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Standardisation in Industry.

IT is now exactly thirty years ago since the British Engineering Standards Association (B.E.S.A.) was formed, namely, in 1901, when a small unpretentious committee was set up representing civil, mechanical, and electrical engineering institutions, together with the Iron and Steel Institute and the Institution of Naval Architects. It may therefore justly claim to be among the pioneers of the movement towards more uniform and standard methods in industry, including simplification of forms and types, a movement which has now, in all the leading countries, reached vast dimensions and become a factor of supreme significance in industrial efficiency and progress. Yet the Association worked for many years in obscurity and discouragement, and did not even receive its Royal Charter of incorporation until 1929, although it had for some time before this received a small grant from the Government. This grant, never very substantial, was some time ago reduced to the pitiful allowance of 100 guineas per annum. At length, however, the patient and indefatigable labours of the Association are receiving some measure of the recognition that they deserve; it has been promised a greatly increased grant from the British Government, and its work has also been commended by the recent Conference on Standardisation—in connexion with the Imperial Conference of 1930—the report of which has recently been published (Cmd. 3716. London: H.M. Stationery Office. 3*d*.).

This report takes note of two kinds of standardisation, distinguished as (*a*) fundamental standards and (*b*) industrial standardisation. The former deals with standardisation of measurement units, and the latter with the rather wider field of industrial simplification and uniformity, and the adoption of standard specifications of material and method in all branches of industry where they can be usefully applied. How wide this field is may be gathered from a glance through the rapidly growing list of the B.E.S.A. specifications, which now number several hundreds, and are constantly being added to and revised and brought into line with the most improved and up-to-date methods. So much is this the case, indeed, that at its last general meeting the B.E.S.A. decided to eliminate the term 'engineering' from its title and all its publications, for it is now generally felt by the Association that 'engineering', despite its vast extent and almost infinite ramifications, is yet not sufficiently comprehensive to cover all the work of

the B.E.S.A. The question of a more suitable title is still under consideration, and its solution is not so simple as it looks.

Several other important and interesting matters also came up at the last general meeting. In the first place, the letter from the Board of Trade announcing the increased Government grant was read, stating that, in view of the recommendations in the final report of the Committee on Industry and Trade, it had been decided to make an annual grant of £3000 as from 1930–31 and for the next four years. The Association's annual subscription list brings in about £13,000, and the Board of Trade grant will be increased in the year 1931–32 by £1 for every £3 that the Association may raise in subscriptions from industry in excess of £13,000 in the year ended March 1931, and similarly in the succeeding three years, subject to a maximum total of £5000 from the Government in any one year. It is a condition of the grant that the Association will resume and energetically pursue the work of translating British standard specifications into foreign languages, organise local committees in oversea countries, and endeavour to strengthen its connexions with standardising bodies in other parts of the Empire with the view of the advancement of Imperial standardisation. The position will be reviewed again by the Government at the end of the period of five years during which the annual grants will be made.

The Association needs no exhortation to carry out these conditions, for they have indeed been the essence of its policy for many years ; in particular, the work of translating and of co-operating to the utmost possible extent, not only with other Empire bodies but also with foreign, has always been in the foreground and has been given the closest attention. The chairman, at the last meeting, was in fact able to refer with justifiable pride to the excellence, for example, of the recent Spanish translations, which would greatly facilitate the spread of standardisation not only in Spain but also in the great and rapidly developing communities of South America.

By way of exemplifying the tremendous growth and extent of the new fields to be covered, it is only necessary to refer to the comparatively new industries of aviation and wireless. In both of these there is almost unlimited scope for standardisation, and already numerous specifications have been agreed upon and published. Tentative feelers have been put out also towards the chemical industries and several conferences have been held. Hitherto, the work of drafting agreed specifications as a basis for contracts and other purposes has been undertaken by individual industries, very often in collaboration with foreign and Imperial interests in the same industry, as, for example, in the glycerine standards and specifications ; but the chairman of the B.E.S.A. is of opinion, and says that it has been generally agreed, that the greatest advantages to be obtained from industrial standardisation would be by the co-ordination of all efforts in a single national organisation. This, on the face of it, appears a very desirable ideal to aim at, but if, beside national co-ordination, one also considers Imperial and foreign co-ordination in all fields of industry, then the whole idea becomes almost colossal.

Great progress has already been made in the desired direction, but the meetings which have been held during the past year by the Central Committee at the Board of Trade have shown very clearly the difficulties of putting into operation on any extensive scale even a national scheme of simplification, without taking into account the further problems of international collaboration. In the national sphere some progress has been made in the building industry; and a very interesting illustration of the Association's widened aims is the recently published specification for the sampling and analysis of small coal, which has been undertaken in co-operation with the Fuel Research Board. This is the first time that a British standard specification has been brought into ordinary everyday commercial relations with the coal industry, and the result cannot fail to be of national value.

The electrical branch of the Association is probably among the most active, especially now that it includes under its ægis the rapidly developing wireless industry and is also growing strongly in other directions. In this branch, too, the international aspect has to be very carefully studied. During the past year, a largely attended meeting of the International Electrotechnical Commission was held in Scandinavia, when more than fifty British delegates were present, and every attempt is to be made to adopt the recommendations of this Commission in electrical work in Great Britain. Similar work is being done in the wireless industry. Other directions in which important and interesting work is being done relate to illumination and transport. Efforts are being made to evolve a standard for artificial daylight, especially with the view of assisting in colour matching.

Generally, the relations of the Association with

the standardising bodies in other countries and oversea dominions, already cordial, are being strengthened and developed, and the recommendations of the Imperial Conference in this matter have been anticipated.

The report of the Conference on Standardisation, already referred to, deals, as we have seen, with the two kinds of standardisation, one of which, the industrial, has been briefly considered in connexion with the work of the B.E.S.A. The other kind, relating to fundamental standards, is really a constituent part of the wider field of industrial standardisation, for this latter necessarily implies uniform and fundamental standards of measurement.

The Conference agreed that Imperial uniformity in these standards is highly desirable, and most of the oversea delegates expressed the view that British standards should be used whenever possible. To this end it is necessary (*a*) to provide in each dominion and in India suitable reference standards for each such unit of measurement used in that country, and (*b*) to provide means for comparison with the corresponding standards at the Board of Trade or the National Physical Laboratory; also that at least one member of the Commonwealth should undertake research so that the fundamental standards can be referred ultimately to natural standards, such as the wave-length of light. The requisite facilities and organisation for such work already exist or are contemplated in most of the oversea dominions, and it remains for closer co-operation to be realised. It may therefore be expected that in many parts of the Empire the standards of derived units, such as the volt, ohm, and the units of length in terms of the wave-length of light, will soon be realised independently. Nevertheless, periodical comparison with the standards in Great Britain should continue, and the report schedules a list of the principal units for which reference standards are likely to be required, with suggested procedure in regard to each.

The report is a useful summary of the work done or proposed in reference to standardisation in various parts of the Empire, and while it does not add greatly to the knowledge of those closely engaged in this field or contain any very original suggestions for solving the many formidable difficulties to be encountered, it provides a definite basis for further work on agreed lines. Moreover, it bestows an official blessing on what is being done and justifies a hope of wider and more intelligent recognition and support.

Morphology of High Molecular Weights.

Der Aufbau der hochpolymeren organischen Naturstoffe: auf Grund molekularmorphologischer Betrachtungen. Von Kurt H. Meyer und H. Mark. Pp. viii + 264. (Leipzig: Akademische Verlagsgesellschaft m.b.H., 1930.) 18 gold marks.

THE problem of fibre structure has been well to the fore during the last few years, especially in the minds of our German friends, and this really stimulating book is the outcome of their meditations on a subject the interest and importance of which are difficult to over-estimate. One might almost claim that the study of fibre structure and fibre properties, carried to its logical limit in the study of *molecular fibres*, is comprehensive enough to include most of the physico-chemical phenomena of living matter; and because we are in the habit of clothing living matter with once-living matter of a fibrous nature, it should be still more easy to substantiate the claim that fibre study is of fundamental importance to industry also. At all events, it would seem that this truism has become palatable in Germany, for here we have a book of first-rate 'academic' interest emanating from such an address as "Ludwigshafen a./Rhein, Hauptlaboratorium der I.G. Farbenindustrie".

It is scarcely possible to suppress a certain twinge of regret that we of Great Britain, so largely dependent on the success of our textile industries, should have played a comparatively inactive part in the actual structure analysis of natural fibres, in spite of the consolation that is to be gathered from the preface and introductory chapters of "Der Aufbau der hochpolymeren organischen Naturstoffe". The authors state plainly at the outset that their treatment of the subject is based primarily on the Bragg concept of atomic and molecular 'sizes', and it is clear that the very considerable success that has attended the analysis of cellulose structures arises from the reasoned application of this principle to the Haworth-Freudenberg formula for cellulose. The extension of the method to the cases of india-rubber, natural silk, and similar polymerised systems, followed naturally. As a matter of fact, model-building has long been a helpful pastime in the Bragg school of crystal analysis, even when the more systematic Continental mind tended to view it with a suspicion which subsequent events have proved to be scarcely deserved.

The great merit of the volume under review lies

in the attempt to correlate a large amount of physical and chemical information with the results of X-ray analysis, a treatment which serves to show once more that structural crystallography is not simply a branch of chess, but a study of such varied applications and possibilities that it is no longer just to regard it even as a sort of second handmaiden of the sciences. It is high time that it took its proper place in our university curricula, so that ideals and aims such as those set forth in the work under notice may attract the attention they deserve and yield their richest returns.

When X-ray analysis points to a small unit of structure and adds a rider to the effect that the periodicity is sound in only one direction, while physical chemistry insists on a high molecular weight, the inference is that we are dealing with crystals, or pseudo-crystals, built up of those typical products of biological activity which the authors call "Hauptvalenzketten". On this thesis they have developed an admirable account of the fascinating ascent which leads from the 'ideally perfect' crystal known as diamond, up through the half-way house of the long-chain paraffins and their derivatives, and on through the synthetic polyoxymethylenes of Staudinger to the complex carbohydrates and proteins, where finally the true crystalline state is lost in the realm of averages and distortions. The whole story is pre-eminently that of the evolution of the "Hauptvalenzkette", even at the risk of offending chemists who might possibly maintain that there is more in protein chemistry than the various permutations and combinations of amino-acid chains in simple peptide linkage. There are those who are prepared to ascribe some part, at least, of the enormous variety in proteins to certain differences in the type of linkage—but it is good, very good, to emphasise the significance in protein structure of mixed crystallisation and its molecular counterpart, the formation of 'mixed molecules'. "Weiter folgt daraus, dass die Bestimmung des Molekulargewichtes aus dem Gehalt des in kleinster Menge vorkommenden Spaltproduktes nicht ohne weiteres brauchbar ist, denn es brauchen nicht alle Moleküle eines Eiweisskörpers auch alle Spaltprodukte zu enthalten, da ja die Voraussetzung, dass alle Moleküle einander gleich sind, nicht mehr gegeben ist." This much, at least, seems clear even from the X-ray analytical data so far available in this field.

There can be no hesitation about recommending "Der Aufbau der hochpolymeren organischen Naturstoffe" as a valuable contribution to the literature of both structure analysis and orthodox chemistry. The research worker, whether academic or industrial, cannot fail to appreciate its helpful and stimulating qualities and find in it a useful source of reference in a wide range of ideas. Above all, there is a very clear account of the X-ray analysis of cellulose and its derivatives, india-rubber, natural silk, and certain other proteins, the whole being enriched by the interweaving of such supplementary and explanatory material as requires a table of 346 references.

W. T. ASTBURY.

The Great Barrier Reef.

A Year on the Great Barrier Reef: the Story of Corals and of the Greatest of their Creations. By Dr. C. M. Yonge. Pp. xx+246+70 plates. (London and New York: G. P. Putnam's Sons, 1930.) 21*s*. net.

THE Great Barrier Reef is one of "the wonders of the world", a breakwater built by living organisms extending along 1200 miles of the Queensland coast. Its seaward edge varies from 10 to more than 100 miles from the shore, and the barrier is an almost continuous line in the northern half, giving place to a series of isolated reefs to the south. On this barrier there are few islets, but the lagoon within is sparsely dotted with sand cays, on one of which, Low Island, Dr. Yonge's expedition made its camp. The continental coast behind varies, being in many parts high and cliffed, and having off-lying islets of volcanic or granitic rock. Many parts of it have been carefully surveyed in recent years by Prof. Richards and his pupils. A bore was also sunk to 600 feet on an islet situated about the middle of the Barrier, but only coral fragments and sand of the regular reef types were obtained. Adherents of each theory of coral reef formation have in turn used the Barrier in support of their views, and this divergence of opinion was a clear indication of the need for further research upon the actual building organisms.

In these circumstances the Great Barrier Reef Committee of Queensland decided to invite a biological expedition from the old country, and this was arranged by a large committee representing zoology, geology, botany and geography, the Empire Marketing Board, most scientific societies and the University of Cambridge co-operating. With Dr. Yonge, who undertook experimental work on the nutrition of corals, were F. S. Russell in charge of plankton, A. P. Orr (hydrography), Drs. T. A.

