THURSDAY, JUNE 5, 1919.

INDUSTRIAL EFFICIENCY.

(1) *The Human Machine and Industrial Efficiency.* By Prof. F. S. Lee. Pp. viii+119. (New York and London: Longmans, Green, and Co., 1918.) Price 5*s.* net.

(2) *The New Physiology, and Other Addresses.* By Dr. J. S. Haldane. Pp. viii+156. (London: Charles Griffin and Co., Ltd., 1919.) Price 8*s.* 6*d.* net.

(1) DURING the last few years the importance of the scientific study of industrial efficiency and fatigue has gradually become more and more recognised, and Prof. Lee's book on the subject comes at a very opportune moment. Prof. Lee speaks with authority, not only by reason of his physiological investigations on fatigue, but also because of the inquiries which he and his colleagues have recently been making into the efficiency and fatigue of certain of the munition workers of the United States. The book does not aim at a complete presentment of the subject, but summarises the main conclusions which should be drawn in the light of recent research. These conclusions are very clearly stated in non-technical language, and it is to be hoped that the book will find its way into the hands of many captains of industry in this country as well as in America. A careful study could not fail to impress them with the practical importance of the subject, for it is one which concerns the employer no less than the employed.

Prof. Lee claims that the efficiency of the worker must be studied on lines dictated by physiological principles, and that a science of industrial physiology must be developed in which the laboratory for investigation is chiefly the factory and the workshop. Here, by suitable observation and experiment, it will be possible to ascertain, for instance, the length of the working day which offers the best conditions for maximum production in various industries. The evidence so far available points to the eight-hour day as being the most suitable in many types of labour, but this period does not necessarily apply to other industries in which the conditions of work have not been investigated. Other inquiries are being made into the suitability of workers for different types of work, and the physical strength of various groups of munition workers has been determined by exact tests. It may surprise some of those who suggest the equality of men and women in industry to learn that the average industrial woman has less than half the strength of the average industrial man. Other chapters in the book deal with rest periods, overtime, accidents, night work, and the welfare and feeding of the worker. Again, the question of "scientific management" is debated, and its excellences and defects are pointed out. It will be evident, therefore, that the book touches on all the main questions relating to industrial efficiency.

(2) In "The New Physiology" Dr. J. S. Haldane has collected six addresses which have been delivered by him during the last few years before the British Association and other learned societies. They deal, for the most part, with his views on mechanistic and vitalistic hypotheses of physiological processes and of the constitution of living matter. He maintains that physical and chemical explanations cannot be accepted, even as a working hypothesis, and he regards them as "probably the most colossal failure in the whole history of modern science." He is likewise unable to accept the existence of a specific vital force, but he propounds other views the tenor of which may be gathered from a few quotations. "The structure and activity of an organism are no mere physical structure and activity, but manifestations of life." Again: "The idea of life is just the idea of life. One cannot define it in terms of anything simpler, . . . but each phenomenon of life, whether manifested in 'structure,' or in 'environment,' or in 'activity,' is a function of its relation to all the other phenomena. . . . Life is a whole which determines its parts."

Dr. Haldane rightly points out that a living organism forms itself and keeps itself in working order and activity. It always tends to maintain a "normal" condition, though subjected to considerable differences of environment, such as the composition of the food it feeds on and the air it breathes. But wherein do these views, and those just quoted, constitute a "New Physiology"? It seems improbable that they have sufficient novelty of outlook and value as a working hypothesis to induce physiologists to renounce what Dr. Haldane admits to be still the orthodox mechanistic creed.

In an address on the relation of physiology to medicine Dr. Haldane urges the importance of our regarding physiology, anatomy, pathology, and pharmacology as the future basis of practical medicine. He points out that if medicine is not grounded on these sciences it is bound to become more and more an anachronism. The preliminary sciences must guide the medical man at every step, and their investigation must not merely be relegated to special laboratories, but be prosecuted at the bedside.

SOLAR THERMODYNAMICS.

A Treatise on the Sun's Radiation and other Solar Phenomena in Continuation of the Meteorological Treatise on Atmospheric Circulation and Radiation, 1915. By Prof. Frank H. Bigelow. Pp. ix+385. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1918.) Price 23*s.* net.

PROF. BIGELOW'S treatise is a work to approach with circumspection. On p. 245 we read: "The formulas of chap. i. should be kept continually in mind, especially in respect of the fact that no term can change without drawing

with it the entire long train of physical terms that are united with it." As there are already ninety-one formulæ when the end of chap. i. is reached, and they are, to say the least, of controversial application, those who are not looking for trouble may be disposed to pass by on the other side. One recalls the "great text in Galatians, Once you trip on it entails, Twenty-nine distinct damnations, One sure if another fails." But such a pusillanimous attitude is not permitted to a reviewer. He has to make up his mind whether the compressed mass of 117 tables and 380 formulæ which the book contains do in fact add light or darkness to the problems of the sun.

The book is a discussion, a contribution to theory; the observations upon which it is based are chiefly those of Mr. Abbot, with the pyrheliometer, but Prof. Bigelow contends that Mr. Abbot's results are erroneously reduced, so that whereas Mr. Abbot concludes a rise of intensity of solar radiation from 1·50 calories per square centimetre at sea-level to 1·94 at the confines of the earth's atmosphere, Prof. Bigelow, using the same observations, says that the latter figure should be raised to 3·98 calories. On p. 376 he remarks: "There is probably no apparatus more difficult to interpret correctly than is the pyrheliometer, because it demands a full knowledge of radiation in gases, in glass, in mercury, in metals, during variable transformations, in which the kinetic, potential, expansion, and free-heat energies are all undergoing mutual readjustments." One may well say so, if doctors disagree to that extent. On p. 210 is a *résumé* of the results of twelve different lines of computation, every one of which gives values between 3·92 and 4·08. This would naturally be very impressive, and one would wish to confirm it by recalculating a few of the numbers. But they are not of the kind that admits of this. One must accept them from the author, and without questioning at all their correct derivation from his formulæ, it must be said these formulæ are of a kind to give one most serious pause. They are, indeed, put forward as revolutionary. On p. 1 we read: "In the Boyle-Gay Lussac Law, $P=\rho RT$, all the terms, including the gas efficiency R, are variable." But if R is not constant, all accepted gas theory, and a great deal of the structure of general physics, tumble down in ruins. On p. 17 is given a list of quantities which must also be variable; they include among them the number of molecules per unit mass of any gas. On p. 129 we read: "The entire thermodynamics of radiation must be based upon a series of non-adiabatic variable coefficients, instead of a set of adiabatic constants, as has been assumed in previous discussions." It cannot be expected that we should make such a change without the most imperative reasons and the most direct and exhaustive proofs of its necessity. But these are wanting. The reasons given in two or three sentences, on p. 16, are certainly not convincing or inevitable. The accepted gas theory is not inadequate to explain, for example, isothermal strata in the earth's atmosphere. But Prof. Bigelow's new doctrine occupies his field of view so exclusively that the whole of his book, upon which immense labour must have been spent, stands or falls with it. R. A. S.

OILS, FATS, AND WAXES.

Technical Handbook of Oils, Fats, and Waxes. By P. J. Fryer and Frank E. Weston. Vol. ii. "Practical and Analytical." (The Cambridge Technical Series.) Pp. xvi+314. (Cambridge: At the University Press, 1918.) Price 15*s.* net.

THE events of the last four years have directed attention to the economic importance of the edible oils and fats, and also to that of fats in general, as being the source from which glycerin is obtained. The national value of the industry which deals with these products is now pretty widely recognised. Fundamentally it is a chemical industry, and a knowledge of the chemistry of the oils, fats, and waxes will tend to become more and more desirable for those who control it on the technical side.

Messrs. Fryer and Weston may fairly claim to have assisted in the spread of such knowledge. In an earlier volume they have described the general chemistry of the oils, fats, and waxes, and the general principles of the methods of analysis used in the examination of these products. The present work is concerned with the practical application of those principles. It appears to be largely intended for technical chemists, but students are also within its purview. Of this we are reminded every now and then by the italicised note: *"Students should cleanse all apparatus in hot soft soap solution. . . ."* One seems to remember those students!

Both classes of users will find the volume very helpful. All the usual methods of analysis are described, with recent improvements and developments, and there are plenty of practical hints and notes.

The earlier parts of the book "begin at the beginning" with descriptions of apparatus and methods of manipulation, whilst the important matter of proper sampling receives due attention. In explaining the "standard" analytical determinations, the general plan adopted is to start with a definition, give a short outline of the method, offer remarks upon it, and describe the apparatus and materials required, before going on to the actual experiments. The directions are categorical, and are couched in a mood which may be characterised as the abbreviated imperative: "Dissolve dry fatty acids . . . decant off alcohol . . . distil off ether." A number of photographs of apparatus are included in the text.

Among the best and most important of the sections is the one which deals with the interpretation of the results obtained in the analyses. It is one thing to be able to carry out experiments on oils, fats, and waxes; it is quite another to know what the results really indicate. The authors discuss this question in some detail. They

point out how the same product may vary through differences of climate, feeding, methods of refining, and so on; and they then show by examples what deductions may legitimately be drawn from the experimental data.

The substances dealt with include hydrocarbon oils and waxes, rosin, turpentine, soap, glycerin, and candle material, as well as the animal and vegetable oils, fats, and waxes. The book appears to be well "up to date," and can be recommended as a very useful addition to the technical chemist's library. C. S.

OUR BOOKSHELF.

Joys of the Open Air. By William Graveson. Pp. 115. (London: Headley Bros., Ltd., n.d.) Price 3*s.* 6*d.* net.

To the town-dweller who has a longing for the countryside, more especially in the dull, damp early months of the year, when spring seems so long in coming, the chapters of this little book will serve as a tonic. Mr. Graveson is a man who loves his garden and his bird-visitors, as well as the meadows, woods, and chalk-downs beyond; he has eyes that can see, and above all he has the faculty of expressing what he sees and feels in simple, charming language.

In this delightful little volume he has jotted down some of his experiences during the months from February to September of last year. He shows how, when exactions of business and various duties curtail hours of recreation, and difficulties of travel prevent holidays from being taken far afield, there are opportunities for seeking new pleasures in familiar surroundings. The rambles described in his book have been in the compass of a half-holiday walk and not more than five miles of a country town within easy distance of London. The arrangement is chronological. Chap. i., "The Haunt of the Kingfisher," describes a bright morning early in the year when the hoar-frost lies thick on the common. "The Promise of Spring" (chap. ii.) recalls the coming of the winter aconite, the crocus, and other harbingers of spring. "The Incoming of Spring" is an epic of a sunny Palm Sunday—daffodils and scillas are out in the garden, a silky-coated Pasque-flower is preparing for its Easter display, and a bright red anemone for the warm April days; and never have the almonds looked more beautiful. And so on through the book to "Foxgloves and Fairies" and "The Lure of the Heather," which are the headings of the two last chapters.

The illustrations, photographic reproductions—a stream choked with water-violet, a bed of winter aconites, a cowslip meadow, and a few others—add to the charm of this series of Nature pictures.

Submarine and Anti-Submarine. By Sir Henry Newbolt. Pp. viii+312. (London: Longmans, Green, and Co., 1918.) Price 7*s.* 6*d.* net.

SIR HENRY NEWBOLT has succeeded in presenting a very fair view of the work of our submarines and of the measures taken to meet the U-boat menace. Despite the fact that a great deal of further information has been published since the date of the armistice, the book will be found to be useful on account of the connected presentment. Opening with the evolution of the submarine and a description of the submarine of to-day, the author passes to the methods of the submarine in attacking warships, and the means taken by warships in meeting attack and in aggressive action. The work of our submarines in the Baltic and in the Dardanelles occupies a large section of the volume, and the work of our trawlers, destroyers, P-boats, and Q-boats is well described. The book closes with an account of the Zeebrugge and Ostend attacks.

One interesting aspect of the submarine campaign is a knowledge of the feelings of the hunted during the chase. This is dealt with in chap. xvi., by quoting a long extract from the "War Diary of U 202," by Lt.-Commdr. Freiherr Spiegel von und zu Peckelsheim. Sir Henry Newbolt comments on the extract by saying that it is not unnatural that von Peckelsheim should enlarge upon his terror at the moment and his self-congratulation afterwards. But his diary contrasts badly with reports from our own submarine commanders in worse circumstances. "We may take pleasure in noting that the steadiness of nerve and the scientific view are in our favour."

Aids in Practical Geology. By Prof. Grenville A. J. Cole. Seventh edition, revised. Pp. xvi+431. (London: Charles Griffin and Co., Ltd., 1918.) Price 10*s.* 6*d.* net.

THERE are few living authors who take so wide a view of the phenomena and problems of geology as Prof. Cole, and none who is more capable of making the subject of interest to the student. He stands out, too, among his contemporaries in his appreciation of the work of the pioneers of the science, and in particular of the French petrologists of the first half of the nineteenth century, especially of Cordier and Delesse. He gives an interesting record of the latter's procedure in determining the volumetric mineral composition of a rock by the measurement of areas on a polished slab, and explains how it may be applied to sections under the microscope. Prof. Cole does not, however, refer to the linear method in which the same result is obtained by the measurement of the mineral intercepts on lines drawn over the surface. This method, which has largely superseded the area method in microscopic work, was described by Delesse in the same paper, though the credit for it is usually given to Rosiwal, who published an account of it just fifty years later in 1898.

In the limited space at the author's disposal it was impossible to include everything he might have wished, but perhaps in a new edition he will endeavour to find room for the shadow (Schröder van der Kolk) method of determining under the microscope the refractive index of grains or fragments relatively to the medium in which they are immersed. It is at once very simple and easily applied. J. W. EVANS.

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.]*

Intravenous Injections in Cholera.

