'Ether pur, l'Ether matériel et les trois formes fondamentales de l'Energie. By Paul Elmassian. Pp. 304. (Genève: Impr. Atar.)

Mathematics for Technical Students. By S. N. Forrest. Junior Course. Pp. viii+260. (With Answers.) (London: E. Arnold.) 7*s.* 6*d.* net.

The Experimental Basis of Chemistry. By Ida Freund. Pp. xvi+408. (Cambridge: At the University Press.) 30*s.* net.

Diary of Societies.

THURSDAY, NOVEMBER 18.

ROYAL BOTANIC SOCIETY, at 3.—Prof. A. W. Bickerton: The Relations of Astronomy to Botany. (2) The Value of Basic Principles.

ROYAL SOCIETY, at 4.30.—Sir Arthur Schuster: The Absorption and Scattering of Light.—Prof. O. W. Richardson: The Emission of Electrons under the Influence of Chemical Action.—Dr. A. E. Oxley: Magnetism and Atomic Structure. I.—Prof. A. O. Rankine: The Proximity of Atoms in Gaseous Molecules.—Prof. A. O. Rankine: The Similarity between Carbon Dioxide and Nitrous Oxide.—Dr. A. M. Williams: Forces in Surface Films. Part I., Theoretical Considerations; Part II., Experimental Observations and Calculations; Part III., The Charge on Colloids.

LINNEAN SOCIETY, at 5.—Prof. E. S. Goodrich: A New Type of Teleostean Cartilaginous Pectoral Girdle found in young Clupeids.—Dr. J. C. Willis: Endemic Genera and Species of Plants.

ROYAL AERONAUTICAL SOCIETY (at Royal Society of Arts), at 5.—L. Damblanc: The Problem of the Helicopter.

ROYAL SOCIETY OF MEDICINE (Dermatology Section), at 5.

INSTITUTION OF MINING AND METALLURGY (at Geological Society), at 5.30.—J. Morrow Campbell: The Origin of Primary Ore Deposits (Adjourned Discussion).—H. C. Robson: Converting High-grade Matte in Magnesite-lined Converters.—C. Brackenbury: An Automatic Counting Machine for Checking Tram Wagons.

CHILD-STUDY SOCIETY (at Royal Sanitary Institute), at 6.—Dr. F. G. Crookshank: The Anthropological Study of the Feeble-minded, or Imbeciles and Apes.

INSTITUTION OF ELECTRICAL ENGINEERS (at Institution of Civil Engineers), at 6.—Ll. B. Atkinson: Inaugural Address.

INSTITUTION OF AUTOMOBILE ENGINEERS, at 8.—London Graduates' Meeting.

CHEMICAL SOCIETY, at 8.

WIRELESS SOCIETY (at Royal Society of Arts), at 8.—A. A. Campbell Swinton: Address.

RÖNTGEN SOCIETY (in Physics Lecture Theatre, University College, Gower Street), at 8.15.—Dr. R. Knox: Presidential Address.

FRIDAY, NOVEMBER 19.

ROYAL SOCIETY OF MEDICINE (Otology Section), at 5.—Sir William Milligan: Chronic Catarrhal Otitis Media; Some Thoughts and Suggestions.

INSTITUTION OF MECHANICAL ENGINEERS, at 6.—Capt. J. S. Arthur: Sterilisation of Water by Chlorine Gas.

INSTITUTION OF ELECTRICAL ENGINEERS (Students' Section) (at City and Guilds (Eng.) College, Exhibition Road), at 6.30.—C. C. Paterson: The Incandescent Electric Lamp from the Inside.

JUNIOR INSTITUTION OF ENGINEERS, at 7.—G. H. Ayres and Others: Discussion on Economical Transmission of Power.

ROYAL SOCIETY OF MEDICINE (Electro-Therapeutics Sections), at 8.30.—Discussion: Radio-therapy; Prof. S. Russ: Physics.—Dr. Batten: Superficial Therapy.—Dr. Finzi: Deep Therapy.

SATURDAY, NOVEMBER 20.

PHYSIOLOGICAL SOCIETY (at St. Bartholomew's Hospital), at 4.

MONDAY, NOVEMBER 22.

ROYAL SOCIETY OF MEDICINE (Odontology Section), at 8.

ROYAL GEOGRAPHICAL SOCIETY (at Æolian Hall), at 8.30.—Major F. M. Bailey: A Visit to Bokhara in 1919.