Stephenson and S. M. Manton (coral ecology and life-history), F. W. Moorhouse (economic animals), S. M. Marshall (plant plankton), G. Tandy (botanist), together with seven volunteer assistants and a party of three geographers. With a few black boys and visitors, the camp had to provide for more than twenty persons, while half of the party required laboratory accommodation similar to that in our universities. Low Island itself is less than 4 acres, but it is on the edge of a shoal of more than 400 acres, most of which is covered with mangroves or shingle exposed at low tide. The seaward reef is largely covered with corals and the whole Barrier is in the East Indian belt, perhaps for marine biology the richest part of the world.

Coral anemones are the chief reef builders by means of their elaborate skeletons of lime, which are excellently described and illustrated. They paralyse their prey by throwing out stinging cells at passing animals and then engulf them. Their whole surface is covered by vibratile hairs (cilia), the main function of which is shown to be the keeping of their surfaces clean. They also assist by directing a current of water with its organisms into the coral mouths, out of which all excreta and the coral larvæ are passed by the same means. The corals are carnivorous; "vegetable matter is useless to a coral". In the inner cell layer of the coral polyps are countless numbers of tiny round unicellular algæ, which appear to supply oxygen to the corals, while they obtain the normal food materials of plants from their host's excretion. In correspondence with these methods of feeding, most corals seem to expand at night and to contract in the day. The same system, perhaps, applies to *Heliopora*, *Millepora*, and many other animals allied to the true corals, but we have to await the publication of the author's experimental work. The life-histories of corals were studied, the young being extruded from the mouth as planulæ, small masses of cells which float away in the currents. These were found to be extruded during the summer at regular intervals of one month "over the period of full moon", but in autumn the intervals increased so that extrusion began to appear "about the period of the new moon". This "lunar periodicity" was better marked in *Chiton*, which, "collected the day before, spawned on the night of full moon". Observations were also made on the rate of growth of corals which were embedded in cement blocks. Photographs show an increase in diameter of 40 to 80 per cent in six months.

Many other reef inhabitants are described. The giant clams are divided into two groups, one of which is seated on the surface of the reef, while the other works its way into the rock, so that the mantle edges look like undulating worms of brilliant hue moving over the reef below. This edge was found to be covered with a brown scum of cells similar to the algæ of corals, which here are regarded as playing "an important part in the nutrition of the animal". While some of these "giant cockles" reach a length of 4½ ft.—a pair are used as holy-water stoops in St. Sulpice in Paris and weigh a quarter of a ton—the common burrowing species are quite small, sixteen having been found in an area of 18 inches square. Of still more importance is the date stone (Lithophaga), a bivalve which bores by "special glands pouring out an acid". Bêche-de-mer, "animated sausages" of large size, continuously shovel sand into their mouths and by triturating it assist in reef destruction. They are fished largely by the aborigines of the Torres Strait region, being split open and dried, to be exported afterwards to China for soup. The pearl shell industry was already well known, but the *Trochus*, a large coiled mollusc, has only been developed as a result of the War, the total export being probably about 1000 tons, valued at £100,000. The animal grows at the rate of about an inch a year for four years, reaching a maximum of 6 inches, but slowing down after 4 inches. It breeds during the winter months, and the adults have quite remarkable powers of hiding away under rocks. The sponge industry seems as yet little developed.

The description of the work of the expedition on the surface fauna and flora is an excellent account of this line of research, the means by which it is pursued, and the objects sought. It is noticeable that there is little fluctuation in the plant plankton during the year, and that the numbers on the average are less than in temperate seas. A good point is made in regarding the coral algæ as "imprisoned phytoplankton" intercepting "the nutrient salts which the coral would otherwise excrete into the sea and so increase its fertility". The vertical movements of the plankton were especially studied, the depth of its concentration being all-important to the animals which feed upon it. There are interesting accounts of the bottom fauna and of visits to Thursday Island, the Torres Straits barrier, and the Capricorn group, but the full record of these must be sought in the scientific publications of the expedition. The story is of natural history, and our author, who has a fine journalistic sense,

loves his beasts and applies the biological methods of 1928 to his study of them. His book must be read by every student of marine biology, and will be found entertaining by that far wider circle which is interested in the wonders of the world.

J. STANLEY GARDINER.

Archæology from the Air.

Ordnance Survey Professional Papers. New Series, No. 12: *Air Photography for Archaeologists.* By O. G. S. Crawford. Published by Order of the Director-General, Ordnance Survey, under the Authority of the Ministry of Agriculture and Fisheries. Pp. 44+19 plates. (London: H.M.S.O.; Southampton: Ordnance Survey Office, 1929.) 4*s.* 6*d.* net.

AIR photography has ceased to be a novelty or a toy, when the Ordnance Survey Office issues a 'professional paper' for the instruction of archæologists in the reading of air-photographs, with hints for airmen also, on the making of such photographs of ancient sites. For 'shadow-sites', recorded with the very oblique light of dawn or evening, need different treatment, and yield different results, from bare soil and rocks, best avoided at any time, and from 'crop-sites' where the growth varies as ancient walls or ditches present either more or less than normal soil or moisture. How striking these variations may be, appears from these admirable photographs, despite the elimination of colour-contrast. In Nature, they may often be detected by pedestrians; and, as is noted on p. 4, this method of archæological survey goes back some way—even further than is stated, for in the reference to Northfield Farm 1904 should be 1894, and the significance of weeds among the corn was suggested by even earlier experience among the tomb-robbing peasantry of Cyprus. There the contrast was enhanced by the effects of parching, such as is described on p. 5: and it may be noted that Mr. Crawford's hopes of "another dry year" were realised in the summer of 1929. Soon, it is hinted, we shall find the normal rotation of crops interrupted by archæological insistence on horse-beans, which have long enough roots to register deep-seated antiquity.

One of the more remarkable revelations of this air photography is to display the very wide extent of earlier farming. Very few tracts have survived altogether untouched; and the question arises, What is the significance of all this, from the points of view of economic history and climatology? Another, not specifically discussed in this memoir, is the marked difference in texture, as seen from the air, of different kinds of grassland, according to the subsoil and geological foundation.

What a training in observation, and the significance of things seen, is all this archæological work for the pilots of the Royal Air Force, who have actually taken the photographs! For it is a very different thing to record known objects, however ingeniously devised to be puzzling, and to engage in what is at the same time real research, in the sense that not even the archæological officer knows beforehand what there will be to see; though evidently he has usually a shrewd notion what is worth exploring and what is not.

This memoir is an indispensable supplement to the author's "Wessex from the Air"; and the four plates borrowed from that book were worth reprinting for the sake of their present letterpress and the light thrown on them by their present company.

J. L. M.

The Position of Women in India.

The Key of Progress: a Survey of the Status and Conditions of Women in India. By several Contributors. Edited by A. R. Caton. Pp. x + 250. (London: Oxford University Press, 1930.) 7*s.* 6*d.* net.

MISS CATON and her collaborators have produced a book which is indispensable to the student of Indian problems—social, religious, educational, sanitary, industrial, and political. The backward condition of the women in India is one of the root-causes of the backwardness of India as a whole, and the title of the book is taken from a striking sentence in the Simon Report—"the women's movement in India holds the key of progress, and the results it may achieve are incalculably great".

The eight chapters on education, health and sanitation, public life, home and marriage, rural life, industry, and social evils are documented at every point; and the references, which, apart from a few slips of trifling importance, are accurate, give a mass of important facts, skilfully and conveniently arranged.

The section on education is largely based on the Report of the Education Committee of the Simon Commission. It points out that in British India the percentage of male literates in 1921 (at the last census) was 13·0, of female literates 1·8, and that up to 1921 the discrepancy in literacy between men and women was increasing. The discrepancy between the number of boys and girls under instruc-

tion is also increasing. Between 1922 and 1927 the increase in the number of boys under instruction was 2,400,000; the corresponding increase in the number of girls was only 400,000.

The obstacles to women's education and all that it means are conservatism in social customs, purdah, and early marriage; and these, with want of education, are the great enemies of women's health in India, and contribute largely to infant mortality. Dr. A. Lankester reported in 1920 that in many cities in India more than twice as many women suffered from phthisis as men. Dr. K. Vaughan, writing in 1928, attributes most of the trouble in child-birth in India to the lack of sunlight due to purdah, with, as its result, osteomalacia and gross pelvic deformity (and it may be added, anæmia). It must, however, be remembered that in large tracts of India, for example, Bombay and Madras, purdah does not prevail (though, except in highly educated circles, the sexes do not mix as in the west). All over India, in spite of recent efforts, the number of skilled doctors and of skilled midwives is small, and the ordinary midwife is desperately inefficient. The recent Report of the Age of Consent Committee (1929), of which only one member was European, gives a painful picture of the effects on health of marriage below the age of sixteen. It is to be hoped that the new Sarda Marriage Act (which could probably not have been passed but for the Age of Consent Report) may stop the evil—when it is enforced.

In turning over the pages of Miss Caton's book it is impossible not to be impressed by the immensity of the work still to be done. On the other hand, there has been a real awakening in India, as every recent report shows. Discounting a good deal of lip-service (especially on the educational side), we must recognise the existence of a large number of agencies, educational, medical, and social, for the improvement of the conditions of girls and women. Indian women themselves, coming from educated and comfortable homes, are now pleading in public the cause of their less fortunate sisters; and some of them have recently occupied conspicuous positions in the world of politics and education. The late Begum of Bhopal was Chancellor of the University of Aligarh, and an able Chancellor; Mrs. Muthulakshmi Reddi was an extremely active Deputy-President of the Madras Legislative Council. But it is in the villages that a change in the position of women is perhaps the most important. Mr. F. L. Brayne, who has done so much in the Gurgaon district of the Punjab, writes: "If I might pick out the heart and centre of the uplift campaign, I should say that it was the elevation of the women".

One must not exaggerate. Inside many Indian homes, the influence of the woman, and especially the grandmother, has been supreme. But the transformation of India, necessary to make her come into line with other countries, will only be possible when the brains of the women are utilised to a far greater extent than at present. There is no sign that they are inferior to those of women in the west. P. J. HARTOG.

Our Bookshelf.

A Cultural History of the Modern Age: the Crisis of the European Soul from the Black Death to the World War. By Egon Friedell. Translated from the German by Charles Francis Atkinson. Vol. 1: *Introduction.* Book 1: *Renaissance and Reformation, from the Black Death to the Thirty Years' War.* Pp. ix + 353 + vii. (London: Alfred A. Knopf, 1930.) 21*s.*

THIS is an extraordinarily stimulating and attractive book. It inclines a reviewer to write far more than his editor could possibly include; for every page either gives provocative pictures of leading figures in the past or else raises profound and eternal questions for discussion. The author sets out to give an "incomplete" but artistic presentation of the modern European world: to pick out, that is, those features in the modern world which he finds of most significance—especially of spiritual significance. He writes well and with enthusiasm. Among recent historical works noticed in these columns, the book most like this is Dr. Wingfield-Stratford's "History of British Civilisation". What he does for England, Dr. Friedell has begun to do in this volume for Europe.

One striking point in which the present author differs in his general outlook from Dr. Wingfield-Stratford raises one of those great questions which we should like to discuss at length. Dr. Friedell declares that his is not to be an economic history, and that "economic life, far from being an adequate expression of any culture, does not, strictly speaking, belong to culture at all, only contributing one of its preliminary conditions and not the most vital". So far we might agree with him. But when he goes on to treat science as the lowest part of the thinking side of man, inferior to philosophy and far inferior to religion, we feel less confidence in his powers of analysis. Science cannot thus be identified with technology and marked off from the sphere of creative thought which embraces art, philosophy, and religion. If art is creative in an individual and eternal form which is denied to any particular scientific construction, yet the mental process has common creative elements in both cases, and to treat philosophy and religion as independent of science would, if it were possible, be a still more serious mutilation of the reality of thought. F. S. M.

Handbuch der Experimentalphysik. Herausgegeben von W. Wien und F. Harms. Unter Mitarbeit von H. Lenz. Band 25, Teil 3: *Angewandte Geophysik.* Unter der Redaktion von G. Angenheister. Pp. xii + 556. (Leipzig: Akademische Verlagsgesellschaft m.b.H., 1930.) 54 gold marks.

THIS work opens with a short account (48 pages), by H. Reich, of the geological foundations on which applied geophysics must build; the remainder of the book consists of small treatises on the various methods, each by a specialist in the method. Gravimetric methods are discussed by K. Jung (162 pages); the next section, on seismic methods, is divided into two parts, one (of 40 pages), by O. Meisser, on 'air-seismology', and the other (of 55 pages) on earth-seismology; the former, though interesting in itself, seems out of place in the present volume, as it bears on the constitution of the upper atmosphere, and not on that of the earth's interior, to which applied geophysics (as now understood) refers. Magnetic methods of prospecting are discussed in 100 pages by H. Haalck, and electrical methods by J. N. Hummel and W. Heine, the former dealing with the theory (67 pages) and the latter with the practice (56 pages). J. N. Hummel also contributes the final section (28 pages) on radioactive methods.

The price of the book, 54 gold marks, seems excessive, but will doubtless not deter commercial users, who are those chiefly concerned with the subject, from purchasing a copy. Even they, however, may feel that the multiplication of books covering much the same ground can be overdone, especially when at so expensive a rate. Some of the joint authors of this volume have recently published fuller accounts, in separate books issued by another publisher, of the sections which they here deal with; the shorter accounts in the present work have the advantage, however, of including mention of the most recent work, with references.

Egyptian Civilization: its Sumerian Origin and Real Chronology, and Sumerian Origin of Egyptian Hieroglyphs. By Dr. L. A. Waddell. Pp. xx + 223 + 21 plates. (London: Luzac and Co., 1930.) 12*s.* 6*d.* net.