IN the address given by Sir Leonard Rogers to the Indian Science Congress at Bombay (NATURE, May 29) reference is made to the treatment of cholera by injections of saline solutions, with the object of replacing the fluid lost from the blood, which loss may amount to 67 per cent. of the plasma volume. The distinguished worker found that isotonic sodium chloride solution (0·85 per cent.) was practically useless, but that hypertonic solutions (1·2 per cent.) were of much greater value. Since the walls of the blood-vessels are freely permeable to salts, there is no permanent difference of osmotic pressure between their contents and the tissue spaces outside them. Hence there is no permanent force to prevent the escape of fluid from the blood-vessels. So long as the salt-content of the blood, as raised by the introduction of hypertonic solutions, exceeded that of the tissue fluids in his cases, there would be absorption of water and the blood-volume would be maintained; but before long the salt concentration of the tissues would rise to that of the blood, and there would no longer be the difference of osmotic pressure necessary to hold the fluid in the circulation against the filtration due to the arterial pressure. This would explain the repeated injections found necessary by Sir Leonard Rogers. In some experiments that I have made, 2 per cent. sodium chloride was found to leave the circulation and cause œdema, although not so rapidly as isotonic solutions did.

Although the walls of the blood-vessels are permeable to salts, they are impermeable to colloids, so that if we could introduce a solution of a colloid which possesses an osmotic pressure, it would not leave the circulation, and its property of attracting water and preventing loss by filtration would be more or less permanent. We have such a colloid in gum-acacia. I have been able to show that a 6 or 7 per cent. solution of this substance in 0·9 per cent. sodium chloride maintains the blood-volume under various conditions in which it was defective. Such solutions were used extensively in France for the treatment of hæmorrhage and wound-shock.

I would therefore venture to recommend the trial of the method in cholera. I understand that some steps have been taken at Aden in this direction. Gum-saline has been used by Dr. Burkitt in Nairobi for black-water fever, and found to raise the blood-pressure permanently and to restore the renal function. Sir Leonard Rogers refers to the last as a very serious factor in cholera, and the state in this disease appears to be such as promises better reaction to intravenous fluids than does black-water fever.

The calcium bicarbonate contained in gum serves also to neutralise any acid produced in the tissues owing to defective blood-supply, and if the physiological action of calcium is required, no further addition is necessary.

Of course, the treatment by gum-saline is not to be regarded as a cure in the ordinary meaning of the word. It keeps up the normal circulation and allows other means, such as are mentioned by Sir Leonard Rogers, to be used effectively. W. M. BAYLISS.

University College, London.

A Crocodile on Rotuma.

CAPT. W. W. WILSON, formerly harbour-master of Levuka, Fiji, has sent me a photograph of a crocodile taken by Mr. G. Missen. This animal landed alive on Rotuma in July, 1913, being afterwards speared by the natives. Rotuma lies 260 miles due north of the Yasawas, the most westerly islands of the Fiji group, and 600 miles east of the New Hebrides and Santa Cruz groups; the nearest Solomon islands are upwards of 300 miles further west.

The photograph represents a full-grown adult crocodile. Dr. H. Gadow has identified it as *Crocodilus porosus,* Schneider, a species which has the habit of wandering out to sea. It is found from the Bay of Bengal to the Solomon Islands. The British Museum Catalogue of Reptiles mentions Fiji as within its area of distribution, but gives no precise record of any occurrence there. It certainly did not come from Fiji or any lands to the east, as crocodiles do not now exist on them, though native legends of live crocodiles landing were rife in Fiji when I was there in 1896–97. It must indeed have crossed from the west, and covered at least 600 miles of open, landless sea. This occurrence is sufficiently remarkable to be placed on permanent record. J. STANLEY GARDINER.

University of Cambridge.

Calendar Reform and the Date of Easter.

As an influential effort is apparently being made in Paris to bring the question of the improvement of the Gregorian calendar before the Peace Conference, I should like to direct the attention of the scientific, commercial, and ecclesiastical authorities who may be interested to the exceptionally favourable opportunity afforded for such rectification by the calendar of the year 1925.

In recent years many proposals for the improvement of the calendar, or rather for the adoption of another, have been placed before the public, but not much consideration has been given to the question of how such an improved calendar is to be coupled to the existing calendar without breach of continuity.

The Gregorian almanac for the year 1925 offers an unusually favourable opportunity for effecting this. If May 31 in that and all following years were declared to be excluded from the weekly series, and if the same rule were applied to the odd day in all leap-years thereafter, it is obvious that the calendar of 1925 with the above modification would become the perpetual calendar of the future.

In this calendar March 1 is a Sunday, and, without in any way changing the enumeration of the years for purposes of dating, that date could very conveniently be recognised as the commencement both of the business and financial, and also of the ecclesiastical, year. Easter Sunday could not be fixed for a more suitable day than April 12, which is the date of its occurrence in the year mentioned, and Pentecost would naturally and appropriately fall on May 31, the day already suggested for exclusion from the weekly series. Pentecost being the anniversary of the foundation of the Christian Church, its special sequestration in this way makes a strong appeal to the ecclesiastical authorities.

Under the above calendar it would be quite unnecessary to remove the 366th day from its position at the end of February, and the only other change required to equip the almanac with equal quarters and half-years would be to restore the original Julian syllabus of months by removing the odd day so unfortunately added to August by Augustus, and restoring it to February. August, 1919, might appropriately be the last to bear the stigma of imperial disfigurement.

I venture to say that an equally favourable opportunity for initiating the reform will not occur until the same almanac is repeated in 1936, when, however, it is complicated by a leap-day. ALEXR. PHILIP.

The Mary Acre, Brechin, N.B., May 8.

Glossina and the Extinction of Tertiary Mammals.

DR. G. D. H. CARPENTER (NATURE, March 20, p. 46) asks why we should suppose that the occurrence of tsetse-flies (Glossina) in the Miocene of Colorado might have had anything to do with the extinction of some of the large Mammalia. He points out that such flies exist in Africa to-day, carrying trypanosomes, and the native Mammalia nevertheless survive and flourish. It is known, however, that in Miocene times there were extensive migrations of animals, from mammals to insects, and the New and Old Worlds each received important contributions from the other. In such periods of migration it is perfectly conceivable that Glossina might appear in a new region, carrying a trypanosome which would be highly pathogenic for certain elements of the resident fauna. Even in Africa we do not know what animals may be absent to-day owing to the former prevalence of disease-producing organisms.

T. D. A. COCKERELL.

University of Colorado, Boulder, Colorado, April 24.

INDICATIONS OF OIL IN DERBYSHIRE.

AFTER a somewhat lengthy interval, the attention of the public has again been directed to the Government drilling operations for oil in this country. On May 26 the *Times* described the progress which had been made in the work, and stated that several of the bores had now reached a critical depth. At any moment oil might be discovered. This was followed three days later by the announcement that oil had been found in the Hardstoft No. 1 boring near Chesterfield. Further details added that the oil had risen 1000 ft. in the well. The form of the announcements was somewhat misleading, and they need to be stripped of their trappings to arrive at a true perspective. A show of oil has been found at Hardstoft—nothing more. Such shows of oil have been found before in the British strata, and have invariably proved to be of little or no value. It remains to be proved that the present indications at Hardstoft are of a different calibre, and it would have been well to postpone, or at least moderate, the announcement of the discovery until the resumed drilling operations had indicated the quantity of oil which was forthcoming.

The position of the general drilling operations in Britain may be summarised as follows. Wells are being drilled in three areas, Chesterfield, North Staffordshire, and Midlothian. The operations in the last two areas are merely in their preliminary stages, but in the Chesterfield region the work is further advanced, and two of the seven wells—namely, Brimington and Hardstoft No. 1—have almost attained their proposed depths. Shows of gas have been encountered in several of the bores, but the porous horizons of the Millstone Grits, where pierced, have in all cases failed to produce the oil which was anticipated. To this extent, then, the results have been disappointing. However, it has never been intended to limit exploitation to the Millstone Grits. The underlying Carboniferous Limestone has been considered by some to be a better horizon for testing, and the wells are being continued through the Yoredale Shales in order to pierce this formation. Both the Hardstoft No. 1 and Brimington bores have almost reached the Carboniferous Limestone, and the oil which is announced in the former probably comes from the beds near the junction.

It must be emphasised that there is nothing in the present situation to warrant the unduly optimistic attitude of a section of the Press. The statement that this is the first discovery of oil in substantial quantity in England is incorrect, and greatly exaggerates the present indications. The announcement that the oil has risen 1000 ft. in the well may bear two interpretations. It may be that the whole liquid column is composed of oil, or it may be merely an upper layer of oil floating on a column of water, as in the case of the Kelham bore. The shales and banded limestones immediately above the main limestone in Derbyshire often contain small quantities of petroleum, though the porosity of these strata is too small to yield large quantities of the material. It is possible that every well which is sunk into these beds will yield some indications of petroleum, but the small porosity and other factors of preservation limit the hope of a commercial production of petroleum.

Judgment must be suspended until the results of the resumed drilling operations are known. In the meantime it is fortunate that the Government has prevented promiscuous drilling, and thus minimised the evils of fevered financial speculation. The Canadian oil boom of 1914, based on an oil show similar in type to the present indications at Hardstoft, and which ended in nothing, is a typical example of these deplorable scrambles.

V. C. ILLING.

THE SOLAR ECLIPSE.

TELEGRAMS received by the Astronomer Royal report that at the station at Sobral, in Brazil, occupied by Dr. Crommelin and Mr. Davidson for photographing the field of stars round the sun on the occasion of the total eclipse of the sun last week (May 29), the sky was clear for at least part of totality, and that the programme was satisfactorily carried out. The photographs have been developed, and all the stars expected are shown on the plates taken with the astrographic lens, as well as on those taken with a second telescope lent by Father Cortie. The expedition will remain at Sobral until the necessary comparison photographs are taken *in situ*. The message from Prof. Eddington at Prince's Island, off the coast of West Africa, which reads "Through cloud, hopeful," may be taken to imply that some success will also be derived from the work of this expedition.

It will be remembered that Prof. Eddington and Mr. Cottingham were provided with the 13-in. object-glass of the astrographic telescope of the Oxford University Observatory, whilst the observers in Brazil had the similar object-glass from Greenwich, and that the programme at both stations was to take photographs of the stars that surrounded the sun, of which there are at least twelve within 100′ of the sun's centre of photographic magnitude ranging from 4·5 to 7·0, for the purpose of testing Einstein's relativity theory of gravitation, and also the hypothesis that gravitation, in the generally accepted sense, acts on light. Photographs that have been taken during the eclipse will be compared with others that have been, or will be, taken of the same stars in the night sky to detect any displacement that may be considered to be due to the presence of the sun in the field.

There is at present no information as to the type of the corona, and apparently few observing parties have been organised to make observations to record this. From a note in the daily Press last week, said to emanate from the Yerkes Observatory, it seems not unlikely that a large prominence may have been on the limb of the sun at the time of the eclipse.

It had been announced that the Cordoba Observatory would dispatch an expedition to Brazil, and that possibly Prof. Abbot, of the Smithsonian Institution, would proceed to La Paz, Bolivia, where the eclipse happened at sunrise, with coronal cameras and with instruments for measuring the sky radiations by day and night, but it is too early to have heard of any results of such observations. Also it has been announced that Prof. D. P. Todd would take photographs of the eclipse from an aeroplane at a height of 10,000 ft. from the neighbourhood of Monte Video, where the eclipse would only be partial.

As to experiments other than astronomical, the actual programme arranged by the British Association Committee for Radio-telegraphic Investigation, the object of which was given in NATURE of May 8, was that the sending-stations at Ascension and the Azores with others in America should send letters of the alphabet at intervals from 11h. 30m. (G.C.T.) until 14h., and that any observers who would take part in the experiment should record these and their strength by a number according to a scale familiar to wireless telegraphists. A scheme for making special magnetic and allied observations during the eclipse was organised by the Department of Terrestrial Magnetism of the Carnegie Institution under the direction of Prof. Bauer, with stations at (1) La Paz, Bolivia, (2) Huancayo (north of belt of totality), (3) near Sobral, Brazil, (4) Prince's Island, and other stations outside the belt of totality if possible. The reports of the observations of this kind that have been made will be given as soon as possible, but much cannot be said until published results arrive from America.

WIRELESS TELEPHONY.

MARCONI'S Wireless Telegraph Co., Ltd., gave a very interesting demonstration of the latest developments of wireless telephony at its works at Chelmsford on May 28. Although there was nothing very new from the scientific point of view, yet the developments in engineering design were remarkable, especially in the receiving apparatus. Many of the devices proved of the utmost value to the Army during the war. We were impressed with the portable wireless telegraph station for use with pack or wheeled transport. Six men are required to work the set, and the whole station can be erected in ten minutes. The masts are of steel, 30 ft. in height, and a single horizontal aerial is used, the earth connection being made with strips of metal gauze placed on the ground. The generating set consists of a two-cylinder, 2¾-h.p. petrol engine, which drives a high-frequency ½-kw. alternator. The "instrument load" consists of transmitting-valves, high-frequency transmitting-circuits, microphone, etc., all contained in a teak travelling-case.

To work the apparatus, the petrol engine is started. This drives the high-frequency alternator. The current generated is carried to the transmitting-circuits, where it is transformed by a series of transformers. The final transformation raises the potential to 10,000 volts; the current is then rectified by a Fleming valve and converted into a continuous-wave current by a system of condensers and choke coils. This current energises the aerial circuit, where a large fraction of the power is radiated off into space. For the transmission of speech the amplitude of the oscillations generated in the aerial is varied by a microphone into which the operator speaks. The microphone acts on a transformer connected in the grid circuit of the transmitting-valve.

The receiver consists of a simple tuning arrangement which is connected to the aerial. The oscillatory currents produced by the received signals are amplified by a series of oscillatory valves. The last of the valves rectifies the currents and feeds the telephones through a suitable transformer. Conversation between the two stations is then carried on in exactly the same way as in ordinary telephony.