MEDICAL SOCIETY OF LONDON (at 11 Chandos Street, W.1), at 8.30.—Dr. F. J. Poynton, Dr. D. H. Paterson, and Dr. J. C. Spence: A Study of an Outbreak of Acute Rheumatism in Children under 12 Years.—Dr. G. E. S. Ward: Some Disorders of the Myocardium (illustrated by the electro-cardiograph).

TUESDAY, NOVEMBER 23.

ROYAL BOTANIC SOCIETY, at 3.—Prof. A. W. Bickerton: The Relations of Astronomy to Botany. (3) Complex Changes of Season and Climate.

SOCIOLOGICAL SOCIETY (at 65 Belgrave Road), at 5.15.—C. R. Enock: Suggestions towards a Science of Corporate Life.

ROYAL SOCIETY OF MEDICINE (Medicine Section), at 5.30.

INSTITUTION OF PETROLEUM TECHNOLOGISTS (at Royal Society of Arts), at 5.30.—Short Chemical Papers.

ROYAL PHOTOGRAPHIC SOCIETY OF GREAT BRITAIN (Technical Meeting), at 7.—W. T. Wilkinson: The Wet Collodion Process Demonstrated, and an Incursion into Litho-Photography.

ROYAL ANTHROPOLOGICAL INSTITUTE (at Royal Society), at 8.30.—Dr. A. C. Haddon: Migrations of Cultures in British New Guinea. (Huxley Memorial Lecture.)

WEDNESDAY, NOVEMBER 24.

INSTITUTION OF ELECTRICAL ENGINEERS (Wireless Section) (at Institution of Civil Engineers), at 6.—Dr. W. H. Eccles: Address.

ROYAL SOCIETY OF ARTS, at 8.—Dr. F. W. Edridge-Green: Colour Vision and Colour Blindness.

INSTITUTE OF CHEMISTRY (in Chemical Theatre, University College, Gower Street), at 8.—J. Turney Wood: Some Scientific Aspects of Tanning.

THURSDAY, NOVEMBER 25.

ROYAL SOCIETY, at 4.—Special General Meeting to consider the Annual Report of Council.—At 4.30.—*Probable Papers.*—Prof. L. Hill: The Growth of Seedlings in Wind.—Prof. P. T. Herring: The Effect of Thyroid-feeding and of Thyro-parathyroidectomy upon the Pituitrin Content of the Posterior Lobe of the Pituitary, the Cerebro-spinal Fluid, and Blood.—W. A. Jolly: Reflex Times in the South African Clawed Frog.—Prof. J. A. Gunn and R. St. A. Heathcote: Cellular Immunity. Observations on Natural and Acquired Immunity to Cobra Venom.—L. T. Hogben: Studies on Synapsis. III. The Nuclear Organisation of the Germ Cells in *Libellula depressa*.

CHADWICK PUBLIC LECTURES (at the Medical Society of London), at 5.15.—Prof. J. B. Farmer: Some Biological Aspects of Disease.

INSTITUTION OF ELECTRICAL ENGINEERS (at Institution of Civil Engineers), at 6.—W. B. Woodhouse: The Distribution of Electricity.—R. O. Kapp: Some Economic Aspects of E.H.T. Distribution by Underground Cables.

EGYPT EXPLORATION SOCIETY (at Royal Society), at 8.30.—Prof. G. Elliot Smith: The Royal Mummies.

ROYAL SOCIETY OF MEDICINE (Urology Section), at 8.30.

FRIDAY, NOVEMBER 26.

ROYAL SOCIETY OF MEDICINE (Study of Disease in Children Section), at 5.

INSTITUTION OF ELECTRICAL ENGINEERS (Students' Section) (at the City and Guilds Technical College, Leonard Street, E.C.), at 6.30.—A. J. C. Watts: Electricity and the Paper-making Industry.

OPTICAL SOCIETY AND PHYSICAL SOCIETY OF LONDON (at Imperial College of Science and Technology), at 7.—The Making of Reflecting Surfaces. (*a*) Technical Methods and Process. (*b*) Properties of Reflecting Surfaces (Reflecting Powers, etc.).

ROYAL SOCIETY OF MEDICINE (Epidemiology and State Medicine Section), at 8.30.—Dr. A. Chaplin: Measures for Preserving the Health of Seamen on Board Ship.

CONTENTS.