IN this volume, the seventh of the series that Col. Waddell has devoted to the exposition of his views on the origin and relations of the great civilisations of antiquity, the author aims at demonstrating the historical character of Menes as an Aryan, a descendant of the first Sumerian or Aryan king who founded civilisation. He maintains that Menes was at one and the same time the Sumerian emperor in Mesopotamia and the first dynastic king of Egypt, a crown-colony of his world-empire.

In a previous volume it has been held that Harappa and Mohenjo-Daro are the relics of a Sumerian colony in India. Arguing from identifications in the king lists of India, Mesopotamia, and Egypt, it is now maintained that Menes was the son of Sargon, the ruler of an empire extending from India to Britain. Egyptian civilisation is made to date from the conquest of the country by the pre-dynastic Pharaohs, now shown to have been Sumerian emperors, the father and grandfather of Sargon, the date of the conquest being about 2780 B.C. Menes, the crown-prince and governor of the Indus valley, erected Egypt into an independent kingdom, civilised Crete as Minos or Min, and extended his power to the Pillars of Hercules and Britain. Col. Waddell regards any discrepancy between his theories and those of a more orthodox chronology as due to the weakness of archæological dating; but until he convinces scholars of the accuracy of his identifications—a difficult task, we fear—his own chronology hangs in the air.

The Art of Study. By Prof. T. H. Pear. Pp. vii + 117. (London: Kegan Paul and Co., Ltd., 1930.) 3*s.* 6*d.* net.

THIS book is the outcome of some broadcast talks to school children on how to concentrate. The author has expanded and developed these talks so that they apply not only to school children, but also to children of maturer years who may find they want to study something and yet feel they do not know how to do so.

Perhaps nobody but Prof. Pear can put abstract psychological problems in such a winning way; the chief difficulty is that the knowledge behind his exposition is so artistically disguised that readers may erroneously believe that the problems involved are really very simple. He discusses what we mean by learning; the differences in people with regard to mental make-up so that a method of study useful to one may be a stumbling-block to another; how to form habits of study; how to memorise. Interspersed between the facts is much good advice, tendered by one experienced in the difficulties of learners.

This book can be recommended as really being what it is called, the art of study; the science of study forms the background.

Jorullo: the History of the Volcano of Jorullo and the Reclamation of the Devastated District by Animals and Plants. By Dr. Hans Gadow. Pp. xviii + 100 + 2 plates. (Cambridge: At the University Press, 1930.) 7*s.* 6*d.* net.

JORULLO stands in an amphitheatre amongst the foothills of the great southern slope of the Mexican plateau. It was subjected to a series of eruptions between 1759 and 1775, about five square miles of land being buried and probably at least ten times as much completely devastated. The late Dr. Gadow, who meditated a larger work on the distribution of animals in Central America, spent a month there and tells the story of the repeopling of the area by plants and animals. These penetrated the devastated area at an average rate of a mile in forty years. This is slow as compared with Krakatoa, to reach which most organisms must have used sea transport, but this is explained by the situation of Jorullo being in a comparatively dry area. We would not care to draw deductions after a month's collecting, but Dr. Gadow was unique in his knowledge of the ways of reptiles and amphibians, upon which mainly he bases his views.

Letters to the Editor.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, nor to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

Mercury Band System in the Neighbourhood of the Resonance Line.

A BAND in the mercury spectrum referred to as 2540 has been the subject of much discussion, owing to its proximity and apparent relationship to the resonance line 2536·52, and to the fact that it is seen in absorption by unexcited mercury vapour of suitable density. I have long suspected that this is only one feature of a complicated band system in this neighbourhood. The investigation is much embarrassed by the glare of the resonance line, which makes it difficult to photograph delicate details in the immediate vicinity.

Recently examining some old spectrograms of a water-cooled mercury arc, I have been able to measure two similar and additional bands between this one and the resonance line. The wave-lengths are 2540·37, 2538·44, 2537·32. These are shaded *from* the red.

In addition, two bands have been measured on the other side of the resonance line at 2535·82 and 2535·35. These are shaded *to* the red.

There are faint suggestions of much more, which could probably be made definite if the source were carefully adapted to the purpose. Unfortunately, the large spectrograph used was destroyed by fire, which hinders any immediate progress.

RAYLEIGH.

Terling Place, Chelmsford,
Jan. 12.

Methods of Investigating the Intensities of γ-Rays.

THERE are two important methods of investigating the intensities of γ-rays, that of Skobeltzyn (*Zeit. f. Phys.*, **43**, 354; 1927: **58**, 595; 1929) and that of Ellis and Aston (*Proc. Roy. Soc.*, A, **129**, 189; 1930). We wish to point out that the results of the measurement of the intensities of the γ-rays of radium B and radium C by these two methods are in as good agreement as can be expected.

Skobeltzyn's method, which depends on the Compton effect, determines the intensity distribution throughout the spectrum, in the sense that it gives the quantity I_ν when $I_\nu \Delta\nu$ is the aggregate intensity of the γ-rays the frequencies of which lie in the interval ν to $\nu+\Delta\nu$. The quantity $\Delta\nu$, in this connexion, is not a differential, but is to be understood as an interval determined by the conditions of the experiment. In certain parts of the spectrum where there are two or more strong γ-rays close together, it is not possible to separate their effects, and, as can be seen from col. 3 of the following table, the Compton effect method gives the summated intensity (cf. Skobeltzyn, loc. cit., **58**, 609, Table 2, col. 4).

The method used by Ellis and Aston depends on the photoelectric effect, and while there are certain definite disadvantages in the method, it does possess the important advantage of giving the intensities of the individual γ-rays. These are shown in col. 2 of the table corrected for filtering through 3·5 mm. of lead to correspond with the conditions of Skobeltzyn's experiment. The ratios of the intensities obtained by the two methods are given in col. 4, from which it will be seen that there is on the whole good agreement.

To see what can be deduced from this agreement it is necessary to refer briefly to the main features of the measurements. Skobeltzyn's method depends on observing by the Wilson cloud method the relative number of electrons ejected within a certain angular range by the Compton effect of the different γ-rays. It is generally accepted that the data about absorption

INTENSITIES OF THE γ-RAYS OF RADIUM B AND C.

$h\nu$ of the τ-rays (volts × 10^{-5}).	Intensities by photoelectric method after 3·5 mm. lead (I_p).	Intensities by Compton effect method (I_c).	$\frac{I_c}{I_p}$.
2·43	0·011		
2·97	0·056 } 0·22	1	4·5
3·54	0·152		
6·12	0·415		
7·73	0·046 } 0·46	1·8	3·9
9·41	0·050		
11·30	0·160 } 0·26	1·19	4·5
12·48	0·050		
17·78	0·22	0·81	3·7
22·19	0·064	0·27	4·2

coefficients needed to deduce the relation intensities of the γ-rays is sufficiently well known for purposes such as the present, and that there is no fundamental uncertainty in the method.

Ellis and Aston's method, which depends on the photoelectric effect, determines essentially the relative values of the quantities $I_1\tau_1$, $I_2\tau_2$, etc., when I_1, I_2, etc., are the intensities of the γ-rays and τ_1 and τ_2, etc., corresponding photoelectric absorption coefficients. There is at present no direct experimental evidence about the variation of τ at these high frequencies, and to evaluate the results it was necessary to extrapolate from the X-ray region by an empirical formula.

The general agreement between the results of the two methods suggests that this extrapolation is approximately correct, and that we have therefore reasonable grounds for accepting the values of the individual intensities of such γ-rays as were measured by the photoelectric method.

In view of the important part played by the intensities of the γ-rays in certain speculations about the structure of radioactive nuclei, we feel it is of interest to point out how these two methods, when combined, yield information which is far more definite than that supplied by either alone. The certainty of the Compton effect method supplies just that deficiency in the photoelectric effect method, whilst the latter has the power of dealing with individual γ-rays, the lack of which is the chief disadvantage of the Compton effect method. A further point which brings out the complementary nature of the two methods is that the photoelectric method is best suited to lower frequency γ-rays, whilst the Compton effect method deals, if anything, rather more easily with the higher frequency γ-rays.

C. D. ELLIS.
D. SKOBELTZYN.

Uniform Propagation of Flame.

MASON and Wheeler,[1] following the initial observation of Mallard and Le Chatelier, considered that when a gaseous explosive mixture is suitably ignited at the open end of a horizontal glass tube, the other end of which is closed, flame travels at a uniform speed for some distance. The results of their experiments have been extended further by Wheeler and

his collaborators to the formulation of a speed law,[2] which has since been criticised by Bone, Fraser, and Winter, and interesting experimental evidence brought to disprove the so-called speed law.[3] At about this time one of us (H. K. S.) was engaged in the determination of ignition temperatures,[4] and came to recognise a certain approximate relation (1 : 2) between the ignition temperatures and flame temperatures of the mixtures generally studied for the uniform propagation law.

From a mathematical analysis (a full account of which is being published elsewhere) we find that a regime of initial uniform flame propagation is *possible*, assuming that pressure plays no part during the short interval of this propagation. Our analysis shows that uniform propagation is given by an equality (not by a certain quantity lying between two limits), which of necessity must be delicately balanced. It is thus possible that in some mixtures uniform propagation may not exist.

The velocity equation developed by us is more rigid than that of Mallard and Le Chatelier and takes note of the distribution of temperature in every section of the gaseous medium comprising the travelling flame. For, whilst Mallard and Le Chatelier's formula implies that the gas immediately in front of the flame is at the constant room temperature, and that at the back is merely at the ignition temperature, we incline to regard the travelling flame as a region having temperature gradients corresponding with the combustion temperature T, at the rear, and the ignition temperature, θ, at the front; in advance of this there is a

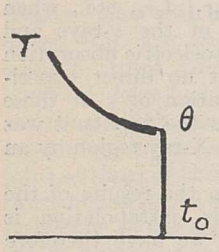

FIG. 1.
(Mallard and Le Chatelier.)

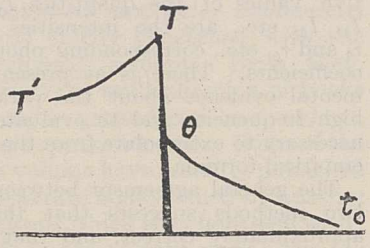

FIG. 2.
(Sen and Sen.)

progressive fall of temperature to that of the cold gas t_0, due to the cumulative effect of the heat generated in the reaction (Fig. 1 and Fig. 2).

On examining our velocity equation we find that the condition for uniform propagation is $\theta = \frac{\alpha Q}{\rho C}$ where

θ = the ignition temperature;
ρ = density of the inflammable mixture, and
C = specific heat;
αQ = the fraction of the total heat of combustion utilised for conduction.

In applying this relationship it must be borne in mind that the flame, the seat of chemical reaction, which in our analysis has been replaced by a mathematical heat source, actually possesses a finite width in which the temperature gradient is represented, say, by some curve, ABC in Fig. 3.

$PCAF$ represents the flame and $FA = \theta$ the ignition temperature. In this distribution, account is taken of heat losses.

$\frac{\alpha Q}{\rho C}$ then represents the average temperature in the flame, the average being taken with regard to the width AD. Moreover, since αQ corresponds to the heat available after combustion, the average temperature here is to be measured above the level of the ignition temperature AD, and is, therefore, given by the area $ABCDA$ divided by the width AD. Let BM represent this average temperature given by $\frac{\alpha Q}{\rho C}$. Hence the condition for uniform propagation is that θ, the ignition temperature, should be equal to BM, or, in other words, the average flame temperature should be double the ignition temperature of the combustible mixture. The modification of the value of αQ may slightly disturb the condition. As stated already, since the distribution of temperature in the flame is intimately connected with the velocity of chemical reaction, the latter may be supposed to be contained in the above condition.

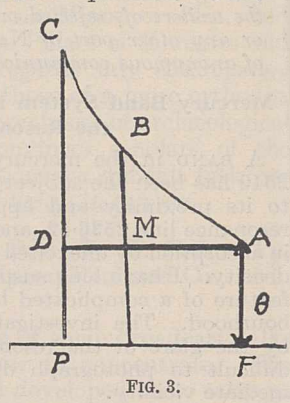

FIG. 3.

We are in a position to test in a few cases the validity of this relation by comparing the ignition temperature and the flame temperature of uniformly propagating mixtures:

	Approximately Instantaneous Ignition Temperatures.	Approximate Flame Temperature.	
	θ	T	T/θ
Coal gas + air	880° C.	1780°	2·02
Methane + air	* 875°	1670°	1·91
Ethylene + air	1000°	1900°	1·90
Carbonic oxide + air	* 815°	1700°	2·08

* These figures represent the means of those given by Dixon and McDavid.

N. R. SEN.
H. K. SEN.

University College of Science,
Calcutta, India.

[1] *Trans. Chem. Soc.*, **111**, pp. 1044-1057; 1917.
[2] Payman and Wheeler: *Trans. Chem. Soc.*, **121**, 363-79; 1922. Payman: *Trans. Chem. Soc.*, **123**, 412-420; 1923.
[3] Faraday Society's Discussions, 1926; also *Proc. Roy. Soc.*, A, **114**, 402-449; 1927. *Phil. Trans.*, A, **228**, p. 197; 1929.
[4] Sen and Chatterjee: *J. Ind. Chem. Soc.*, pp. 441-450; 1929.

Alternation in Properties of Long Chain Carbon Compounds.