For normal flat country the guaranteed range for telephone transmission is 60 miles, but communication can sometimes be made over 120 miles. For continuous wave (C.W.) transmission the guaranteed range is 200 miles. A demonstration of the working of the apparatus was given, and conversation was carried on as easily as over an ordinary telephone line.

Amongst other devices shown were the wireless telephone apparatus used in aeroplanes with the pendent aerial and the windmill generator. Very large high-power spark generators for long-distance transmission were shown in action. A demonstration was also given of telephonic com-

munication with distant stations from a motor-bus in motion. The aerial fixed on the bus was only a rectangular coil about 3 ft. square, containing a few turns of wire. The bus drove some miles towards Colchester, and then its position was accurately located by the Marconi direction-finding device, which was so useful in other days for locating the position of enemy aircraft. Now it promises to be very useful in connection with navigation by sea and air. In the English Channel, for instance, a ship furnished with direction-finding gear can check its position at frequent intervals by taking bearings on the numerous shore wireless stations without disturbing them in their work. The relative position of other ships also can be ascertained, and the dangers of navigation in fog greatly lessened.

The Marconi Co. is erecting a huge aerial in Buenos Aires, and it seems probable that in two or three years' time telephonic speech will be possible between this country and the Argentine. Unlike ordinary telephonic waves transmitted over wires which travel with speeds depending on their wave-lengths, aerial waves all seem to travel with the same speed, and so it is highly probable that, even over this distance, there will be no "speech distortion."

THE ATLANTIC FLIGHT.

THE American seaplane N.C.4 has completed its flight to England, *via* the Azores and Portugal, and arrived at Plymouth at 1.26 p.m. G.M.T. last Saturday. The honour of the first Atlantic crossing by air thus falls to the Americans, though the yet greater honour of the first direct flight from continent to continent remains to be won. The feat accomplished by the N.C.4 clearly illustrates the advantage of the seaplane for long flights over the ocean, owing to its ability to alight on the water in any calm locality and carry out minor repairs, if necessary. Even in mid-Atlantic such an aircraft would have a fair chance to rectify some slight defect and proceed on its course, whereas an aeroplane is certain to be useless for further flight if forced to descend on the water.

The three longest stages of the flight of the N.C.4 were as under:—

	Miles
Newfoundland to the Azores ...	1381
Azores to Portugal	904
North of Spain to Plymouth ...	500

The machine also made a flight of 190 miles in the Azores, and proceeded from Lisbon to the North of Spain in two short stages before making the final flight to England. The last 500 miles were accomplished in 5 hours, a fact that speaks well for the condition of the machine after its preceding long journeys. The seaplane was obliged to fly very low on account of fog, and the greater part of the last stage was covered at an altitude of less than 100 ft. The satisfactory termination of this trans-Atlantic flight reflects the greatest credit upon Lt.-Commdr. Read and his crew, who will ever be remembered as the first persons to cross the Atlantic by air.

In view of the length of the first stage of this historic flight, viz. 1381 miles, it seems reasonable to expect that a machine of this type should soon be able to attempt the direct passage—a distance only 420 miles greater than that already accomplished. An aerial voyage from England to Australia also seems well within the reach of such a seaplane, convenient harbours or lakes *en route* being selected as halting-places. A seaplane has the disadvantage, for such a flight, that a forced landing on *terra firma* is as fatal as is a descent at sea to an aeroplane, and it is conceivable that the future will produce a machine capable of alighting either on water or land. Such a machine would have vast possibilities, but the design presents many difficulties.

Meanwhile, another great triumph has been added to the record of flight, and it seems likely that the present year will witness even greater achievements in the aeronautical world.

NOTES.

THE honours announced on the occasion of the King's birthday on June 3 number several thousand, but are confined almost entirely to the fighting forces. A further list will be issued in a few days. We notice in the list published on Tuesday the following distinctions conferred upon men known in the scientific world:—*K.C.S.I.:* Dr. Michael E. Sadler, Vice-Chancellor of the University of Leeds and chairman of the Calcutta University Commission. *C.I.E.:* Lt.-Col. J. Stephenson, principal and professor of biology, Government College, Lahore, and Mr. R. S. Hole, Imperial Forest Botanist, Dehra Dun. *Knights Bachelor:* Mr. Charles Bright and Dr. J. H. Mac-Farland, Chancellor of the University of Melbourne.

WITH the approval of H.R.H. the Duke of Connaught, president of the Royal Society of Arts, the council has awarded the society's Albert medal for 1919 to Sir Oliver Lodge "in recognition of his work as the pioneer of wireless telegraphy." The medal was instituted in 1864 to reward "distinguished service in promoting arts, manufactures, and commerce." The presentation will be made by the Duke of Connaught at Clarence House on June 6.

THE annual visitation of the Royal Observatory, Greenwich, will be held on Saturday, June 14.

LORD BLEDISLOE has been elected chairman of the governors of the Royal Agricultural College, Cirencester, in succession to Lord Moreton, who has resigned.

DR. JOSEPH BURRELL, who, after serving for five years as assistant professor of geology at Yale University, was appointed to a full professorship in 1908, died recently in his fiftieth year.

MR. HAROLD KING, of the Wellcome Chemical Research Laboratories, has been appointed by the Medical Research Committee to the post of organic chemist in the department of biochemistry and pharmacology.

A CONFERENCE on "The Benefit to the Workman of Scientific Management" will be held under the

auspices of the Industrial Reconstruction Council on June 10, at 5.30 p.m., in the hall of the Institute of Journalists, 2 and 4 Tudor Street, E.C.4. The chair will be taken by Dr. H. Chellew, and Major Pells, R.E., will introduce the subject, after which the discussion will be open. No tickets are necessary.

THE seventy-first general meeting of the Institution of Mining Engineers will be held in the rooms of the Geological Society, Burlington House, on Thursday, June 19, under the presidency of Mr. G. B. Walker. Two institution medals will be presented for the year 1918–19 to Dr. Auguste Rateau (French) and M. Victor Watteyne (Belgian) respectively.

A BIOLOGIST having a knowledge of life in streams is about to be appointed by the Joint Committee of the Board of Agriculture and Fisheries and the Road Board to assist in experiments in connection with the tarring of roads. Applications for the post, marked "Biologist," must reach the Secretary of the Road Board, 35 Cromwell Road, S.W.7, by, at latest, the first post of Monday, June 16.

APPLICATIONS are invited by the Imperial Mineral Resources Bureau (14 Great Smith Street, S.W.1) for the position of Chief of the Intelligence and Publications Section of the Bureau to compile and produce for publication statistical information in regard to the resources, production, and cost of production of metals and minerals from all parts of the world. The forms of application, with testimonials, are returnable by, at latest, June 19.

THE death is announced, in his eightieth year, of Dr. Alexis A. Julien, of South Harwich, Mass. From 1860 to 1864 Dr. Julien was the resident chemist on the guano island of Sombrero, and made scientific collections there for the Smithsonian Institution. From 1865 to 1909 he was on the staff of the School of Mines, Columbia University. He had also been connected with the Geological Surveys of the States of Michigan and North Carolina.

THE annual meeting of the British Science Guild will be held on June 17, at 4 p.m., at the Goldsmiths' Hall, by kind permission of the Master and Court. The speakers will be the Right Hon. Lord Sydenham (president of the guild), Major-Gen. the Right Hon. J. E. B. Seely, Under-Secretary of State, Ministry of Air, Sir Joseph Thomson, president of the Royal Society, and Sir Robert Hadfield, Bart. Cards of invitation to the meeting may be had on application to the Secretary, British Science Guild, 199 Piccadilly, W.1.

A PORTION of the Ministry of Munitions has become a branch of the Board of Trade. The portion that is transferred to the Board of Trade will deal with questions of assistance to, and organisation of, the optical scientific instrument, glass, and potash industries, including administration of the Glass Control (Consolidated), Clinical Thermometer, and Potassium Compound Orders. All communications relating to such questions in future, therefore, should be addressed to the Assistant Secretary, Board of Trade, Industries and Manufactures Department, Scientific Instruments, Glassware, and Potash Production Branch, 117 Piccadilly, W.1.

AT the annual general meeting of the Linnean Society, held on May 24, the following were elected officers and council for the ensuing year:—*President:* Dr. A. Smith Woodward. *Treasurer:* H. W. Monckton. *Secretaries:* Dr. B. Daydon Jackson, E. S. Goodrich, and Dr. A. B. Rendle. *Council:* E. G. Baker, Dr. W. Bateson, *Prof. Margaret Benson, *E. T. Browne, R. H. Burne, S. Edwards, Prof. J. B. Farmer, E. S. Goodrich, Dr. B. Daydon Jackson, C. C. Lacaita, *G. W. E. Loder, H. W. Monckton, R. I. Pocock, Dr. A. B. Rendle, Dr. D. H. Scott, Miss A. Lorrain Smith, A. W. Sutton, *Dr. Harold Wager, Lt.-Col. J. H. Tull Walsh, and *Dr. A. Smith Woodward (new members are shown by an asterisk). Prof. I. Bayley Balfour was presented with the Linnean medal in gold.

A CONFERENCE devoted to the consideration of problems of reconstruction in relation to public health has been arranged by the Royal Institute of Public Health, to be held from Wednesday, June 25, to Saturday, June 28, inclusive. The inaugural meeting of the conference will he held in the Egyptian Hall of the Mansion House, under the presidency of the Right Hon. the Lord Mayor of London, and the other meetings will be held in the Council Chamber of the Guildhall of London. The subjects to be considered will come under the following heads:—(1) The Work of the Ministry of Health; (2) The Prevention and Arrest of Venereal Disease; (3) Housing in Relation to National Health; (4) Maternity and Child Welfare; and (5) The Tuberculosis Problem under After-War Conditions.

IN view of the imminent resumption of international co-operation in the study of questions connected with the art of illumination and the sciences related thereto, a meeting of the National Illumination Committee of Great Britain was held on May 27, when vacancies in the executive of the committee, due to the decease of Mr. W. Duddell and Prof. Silvanus P. Thompson, were filled. The executive, with the institutions represented, is now as follows:—Chairman, Mr. A. P. Trotter (Illuminating Engineering Society); vice-chairmen, Mr. John Bond (Institution of Gas Engineers) and Mr. Kenelm Edgcumbe (Institution of Electrical Engineers); hon. secretary, Mr. Haydn T. Harrison (Institution of Electrical Engineers); hon. treasurer, Mr. W. J. A. Butterfield (Institution of Gas Engineers); and representatives on the executive committee of the International Commission on Illumination, Dr. Harold G. Colman (Institution of Gas Engineers) and Mr. Leon Gaster (Illuminating Engineering Society). The resumption of research work, etc., was considered, and a programme for further discussion at a meeting at an early date was settled.

THE Air Ministry has begun the publication, in the *Geographical Journal* for May (vol. liii., No. 5), of some notes on proposed air routes. The first one is the route from Egypt to South Africa. From Cairo to Kosti there seems to be little difficulty: either the Nile or the railway indicates the course. South of Kosti is a forest region, and the Nile banks are wooded or swampy, while the sudd region makes the White Nile a practically impossible route. The route proposed is by Sennar up the Blue Nile to Roseires, thence south to Gambela and the western shore of Lake Rudolf; or from Roseires by Nasser on the Sobat to Gondokoro. But on either route landing-places are not numerous and communications are bad. It is suggested that a seaplane might be the best type of machine for this section. A seaplane is also favoured for the route from Gondokoro to Lake Victoria by Murchison Falls. Across Lake Victoria the proposed route is to Mwanza by seaplane, thence to Kigoma and Abercorn on Lake Tanganyika. The route continues by Broken Hill to Bulawayo, thence following the railway to Mafeking, Kimberley, and Cape Town. Alternative routes are suggested for parts of the course. It is proposed to provide landing-places, so far as possible, every 200

miles. The Air Ministry states that it will be glad to receive criticisms and remarks.

DR. CHARLES GORING, late Medical Officer to Manchester Prison, whose recent death after a short illness deprived the Prison Medical Service of one of its ablest members, had a brilliant career as a student at University College, London, and from his early years showed a strong bent towards scientific research. This tendency led him to the study of medicine, and his special interest in psychology and general anthropology found an ample field of work when he was appointed to the staff of Broadmoor Criminal Lunatic Asylum, and later to the Prison Medical Service. During several years Dr. Goring contributed a vast number of observations to an inquiry which had been undertaken at several prisons concerning certain doctrines as to the relation of crime to physical and mental peculiarities, and he readily undertook the great labour entrusted to him of tabulating the whole of the observations made and of writing the report. This report was published by the Government under the title "The English Convict: A Statistical Study," and has attracted wide attention, both here and in other countries, among those interested in the study of crime and criminals. It is impossible in this necessarily short notice to enter into further criticism of the method of research followed by Dr. Goring and of the conclusions arrived at by him than that made in NATURE for March 26, 1914 (vol. xciii., p. 86), soon after the publication of this work. It must suffice to say that the nature and arrangement of the material and the inferences drawn therefrom follow closely on the lines of the biometrical school, and that the validity of the conclusions depends on the full acceptance of the applicability of the method to the material. Dr. Mercier's recent book on "Crime and Criminals" shows that much can be said on this subject from a point of view which differs widely in many respects from that set forth in "The Statistical Study of the English Convict"; but, looked at from any point of view, this work will remain as a monument to Dr. Goring's untiring industry, his single-minded enthusiasm for scientific research, and his unquestionably great ability.

UNDER the title of "The Dendroglyphs, or Carved Trees of New South Wales," Mr. R. Etheridge has published a memoir, issued by the Department of Mines (Memoirs of the Geological Survey of New South Wales, Ethnological Series, No. 3). The records of these trees begin with a note by Surveyor-General J. Oxley in 1817, and since that time many specimens have been discovered. They seem to fall into two groups—those which adjoin native graves, and may be considered memorials of the dead or of some important tribal event; and those carved with symbols, apparently in connection with the Bora, "man-making" or puberty rites. They do not appear to be associated with tree-worship or with any regular cult of the dead. Some of the designs may be of a totemic nature, and they have been compared with those engraved on the inside of skin-cloaks worn by the aborigines. As to the date of these memorials, all that seems clear is that the glyphs were made after the natives became possessed of metal tools. Very little is known of the class of records associated with the Bora rites, but some of the designs seem to be totemistic. An attempt is made, without much success, to compare the designs used by Dravidian tribes in southern India, with whom the Australians are supposed to be racially connected. The memoir is interesting and well illustrated, and raises many questions in connection with the beliefs and ceremonies of the natives of Australia.