ONE of the most interesting features of long chain compounds in the solid state is the well-known alternation in properties depending upon whether the chain contains an even or an odd number of carbon atoms. The X-ray work of Müller on single crystals and of Piper, and Müller and Shearer on the long crystal spacings has shown that long chain compounds crystallise in long zigzag chains lying perpendicular or tilted with regard to the planes formed by the terminal groups. It follows at once that there will be a difference between chains containing an odd and an even number of carbon atoms; the terminal groups being respectively in the *cis* and *trans* positions. It has been suggested by Pauly [1] and Nekrassow [2] that this is the cause of alternation, and Müller,[3] apparently unaware of this, came independently to the same conclusions.

The difficulty with regard to this theory is that it implies alternation in all long chain compounds independent of the tilt of the chain (see Fig. 1), whereas, actually, the paraffins, methyl ketones, alcohols, and ethyl esters of mono- and di-basic acids do not alternate. It is now suggested by me that the essential

feature of an alternating series is that the zigzag chain is *tilted* with respect to the terminal planes.

X-ray and thermochemical [4] work indicates that alternation is due to some difference in the terminal groups; it will be seen from the figure that there is no essential difference in the terminal planes, between odd and even, when the zigzag chain is vertical. In tilted chains, however, a difference is at once apparent, alternate terminal planes of odd chains being less closely packed. This is readily seen if the distances between penultimate carbon atoms in two chains are considered (*a* and *b* in Fig. 1); over these different distances the same groups are responsible for holding the molecules together. The stability of odd chains will therefore be smaller than that of even, and they will melt at the lower temperatures.*

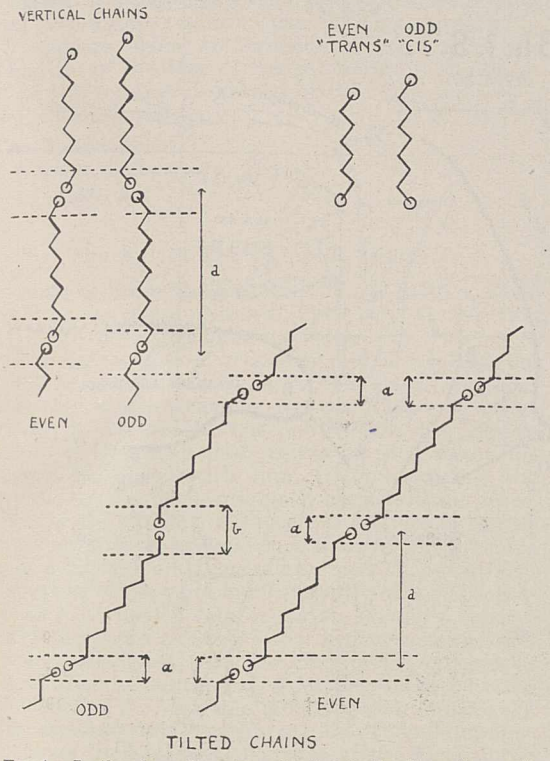

FIG. 1.—In the above diagrammatic sketch, the discontinuous lines are parallel to terminal planes. Circles represent terminal groups. d = long crystal spacing ($2d$ in the case of double molecules).

X-ray evidence is in agreement with the above suggestion: thus, non-alternating series possess vertical chains (hydrocarbons, methyl ketones, alcohols), whereas alternating series possess tilted chains (mono- and di-basic acids, iodides, and nitrils). The following experimental facts are also clear from the figures: (1) The long spacings of odd alternating compounds are always slightly greater, in proportion, than the even, whereas in non-alternating series odd and even spacings increase linearly. (2) The molecular volumes of solid odd fatty acids are greater than those of the even.[5] (3) The even alternating series are more tilted than the odd, as was shown in the case of di-basic acids.[6]

The only apparent exceptions to the above rule are the ethyl esters of mono- and di-basic acids, which normally possess tilted chains. I now find that ethyl esters of fatty acids possess vertical chains just below the melting-points, and although I have not examined esters of di-basic acids, it is noteworthy that Normand, Ross, and Henderson [7] observed a second longer spacing for the ester of undecane dicarboxylic acid, which melts just a little above room temperature. It seems probable that this longer form would appear generally, for the series, at temperatures not too far removed from the melting-points.

A detailed account of an investigation of the long spacings of ethyl and methyl esters, showing the alternate forms in which they both exist, together with a fuller discussion of the above, is in preparation. It may be mentioned here that methyl esters differ fundamentally from ethyl, behaving in a weaker degree like the acids and crystallising in double molecules with the polar groups together. This offers a satisfactory explanation of their anomalous high melting-points, since ethyl esters crystallise in layers of single molecules.

My best thanks are due to Mr. S. H. Piper for his encouraging interest in the work.

T. MALKIN.

H. H. Wills Physical Laboratory,
and the Chemistry Department,
University of Bristol,
Dec. 27.

[1] *Zeit. f. anorg. Chemie*, **119**, 281; 1921. Pauly also introduces polarity considerations.
[2] *Z. f. phys. Chem.*, **128**, 208; 1927.
[3] *Proc. Roy. Soc.*, A, **124**, 318; 1929.
[4] Garner and Randall, *Jour. Chem. Soc.*, **125**, 881; 1924.
[5] Garner and Ryder, *ibid.*, **127**, 721; 1925.
[6] Caspari, *ibid.*, 3236; 1928.
[7] *Ibid.*, **127**, 2632; 1925.

Optical Investigations on the Passivity of Iron and Steel.

SOME results concerning the passivity of metals were described by me recently in NATURE,[1] and afterwards published *in extenso*.[2] It may now be of interest to give some new data obtained by means of optical methods. These experiments were all carried out by employing mirrors of iron and steel—both ordinary steel and stainless steel—electrolytically treated simultaneously in baths of alkaline, neutral, or acid sodium sulphate solutions. Different current densities were used.

It is well known that Drude [3] has developed equations which are valid for reflection in air, and by means of these it is possible to compute approximately the mean refractive index and the mean thickness of a surface film from the change in polarisation of the reflected light. These equations have now been generalised so as to apply to any medium, and they consequently hold good also for films formed in aqueous solutions.

In preparing the metal mirrors, special precautions should be taken to exclude the possibility of any increase in the thickness of the surface film, and I have always attached great importance to this point. The constants found by the old methods of preparation are therefore not likely to agree so thoroughly with the true values for the compact metal—free from any 'air-formed' films—as do the optical constants obtained by the method employed in this investigation.

According to Bannister and Evans,[4] the process of activation brings about destruction of the 'air-formed' film, and thus a definite 'standard state' of the mirror could be obtained after a few minutes. On the other hand, destruction of the mirror itself also occurred in some cases.

It is remarkable that during the very first time of making the metals passive, all mirrors examined showed a change in the reflected light, which corresponded to the formation of a surface film with a mean refractive index of about 3·0 and a mean thickness of about 30 A. The mean refractive index computed in this way agrees with

* The case of the iodides where this is reversed will be discussed elsewhere.

that of ferric oxide, and from this fact it is evident that the film is actually an oxide film, as demanded by the theory of Faraday. Since the optical properties of the mirrors are constant during the process of continuous anodic treatment, independently of the current densities employed, it is further evident that the films should be impenetrable to the constituents of the solution, for example, to atoms or molecules of oxygen. The metals are, therefore, made passive in the real sense of the word.

As a general rule, reactivation did not completely remove the oxide skin, the destruction of the film on the ferrite grains, however, being more pronounced than that on the cementite grains. Thus, by alternating cathodic and anodic treatment (the current was reversed three times in the course of three hours), the oxide film on the cementite particles was microscopically visible as dark brown spots, whereas on the ferrite particles faint yellow interference colours could be detected only by employing slanting incidence. According to Evans,[5] the rate of destruction of the films decreases when the solutions are made alkaline, and hence the average thickness of the film is greater in these solutions than in neutral or acid baths.

The experimental part of this investigation was carried out in the Metallografiska Institutet, Stockholm, and I wish to thank the Director of the Institute, Prof. C. Benedicks, for his help and kindness during this time. A complete record of all data obtained are to be published in *Det Kgl. Norske Videnskabers Selskaps Skrifter*, 1931 (*Transactions of the Royal Society of Science*, Nidaros, Norway).

L. TRONSTAD.
Norges Tekniske Höiskole,
Nidaros, Norway,
Dec. 12.

[1] NATURE, **124**, 373; 1929.
[2] *Zeitschrift für physikalische Chemie*, A, **142**, 241; 1929.
[3] *Wied. Ann. Phys.*, **36**, 532, 865; 1889.
[4] *J. Chem. Soc.*, 1361; 1930.
[5] *J. Chem. Soc.*, 478; 1930: NATURE, **126**, 130; 1930.

Mechanism of Bengal Tornadoes in the Nor'wester Season.

THE first requisite of tornado formation is a violent updraught of moist air. In a paper on the nor'westers in Bengal, which will be published shortly, it is being shown from a large number of weather charts that the nor'wester squalls during the period February to June are due to the katabatic flow of air-wedges advancing along the valleys and undercutting moist southerly winds over the plains of Bengal. In the afternoon when the moist air has attained a certain specified state, conditions become favourable for the formation of squalls near the 'noses' of the valley air-wedges. The strength of the squalls increases with the depth of the valley and of the Bay air, and the temperature differences between the two air masses. The accompanying diagram (Fig. 1) is based on the 13 h. I.S.T. chart of April 27, 1930, when a passenger steamer named *Condor* was caught in a violent squall, believed to have been of tornadic violence, and sank at 17 h. near Nagarbari.

A detailed analysis of daily weather charts shows that the Bay current becomes divergent in the presence of a valley air-wedge or barrier. In the diagram the divergent moist air stream lines due to wedge-barrier *A*, advancing from the Brahmaputra valley, are the systems *a* and *b*, whilst those due to *B*, advancing from the Cachar valley, are *c* and *d*. Of these, the systems *b* and *c* converge along the broken line *PQ*,

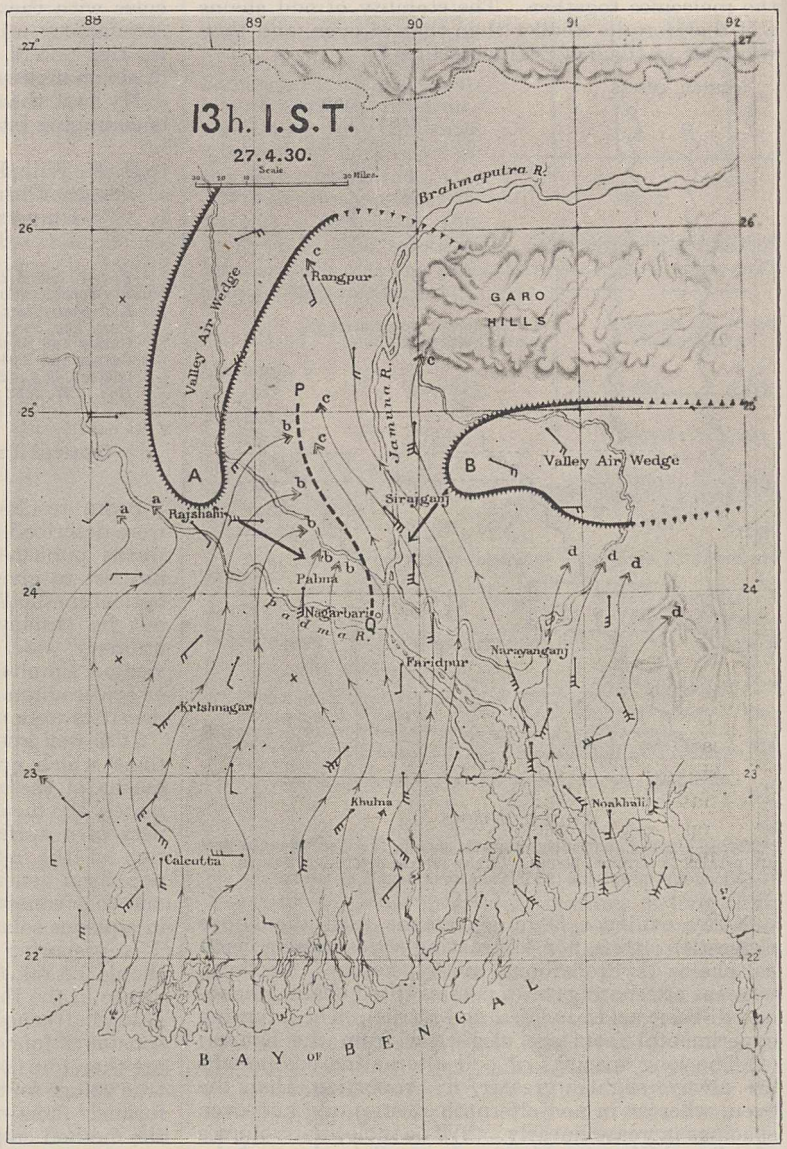

FIG. 1.

initiating an anti-clockwise circulation between the two wedge-barriers and consequently an updraught which is probably sufficient for ordinary thunderstorms. The directions of motion of the 'noses' of *A* and *B*, indicated by the long thick arrows from the tips of the wedges, were such that the two 'noses' apparently collided with each other (*A* travelling approximately three times as fast as *B*) at Nagarbari, situated approximately at the junction of the two rivers, the Jumna and Padma. The upward convection was, therefore,

much accentuated, due to the motion as well as the lateral displacement, slipping, or spreading of the wedge-barriers.