DR. A. GALLARDO continues his extensive memoir on the ants of the Argentine with a monograph on the Ponerinæ (Ann. Mus. Nac. Hist. Nat. Buenos Aires, vol. xxx., 1918). To the thirty species comprised in this section he devotes more than a hundred pages of careful description with clear structural figures.

THE greater portion of part 5, vol. xv., of the Records of the Indian Museum is occupied by the second instalment of Mr. E. Brunetti's "Revision of the Oriental Tipulidæ." Nearly six hundred species of these insects (the crane-flies or "daddy-long-legs") are now known from India and south-eastern Asia, so that the field of study is extensive. Mr. Brunetti's treatment is somewhat rigidly systematic.

MR. J. M. SWAINE issues, as Bulletin 14 of the Entomological Branch of the Canadian Department of Agriculture, what may be regarded as a monograph of the Canadian bark-beetles (Scolytidæ), dealing with structure, classification, habits, and methods of control. A feature of this memoir is the beauty of the illustrations, though some of the plates are overcrowded with figures.

WE have received the first part (January, 1919) of a "Treubia," a new publication issued from the famous Botanical Garden of Buitenzorg, Java. It contains five entomological papers by Dr. W. Roepke, of which one on two new Javan species of Oligotoma is of bionomic as well as of systematic importance, the curious Embiidæ—allies of the Termites—to which these insects belong, being of exceptional interest. In his other papers, on various beetles and wasps, the author gives much welcome anatomical detail.

SOME interesting contributions to agricultural zoology have lately been made by workers in India. The report of the Imperial Entomologist (Mr. T. B. Fletcher) for 1917–18 contains descriptions, with excellent figures, of the larval stages of several beetles and moths of economic importance. Dr. E. J. Butler writes (Mem. Dept. Agric. India, Bot. Series, vol. x., No. 1, 1919) on the rice worm (*Tylenchus angustus*), and points out that this destructive eelworm can migrate over apparently dry surfaces if the atmosphere be saturated so as to cause the formation of a droplet or film of moisture around the worm's body. This fact accounts for the general immunity of the "boro" or spring rice crop to the disease caused by the worm, as the air is at its driest from February to May. A valuable paper on the Aphididæ of Lahore by the late Mr. Bachambar Das appears as No. 4 of vol. vi. of the Memoirs of the Indian Museum. Forty species are described, with critical systematic and bionomic notes, illustrated with sixteen plates. The work shows high entomological ability, and the early death of the author, resulting from his devotion to students attacked by cholera, has cut short a career of great promise.

RECENT geological work in France and her colonies is usefully reviewed by M. J. Révil in the *Revue générale des Sciences* (January 15 and 30, 1919).

IN *Naturen* for November, 1918, Hr. N. H. Kolderup records the excursions of the first Scandinavian Geological Congress in Denmark, and furnishes a good map, after V. Nordmann, of the concealed geology of the north of Jylland (Jutland). The strata range from Senonian to Miocene.

THE great size of the boulders in the rubble-drift of Brighton leads Mr. E. A. Martin to conclude (*Hastings and E. Sussex Naturalist*, vol. iii., p. 64) that some form of moving ice occupied the local

valleys at the time of deposition of this drift. The paper provides further evidence of the influence of the Glacial epoch on the older superficial deposits of southern England.

MR. A. L. HALL furnishes a complete review of the minerals used as asbestos and of the requirements of the trade in a memoir on "Asbestos in the Union of South Africa" (Mem. 12, Geol. Surv. S. Africa, 1918, price 5*s*.). Crocidolite naturally receives full treatment, and the author's new species amosite, with a long, flexible, and strong fibre, is recommended as being less fusible than crocidolite, which contains more soda. Amosite, indeed, seems to rival chrysotile in its commercial qualities.

PROF. W. M. DAVIS contributes a further comprehensive paper on "The Geological Aspects of the Coral-reef Problem" to *Science Progress* (vol. li., p. 420, 1919). Mr. W. G. Foye, in a memoir on "Geological Observations in Fiji" (Proc. Amer. Acad. Arts and Sciences, vol. liv., No. 1, 1918), states that he finds no evidence of the wave-cut Pleistocene platform which is postulated by Prof. R. D. Daly in his theory of the post-Glacial origin of the reefs, and he remarks that "if the Glacial-control theory is still adhered to, the atolls must be pre-Pleistocene in age." The Fiji area shows that elevation has here taken place in differing degrees, leading to various states of erosion. At present "all of the islands are being rapidly reduced to sea-level by atmospheric solution." Subsidence has already followed on the last uplift, and some of the most eroded islands have, in consequence, deep lagoons.

A "TSUNAMI" is the name given in Japan to any abnormally high water that causes damage to property. Most "tsunamis" are due to submarine earthquakes or volcanic eruptions. The sea-level then suddenly rises or falls, after which a train of waves succeeds, which may last a few hours or days. Other "tsunamis" are caused by heavy winds along the coast or by typhoons. These different forms of "tsunamis" are considered by Mr. S. T. Nakamura in a paper read before the Tokyo Mathematico-Physical Society (Proceedings, vol. ix., 1918, pp. 548–55), in which special reference is made to the "tsunami" caused by an earthquake off the eastern coast of North Japan on September 8, 1918. Mr. Nakamura explains the wide variation in the height of the waves by supposing that movements in adjacent quadrants are opposite in direction, so that the height of the waves would be zero or very small on the boundaries of the quadrants, and greatest along their central lines. The evidence of the recent "tsunami," so far as it goes, favours this explanation.

THE Danish Meteorological Institute has published its report for 1918 on the state of the ice in the Arctic Seas. The year was a very favourable one for navigation to Spitsbergen. From April until October the west coast was practically free from ice, except for a little around the South Cape in May and June, and a good deal of pack in Bell Sound and Horn Sound in September. The east coast, so far as reports go, seems to have been fairly open late in the summer, and the north coast from June onwards was navigable. In the Greenland Sea, on the other hand, the ice reached far eastward, and seems to have been unusually heavy. Conditions in the Barents Sea and around Iceland seem to have been fairly normal. There was little information from the Kara Sea, except the report of Capt. Amundsen, who found it filled with ice in the middle of August. The entrance to the White Sea was not navigable before May, but the sea remained open until late in the autumn. The report, which is printed, as usual, in Danish and English, is well illustrated with maps.

BULLETIN No. 105 of the University of Illinois contains an account of hydraulic experiments with valves, orifices, hose, nozzles, and orifice buckets. Ordinary gate, globe, and angle valves were purchased in the open market and tested as received; the valves were 1 in. and 2 in. in diameter, and were tested with settings ranging from one-fourth open to full open. It was found that the loss of head caused by small valves varies as the square of the velocity in the pipe for all the valve openings. When wide open, a globe valve causes more than twice as much loss of head as an angle valve of the same size; while a gate valve causes much less loss of head than either a globe or an angle valve, the velocity in the pipe being the same in the three cases. With equal velocities in the pipe, the loss of head for an angle valve is somewhat less when about three-fourths open than when wide open. The form or shape of the passageways through a globe or angle valve has a large influence on the loss of head for the small valve openings; the portion of the passageways in which the form seems of greatest importance is in the exit from the valve rather than in the passageways leading to the valve disc. Graphs of the results and tables of the coefficients obtained are included in the paper.

IN an address given to the chemical section of the American Association for the Advancement of Science in December last, Prof. W. A. Noyes emphasises the fact that the theory of valency is one of the most important theories in chemistry. Scarcely any other except the atomic theory, with which it is inseparably connected, has been so fruitful in results which have led to practical applications, and also to the development of chemical knowledge. But in spite of these results, which no one can dispute, the theory just now is more or less in disrepute, especially among physical chemists and teachers of inorganic chemistry. In many elementary text-books structural formulæ are used so sparingly that they make no impression on the student, and in some they are not even mentioned. This attitude is due, in part, to a reaction from the over-emphasis given to the subject at a time when nearly all chemists were working on the structure of organic compounds. In part also it is due to confused ideas on the philosophy of science; to some persons science is only an orderly description of phenomena which we can see and handle, weigh and measure, and connect by mathematical processes. But the positive achievements of the valency theory are so great that no one can doubt that there is in the relations of atoms some reality which corresponds with the theory. At the same time our knowledge is vague and indefinite at many points, so that we cannot yet consider the theory satisfactory. The most important recent advance has been the interpretation of valency in connection with the electron theory, and the beginning which has been made towards the study of positive and negative atoms in organic compounds. As a basis for the better understanding of valency there is need for a more definite knowledge of the structure of atoms. Whatever other conclusions may be reached, it seems certain that this structure will be found to be dynamic rather than static; it is hard to conceive of a quiescent electron.

As is well known, the industry of ferro-cerium flints was practically in the hands of Germany when war broke out. Since then one French manufacturer has succeeded in establishing the industry in France on a scale sufficient to supply the requirements of that

country. In the January–February issue of the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale* some interesting details are given on the manufacture of these stones or "flints," which are now so well known to smokers in this country. Ferro-cerium is an alloy consisting, for the purpose under discussion, of 30 parts of iron to 70 parts of cerium. The raw material is derived from the monazite sands of Brazil. These sands are enriched until the pure monazite is obtained. They are then treated chemically to extract the oxylate of thorium, phosphoric acid, and oxylates of cerium, lanthane, and didymium. The cerium oxylates are afterwards converted into hydrates or carbonates, then into chlorides. The chloride is finally electrolysed and decomposed into its elements, chlorine and cerium, the electrolytic process being continuous. The pure cerium is alloyed to iron in the proportions mentioned above. The two substances are placed in fire-clay crucibles, which are heated to 1100° C. by a gas furnace. When the alloy is thoroughly liquid it is cast in moulds formed by a series of several hundred sheet-iron tubes, 2·8 mm. in diameter and 30 cm. long. These tubes are allowed to cool in the air and then "stripped," *i.e.* they have an opening down the side and the thin sheet-iron is simply wound off the ferro-cerium, which is left in the form of a thin rod. One kilogram of ferro-cerium contains 5500 "flints" of 5 mm. length, which are each capable of giving some nine hundred flashes. The French manufacturer who took up this industry has also prepared other products of some importance, *e.g.* thorium nitrate, which is being used in a special type of incandescent lamps, and cerium, which is being used for the manufacture of cerium steels. This new application on the part of the French will release them from the German tribute after the war.

M. LÉON APPERT, in the January–February issue of the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, contributes a long and interesting paper on the welding of glasses. He traces the history of these attempts from the earliest ages, and considers the technical methods most likely to lead to success. His conclusions are:—(1) That it is always possible to weld together, completely and permanently, glasses of different composition, whatever the constituents of the glasses. (2) That the limits within which the relative proportions of these constituents may be varied are very close; and, to ensure success, the modifications which may result must be carefully borne in mind in practice, such as changes in the quality of the products used, modifications in composition which may occur spontaneously, the temperature at which fusion is carried out, and the duration for which this temperature is applied. (3) As regards conditions of athermancy and diathermancy, the most simple methods should be used for controlling these conditions, a glass of known composition being used as a standard and for purposes of comparison. (4) As regards neutrality, direct experiments with the blowpipe should be made. This kind of test, which is very simple to carry out, gives at the same time information on the greater or less fusibility of the glass, and on the consequences arising out of the use of a variable temperature, which may sometimes be too high or applied too long. (5) As regards the welding of enamels with metals, the question of adhesion being of the first importance, care should be taken over the qualities of the mordant, which must have the same dilatation coefficient at the outset, and at the same time be capable of attacking the underlying metal with the view of multiplying the points of adhesion. (6) The enamel should be employed only in as thin layers as possible and by successive applications. If these conditions are observed, the success of the operation of welding may be regarded as ensured.

IN the *Journal of Agricultural Research* for December 2 last, Messrs. True and Geise give an account of a series of pot experiments carried out to determine the value of greensand (glauconite) deposits as a source of the potassium required by growing plants. Potassium is a normal constituent of glauconite; the question was whether in this silicate it is present in a sufficiently soluble form to be utilisable by the plant. In the result it was found that greensands and greensand marls from Virginia and New Jersey were able to supply sufficient potassium to meet the demands of wheat and red clover during the first two months of growth, *i.e.* at the time when the absorption of potassium is greatest. The plants, in fact, made a greater weight of "tops" than was found in similar cultures where the potassium requirements were supplied by means of the chloride, sulphate, and phosphate. The authors conclude that the deposits mentioned can apparently furnish available potassium to meet the needs of many farm crops, and perhaps of most.

A NEW form of ship's rudder, invented by Mr. J. G. A. Kitchen, of Lancaster, forms the subject of an article in *Engineering* for May 16. The invention permits the boat to be steered, reversed, controlled in speed, and manœuvred in any way from a single tiller, with the engines running continuously at full speed in the forward direction. Complete and direct control is obtained by the steersman over all movements during manœuvring, and all engine-reversing gear may be eliminated. Two curved deflectors forming parts of a circular cylinder partly enclose the propeller. The deflectors are pivoted at the top and bottom on common centres, and are capable of being swung together in the same direction, or equally in opposite directions. A graduated opening or no opening is thus provided for the stream of water leaving the propeller; in the case of no opening, the entire stream of water is deflected forwards, and the boat moves astern. There is a neutral position of the deflectors in which the boat remains at rest with engines working at full speed. The operating gear is exceedingly simple, so that even a novice acquires complete command over the boat's movements after a few minutes' practice. Many of the Admiralty pinnaces, etc., driven by oil-engines have been fitted during the war, although publication of particulars has been hitherto prevented. The following gives some idea of the importance of the device, and relates to trials of a 25 ft. launch belonging to the Air Ministry. Ahead speed, 9·80 knots; astern speed, 3·5 knots (sufficient for all requirements). Full speed ahead to dead stop: boat pulled up in 16 ft. (one man aboard). Time of turning through a complete circle, without progression in any direction: to starboard, 33 secs.; to port, 26 secs. The results for several other boats are given, and are equally good.

THE statement in a letter in last week's NATURE that Messrs. Newton and Wright, Ltd., produced interrupterless machines before "any American firm" had done so should have read "any other American firm." The word "other" was inadvertently omitted from the sentence. Mr. Snook's own factory was the first to place a practical machine on the market, and Messrs. Newton and Wright, Ltd., were the first on this side of the Atlantic.

OUR ASTRONOMICAL COLUMN.

AN EARTH-EFFECT ON THE SUN.—A shift of the lines in the solar spectrum towards the red with reference to the arc-lines which varies with distance from the centre of the disc observed at the solar observatory at Kodaikánal has been attributed to an earth-effect, and an attempt is being made to unravel the problem by observing the spectrum of Venus at different phases. The method of the scheme is to find if a similar shift is apparent in the spectrum of Venus when illuminated by the light of the solar hemisphere which is turned 90° or more from the earth, in which case the phenomenon of the shift of the lines, not being peculiar to the part of the sun towards us, could not be ascribed to a terrestrial cause.

Dr. Gilbert Walker has suggested that the law of increase of shift of the solar lines from the centre of the disc to the limb as observed at Kodaikánal might be explained on the hypothesis of a constant "relativity" shift towards red, combined with a shift towards violet, due to a radial outflow of the gases of the reversing layer.

In his report of the observatory for the year 1918 Mr. Evershed gives the recent progress of the investigation by saying that the Venus plates taken about the western elongation of the planet when the angle Venus—sun—earth was about 45° yield slightly smaller values of the shifts, and there is a progressive diminution of wave-length as the angle at the sun increases. When this angle exceeds 90° the displacements sun—arc all have the *minus* sign—that is, the solar lines reflected by Venus are shifted to violet instead of to red with reference to the iron arc. Mr. Evershed adds that the result of the Venus work seems to dispose finally of the possibility that the solar line-shifts are due to the gravitational effect resulting from Einstein's generalised relativity hypothesis, and thinks the facts undoubtedly show earth-effect, whether the shift is interpreted as motion or otherwise. But he thinks it is very desirable that confirmation of these results should be obtained independently by other observers.

THE LUNAR ATMOSPHERIC TIDE.—The object of a paper read by Dr. S. Chapman before the Royal Meteorological Society in February last, and published in the April issue of the Quarterly Journal of that Society, was to discuss certain recent determinations of the lunar diurnal variation of barometric pressure for Batavia and Hong Kong. Opportunity was taken to refer to previous work and to review the present state of knowledge of the subject. The lunar daily barometric variation at Batavia has a semi-amplitude of 0·065 mm. of mercury, which may be compared with the semi-amplitude of 0·0090 mm. found by Dr. Chapman last year from sixty-four years' observations at Greenwich. This lunar variation is purely semi-diurnal, no appreciable diurnal component being observable. It is independent of lunar phase, and the data are inconclusive as regards the influence of lunar distance; for, though the amplitude is probably larger at perigee than at apogee, the exact ratio is not yet determined. The slight variation of amplitude depending on the moon's declination which tidal theory predicts is not detectable, but a marked seasonal variation affecting both amplitude and phase is rather surprising. The discussion of these results for various stations shows that the amplitude diminishes from the equator approximately as the fourth power of the cosine of the latitude. These departures from theory in the value of this quantity, which, it will be realised, is very small and difficult of detection, lead to the conclusion that the lunar atmospheric tide is not a simple tidal phenomenon, but is complicated by other causes.

THE DATE-PALM SUGAR INDUSTRY OF INDIA.

OUT of India's annual output of some 3,000,000 tons of crude sugar it is estimated that about 10 per cent. is derived from palms and about 4 per cent. from the date-palm, cultivated for this purpose in Bengal. Palm-sugar is obtained by making an incision in the soft upper part of the stem, whereby certain pathological changes appear to be induced, which result in an outflow of liquid containing sucrose. This liquid is collected and concentrated in earthenware pots until it is of such a consistence as to solidify on cooling, when it constitutes "gur" or "jaggery," a crude, dark brown sugar for which there is a considerable demand in India. "Gur" is sometimes treated in native-owned refineries for the production of a more or less white sugar by placing it in baskets with pots underneath, into which the molasses drains, the removal of the molasses being facilitated by placing on the surface of the "gur" a layer, 4 in. or 5 in. deep, of water-weed (*Vallisneria spiralis*) to supply moisture.

This process of producing palm-sugar has been investigated recently by Mr. H. E. Annett, agricultural chemist to the Government of Bengal,[1] chiefly with the object of placing the industry in a better position to compete with sugar and molasses imported from Java.

In the second memoir Mr. Annett gives the results of the investigations he has made with the view of finding means of avoiding loss of sucrose, improving the quality of the crude sugar, modernising the refining process, and economising in fuel. There may be a considerable loss of sucrose by inversion while the juice remains in the collecting pots. This is reduced to some extent by the native process of smoking the insides of the collecting pots before use, but it can be further reduced by coating the insides of the pots with lime-wash. By this use of lime the yield of "gur" can probably be increased by about 20 per cent.

The liquid as it exudes from the trees is normally water-white, but rapidly darkens on boiling, due mainly to the action of alkaline constituents of the juice on the reducing sugars. This darkening can be avoided by neutralising the juice with an acid before boiling down. Suitable acid liquids are lime-juice, alum solution, or aqueous extract of tamarind fruits.

A considerable item in the cost of producing palm-sugar is fuel, which in some of the areas is scarce and dear. Trials of an imported American maple-sugar plant as a means of economising fuel gave disappointing results, but it has been found possible to make various suggestions regarding concentration pans, the construction of the native furnace, and possible waste combustible materials, the adoption of which would lead to a reduction in the fuel costs.

"Gur" made from juice collected in limed pots, and carefully concentrated after neutralisation with acid, was of good colour, and gave the satisfactory yield of 59 per cent. of refined sugar on treatment in a centrifugal machine, whereas from "gur" made by the native process only 31 per cent. could be obtained. A thorough trial of centrifugal machines for refining the crude sugar in place of the tedious native process is recommended.

In his first memoir Mr. Annett made the useful suggestion that it might be feasible to set up small central factories for the production of refined palm-sugar in suitable areas, supplies of juice being bought

[1] Memoirs of the Department of Agriculture in India. Chemical Series vol. ii., No 6, and vol. v., No. 3. (Calcutta: Thacker, Spink, and Co.

from the owners of palm-gardens; but in his second memoir he has regretfully to confess that "such a scheme would be unworkable in practice unless the owner of the plant also had his own trees. Personal experience showed us that one is entirely at the mercy of the cultivator, and no amount of argument will persuade him to sell his juice at a reasonable rate."

SUSSEX NATURAL HISTORY.[1]

THE Hastings and St. Leonards Natural History Society may be congratulated on the well-sustained number of its members (373), on the smallness of its annual subscription (3*s.* 6*d.*), and on the interesting character of its journal. It is, in the opinion of many naturalists, disastrous when local societies undertake to publish scientific information important for its novelty. In after-years the duty of reference to such a source may cause students serious inconvenience. The faunistic lists in the present journal so industriously compiled—of Coleoptera by Mr. W. H. Bennett, of Aphididæ by Mr. F. V. Theobald, of Oligochæta by the Rev. H. Friend, and of the local fauna and flora in general by the late memorable Rev. E. N. Bloomfield, Mr. E. A. Butler, Mr. W. Ruskin Butterfield, Mr. Thomas Parkin, and others—will serve to illustrate this point of view. They are, for the most part, of purely local interest, legitimately recorded in the archives now under review. But in a few instances the entries seem less appropriately placed. Thus Mr. Theobald (vol. ii., No. 1, p. 15) renames two species of Aphis. Mr. Friend (vol. ii., No. 3, p. 119) gives details of an Oligochæte as a new species, though he mysteriously says that he had "described" it more than a year earlier. Among Hymenoptera Mr. Bloomfield (vol. ii., No. 3, pl. 9, p. 101) gives excellent figures of *Neurotes iridescens*, male and female, assigning them on the following page to "*Neurotis iridescens* (Enoch)," name of genus and author's name misprinted. Nearly a year later (vol. ii., No. 4, p. 178) that author, the late Mr. Fred Enock, fully describes the genus and the species, both still considered as new, of this interesting addition to the family of Mymaridæ or fairy flies.

Apart, however, from the impolicy of publishing novelties of classification in local records, Mr. Enock's account of the family is well worth reading, as is Mr. Friend's notice of the Oligochæta. In view of the common demand for significant names in biology, he amusingly notes that in these Annelids, named for few setæ, "sometimes the total number of setæ is two thousand, though the worm may not exceed half an inch in length."

In other branches of knowledge things are not always what they are called. In a lecture to which Mr. Anthony Belt, the editor, directs attention, Mr. J. E. Price, a soldier, explains that "smokeless powder" is not a powder at all. This author, speaking in 1912, suggests that the scientific perfection of arms, by rendering the prospect of war too awful to contemplate, "may materially contribute to the preservation of that peace of nations which is so much desired by every thoughtful man to-day." Meanwhile, some of these "thoughtful men" were engineering a conflict which is reckoned to have cost more than four millions of lives of men, not to speak of heart-aching to millions of women that no one can number.

As might be expected with Mr. Thomas Parkin, sometimes as president and always as enthusiastic supporter of the society, the journal may be said to be on the wing with bird-life, and his well-illustrated articles on historic houses—the Grey Friars, Winchelsea, and its rookery (vol. ii., No. 2), Ashburnham Place (vol. ii., No. 4), and Brickwall and Brede Place (vol. ii., No. 6)—must be of continuing interest. In the last he shows how legends may arise. On a vast oak beam there was a great iron hook, of which he said to a companion, "Look where the old lord used to hang his vassals." Lo and behold, "two or three years afterwards I went there again, and the custodian, having forgotten me, repeated my own words as authentic history." Naturally, in speaking of heronries, Mr. Parkin is all in favour of the noble birds, but those who wish to keep goldfish in ornamental waters have been heard to denounce herons as abandoned pirates. There are two sides to many problems, as Mr. Ticehurst shows in regard to the introduction of the little owl (vol. ii., No. 2).

Remarkably full of interest are the papers on *Eoanthropus dawsoni* by the late much lamented Charles Dawson (vol. ii., Nos. 2 and 4). But here again we must take into account what Mr. Anthony Belt has to say in his article on prehistoric Hastings (vol. iii., No. 1, p. 6). Limits of space exclude from notice many other notable essays, such, for example, as that by Prof. Seward on Wealden floras.

[1] *Hastings and East Sussex Naturalist*, vol. ii., Nos. 1–6; vol. iii., No. 1 (December 31, 1912–18).

NEW IDEALS OF SCIENCE TEACHERS.

A LITTLE more than a year has now elapsed since the publication of the report of the Government Committee which, with Sir J. J. Thomson as chairman, inquired into the position occupied by natural science in the educational system of Great Britain. In the meantime, the recommendations made in this report have been carefully considered by science teachers and others, and at a conference held on May 30, under the auspices of the London County Council, with Sir Cyril Cobb as chairman, the general aims of science teaching were freely discussed.

The main fact which seemed to be made clear by the discussion was that the science teacher of the present day must have two well-defined aims: the one to prepare children for the business of life, and the other to prepare them equally well for the more difficult business of living. On ethical grounds alone there can be no doubt as to which of these is the higher, for "the life is more than meat and the body than raiment." To this we can add that without the meat and raiment and the things of which these are but symbols, life in its broadest, as well as in its more restricted, sense is impossible. Hence these two aims, which appear to some incompatible, or even antagonistic, are in reality convergent, and meet on the common ground of national welfare.

Sir J. J. Thomson, in the opening speech, gave the key-note of the seemingly more ideal theme. Science teaching which is to add to the interests of life and contribute to the *joie de vivre* by dispelling the boredom of unoccupied leisure must be of the popular kind—that is, stimulating rather than feeding. It must cover a very wide field, and be given in the form of lectures, accompanied, when possible, by practical work of a suitable kind.

Such a course as this, essentially the same for boys and girls up to the age of sixteen, must include biology as well as chemistry, physics, and astronomy, for no general course can be considered complete which does not include the consideration of man in relation to his environment. Moreover, if we are to change a C3 population to an A1 nation, we must seek the "elixir

of life" in a new way, and to that end everyone should know something of what Sir Ronald Ross calls the "romance of disease" in order that he may value personal fitness and develop what another speaker called a "health conscience."

To turn now to the other aspect of science teaching, namely, preparation for the business of life, the attention of the meeting was rightly directed by Sir Richard Gregory to the scarcity of university-trained scientific workers required for industrial and other purposes. In the proportion of university students to population England stands far behind other nations, having only 5 per 10,000 as against 10 per 10,000 in America and 17 in Scotland. Though the power to remedy this rests mainly with the Government and those who administer the affairs of education, yet the teacher can do a great deal by endeavouring to turn the talent of the nation into the most suitable channels. We can no longer afford to have square pegs trying to fill round holes, and to prevent this the teacher must consider his work unfinished until every effort has been made to place boys and girls in that walk of life which seems most suited to their talents, attainments, and temperaments.

If carried to these culminating points, the work of the teacher will do more than anything else to bring about the full appreciation of the value of education, and with that there will come recognition of the importance of his office and the due reward for his services. G. H. J. ADLAM.

THE SELOUS COLLECTION.