On the day of the *Condor* disaster the temperature contrast between the valley and the Bay air masses at the surface at 8 h. was of the order of 8° or 9° C. and their depth between 1 km. and 2 km. At and above 2 km. level there was a westerly or north-westerly circulation, wind speed increasing with height, which often carries with it super-adiabatic lapse rates favourable to accelerated updraughts (*vide* Roy and Chatterji, NATURE, Sept. 28, 1929, p. 481). Inversions in the lower layers of the atmosphere over Bengal usually retard updraught of moist air until noon, but this factor often disappears in the afternoon.

The above facts suggest that nor'wester thunderstorms can occasionally develop into tornadoes if additional favourable conditions can combine suitably.

It appears from preliminary studies that the mechanism of the Bay of Bengal storms is similar to that of the tornado described above. The subject is under investigation. S. N. SEN.

The Observatory,
Alipore, Calcutta,
Oct. 22.

The Latent Photographic Image.

IN a recent letter to NATURE (Nov. 15, 1930) A. P. H. Trivelli replies to our criticism (*Proc. Roy. Soc.*, A. **127**, 613; 1930) of his "elementary voltaic cell" theory of latent image formation, originally put forward by him in 1927 (*J. Franklin Inst.*, vol. 204, 649), and concludes that our criticism is not justified. It seems from his letter that he has not realised the significance of our experimental results as they affect his theory. We agree with him, of course, that the larger the silver nucleus originally present in the grain, the less is the amount of silver which must be added during the exposure in order that a development centre may be produced, and hence the greater the sensitivity of the grain. But quite independently of the absolute mass of silver which (according to Trivelli's theory) must be deposited *electrolytically* during the exposure, his theory demands that the electrolytic current in the light shall be enormously great *relative to its value in the dark*. We say this is extremely improbable, mainly because our experiments show that illumination causes little, if any, increase in the electrolytic conductivity of silver bromide.

Our second criticism of Trivelli's theory is based on the fact that the electrolytic current in silver bromide falls exponentially with decreasing temperature, being 10^5 times less at the temperature of boiling liquid oxygen than at room temperatures. On the other hand, photographic sensitivity at the former temperature is still a large fraction of its value at room temperature. Trivelli says, "This objection again ignores the effect of the size of the pre-existing speck. Only if sensitivity specks were totally absent would the temperature coefficient of photographic sensitivity be comparable with that of electrolytic photoconductance." We cannot agree with this. Since the mass of silver deposited in a given time by an electrolytic current depends on the magnitude of the current, a large decrease in current (by lowering the temperature) must necessarily produce a corresponding decrease in the *rate* at which silver is deposited. This is a fact which is quite independent of the number of silver atoms which must be added to the original silver nucleus to make a development centre, and which is, therefore, unaffected by the size of the sensitising nucleus. Therefore, on Trivelli's theory, the temperature coefficient of photographic sensitivity should, to some extent, be comparable with that of electrolytic conductance.

On both these grounds it still seems to us that Trivelli's theory is quite incompatible with our experimental results. F. C. TOY.
G. B. HARRISON.

The Shirley Institute,
Didsbury, Manchester.
Dec. 12.

Structure of Hydrogen Sulphide and Hydrogen Selenide.

IN NATURE of Dec. 13, p. 916, Prof. L. Vegard communicates the results of the investigation of crystalline structure of hydrogen sulphide and selenide, which were made by him in the Physical Institute of Oslo and finished in July last, while his letter is dated Nov. 6.

I may be permitted to recall that I have already published two papers on the structure of these substances. These papers were presented to the R. Accademia dei Lincei in Rome at the meetings of Mar. 2 and April 6, 1930, and published in Fasc. 7 and 8 of vol. 11, 1st sem., pp. 679-684, 749-754. Abstracts appeared in NATURE of Sept. 6, p. 387, and Sept. 27, p. 495.

The data generally agree with those given by Vegard, as for both substances we found a cubic lattice, with face-centred distribution for sulphur and selenium atoms. For the side of the cell (a) and density of hydrogen sulphide our values are also very similar: $a = 5{\cdot}778$ A. (N.), 5·76 A. (V.); density = 1·166 (N.), 1·17 (V.). For hydrogen selenide there is a certain quantitative difference: $a = 6{\cdot}020$ A. (N.), 6·10 A. (V.); density = 3·45 (N.), 2·34 (V.), as to the cause of which I cannot for the moment decide, and which I shall investigate further.

For the distribution of the hydrogen atoms and the structure of the whole lattice, Vegard considers as most probable space groups T^4 or T_2^6. Considering both substances as ionic compounds, I regard as most probable the space group Oh^5, that is, a fluorite type, which is shown also by lithium sulphide (Claassen, *Rec. Trav. Chim. Pays Bas*, 44, p. 790; 1925).

G. NATTA.

Laboratorio di Chimica Generale,
R. Politecnico, Milan,
Dec. 27.

Viscosity of Electrolytes.

IN NATURE of Dec. 27, p. 994, there are some general statements as to the viscosity of electrolytes, which are by no means universally true. I refer to the statements that "the relative viscosity of all electrolytes must be greater than unity at high dilutions"; and that the phenomenon of 'negative viscosity' will disappear. In a paper on the viscosity of aqueous solutions (*Trans. Chem. Soc.*, vol. 107, p. 1789; 1915) the example of nitric acid is given and the relative principles are discussed. It appears that the viscosities depend upon the mutual depolymerisation of the electrolyte and the solvent, and that the resultant behaviour depends on the temperature.

At low temperatures, where a large proportion of trihydrol is present, the addition of the electrolyte breaks up so many of the ice molecules that even at high dilution the viscosity of the solution is reduced below that of water. The subject is treated at length in the paper to which I have referred.

W. R. BOUSFIELD.

St. Swithins, Northwood,
Middlesex, Dec. 31.

Stellar Structure.

THE investigation of the structure of the stars, which has for long been a subject of disagreement between Sir James Jeans and Sir Arthur Eddington, has now entered on a new phase through the work of Prof. E. A. Milne. A long paper on this matter by Prof. Milne, which appears in the November number of the *Monthly Notices of the Royal Astronomical Society* together with related papers by Messrs. R. H. Fowler, N. Fairclough, and T. G. Cowling, was introduced to the Society in November last, but no time was available for discussion. The whole of the meeting of the Royal Astronomical Society on Friday, Jan. 9, was accordingly devoted to a debate on the subject, which was briefly opened by Prof. Milne, and in which many astronomers and mathematicians took part.

Prof. Milne's views were outlined in NATURE of Jan. 3, p. 16. In opening the discussion, he stated that the pioneer work in the subject had been done by Sir Arthur Eddington, and what he himself had done was to rationalise Eddington's theory by clearing it of *ad hoc* hypotheses. He could not accept Sir James Jeans's theory, because it depended on unlikely extrapolations of the laws of physics. He considered that the mass-luminosity law which Eddington claimed to have established was not a possible deduction from the fundamental formulæ. It could follow only from the addition of a missing equation expressing the unknown dependence on physical conditions of the rate of generation of energy in stars. He had, therefore, begun his investigations with observed quantities, representing conditions at the surface of the star, and had worked inwards, without making any assumptions unwarranted by observation.

Sir Arthur Eddington, who followed, pointed out that disagreements in physical discussions could be of two kinds: first, those which depended on the adoption of different assumptions or hypotheses in the absence of definite knowledge; and secondly, disagreements on the logical or mathematical deductions from given premises. He thought that the disagreement between Sir James Jeans and himself was entirely of the first kind; but between Prof. Milne and himself there appeared to be a mathematical disagreement, which was very unfortunate. He did not approach Prof. Milne's latest work in a spirit of opposition. He regarded it as quite a permissible attempt to improve the existing theory in points where room for improvement undoubtedly existed. The main feature of Milne's picture of the stars was that the mass was largely concentrated in a dense hot core with a surrounding rarefied envelope. His own theory gave a much more gradual and uniform increase of density from the centre outwards. For the sun it gave a central density of 70, whereas Milne's theory gave a value of about 700,000. The matter there was therefore, according to Milne, not in the condition of a perfect gas, and hence the mass-luminosity relation could not be deduced. There were certainly loopholes in that relation—it did not apply to a star composed mainly of hydrogen, for example—but he did not believe that Milne's theory had sealed up those loopholes. Milne himself had confessedly not been able to satisfy himself that the equations for his stars possessed solutions, and Sir Arthur thought that it was *a priori* unlikely that they did. If such solutions existed, however, it still remained to decide between the two widely different central densities. This might be done by considering the intrinsic opacity in the interior, or its average if it was variable. An appeal on this ground, however, would show that both theories were wrong—that was the long-outstanding discrepancy between the physical and astronomical opacities of matter. Both theories required a larger opacity than would follow from current physical theory, but he had found that the discrepancy on Milne's theory was far greater than that on his own. A great deal depended on how large a mass was concentrated at the centre. If it was merely a point-source of extremely high temperature and density, with the rest of the star following a distribution of density almost identical with that of his own theory, he might be willing to accept the modification as a useful addition to that theory: it would provide a source of stellar energy. The large amount of mass, however, which Milne placed around the centre, inevitably made worse the existing discrepancy with regard to the opacity. Prof. Milne had objected to his theory being called a hypothesis, regarding it rather as an inevitable conclusion. It was inevitable only if the premises were granted, and Sir Arthur had been denying them for fourteen years.

Sir James Jeans found himself in almost complete agreement with what Sir Arthur Eddington had said, because Sir Arthur had not touched on the points on which they differed. If Sir Arthur, Prof. Milne, and himself all suddenly became infallible and omnipotent as mathematicians, he and Sir Arthur would still differ on the same points as before, but Prof. Milne would agree with one or the other accordingly as he considered the stars to be gaseous inside or otherwise. There was nothing new in Milne's theory; all that was accurate in it had been done previously by Eddington or himself. He had shown long ago that if you integrated outwards from the centre of a star you got definite results right up to the boundary, but that there an infinite number of solutions were possible, and Nature itself decided which was the actual one. When, therefore, Milne reversed the process by integrating from the boundary inwards, it did not matter with which of those solutions his initial data corresponded; he would necessarily arrive at the same conditions in the interior. The work, however, would be much more cumbersome. He agreed with Eddington about the opacity discrepancy, but considered that the case had not been put strongly enough. The factor 10 in the luminosity, by which Eddington's own theory deviated from observation, was much greater than was permissible. Expressed in terms of volume, it meant that the sun should be as big

as Antares. Since Milne's theory made matters worse still, he considered that that theory was ruled out of court entirely.

Dr. W. M. Smart directed attention to the fact that the problem was an idealised one, since we knew nothing at all about the interior of a star from observation. Assumptions had to be made, and it should not be forgotten that they were assumptions. He considered the stars themselves were the final umpires in the matter. Sir Arthur Eddington had suggested the opacity as the criterion by which the umpires gave their decision; he would suggest one of several other criteria. Sir James Jeans's theory had been very successful in explaining the formation of spectroscopic binaries by fission, but he did not think that Prof. Milne's centrally condensed stars would provide a satisfactory explanation.

Prof. F. A. Lindemann hoped that Prof. Milne would maintain his theory, because it was the only one which gave really high temperatures in the stars. The temperatures required by Sir Arthur Eddington were, on thermodynamical grounds, incapable of permitting the conversion of matter into radiation. It was all very well to say that Milne's conclusions were inevitable only if you presupposed something. Something had to be presupposed, and Eddington's *ad hoc* assumptions did not meet the facts of the generation of energy. He considered that the discrepancy of a million-fold in the densities of stars according to Eddington's theory was sufficiently large to make the increase to several million-fold in Milne's theory of no significance in deciding between the theories.

Sir Oliver Lodge remarked that what struck him most in the discussion was the remarkable agreement between the three protagonists. They were agreed on knowledge of fundamental importance which was not available twenty years ago, and, in comparison with that, the differences were unimportant. His idea of dealing with the problem would be to start with what we know—the surface temperature of the sun, its rate of generation of energy, the fact that energy comes from the disintegration of atoms. Prof. Lindemann had assured us that the last-named process required a very high temperature. Let that temperature at the centre be assumed. Then we knew the relation between radiation pressure and gravitational pressure, and with regard to the opacity the Compton effect would give us some information. From all these data a mathematician might work out some definite result. He was fascinated by Milne's theory of a nova resulting from the collapse of a star. Such a possibility had not occurred to him, but it seemed to work out.

Several other speakers contributed to the discussion, which concluded with brief comments by Prof. Milne. He did not agree that his work covered the same ground as Sir James Jeans's. He had started from the surface and worked inwards because it was only the surface that we could observe, and he had avoided assumptions which were necessary if you started in an unknown region.

Although it could not be said that the discussion led to a greater measure of agreement between the various speakers, it undoubtedly helped, by bringing together different methods of dealing with the question, to focus the nature of the problem more clearly in the minds of those present.

Vitamin B.

VITAMINS B_2 AND B_3: BIOS.

THE possibility of obtaining vitamin B_1 in a relatively pure condition has facilitated the differentiation of the other factors which, with B_1, make up the vitamin B complex. Chick and Roscoe used Peters' concentrate to demonstrate that the rat required two factors, the second being known as B_2 or the antipellagrous vitamin. More recently, they have published papers dealing with the chemical properties of this factor (*Biochem. Jour.*, vol. 23, pp. 504 and 514; 1929: vol. 24, p. 105; 1930).

Yeast extracts contain vitamin B_2, but the final antineuritic concentrate none: examination of the by-products of the concentration showed that about half the B_2 was precipitated by lead acetate, in the treatment of the extract with this reagent (at *p*H 4·5) and another third in the treatment with baryta and sulphuric acid, the remainder being precipitated during the treatment with acid mercuric sulphate and the subsequent passage of hydrogen sulphide through the filtrate. The lead acetate precipitate was the most convenient source for obtaining a concentrated preparation: examination of this stage in detail showed that all the vitamin was carried down when the precipitation was carried out at a neutral reaction, but less than half at *p*H 2·6. The vitamin was recovered by decomposing the precipitate with hydrogen sulphide: to ensure precipitation of the lead sulphide at an acid reaction, at which the vitamin is not adsorbed on the precipitate, it was necessary first to hydrolyse the yeast gum in the extract with hydrochloric acid. Unfortunately, the lead precipitate also carries down some vitamin B_1, and it was not found possible to obtain a preparation of B_2 free from B_1 by dialysis, by making use of their different solubilities in alcohol or their different rates of destruction by ultra-violet light. The concentrate was active in a dose of 0·03 gm., equivalent to 0·5 gm. dried yeast daily. It is possible that yeast extract is an unsuitable medium for effecting a separation. Rosedale (*ibid.*, vol. 21, p. 1266; 1927) precipitated from rice polishings extract (by means of lead acetate) a factor which was not B_1, although enabling pigeons to grow and maintain health on a diet of polished rice. It cannot yet be said with certainty, however, that this factor is vitamin B_2.

B. T. Narayanan and J. C. Drummond have also carried out experiments on the concentration of vitamin B_2 (*ibid.*, vol. 24, p. 19; 1930). Yeast

was extracted with dilute alcohol and the extract concentrated; lead acetate was then added, sometimes following a preliminary hydrolysis of the extract with baryta. The lead precipitate was decomposed with sulphuric acid, vitamin B_2 passing into the filtrate. It could be adsorbed on fuller's earth in strongly acid solution, but no satisfactory method of eleuting it again was found. Norite charcoal was not efficient as an adsorbing agent, and its use led to disappearance of the activity.

A certain amount is known about the properties of vitamin B_2: it is soluble in dilute, but insoluble in strong ethyl alcohol, and exposure to the latter results in its destruction. It is stable to hydrogen peroxide and nitrous acid and, to a certain extent, to heat, provided the reaction is acid. Autoclaving or even boiling at an alkaline reaction brings about rapid destruction. It is more easily destroyed by exposure to ultra-violet light than vitamin B_1.

Narayanan and Drummond examined a number of chemical compounds, including nucleic acid, purines, nicotinic acid, betaine and inositol, for vitamin B_2 activity, but all were, without exception, inactive.

V. Reader has adduced evidence that a third factor, tentatively called vitamin B_3, is necessary for the nutrition of the rat (*ibid.*, vol. 23, p. 689; 1929: vol. 24, p. 77; 1930). Animals kept on an apparently complete synthetic diet, in which Peters' concentrate supplied vitamin B_1 and alkaline autoclaved yeast B_2, failed to grow after some weeks; substitution of yeast extract for the two supplements led to an immediate resumption of growth. The failure did not appear to be due to lack of either vitamin B_1 or B_2, since increasing the amounts given did not improve growth. More convincing evidence of the existence of the third factor rests in the fact that it was found to be precipitated by the mercuric sulphate used in the preparation of the B_1 concentrate, and was recoverable, to the extent of 75 per cent of that present in the original extract, from the precipitate. Vitamin B_3 is even more easily destroyed by heat than B_1; under certain conditions it is soluble in ether. Rats fed on an ordinary diet carry a larger store of vitamin B_3 than of B_2; it is, therefore, possible that in short-time growth experiments, such as were used by Chick and Roscoe in the assay of B_1 or B_2, lack of B_3 does not play a part; again, it is also possible that antineuritic concentrates, unless highly purified, or autoclaved yeast, may be contaminated with traces of the third factor.

Chick and Roscoe found that vitamin B_2 was alone present in egg-white, but that rats on a synthetic diet with this material as source of the vitamin instead of autoclaved yeast, showed subnormal growth after a few weeks. They suggest that yeast contains a third B factor, which is, however, thermostable in contradistinction to Reader's B_3. M. A. Boas, some years ago, found that a diet containing dried egg-white produced skin lesions and nervous symptoms in rats, whereas fresh egg-white had no such effect (*Biochem. Jour.*, vol. 21, p. 712; 1927). A number of foodstuffs contained a factor which counteracted the ill-effects of the ingestion of dried egg-white; it could not be identified with either vitamin B_1 or B_2.

The above account by no means exhausts the work which has been done on the chemistry of vitamin B. That three or four factors are included under this term appears certain, but it is not easy to relate the work of different investigators, especially when the claim for a new factor is based on the supplementary effects of different foodstuffs. Peters, in his Harben Lectures, reviews some of these investigations. Williams and Waterman found that pigeons maintained their weight on a polished rice diet when supplemented with marmite; transference to wheat, however, produced growth. Hence there is a factor in wheat which is absent from marmite and cannot be B_3. Hunt found that the residue of autolysed yeast, after thorough extraction with water, contained a factor which supplemented two obtainable from the extract; again this third factor does not appear to be B_3, which is soluble in water. Peters has also found that pigeons require for growth, in addition to B_1 and the factor of Williams and Waterman, a thermolabile factor which is present in yeast extract, and may be considered provisionally as identical with B_3: pigeons apparently do not require B_2. It appears, therefore, that the rat requires B_1, B_2, and B_3 with possibly Hunt's factor, whilst the pigeon requires B_1, B_3, and the factor of Williams and Waterman.

It may be of value to refer also to some recent work upon a substance which has been related by many observers to vitamin B, the yeast-growth stimulant or 'Bios'. Confusion was caused by the fact that it was not realised that different yeasts behave differently on various media, that their requirements for bios vary, and that the requirements of other micro-organisms need not necessarily be the same as those of yeast. Peters and his colleagues have investigated the growth factors required by *Streptothrix corallinus* (V. Reader, *Biochem. Jour.*, vol. 22, p. 434; with J. Orr-Ewing, pp. 440 and 443; with R. A. Peters and H. W. Kinnersley, p. 445; 1928). When the organism was grown on a synthetic medium, a growth-stimulating factor was found in tryptic beef broth, yeast, rabbit muscle, serum, and wheat embryo; it is organic, soluble in water but not in ether, dialysable, and not precipitated by lead acetate. It accompanies vitamin B_1 in the preparation of the antineuritic concentrate but is stable to alkali in this concentrate (although unstable when crude) and is not, therefore, the same factor as the vitamin. It is synthesised by the meningococcus. It is not vitamin B_2. By parallel tests on the organism and on pigeons, it was shown that the factor and vitamin B_1 fractionate quantitatively together through all stages into the final concentrate.

The pitfalls encountered in such work are disclosed by certain anomalous results obtained with this organism, impure preparations of the factor sometimes appearing to contain relatively more growth-promoting activity when used in high concentrations than when used in lesser amounts. Reader has found that this effect can also be pro-

duced by adding mannitol to the purer extracts (*ibid.*, vol. 23, p. 61 ; 1929). Mannose itself and related alcohols cannot replace mannitol ; it appears that the organism uses the alcohol as a specific source of food supply.

Working on the relation of bios to yeast, A. M. Copping (*ibid.*, vol. 23, p. 1050 ; 1929) has found that the necessity for bios depends on the yeast and the medium used. Those which grow in a synthetic medium without the addition of a factor such as is supplied by an autoclaved extract of yeast, produce a stimulant for other yeasts. Bios is required by yeasts which only ferment and do not respire in its absence ; added bios then stimulates both respiration and fermentation.

Narayanan has separated a yeast bios from vitamin B_2 in yeast extract, since the former is not precipitated by lead acetate in the hydrolysed extract (*ibid.*, vol. 24, p. 6 ; 1930). The bios is not adsorbed on norite charcoal, but is soluble in strong alcohol ; it is precipitated by phosphotungstic acid but not by silver or platinic chloride. By a series of fractionations a highly active concentrate was obtained. The material contained nitrogen but no phosphorus : most tests for nitrogenous compounds were negative, but a positive Pauly reaction was obtained. It is stable to nitrous acid but destroyed by hydrogen peroxide. Narayanan also tested a large number of pure substances, such as nucleic acid, purines, nicotinic acid, betaine, lipoids, and various bases and amino acids for bios activity, but all were found to be inactive.

Henry Briggs, 1561–1631.

HENRY BRIGGS died three hundred years ago, on Jan. 26, 1631. He is famous for his important works on logarithms. Napier's first publication of the invention of logarithms, in 1614, had come on the world, as Lord Moulton said, "as a bolt from the blue," breaking in upon human thought abruptly without borrowing from other workers or following known lines of thought. Twenty years of persistent effort had been expended by Napier before he arrived at his great discovery, but within far less time than that after its publication the new method of computation was in use in England, France, Germany, and Italy, and its almost immediate adoption for astronomical and other calculations was mainly due to Briggs.

Well over fifty years of age when he heard of Napier's work, Briggs made two visits to Scotland to see Napier, and the remainder of his life was almost entirely devoted to the compilation of his three works, "Logarithmorum Chilias Prima", 1617 ; "Arithmetica Logarithmica", 1624 ; and "Trigonometria Britannica", 1633. The first of these contained the logarithms of the first thousand natural numbers calculated to eight decimal places ; in the second, he gave the logarithms of 30,000 natural numbers to fourteen places of decimals ; while the third work, completed after his death by his friend Gellibrand, contained tables of logarithms of sines and tangents carried to the hundredth part of a degree and a table of natural tangents, sines, and secants. The labours involved in these works have placed Briggs among the most industrious of men and the benefactors of mankind.

Had Briggs never heard of Napier's invention and had he not taken a leading part in spreading abroad a knowledge of logarithms, he would still be remembered as one of the outstanding British mathematicians of his day, for he was the first to hold the Gresham professorship of geometry in London and the Savilian professorship of geometry at Oxford. In a city rich in scientific associations the name of Sir Thomas Gresham (1519–1579) will always be connected with the foundation of the Royal Exchange and of Gresham College, from the latter of which, in other circumstances, might well have sprung a great university of London. A visitor to-day leaving St. Helen's Church—the Westminster Abbey of the City—where Gresham is buried, passes into a busy centre of finance and commerce. Three hundred years ago it was not so, for just opposite the church stood the entrance gates to Gresham's mansion, which, by a will made in 1575, he bequeathed to the Mayor and citizens of London for the use of seven professors, who were to read daily lectures on astronomy, music, geometry, law, physic, rhetoric, and divinity. Confirmed by an Act of Parliament, on the decease of Lady Ann Gresham the bequest became available, and in 1596 the chair of astronomy was bestowed upon Edward Brerewood (1565–1613), of Brasenose College, Oxford, while Briggs was appointed to the chair of geometry.

Briggs was then thirty-five years of age. Born at Warleywood, near Halifax, Yorkshire, in 1561, he attended a grammar school in the district, and in 1577 entered St. John's College, Cambridge. He became a scholar in 1579, took the degree of B.A. in 1582, that of M.A. in 1585, and was elected a fellow in 1588. In 1592 he was made examiner and lecturer in mathematics, and for a time held the lectureship in physics founded by Linacre.

Removing to London in 1596, like the other Gresham professors, he occupied "commodious and comfortable" apartments in Gresham's house, and, with his colleagues, began delivering those lectures which were given, we are told, "to the great delight of many, both learned and lovers of learning". Some idea of Gresham's house, with its reading hall, its observatory, its galleries, its colonnade, and its great quadrangle, can be obtained from the sketch in Ward's "Lives of the Professors of Gresham College". For more than a century and a half it sheltered the professors and for half a century it was the home of the Royal Society, but to-day nothing of it remains. The Royal Society removed its headquarters to Crane Court, at the other end of the City, in 1710 ; the interest in the lectures diminished, the buildings became dilapidated, and in 1767 "for the poor sum of 500£ per annum the trustees agreed to demolish the College and to part with all the land [the property really of the public] for the very unphilosophical purposes of an Excise-office".

After this, lectures were given in the Royal Exchange until 1843, when a special building was erected, and this in 1913 was replaced by the handsome Gresham College in Gresham Street, where the present Gresham professors continue the work which was inaugurated more than three centuries ago by Briggs and his fellow-workers.

In 1620, Briggs removed to Oxford as Savilian professor of geometry, at the invitation of Sir Henry Savile (1549–1622). Savile himself had already read thirteen lectures upon the first eight propositions of Euclid's "Elements", and Briggs began his own lectures with the ninth proposition. His teaching, however, was of secondary importance to his compilation of logarithmic tables, and it was largely due to the leisure he enjoyed at Oxford that he was able to accomplish so much. "A contemner of riches, and contented with his own station; preferring a studious retirement to all the splendid circumstances of life", his close habits of study did not prevent him gaining the good opinion of his contemporaries, one of whom, William Oughtred, called him "the Mirror of the Age". Briggs's long and useful life came to an end when he was nearly seventy years of age, and he was buried beside Savile in the chapel of Merton College, "a plain Stone being laid over him, with his Name only inscribed on it".

Obituary.

Dr. J. W. Evans, C.B.E., F.R.S.