THE Selous collection of big-game trophies, which has been presented to the Natural History Museum by Mrs. Selous, is, without doubt, the finest ever brought together as the product of one man's gun. It consists of some five hundred specimens shot by the late Capt. F. C. Selous, D.S.O., during a period of nearly forty years, some of the trophies dating from his earliest days as a hunter. The greater part of the collection is African, but there are many specimens from Canada, Newfoundland, the southern Carpathians, and Asia Minor.

Although the collection contains only a few actual "records," the average standard of the heads is very high, the series of Kudu being especially fine. The horns of the grandest specimen of this animal in the Selous Museum measure:—Length, (curve) 60⅝ in., (straight) 45⅜ in.; circumference, 11½ in.; tip to tip, 33 in. It was shot in 1890, and Capt. Selous's diary contains an entry referring to this specimen:—"My joy may, therefore, be imagined when I saw that the most superb specimen of a koodoo bull that my eyes had ever looked upon lay dead before me." Another equally grand specimen is the skull with horns of the white rhinoceros from Mashonaland, a practically extinct species. This animal was shot in 1880, and Capt. Selous records that "the anterior horn is the longest for a bull" that he ever saw. There are sixteen specimens of lion, chiefly heads. A mounted specimen measures 9 ft. 11 in. in a straight line from nose to tail. The series of heads of wapiti, from Wyoming, U.S.A., includes several remarkable examples.

Mrs. Selous has also presented to the Natural History Museum the superb collection of European birds' eggs, every clutch in which was collected by Capt. Selous, and is labelled most carefully, with exact date and locality.

The specimens will in due course be removed from Worplesdon to South Kensington, and kept together as the "Selous collection" for a period of years.

FORTHCOMING BOOKS OF SCIENCE.

"A MANUAL of Meteorology," Sir Napier Shaw (part iv., "The Relation of the Wind to the Distribution of Barometric Pressure"); "Problems of Cosmogony and Stellar Dynamics," J. H. Jeans; "An Enquiry Concerning the Principles of Natural Knowledge," Dr. A. N. Whitehead; "Lectures on the Principles of Symmetry," Prof. F. M. Jaeger; "Advanced Lecture Notes on Light," J. R. Eccles (a sequel to the author's earlier work); the fourth and final volume of "Fossil Plants," Prof. A. C. Seward; "Days in My Garden," E. Ballard; "Study of the Weather," E. H. Chapman (Nature Study Series); "Cattle and the Production of Beef," K. J. J. Mackenzie; "Yorkshire, North Riding," Capt. W. J. Weston; "Dumbartonshire," Dr. F. Mort (each in the Cambridge County Geographies); "Euclid in Greek (Book i.)," Sir T. L. Heath; "Short History of Education," Prof. J. W. Adamson; and new and revised editions of "Elasticity," Prof. Love, and "Infinitesimal Calculus," Prof. Lamb (*Cambridge University Press*); "The Living Cycads," C. J. Chamberlain; "Problems of Fertilization," F. R. Lillie; "A Laboratory Manual of Elementary Zoology," L. H. Hyman; "A Source Book of Biological Nature Study," E. R. Downing; "The Function of Death in Human Experience," G. B. Foster; "Fourth Year Mathematics for Secondary Schools," E. R. Breslich (*Chicago: University of Chicago Press; London: Cambridge University Press*); "Locomotive Valves and Valve Gears," J. H. Yoder and G. B. Wharen; "Physical Laboratory Experiments for Engineering Students," S. Sheldon and E. Hausmann; "Hot Bulb Oil Engines and Suitable Vessels," W. Pollock; "The Manufacture of Chemicals by Electrolysis," A. J. Hale (Electro-Chemistry Series); and new editions of "Glass Manufacture," Dr. W. Rosenhain; "The Manufacture of Paper," R. W. Sindall; "Wood Pulp," C. F. Cross, E. J. Bevan, and R. W. Sindall; "Photography," by Alfred Watkins (Westminster Series); "Handbook for the Care and Operation of Naval Machinery," Commander H. C. Dinger (*Constable and Co., Ltd.*); "Souvenirs Entomologiques: Etudes sur l'Instinct et les Mœurs des Insectes," J. H. Fabre, édition définitive illustrée, 10 vols. (*Paris: Delagrave*); "Birds in Town and Village," W. H. Hudson (*J. M. Dent and Sons, Ltd.*); "An Introduction to Child Psychology," Prof. C. W. Waddle; "The Measurement of Intelligence," Prof. L. M. Terman (*G. G. Harrap and Co., Ltd.*); "Annals of the Philosophical Club of the Royal Society, Written from its Minute Books," Prof. T. G. Bonney; "Science and Fruit-Growing: Being an Account of the Results Obtained at the Woburn Experimental Fruit Farm since its Foundation in 1894," the Duke of Bedford and S. Pickering; "A Text-book of Embryology" (vol. iii., Mammalia), by the late Dr. R. Assheton, completed by Dr. F. H. A. Marshall and J. T. Saunders; "Lectures on Sex and Heredity," Prof. F. O. Bower, Prof. Graham Kerr, and Dr. W. E. Agar; "Essays on the Surgery of the Temporal Bone," Sir C. A. Ballance, with the assistance of Dr. D. Green; and new editions of "Mendelism," Prof. R. C. Punnett, and "On Longevity and Means for the Prolongation of Life," the late Sir H. H. Weber, edited by Dr. F. Parkes Weber, with a preface by Sir Clifford Allbutt (*Macmillan and Co., Ltd.*); "The Thermionic Valve in Radio-telegraphy and Telephony," Prof. J. A. Fleming; "The Oscillation Valve: The Elementary Principles of its Application to Wireless Telegraphy," R. D. Bangay; "Telephony without Wires," P. R. Coursey (*The Wireless Press, Ltd.*).

THE ROYAL SOCIETY CONVERSAZIONE.

PREVIOUS to the war the Royal Society held two conversaziones annually—one to which gentlemen only were invited, and the other at which ladies as well as gentlemen were present. These social meetings were resumed on May 28, when a distinguished gathering of men of science and others met at Burlington House for the usual first conversazione, after an interval of four years. Many exhibits of apparatus and objects of scientific interest were on view, and the subjoined descriptions of them are abridged from the official catalogue. Exhibits relating to like departments of scientific activity have been brought together, and only such descriptions have been included as can be comprehended without seeing the actual objects.

Prof. H. F. Newall: Dr. G. E. Hale's photographs of the Zeeman effect in the spectra of sun-spots. An image of the sun's disc is thrown by means of the 150-ft. tower telescope at Mount Wilson on the slit-plate of the 75-ft. spectrograph. Close to the slit a Nicol prism is placed. Above the Nicol prism are mounted strips of mica 2 mm. wide, with their axes inclined $+45°$ and $-45°$ to the length of the strips, alternating in adjacent strips. This device is called a compound quarter-wave plate. When a sun-spot near the centre of the sun's disc falls on the slit through the polariscopic apparatus, certain lines in the spectrum are widened, and others resolved into two or three components. From a comparison of the solar effects and of the magnitude of the Zeeman effect in experiments in the laboratory on the corresponding lines, the strength of the magnetic field in the sun-spot is deduced. Average spots exhibit fields ranging from 2000 to 2700 gausses. The field varies approximately in proportion to the size of the umbra.

Sir Napier Shaw: Illustrations of the structure of the atmosphere on selected occasions. (1) Records of wind, on tube-anemometers, corrected for the difference of exposure in different orientations. (2) Maps of stream-function of the air for different levels on the occasion of the destruction of a fleet of Zeppelins, October 19–20, 1917, and another similar distribution on October 13, 1918. (3) Theoretical maps of the stream-function of the free air and distribution of pressure in the case of a cyclone consisting of a simple vortex with maximum velocity 43 metres per second, enclosing a core of fluid-rotating-like-a-solid, in a uniform atmospheric current of 16 metres per second; with maps for 18h., September 10, 1903, for comparison.

Mr. George H. Gabb: Portrait of Dr. John Jeffries, in pastel, by John Russel, R.A. Dr. Jeffries was, with Blanchard, the first to cross the Channel in a balloon, on January 7, 1785. The account of this epoch-making "aerial voyage" was read before the Royal Society in January, 1786. This portrait was exhibited in the Royal Academy in 1786, and was lost for more than a hundred years until it was discovered a short time ago, quite unknown, among a miscellaneous collection of pictures. Dr. Jeffries was the first to make an ascent solely for scientific purposes, and the first to attempt meteorological observations from a balloon. In his ascent from London on November 30, 1784, he included in his scientific equipment a barometer, a thermometer, a hygrometer, an electrometer, a marine compass, a telescope, and six small phials filled with water given him by Cavendish in order to collect samples of air at different altitudes.

Prof. MacGregor-Morris: Portable apparatus for measuring air-currents. A Wheatstone bridge is made of four wires all exactly alike of a material the resistivity of which varies with temperature. This bridge is heated by the passage of an electric current. Adjacent arms are so arranged as to be unequally cooled when placed in an air-current. The apparatus can be carried on a bicycle, and has been used for determining the velocity of the wind about a cliff-edge, and also around the gallery of a lighthouse.

Royal Aircraft Establishment, Farnborough: Standard and research aeronautical instruments. (1) R.A.E. Mark II. Compass.—An instrument designed by the late Capt. Keith Lucas to avoid, so far as possible, the errors which occur when flying in a northerly course. (2) R.A.E. Accelerometer.—This instrument records the variations of apparent gravity on an aeroplane by photographing the movements of a fine glass fibre bent into a bow. (3) R.A.E. Kymograph.—The instrument is to record movements of the aeroplane in roll, pitch, or yaw. (4) R.A.E. Pressure-plotting Apparatus.—The apparatus records the pressure or suction over an aeroplane's wings by means of small pipes which open flush with the surface and lead to a multiple recording pressure-gauge. (5) R.A.E. Climbmeter.—An instrument which indicates the rate at which an aeroplane is rising or falling.

The Cambridge Scientific Instrument Co., Ltd.: Dr. G. A. Shakespear's katharometer for measuring the purity of gases. Two small spirals of platinum wire form two arms of a Wheatstone bridge, and their resistances, depending on their temperatures, depend on the viscosities of the surrounding gases. A galvanometer connected across the bridge indicates its out-of-balance, and is calibrated to give a direct reading of the purity of the gas, or otherwise, as required. Many practical applications are possible: (*a*) A hydrogen purity meter for use with aircraft is exhibited; (*b*) permeameters for testing airship fabrics and exploring seams or searching for leaks are exhibited; and (*c*) a humidity recorder showing the vapour pressure in the air of the exhibition room was shown working.

Mr. F. W. Aston: Rapidly moving striated discharge in neon and helium. The light in the capillary of a spectrum discharge tube containing neon or helium is apparently continuous, but when analysed by a rotating mirror is found to consist of a procession of alternate bright and dark bands or striations travelling in the direction of the current, *i.e.* from anode to cathode. These appear in the mirror as ribbons of light, their waviness indicating variations in speed and being more marked in neon than in helium. The mean velocity can be calculated from the slope, and is found to be approximately that of pressure-wave propagation, *i.e.* sound, in the gas in the discharge tube.

Mr. C. T. R. Wilson: (1) Stereoscopic photographs of the tracks of ionising particles through air. By causing water to condense upon the ions set free, the invisible trail of ions left by each flying particle along its course is converted into a sharply defined line of cloud. Stereoscopic photographs of the tracks thus rendered visible are taken before convection currents have had time to distort them. (2) Photographic record of the changes in the electric potential gradient during a thunderstorm. The record showed the sudden changes produced in the electric field by the passage of lightning discharges.

Prof. E. H. Barton and Miss H. M. Browning: Vibrations, forced and coupled. The phenomena of forced vibrations and resonance were experimentally illustrated by a number of pendulums of graduated lengths, with light bobs hanging from a horizontal cord and set vibrating by a pendulum, with heavy bobs hanging from the same cord. All the salient points of the mathematical theory of forced vibrations

(mechanical, musical, or electrical) were thus rendered simultaneously visible.

The National Physical Laboratory: Mechanical and optical apparatus for measuring and inspecting screw gauges (Metrology Department). A vertical projection machine shown produces an enlarged image of the profile of the thread on a diametral plane to a magnification of 50. This image can be compared with the standard form for the thread which is drawn out to the same magnification. Errors of 0·0001″ in the thread-form can be so detected.

Mr. A. Mallock: Apparatus used in the measurement of the growth of trees. An "invar" tape was passed round the tree and over the "rockers" on the apparatus, the arms of which control the angle between a plane glass surface and the face of a right-angled glass prism. The growth of the tree continually alters this angle, the variation of which was measured by observing the change of position of the interference bands formed, at grazing incidence, between the plane and prism. The details of the procedure are given in Proc. R.S., vol. xc. B, 1918, p. 186 *et seq.*

Prof. Ernest Wilson: Instruments for measuring minute susceptibilities, including a portable instrument for survey work. The action of the instrument depends upon the mechanical force exerted by a magnetic field on a magnetic material placed in it, the force per unit volume being proportional to the gradient of the square of the field. It is ultimately measured by a galvanometric method involving the action of a spot of light, except in the case of the portable instrument, when a pointer is more convenient.