BY the unexpected death of John William Evans on Nov. 16 last, geological science has lost an indefatigable worker and writer, and many geologists a valued teacher, colleague, or friend. Born in 1857 and educated at University College School and College, he took the LL.B. of the University of London and he was called to the Bar in 1878. He turned, however, to science and joined the Royal College of Science, where he studied under Judd and Cole, and was one of a brilliant group of students that included Holland, Wells, Davies, and Lanchester. He was awarded the Murchison Medal and joined the staff as demonstrator in 1889. He published his first paper in 1891, on the Old Red Sandstone of Caithness, a subject pursued again in later years, when he made important discoveries in the Devonian Rocks of southern England and made contributions to the classification of the rocks.

In 1891–92 Evans was geologist to an expedition to the Upper Paraguay and other rivers in an almost unknown area in Brazil, later publishing a paper on the geology of Matto Grosso. He returned to South America as leader of an expedition to north-east Bolivia in 1901–2, and wrote descriptions of the area for the *Geographical Journal*, as well as geological papers.

Meanwhile Evans had been appointed geologist to the State of Kathiawar, where he made important collections, afterwards described by himself or his students. Then, in 1894, he passed to Mysore, becoming chief geologist and chief inspector of mines, etc. In 1901 he received the Lyell award from the Geological Society, and about the same time took the D.Sc. of the University of London for a thesis on the geology of India.

In 1904 Evans became special assistant in geology at the Imperial Institute, serving on the Colonial Survey Committee and Mineral Council of the Institute, posts which not only gave him the opportunity of acquiring a wide knowledge of the mineral resources of the Empire, but also a close interest in the personnel and work of the surveys. This interest was enhanced by his appointment, later, as Colonial Office representative on the Imperial Mineral Resources Bureau, and here his legal knowledge was of much use in connexion with the improvement of mining codes in the Dependencies.

From this time onward, Evans took much interest in mineralogy and crystallography, publishing papers on projections, classification, and nomenclature, on methods of investigation, and on the properties of certain minerals. Much of this work was summed up in his own book on the determination of minerals under the microscope, and in his joint work on crystallography. He was treasurer of the Mineralogical Society from 1918 until 1924, and afterwards foreign secretary until his death. His teaching work was at the Birkbeck College from 1906 until 1920 and, as lecturer in petrology, at the Imperial College from 1912 until 1927. He was an inspiring teacher, and many of the students beginning research under his supervision have become leading geological surveyors or investigators.

Dr. Evans was a devoted adherent to the Geologists' Association, often leading excursions or contributing to the proceedings. He was president in 1913–14, and dealt in his addresses with the wearing down of the rocks, a subject which his mathematical ability enabled him to treat in a fashion unusual and provocative of new work. He was president of Section C (Geology) of the British Association at Bournemouth in 1919.

The great War revealed a new side in Dr. Evans's character. His experience as a volunteer qualified him for a commission, and with the rank of lieut.-colonel he was put in charge of a section of the northern defences of London. He also served on the tribunal, was made a Justice of the Peace, and received the Volunteer Decoration.

After being elected a fellow of the Royal Society, gazetted a C.B.E., and awarded its Murchison Medal by the Geological Society, Evans served in the presidency of the Geological Society during 1924–1926. Again he broke new ground and devoted his first address to the consideration of areas of tension in the earth-crust, and the second to areas of compression. About this time he became interested in the Wegener hypothesis, led a discussion on it at the British Association, and revised Skerl's translation of Wegener's book.

Although petrology and mineralogy, and especi-

ally their fundamental problems of genesis, were the main subjects to which Evans devoted his technical attention, his wide knowledge and critical acumen were constantly in evidence at meetings of many scientific societies, and particularly those dealing with geology and geography. His contributions invariably brought up some overlooked fact, some unexpected point of view, or some novel theory or new application or an old principle. It was the same with his letters and reviews in NATURE and other scientific journals.

Before the War, Evans had got together a team of geologists to write the British volume of "Regionale Geologie", to which he himself also contributed. This was in type before 1914, and was actually published in Heidelberg during the War. The copyright passed to England, and a revised edition has been brought out lately under his joint editorship and with the title of "Handbook to the Geology of Great Britain". He retired from the Imperial College in 1927 and took over the chairmanship of the Geophysical Company, for whom he visited the near East. Evans rejoiced in every opportunity for travel, and for learning at first hand from the field itself or from the experiences of his colleagues there. He was present at the last three International Geological Congresses, and after the last, at Pretoria in 1929, he travelled from the Cape to Cairo, visiting *en route* the various geological surveys, several of them run by his old pupils, inspecting their work, learning their problems, and inspiring them with new ideas. Although to a man of his years such a journey was fraught with fatigue and some hardship, there was no suspicion that the end was near. Indeed, when he returned to England in the spring of 1930, he travelled abroad again, and had planned a later visit to Palestine and Egypt.

It is difficult to do justice to the work and career of so many-sided a man, and this is a mere sketch of the chief of his work. It may be said that while he left few branches of geology unstudied, he extended knowledge, improved methods, or clarified results in every division of the subject that he touched. The simplicity of his character, the lovableness of his nature, his genuine interest and enthusiasm made him hosts of friends; while as for adversaries, if he had any, in the kindness of his heart he never realised their existence.

PROF. FRITZ PREGL.

THE world-famous Austrian micro-chemist, Dr. Fritz Pregl, died of pneumonia, after a very brief illness, on Dec. 13 last. Prof. Pregl, who was sixty-one years of age when he died, was born at Laibach, a town which is now in Jugo-Slavia but is less than 100 miles south of Graz, the capital of 'green Styria', where he lived nearly all his life as student, research assistant, and finally as professor, the head of the Department of Medical Chemistry in the university. He studied medicine—which in Austria comprises considerably more pure science than in most English medical schools—and after taking his degree, he chose rather physiological research than the practice of medicine. He was appointed an assistant in the Department of Physiology in the University of Graz, and his first work was on the various organic constituents of the intestinal juice of a lamb, and a study of their digestive action, which he published in *Pflüger's Archives* in 1895.

Prof. Pregl's most important physiological work was on the acids in human and ox bile, of which cholic acid is the chief constituent. He studied, so far as possible on a quantitative basis, their preparation, behaviour, and oxidation products, and built up that wonderful technique which was to enable him later to achieve success in more delicate quantitative organic determinations than had hitherto been considered possible.

Prof. Pregl's own words may be used to describe why he began his micro-analytical work. "In the summer of the year 1910, in the course of a lengthy investigation of the gallic acids, I obtained an extremely small quantity of a decomposition product. I had to make a decision either to continue the investigation with exceptionally large quantities of the original material, or so to refine the quantitative analysis of organic substances that it should be possible to obtain correct analytical figures, from which formulæ could be determined with certainty, with exceptionally small quantities of material." He decided on the second alternative, with such success that by the end of 1911 he had worked out methods for the combustion of carbon and hydrogen, and a Dumas determination of nitrogen, on a micro scale. Since then he improved his methods and extended them to include all the commoner elements which may be present in organic compounds, as well as the determination of many organic groups. The amount of material used in each determination is only a few milligrams, or about a hundred times less than on the ordinary or macro scale, but the same degree of accuracy is attained.

As well as great skill in glass-blowing—for Prof. Pregl designed and made his own glass apparatus—the work necessitated extreme care and attention to detail, and it is interesting that in investigating the possible sources of error he was able to throw light on many hitherto unexplained errors obtainable on the macro scale. In recognition of his services to science, Prof. Pregl was awarded the Nobel prize for chemistry for 1923. The methods are described in his book, "Quantitative Organic Micro-Analysis", first published in 1917; the third edition, completely revised, was published in the year of his death. The book is written in a style as careful and accomplished as is his laboratory technique. Prof. Pregl, however, believed rather in the old tradition of learning by personal tuition than from practical manuals, and the hospitality of his laboratories has always been given to scientific workers from all over the world who wished to learn his methods. In this way no less than three hundred chemists and biologists have learned his technique, and on returning to their own laboratories have developed and applied his methods to all branches of chemistry where economy of time or

material is of importance. All who had the privilege of knowing him personally will remember him not only as a great scientific worker, but also as a charming man and a gifted talker, with an enthusiasm for his work that was contagious.

The great importance of Prof. Pregl's influence is that he stressed the fact that careful, accurate technique is the basis of all good scientific work, while his methods have made accuracy possible in realms where previously there were only rough approximations.

Dr. Henry M. Ami.

Dr. Henry Mark Ami, who died at Menton, southern France, on Jan. 4, aged seventy-two years, was a well-known geologist who had made valuable contributions to our knowledge of the Palæozoic rocks and fossils of Canada. He was born in Geneva, the son of a Swiss Protestant clergyman who emigrated to Canada when he was a child. He was at school in Ottawa, and thence proceeded to McGill University, where he had a distinguished career and came under the influence of the eminent Canadian geologist, Sir J. William Dawson, who was at that time Principal of the University. He graduated as M.A. and D.Sc. in 1882, and in the same year he joined the staff of the Geological Survey of Canada, from which he retired in 1912.

During his official life, Dr. Ami devoted special attention to the Palæozoic fossils of eastern Canada in the Survey Museum in Ottawa, and added greatly to the value of his researches by studying all the localities whence the fossils were obtained. He also made frequent visits to Europe, especially to England and France, to compare the corresponding geological formations on the two margins of the Atlantic Ocean. He was thus able to throw much new light on disputed questions as to the precise age and succession of the various rocks. His researches on the Devonian and Carboniferous formations of Nova Scotia were particularly noteworthy.

While occupied with his technical work, Dr. Ami travelled extensively and took a deep interest in everything Canadian. He was thus well equipped on his retirement from official duties to undertake the revision and partial rewriting of the volume on Canada and Newfoundland in Stanford's "Compendium of Geography", which was published in 1915. During the War he did good service to the Government in advising on the source of metallic minerals, and was for some time connected with the Trade Department of the British Embassy at Washington. During more recent years he was much handicapped by failing health, but from 1922 onwards he paid an annual visit to the Dordogne, France, where he directed the Canadian School of Prehistory, which he founded. He took part personally in the diggings, which furnished fine collections of Palæolithic flint implements to many of the chief museums in Canada.

Dr. Ami was a familiar figure at scientific congresses, and his genial good nature won him a host of devoted friends on both sides of the Atlantic. He was a fellow of the Royal Society of Canada and of the Geological and Royal Geographical Societies of London, and was awarded the Bigsby Medal of the Geological Society in 1903. A. S. W.

Mr. W. D. Christmas.

William Durant Christmas died at Peppard, Oxon, on Jan. 3, at the age of sixty years. Educated at Ellesmere College, Shropshire, he was at first a teacher, holding appointments at Haverfordwest and Rugeley. His natural bent for figures found an outlet later when he joined a Stock Exchange firm. During the War he joined the staff of the Rothamsted Experimental Station in a voluntary capacity, at a time when difficulties were being experienced in getting the work done owing to the absence of members of the staff on War service. He assisted in keeping the records, and was particularly attracted to meteorology.

After the War considerable expansion took place in the Rothamsted Experimental Station, and a Statistical Department was set up; Mr. Christmas continued until his death as an honorary worker on the staff of this Department. Aided by W. C. Game and A. D. Dunkley, of the regular staff, he undertook the compilation of the monthly weather records with great enthusiasm and abundant energy. In letters to Nature of Nov. 3, 1921, and Jan. 26, 1922, he directed attention to the abnormal conditions of the year through which we had been passing, a year which will be remembered for its record low rainfall. He followed this up by contributing to the *Times* of Jan. 26, 1923, a summary of the rainfall in 1922. This was the beginning of a regular series of letters which appeared in the columns of the *Times* at frequent intervals until the issue of Nov. 3, 1930, when his last letter was published. Besides rainfall, he dealt with percolation, sunshine, temperature, and related meteorological phenomena, such as fogs and storms.

Mr. Christmas had been in failing health for some years, and never recovered from the blow occasioned by his wife's death in 1929. But he kept up his Rothamsted work until his last illness, and it was a matter of deep regret to him that he was unable to contribute his customary summary of the year's weather to the *Times* on Jan. 2, but had to entrust the task to another.

We regret to announce the following deaths:

Prof. S. Henschen, professor of internal medicine at the Caroline Medical-Chirurgical Institute, Stockholm, who carried out much research in anatomy and the pathology of the nervous system, aged eighty-three years.

Prof. C. von Monakow, of Zurich, one of the founders of modern neurology and author of "Die Lokalisation im Grosshirn", aged seventy-seven years.

Prof. J. Ricard (S.J.), who was professor of mathematics and later director of the observatory of the University of Santa Clara, aged eighty years.

Dr. I. Urban, assistant director of the Botanical Museum, Berlin, on Jan. 7, aged eighty-two years.

News and Views.

PROF. JOHN MACLEAN, of Wilson College, Bombay, writes in dissent from our article, "Administration and Research in India" (NATURE, Nov. 22, 1930, p. 797), to point out the danger of certain views on the Indian question current in England, among which he includes those we have expressed. He maintains that Western education in India should not be criticised without allowance for misdirected effort, poverty of resources, and subservience to tradition. Further, that no one thinks that self-government will lead to peace and absence of friction: nine months ago a fundamental change took place in India which has astonished the Indians themselves. The Indian now claims to be regarded as a self-respecting fellow-man. This has aroused the Indian woman. Any assumption of superiority on the part of the Englishman, such as is now to be observed in London, will lead to ineradicable bitterness. He asserts that gradual progress is not enough and that there is sufficient goodwill in India to warrant a leap in the dark. He adds that the poll of the *Times of India* has shown that four out of five of the non-official Europeans in Bombay are in favour of Dominion status. Prof. Maclean's criticism of our views trenches upon political arguments with which it would be out of place to deal here. We may, however, point out in passing that the grant of a form of self-government which admittedly will not lead to peace is perhaps a questionable improvement upon the *status quo*; but the fundamental change in India to which he alludes has not escaped attention in England. He confirms the view that the situation is far more critical than is generally realised. Be that as it may, these arguments do not affect our main contention. The question of superiority does not arise: it is difference of culture that counts. In the future, even more than in the past, a satisfactory solution of Indian problems of government must be sought through the application of the results of scientific study of race and culture.