The National Physical Laboratory: (1) Apparatus for the determination of the absolute viscosities of liquids at high pressures. (Designed by Mr. J. H. Hyde; method suggested by Dr. T. E. Stanton.) The apparatus consists essentially of a system of two horizontal (the upper one of capillary dimensions) and two vertical tubes forming a closed circuit of liquid under pressure, the lower half of the circuit containing mercury and the upper half the liquid under test. The system rests on a horizontal knife-edge, and is supported in a horizontal position by a spiral spring. On the mercury being displaced by a given amount, flow will take place round the circuit owing to the difference of head, and if the spring is so adjusted that its rate of extension is equal to the rate of change of head of the mercury, it is evident that flow of the liquid under test will take place through the capillary under a constant-pressure difference, and at a velocity which can be calculated from the rate of extension of the spring. (2) Three-electrode vacuum tube with circuits arranged to produce oscillations of telephone frequency. (Mr. F. E. Smith.) The apparatus consists of a three-electrode vacuum tube with appropriate inductances and capacities in the plate- and grid-circuits. The values of these are such as to maintain oscillations of audible frequency. By varying either inductance or capacity the frequency of the oscillations is varied. A coil coupled to the plate inductance with a telephone in circuit serves to make the note audible. By suitably choosing the inductances and capacities, frequencies from about twenty per second to several millions per second are readily obtained. (3) Plotting chronograph, thermal curves, and model relating to ternary alloys. (Dr. W. Rosenhain.) The chronograph was designed for the direct plotting of time-temperature observations in the form of "inverse rate" curves as required for the heating and cooling curves of metals and alloys. The constitution of a binary alloy system can be completely represented by a plane diagram, but for a ternary system a three-dimensional model is required. The model shown indicated the constitution of a part of the system zinc-copper-aluminium, including alloys rich in zinc, and containing up to 10 per cent. of copper and 15 per cent. of zinc.

Sir Robert Hadfield: Stereoscopic radiographs of large carbon electrodes. These electrodes are used in electric steel-smelting furnaces, the largest type being no less than 22 in. in diameter. For effective and economical working of the furnaces it is essential that the electrodes do not break and fall into the bath. The finer the structure of the electrode and the fewer the inclusions, the less does the possibility of breakage arise. The stereoscope showed four different types of electrodes which are largely used.

Major G. W. C. Kaye and Dr. R. Knox: The detection of defects in aeroplane timber by the X-rays. The best workmanship and the highest quality material are essential in aircraft construction. The X-rays readily reveal bad workmanship and hidden defects in the interior of laminated or box spars and struts which cannot be seen by ordinary visual examination. As wood is very transparent to X-rays the fluorescent-screen method of examination suffices for routine inspection.

The Munitions Inventions Department: War research on nitrogen fixation. For the past three years the research laboratory of the Munitions Inventions Department, constituted under the auspices of the Nitrogen Products Committee of the Ministry of Munitions, has been conducting experimental investigations on various methods for the fixation of nitrogen. The most important divisions of the work have been concerned with the synthesis of ammonia, the oxidation of ammonia and the preparation of nitrates, and the preparation and purification of hydrogen. Experiments illustrative of the work of three of the sections are shown.

Mr. A. Chaston Chapman: "Mineral yeast," used in Germany during the war for human food. The organism exhibited is very similar to, if not identical with, the so-called "mineral yeast" which was manufactured in Germany in considerable quantities during the war and used to supplement the bread ration. The organism is not a true yeast—that is to say, it does not belong to the genus Saccharomyces. It grows freely upon nutrient solutions at a temperature of 38°–40° C., forming a thick, greasy, crinkled film. It does not produce alcohol, and the time needed for a full crop is about thirty-six to forty-eight hours. The separated organism contains 50–55 per cent. of protein and about 5 per cent. of fat, expressed on the moisture-free material. It is entirely free from bitterness and has a pleasant flavour, suggestive of that of cream cheese. As a source of carbon, glucose or molasses answer well, and the organism is capable of supplying the whole of its nitrogen needs from ammonium salts—that is to say, it does not require any organic nitrogen. In addition to the above, phosphates must be present, and small quantities of potassium and magnesium salts.

Mr. J. E. Barnard: Methods of observing Spirochætes by dark-ground illumination. It is recognised that for the identification of Spirochætes, particularly *Spironema pallidum*, the method of microscopical observation known as dark-ground illumination is the most satisfactory. To employ it successfully certain optical principles must be complied with. Such organisms are always within the limits of microscopic resolution in the direction of their length, but are often beyond the limits in breadth. It follows that any granular contents are ultra-microscopic, and that these are seen only under certain conditions.

Dr. R. T. Leiper: Demonstration illustrating the

experimental transmission of Bilharzia infections of man. In Egypt nearly 50 per cent. of the population suffer from bilharziasis. Owing to the risk to which the troops were exposed, the War Office, in conjunction with the Medical Research Committee, authorised, in 1915, a special inquiry into the mode of spread and prevention of the disease. The exhibit illustrated some results. It was shown that the vesical and dysenteric lesions of bilharziasis are caused by two different species of worms: that these worms require fresh-water snails as intermediate host. *Bilharzia haematobia*, which infects the bladder-wall, undergoes metamorphosis in *Bullinus dybowski*, and *Bilharzia mansoni*, which infects the intestine, develops in *Planorbis boissyi*. The infective stage enters through the skin.

Dr. E. J. Allen (for the Marine Biological Association): Living marine animals, illustrating the fauna of Plymouth Sound. The specimens were arranged to illustrate the changing character of the fauna with changing physical conditions, such as depth of water, movement of water, nature of the soil, tidal exposure, and varying salinity.

Prof. E. W. MacBride: Artificially produced abnormal Echinoderm larvæ. (1) Specimens of larvæ of *Echinus miliaris*, with a hydrocœle (*i.e.* rudiment of a water-vascular system) on each side. This modification is produced by subjecting the larvæ when three days old to the influence of water of increased salinity, and then when a fortnight old re-transferring them to ordinary sea-water and feeding them up. (2) Specimens of larvæ of *E. miliaris* devoid of a hydrocœle, but with spines on both sides. These larvæ are produced by starving them between the ages of three and six days and afterwards feeding them up.

Mr. E. S. Goodrich and Mr. A. F. Coventry: Frog and tadpoles obtained by artificial parthenogenesis. Apparatus used and results obtained by the method devised by Prof. E. Bataillon in 1910, who discovered that unfertilised eggs of a frog will develop if removed from the oviduct and pricked with a very fine needle. Some 80 per cent. of the eggs so pricked undergo cleavage, a much smaller number pass through later stages of embryo formation, and a very small percentage develop into tadpoles and succeed in metamorphosing into frogs.

Mr. C. Tate Regan: Models of fishes illustrating adaptive modifications in related genera. (1) Epibulus (Labridæ) differs from Cheilinus in the extremely protractile mouth; associated with this are remarkable modifications of the skeleton; the long movable quadrate is unique among fishes. (2) Xiphasia (Blenniidæ) has the specialised characters of Petroscirtes (canines very large, gill-opening a small foramen), but differs in its eel-shaped form, with the tail long and tapering and the vertebræ increased in number from fewer than 40 to about 125.

Prof. E. B. Poulton: Families of the African *Papilio dardanus* (*merope*) with the female parents. All the families, from the following parts of Africa, include non-mimetic males and the female forms mentioned below:—(*a*) Two from West Africa, bred by Capt. W. A. Lamborn from mimetic black-and-white *hippocoon* female parents. Female offspring all *hippocoon* in one, half *hippocoon* and half the ancestral non-mimetic *dionysos* in the other—the mimetic females constant, the non-mimetic variable. It is probable that *hippocoon* is a Mendelian recessive, and that the male parent was a heterozygote combining *hippocoon* and *dionysos*. (*b*) One from the Sesse Islands, N.W. Victoria Nyanza, bred by Capt. G. D. H. Carpenter from a *planemoides* female, mimicking large Acræinæ of the genus Planema. The offspring include *planemoides* and, in larger numbers, *hippocoon*. Another from the Kagera River in ex-German East Africa just south of Uganda, bred by the same naturalist from a rare female form combining *planemoides* and *trophonissa*. The two female offspring belong respectively to these latter forms. (*c*) Three from the neighbourhood of Durban, Natal, bred by Mr. G. F. Leigh, from the three mimetic females of S.E. Africa—*hippocoon*, *trophonius*, and *cenea*. In all three families the commonest local form *cenea* was present in larger numbers than any other form.

Dr. J. S. Haldane: Army form of apparatus for continuous oxygen administration. In cases of poisoning by irritant gas, and in various other conditions, one of the main dangers is due to the fact that the partial pressure of oxygen in the lungs becomes inadequate to oxygenate the blood. It is, therefore, necessary to add oxygen to the inspired air until a sufficient degree of recovery takes place. With the help of a reducing valve and graduated tap, a constant stream of oxygen of the required amount is delivered into the small bag attached to the face-piece. This bag is emptied at each inspiration, none of the oxygen being wasted. The administration can thus be continued, if necessary, for several days, as the consumption of oxygen is reduced to a minimum.

Mr. Joseph Barcroft: The treatment of chronic cases of gas-poisoning by means of continuous inhalation of oxygen. A hospital consisting of three small wards, each made of glass, was established in the Cambridge Physiological Laboratory. A model of this was shown. In the glass rooms patients were placed each for five days; they were allowed out for exercise, etc., for about seven hours of each day.

Sir Almroth E. Wright, Mr. L. Colebrook, and Mr. A. Fleming. Methods employed in the study of wound infections. (1) Investigation of the part played by the white blood corpuscles. The experiments showed that white blood corpuscles collected from the blood *in vitro*, or freshly arrived in the wound, are capable of killing great numbers of microbes—and that they fail to do so if injured by drying, or if an excess of fluid enables the microbes to keep out of their reach. (2) Investigation of the part played by the blood fluids. The experiments showed that (i) the unaltered blood serum provides a very unfavourable medium for the growth of most of the types of bacteria met with in wounds, but that a few of these—notably the streptococci and staphylococci—can grow in it quite unchecked. (Sero-phytic bacteria.) (ii) If the blood serum is corrupted, as it is in a wound, by abolishing its anti-proteolytic property, all the other types of bacteria are enabled to grow freely. (Sero-saprophytic bacteria.) (iii) If the alkalinity of the blood serum is blunted off, as in the condition of acidosis which is associated with "shock," the gas-gangrene bacilli are enabled to grow freely.

Dr. G. Sims Woodhead and Dr. Varrier Jones: Quasi-continuous temperature recording apparatus for clinical use, and specimens of records obtained. The outfit consists of a resistance thermometer with compensating leads, a galvanometer with "bridge" and resistances, by means of which a wide range of temperature changes may be observed, and a Cambridge thread recorder, which gives a quasi-continuous (at half-minute intervals) and permanent record of the temperature of the human or animal body. This apparatus has been of use in determining the diurnal variations of temperature of normal subjects and in studying febrile conditions in disease, *i.e.* tuberculosis. Continuous temperature records for seventy-two hours are readily obtained.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The Grace authorising the Vice-Chancellor to inform Mr. Fisher that the University would welcome a comprehensive inquiry into its financial resources and approving an application to the Government for an emergency grant pending such inquiry passed the Senate without opposition.

The generous offer of the British oil companies to present a sum of 210,000*l.* to the University for the endowment of the school of chemistry has now been formally made to the Vice-Chancellor by Mr. R. Waley Cohen on behalf of the donors. In conveying this offer Mr. Cohen indicates the wishes of the donors as to the general manner in which their gift should be applied. They understand that not more than half of the sum will be devoted to the extension of the present chemical laboratory, and that the remainder will be utilised for supplementing the funds at present available for the upkeep of the laboratory and for the payment of its teaching and research staff. It is their desire that as large a portion of the fund as possible should be reserved for endowment purposes, and as small a portion devoted to the building as the University may consider to be consistent with efficient equipment. Since they feel a very deep interest in the success of the scheme, they would be glad to have an opportunity of expressing their views in regard to it when it has been drafted in detail by the University authorities. Whilst their main object is that the University may be enabled to render great service to all scientific work, they trust that the connection which will thus be established between the school of chemistry at Cambridge and the oil industry may lead to the study in Cambridge of the chemical problems connected with mineral oil.

Mr. F. T. Brooks, of Emmanuel College, has been appointed a University lecturer in botany for five years from Midsummer, 1919.

Dr. Peter Giles, Master of Emmanuel College, has been elected Vice-Chancellor of the University for the ensuing academical year beginning October 1.

LIVERPOOL.—Col. J. G. Adami, F.R.S., professor of pathology, McGill University, Montreal, has been elected Vice-Chancellor of the University in succession to Sir Albert Dale, who retires at the end of September. Col. Adami was born in 1862. Educated at Owens College and Christ's College, and later fellow of Jesus College (Cambridge), he is a pathologist of the highest distinction. Since 1892 he has held the chair of pathology and bacteriology in the McGill University, Montreal. He is well known in Britain and oversea for his great experience in university affairs. His presence will be another link between Transatlantic and British universities. Col. Adami has served in the Canadian Army Medical Corps as Assistant Director of Medical Services, and is medical historical recorder for the Canadian Expeditionary Force.

LONDON.—Prof. G. Elliot Smith has been appointed to the University chair of anatomy tenable at University College. Prof. Elliot Smith graduated at Sydney, taking the M.D. with First Class Honours and University medal, and at Cambridge, where he was a fellow of St. John's College. He was formerly professor of anatomy in the Egyptian Government School of Medicine at Cairo, and since 1909 he has been professor of anatomy in the University of Manchester.

Major A. J. Allmand has been appointed to the University chair of chemistry tenable at King's College. In 1910 he was awarded an 1851 Exhibition scholarship, and has since worked with Prof. Haber at Karlsruhe and Prof. Luther at Dresden. From October, 1913, to Christmas, 1914, he was assistant lecturer and demonstrator in physical chemistry at Liverpool, and, after holding a commission in the Army, was appointed Chemical Adviser at Army Headquarters.

Mr. A. E. Richardson has been appointed to the University chair of architecture tenable at University College.

The report and recommendations of the general committee on degrees in commerce have been approved by the Senate; the syllabuses and draft regulations for the Intermediate Examinations and the outline syllabus for the Final Examination have also been approved. A commerce degrees committee, which includes business men representing various commercial interests, has been appointed, the duty of which will be to report on matters connected with degrees in commerce from time to time and to review the scheme annually.

The Senate has resolved that it is desirable to institute a degree of Ph.D. for internal students in the faculties of theology, arts, science, and economics for students who pursue a course of not less than two years of full-time research work (or its equivalent in evening work). No alteration is proposed to be made in the existing regulations for the M.A. and M.Sc. degrees for internal students as a consequence of the institution of the Ph.D. degree.

It has been resolved by the Senate to institute a chair of aeronautics tenable at East London College.

The following doctorates have been conferred:—*D.Sc. (Physics)*: Mr. E. A. Owen, an internal student, of University College, for a thesis entitled "Phenomena Attending the Passage of X-Rays through Matter." *D.Sc. (Economics)*: Mr. G. H. Scholefield, an external student, for a thesis entitled "A History of British Policy in the Pacific," and other papers. *D.Sc. (Chemistry)*: Mr. G. N. White, an internal student, of University College, for a thesis entitled "The Action of Chloroform on Certain Aryl Mercaptans in Presence of Caustic Soda."

Mr. Pember Reeves has resigned the post of director of the London School of Economics.

OXFORD.—The statute making Greek optional was passed in its amended form by Congregation on June 3. The ultimate decision now rests with Convocation, which body will give its vote on June 17.

Difficulties have arisen about the appointment of a Romanes lecturer, and it has been found advisable to suspend the lecture for the present year.

A decree has passed Convocation authorising the erection of a new class-room and preparation-room at the physiological laboratory.

DR. W. M. VARLEY, at present principal of the Swansea Technical College, has been appointed principal of the Brighton Municipal Technical College in succession to Dr. W. B. Burnie.

THE Goldsmiths' Company has offered the sum of 15,000*l.* to London Hospital for the endowment of a chair of bacteriology, to be known as the Goldsmiths' Company's chair of bacteriology.

AT a conference of the Universities of the United Kingdom, held in London on May 23, it was unanimously resolved:—"That this conference of British universities desires the representatives who are about to proceed to visit the universities of France to convey to them its cordial greetings and congratulations, and its desire for the growth and consolidation of their fraternal relations, in the interest both of humane learning and science and of international comity and progress."

LORD DURHAM was installed Chancellor of Durham University on May 31. The following honorary degrees were conferred:—*D.C.L.*: Lord Crewe, the Right Hon. J. R. Clynes, Sir George Newman, the Rev. Prof. G. Milligan, Prof. Arthur Thomson, and Prof. J. R. Morrison. *D.Litt.*: Lady Frances Balfour, Sir Martin Conway, and Prof. W. P. Ker. *D.Sc.*: Sir E. Rutherford, Sir G. T. Beilby, Prof. A. A. Herdman, and Prof. J. J. Welsh.

THE Manchester City Council has approved a new method for the selection of elementary-school pupils who are to continue their education in secondary schools. Hitherto the only candidates for admission to secondary schools have been the children of parents who have made an application for the privilege. In future all elementary-school children between eleven and thirteen years of age will be examined by their head teachers with the definite purpose of selecting those best qualified to benefit by secondary education. The examination will be partly written and partly oral. The written portion will consist of general papers in arithmetic and English, and will be the same in all schools. The parents of all selected children will be approached with the object of gaining their co-operation in sending forward the children's names as candidates for admission to secondary schools. A further examination will follow, upon the result of which scholarships will be awarded. There will be some 60,000 pupils to take the preliminary examination, and all who get 50 per cent. of the maximum marks will be judged fit for extended education.

THE number of employers who are interested in the education of their employees has been increasing gradually for a number of years, and has received a considerable impetus from the development of welfare work during the war and from the Education Act of 1918. Conferences were held in June, 1918, and February, 1919, and at a larger and more representative meeting held in London on May 28–30 an Association for the Advancement of Education in Industry and Commerce was established. The first president is Lord Leverhulme, with Sir Woodman Burbidge as vice-president, Mr. J. Knox (of Lever Brothers) as chairman of the executive committee, and Mr. R. W. Ferguson (of Cadbury Brothers) as secretary. The association includes in its membership many of the largest and most enterprising firms in the country. The objects are to encourage the provision of education in industrial and commercial undertakings, and to aid in the general advancement of education by conferences, the printing and circulation of information, and co-operation with other educational bodies. Many of the firms have already anticipated to some extent the Act of 1918 by the establishment of schools on their own premises, while others have already utilised, or propose to utilise, the facilities which local education authorities are willing to provide. The papers read at the conference and the subsequent discussion indicated that the training of young people in works, factories, offices, and business houses already instituted or desired was in no sense to be narrowed down to the special requirements of vocation. As one of the speakers put it: "A better workman was a secondary aim, but a logical conclusion"; and another remarked that "the problems of to-day were not so much those of industry as those of leisure." The clever boy or girl was to be encouraged; the less fortunate ones had equal rights and greater needs. On the second day the members of the conference were entertained at a garden-party by Lord Leverhulme at The Hill, Hampstead Heath, and were afterwards addressed by Mr. H. A. L. Fisher and Sir Robert Blair.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, May 22.—Sir J. J. Thomson, president, in the chair.—Prof. W. J. **Sollas**: The structure of Lysorophus as exposed by serial sections. As the precise position of Lysorophus, regarded by Broom as the most interesting vertebrate fossil discovered for many years past, still remained open to discussion, some nodules containing its remains were placed in the author's hands for investigation by serial sections. This work is now complete, and all the facts of the anatomy of the skull and vertebræ and the main features of the shoulder-girdle and fore-limbs are exposed with a precision and wealth of detail only otherwise to be looked for in a recent skeleton. It is now placed beyond question that Lysorophus belongs to an ancestral group of amphibians closely related to the Urodela. Among the striking primitive characters it retains may be mentioned the presence of a basi-occipital and a supra-occipital bone, with a foramen in the former for the twelfth nerve, and possibly connected with this the presence of a large paired proatlas.—O. **Rosenheim**: A preliminary study of the energy expenditure and food requirements of women workers. Direct determinations (by the Douglas-Haldane method) of the energy expenditure of women were made during periods of rest, recreation, and work, the last referring to work on the lathe. By means of the data obtained an approximate estimate of the daily food requirements, expressed in Calories, was arrived at on the basis of certain considerations set forth in the communication. The results agree with those of previous workers obtained by indirect statistical methods.—M. **Greenwood**, C. **Hodson**, and A. E. **Tebb**: Report on the metabolism of female munition-workers. Observations were made upon forty-three women engaged upon twelve different processes in the manufacture of projectiles, the rate of metabolism being determined by the method of indirect calorimetry. Making the allowance for metabolic needs during non-working hours recommended by the Royal Society Food (War) Committee, the workers were found to fall into four classes, for each of which the daily net requirements per average woman were 2530 Calories, 2810 Calories, 3200 Calories, and 3425 Calories. The results were concordant with the inferences drawn from a study of food consumption in a large explosives supply factory during the war. The figures obtained in this experimental work were somewhat larger than those reached by Becker and Hämäläinen.

Royal Anthropological Institute, May 20.—Sir Everard im Thurn, president, in the chair.—Capt. A. M. **Hocart**: Early Fijians. Layers of culture have generally been distinguished and dated in a rather arbitrary manner. It is too often taken for granted that the rudest culture is the earliest. Fiji is an instance in point; it is usually assumed that its rudest tribes are its earliest inhabitants. The evidence is rather against that. Titles that once existed in eastern Fiji are now to be found in the more easterly groups of Samoa and Tonga. Samoan legends are full of references to Fijian immigrants. Fijian tribal traditions agree, being almost unanimous in placing their own original home in the northern hills of the main island in the west. Evidently there has been a general displacement from west to east. Linguistic remains show that Polynesian was once spoken in the east. Society was feudal and the chiefs divine. There was a dual chieftainship similar to the Japanese, and certainly a dual organisation, and so on. If we look outside Fiji we shall find the proper name of those islands, namely, Viti, occurring in Polynesian tradi-

tions and place-names. We must, therefore, recognise the existence of a people, the Vitians, who overspread the whole of Polynesia. They were driven eastwards by a barbaric invasion, which repeated some features of the invasion of Europe by the Germanic hordes. Hints of a similar cataclysm are to be found in Melanesia, and even so far west as Indonesia.

PARIS.

Academy of Sciences, May 12.—M. Léon Guignard in the chair.—G. **Humbert**: The measure of the classes of quadratic forms, ternary and positive, of given determinant.—L. **Lecornu**: The vortices of a fluid vein.—P. **Sabatier**, A. **Mailhe**, and G. **Gaudion**: The action of finely divided metals upon pinene vapour. Four metals were used in these experiments, copper, nickel, cobalt, and iron, and the results of the two first are given in detail. With copper as catalyst, aromatic hydrocarbons predominate; with reduced nickel at 600° C. the decomposition is very energetic, but as soon as the activity of the metal is reduced by deposited carbon the products are similar to those obtained with copper.—E. **Ariès**: Direct determination of the temperature exponent in the equation of state of fluids. A formula deduced in an earlier communication has been applied to the experimental data (Sydney Young) for seven substances, with satisfactory agreement.—M. Hilaire de Chardonnet was elected a member of the division of the applications of science to industry.—E. **Belot**: Spiral orbits with balanced gravitation.—C. **Chéneveau** and R. **Audubert**: The velocity of light in turbid media.—A. **Boutaric**: The application of the Gibbs-Helmholtz equation $A-U=T(\partial A/\partial T)$ to monovariant systems. It has been assumed by Nernst and others that for monovariant systems the above equation becomes $A-U=T(dA/dT)$, in which dA/dT is the differential coefficient of A (a function of T only) with respect to T. It is shown that, in general, this extension is not legitimate.—A. **Colson**: Eutectics and dilute solutions.—A. **Béhal**: The isolation and characterisation of alcohols as allophanates. The alcohol is converted into the allophanate by cyanic acid, produced in the gaseous state by depolymerisation of cyanuric acid, and the reaction product washed with ether to remove unchanged alcohol and urethane. All the allophanates are crystalline, very slightly soluble in ether, and serve well for the separation and identification of alcohols.—G. **Reboul** and L. **Dunoyer**: The influence of the seasons and the aerological systems on the correlative variations of atmospheric pressure and of the intensity of the wind.—J. **Braun-Blanquet**: The discovery of *Laurus canariensis* in the tufas of Montpellier.—P. **Bertrand**: Relations of the plant zones A_1A_2 and B_1B_2 with the marine levels of the Coal Measures of the North of France.—L. **Joleaud**: The *rôle* of the maritime channels of North Florida and South Caribee in the migrations of Tertiary and Quaternary mammals.—J. **Amar**: Pulmonary ventilation and hæmatosis.—J. **Pellegrin**: The ichthyological fauna of the eastern Sahara.—E. **Sollaud**: The first phases of embryonic development in *Leander squilla*.—L. **Roule**: The pigmentation of young salmon (*Salmo salar*) and its relations with the first stay in fresh water and the first migration to the sea.

DIARY OF SOCIETIES.

THURSDAY, JUNE 5.

ROYAL INSTITUTION, at 3.—Sir Valentine Chirol: The Balkans.

ROYAL SOCIETY, at 4.30.—Dr. P. Phillips: The Relation between the Refractivity and Density of Carbon Dioxide.—P. N. Ghosh: The Colours of the Striæ in Mica, and the Radiation from Laminar Diffracting Boundaries.—Dr. E. F. Armstrong and Dr. T. P. Hilditch: A Study of the Catalytic Actions at Solid Surfaces.

ROYAL SOCIETY OF ARTS, at 4.30.—Lord Montagu of Beaulieu: Aviation as Affecting India.

LINNEAN SOCIETY, at 5.—H. N. Dixon: Mosses from Deception Island, New Guinea.—Miss Alwin M. Evans: The Structure and Occurrence of Maxillulæ in the Orders of Insects.—Ernest E. Unwin: Notes upon the Reproduction of *Asellus aquaticus*.—The General Secretary: A Medallion Portrait of Carl von Linné, hitherto unknown; The Original Seal of the Society, in use from 1789 till 1803.

CHEMICAL SOCIETY, at 8.—W. H. Perkin: Cryptopine. Part II.—P. Blackman: An Isotonic (Isosmotic) Apparatus for comparing Molecular Weights. Part I.—V. Cofman: The "Active Substance" in the Iodination of Phenols.—N. V. Sidgwick: The Influence of Orientation upon the Boiling-points of Isomeric Benzene Derivatives.—J. Senior: The Atomic Weight of Iodine, and the Discovery of a New Halogen.—H. Hepworth: The Absorption Spectra of the Nitric Esters of Glycerol.

FRIDAY, JUNE 6.

ROYAL INSTITUTION, at 5.30.—Sir E. Rutherford: Atomic Projectiles and their Collisions with Light Atoms.

SATURDAY, JUNE 7.

ROYAL INSTITUTION, at 3.—J. M. Price: The Italian Front.

THURSDAY, JUNE 12.

OPTICAL SOCIETY, at 7.30.—S. D. Chalmers: The Recognition of Detail.

FRIDAY, JUNE 13.

ROYAL ASTRONOMICAL SOCIETY, at 5.

PHYSICAL SOCIETY, at 5.—B. Van der Pol, jun.: A Comparison of the Wave-form of the Telephone Current produced by a Thermal Detector and a Rectifier in the Heterodyne Reception.—E. Wilson and E. F. Herroun: The Magnetic Properties of Varieties of Magnetite.

MALACOLOGICAL SOCIETY, at 6.—G. C. Crick: *Ammonites navicula* (Mantell).—R. Bullen Newton: A Sandstone Cast of *Aturia aturi* (Basterot) from the Miocene of Western Australia.—A. S. Kennard and B. B. Woodward: The Generic Names for the Two British *Ellobiidae* [olim *Auriculidae*] *myosotis*, Draparnaud (=*denticulata*, Montagu) and *bidentata*, Montagu.—G. Despott: The Mollusca of Marsascirocco Harbour, Malta.—Tom Iredale: Notes on Polyplacophora. Part II.

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MACMILLAN AND CO., LTD.,
ST. MARTIN'S STREET, LONDON, W.C.2.

Advertisements and business letters to be addressed to the Publishers.

Editorial Communications to the Editor.
Telegraphic Address: PHUSIS, LONDON.
Telephone Number: GERRARD 8830.