THE truth of the matter is that the divergence of opposing views on the Indian question is so great as to make it difficult to find a common denominator which will afford a basis of discussion. Prof. Maclean sends us a report of an address on "Gandhi: Politician and World Teacher", by Prof. A. Wadhia, as president of the Indian Philosophical Congress, in which he extols Gandhi as one of the world's great philosophers, a thinker who has transcended, or transformed, Hinduism and attained universality. When Prof. Wadhia turns to Gandhi's work as a political thinker and practical politician, the only concrete proposal is "Hind Swaraj". For Gandhi, Indian Home Rule is 'the ideal state'. It must be remembered that Gandhi's philosophy is no mere intellectual system, but a 'way of life'. It is the practical means of attainment, which, barely and baldly stated, have an element of bathos, that have laid him open to the charge of narrowness, casuistry, insincerity, and worse. Even admitting the universality of Gandhi's philosophy—assuredly no product of intellectual or cultural inferiority—this is no warrant for allowing claims that would hand over control of the destinies of many millions to a comparatively small section, however much these claims may receive the doubtful support of pseudo-scientific theory which seeks to show that India is virtually one in culture and race. It may be that the trend of development in India is along the lines of Hinduism; but there are many who are and always will be outside those lines. As we have already pointed out in these columns, an accurate knowledge and exhaustive study of the facts is required. Only then can the claims of caste, outcaste, and depressed receive fair and equal treatment.

ON Jan. 14 the freedom of the Borough of Bangor was conferred on Dr. Griffith Evans, who, fifty years ago, was inspecting veterinary surgeon to the Government of Madras. In then discovering the first pathogenic trypanosome he laid bare the cause of a disease which was causing havoc amongst the camels and horses of the Punjab Frontier Force. Although the senior medical officers in India were definitely opposed to the theory of pathogenesis advocated by Dr. Evans, the younger men have followed with success the lines of investigation he indicated. He thus opened a campaign, which still continues, against what is now recognised as one of the most destructive groups of disease-producing organisms with which science has to contend. Tetanus was another field in which Dr. Evans showed his power of original thought. At Ipswich in 1870 there was a bad outbreak of the disease, in which every case had proved fatal. Being invited to a consultation, he gave his view that the disease was a specific fever for which there was no known specific remedy. Arguing from his experience of the disease in horses, he urged that the treatment should be rest in a dark, silent room, no noise from without or within, no food of any kind nor any medicine, but let the patient drink water *ad lib.*, and leave the rest to Nature. Accepting responsibility for the treatment of the case of a child, he had the full courage of his convictions, and the case recovered. At the age of ninety-six years, Dr. Evans still retains his mental activity.

LITTLE direct news has come through of the earthquake that was so destructive in the south of Mexico on Jan. 14. That it was a great earthquake is shown by the record at Kew. The first movements reached that observatory at 2 h. 2 m. 59 s. A.M. on Jan. 15, and the earthquake that gave rise to them must have occurred in Mexico at about 9 P.M. local time on the previous evening. The earthquake is said to have been the most violent experienced in the country since 1911. The epicentre was probably close to the City of Oaxaca, which has been almost completely destroyed, with the loss of at least 40 lives. The extent of the disaster may, however, remain for some time unknown, owing to the wide interruption of communications. How great it was is clear from the fact that there was also considerable damage in the City of Mexico, 230 miles from Oaxaca. In the south of the country, there are numerous well-defined earth-

quake centres, one of the most important of which lies in the district round Oaxaca. That city suffered twice from earthquakes in 1928, on June 16 and Oct. 9 (NATURE, vol. 121, p. 994, and vol. 122, pp. 68, 620), but the epicentres then were both submarine, at some distance from land. On Jan. 2 (*Daily Science News Bulletin*), a strong submarine earthquake occurred with its centre in lat. 17·8° N., long. 108° W., several hundred miles to the west of those in 1928.

ANOTHER step forward has been taken in making navigation safer during a thick fog. We learn from the *Times* of Jan. 13 that the Clyde lighthouse trustees have put a talking beacon in the Cumbrae lighthouse, and that instructions have been given to mariners regarding its use. It is the first device of the kind in the world. It consists merely of a radio gramophone used in conjunction with the lighthouse foghorn. By this means the radio operator on the ship is told exactly how far his ship is from the lighthouse. The record played on the lighthouse gramophone is simply the name of the beacon in speech (Cumbrae) repeated every 70 seconds, and numbers counted in miles and cables up to five miles. These signals are transmitted by radio. There is then an interval of silence of 27 seconds until the name Cumbrae is heard again and the counting recommences. The signals of the foghorn are heard directly. The difference in the times of hearing the word Cumbrae and the foghorn is practically equal to the time taken by sound to travel this distance, and so the gramophone numbers give the distance. Actual tests have been carried out on this device by ships of the Anchor line and were found quite satisfactory. The 'talking beacon' was invented by C. A. and D. A. Stevenson, of Edinburgh, the connexion of whose family with lighthouses is well known to every reader of R. L. Stevenson. When vessels are equipped with this device, which is quite cheap to install, they will have a good idea of their distance from other ships, thus avoiding one of the causes of collision at sea. While the apparatus is still in its infancy, the trustees have warned mariners to take, in addition, the usual precautions during fog.

NEARLY all the peculiar phenomena which are experienced in radio transmission can be explained by supposing that the radio signals travel from one station to another by more than one route. The direct line of transmission is usually one of these paths. Very often the greater part of the signal which we hear has travelled to the upper regions and back, and constitutes what is called a wireless echo. In the *Wireless World* for Jan. 7 and 14, Prof. E. V. Appleton gives an interesting paper on the timing of wireless echoes, and suggests alternative theories of the Kennelly-Heaviside layer. The time taken to traverse the different paths is known definitely, and guesses are made as to what these paths are. The first experiments on the timing of the journeys of radio waves were carried out almost simultaneously in Great Britain and the United States. It was assumed that there was a conducting layer, and the English experiments placed its height as about 100 km. On the other hand, the American experiments indicated a height of about 220 km. Whilst the wave-length used by the English physicists was 400 metres, that used by the Americans was 75 metres. On repeating the English experiments with wave-lengths of 75 metres, it was found that the height deduced for the conducting layer was the same as that found by the Americans. There was a certain critical wave-length at which the echo-time suddenly doubled. There is therefore definite evidence that there are two reflecting layers at different heights, the lower sending back the long waves and the upper sending back the short waves. In the second part of his paper Prof. Appleton discusses the effects that these short period echoes will have in radio picture-telegraphy and in radio television.

IN a paper on "Recent Developments in Telephony", read by Dr. E. H. Colpitts at the Cleveland meeting of the American Association for the Advancement of Science, a summary of which appeared in the *Daily Science News Bulletin* for Dec. 30, it was stated that the plans for a Hawaii-California telephone circuit are now well under way. Hawaii is very centrally situated, as it is roughly equidistant from North and South America, Asia, and Australia. A short-wave station will be established to communicate with Honolulu, and another radio link from a point on the Atlantic coast to Bermuda is also planned. Radio stations of limited range are being established at several of the principal ports. They are equipped so that communication with ships at sea can easily be made. This extends the service given by liners like the *Leviathan*, which, at present, is in telephone communication with the shore all the way across the Atlantic. Although radio has made huge advances of recent years, it is still not so trustworthy as a submarine cable. A trans-Atlantic telephone cable is now being prepared. When completed it will be connected with about 2000 miles of land cable in Europe. It will thus be possible from Hawaii to talk over about 7000 miles of wire. Surprise was expressed that no mention was made of the work done by the Bell Telephone laboratories on television, as recently two-way television was shown to be possible in New York. This is interpreted as meaning that the commercial application of television is still in the distant future.

ONE of the earliest writers on marine engineering spoke of the boiler as "the source and magazine of all our power", while another referred to it as "the fountain-head from which all benefit is derived". These remarks were made when the ordinary steam pressure at sea was but 5 lb. per sq. in., but they apply equally well to-day when pressures have risen to 400 lb. and 500 lb. Recent progress in marine boilers is among the subjects dealt with in the *Engineer* for Jan. 9, in which are given illustrations of the latest designs of the well-known Yarrow and Babcock and Wilcox boilers for high pressures and temperatures. Another boiler is that recently designed by J. Johnson, the superintendent engineer of the Canadian Pacific Steamships, Ltd. In some ways the Johnson boiler is a new departure, there being only two drums, an upper and a lower one, and these are joined by

tubes bent to crescent form bulging out either side of the centre line of the boiler. Other tubes run vertically between the drums, and still more tubes form water walls at the end of the boiler. The furnace spaces are thus practically enclosed by walls of water tubes. Tried first in the *Princess Helene*, another boiler has been built for the *Empress of Britain*, and a test of this 10,000 h.p. boiler showed that at mercantile ratings and for the same efficiency it will yield, for the same weight of boiler and air heater, double the output of the three-drum water-tube boiler. One feature of the boiler is the use of air for combustion preheated to 500° F.

IMPORTANT statistics regarding the production of rubber were given in a paper read on Jan. 13 by Dr. G. Rae, at Birmingham, to the Midland Section of the Institution of the Rubber Industry. The total area under plantation rubber at the end of 1929, he said, was between 6,600,000 acres and 7,200,000 acres, of which the area under native rubber in the Dutch East Indies was variously estimated at between 1,100,000 acres and 1,700,000. About 3,360,000 acres were in estates owned by Europeans and Americans ; 510,000 acres in Asiatic-owned estates of more than 100 acres, and 1,630,000 acres in native holdings of less than 100 acres. The total exports of rubber from producing countries were 94,000 tons in 1910 ; 354,000 tons in 1920 ; 518,000 tons in 1925, and 861,000 tons in 1929. The output for 1930 was 820,000 tons. Of the output in 1929, British producers were responsible for 36 per cent, Dutch and other European producers 10·2 per cent, and American producers 2·6 per cent. The absorption of rubber by manufacturers (that is, the quantities of rubber they turned into rubber goods) was 85,000 tons in 1910 ; 310,000 tons in 1920 ; 560,000 tons in 1925 ; 790,000 tons in 1929, but would be approximately only 705,000 tons in 1930.

THE United States Department of Agriculture has published a booklet, written by Prof. A. J. Henry, Principal Meteorologist, Weather Bureau, entitled "Weather Forecasting from Synoptic Charts", which deals primarily with American methods of weather prediction. These are described in considerable detail. They are of interest in showing, among other points, the specialised methods that have been developed for dealing with the requirements of particular sections of the agricultural community, and the arrangements for issuing storm warnings. There is no other country that has to deal with such violent fluctuations of temperature in a short time and with such possibilities of financial loss involved in consequence of them, and that has also to take into account possibilities of locally destructive tornadoes and of tropical revolving storms that may cause the loss of thousands of lives, in addition to gales arising as a result of the eccentricities of an exceptionally lively portion of the storm belt of middle to high latitudes, where anticyclones have the peculiar characteristic of a mean rate of travel approximately equal to that of depressions. It is not surprising to find that an unusually extensive development of the system of local forecasting has taken place, and that it has apparently met with great success. This system involves the delegation of forecasting for single States, and even in some instances for parts of one State, to forecasters resident within the area allotted to them, having authority to amplify or modify the deductions about future weather made at the central bureau in Washington. Such forecasters construct their own synoptic weather maps, and doubtless employ a closer network of stations than can be dealt with at the central bureau, gaining thereby a special knowledge of local conditions. The booklet is intended primarily for home use. It is, however, an important addition to European meteorological libraries, and deserves careful study on this side of the Atlantic when the creation of new meteorological services or the enlargement of existing ones is under consideration.

IN the *Časopis Společnosti Přátel Starožitnosti Československých*, Dr. O. Odložilík has traced a letter written by the medieval pedagogue, Jan Amos Komenský (Comenius), dated Mar. 4/14, 1647, relating to the exile of himself and the engraver, Václav Hollar. Komenský expresses his regret that circumstances forced them to leave home through the religious persecution of the counter-reformation. Dr. Odložilík comments upon the work and influence of these Czech scholars on contemporary thought. Komenský conceived the idea of making a survey of all human knowledge, which was even then becoming more and more extensive owing to the development of the natural sciences. He began the compilation of a kind of encyclopædia where knowledge was to be arranged under twenty-eight sections. Only a fragment of this work remains. He attempted a definition of the most intrinsic and general features common to all created things, thinking that if this could once be achieved it would be easy for him to indicate the way to a knowledge of details. Knowledge might be infinitely differentiated and divergent so long as a common foundation could be established, such as would assure a steady progress in science. These ideas of Komenský were first outlined in a work which appeared in Oxford in 1637 under the title "Conatuum Comenianorum Præludia". Although his views impressed and influenced those English men of science who later were instrumental in founding the Royal Society, Komenský's pan-sophic schemes and educational programmes could scarcely succeed during his lifetime. There was civil war in England and the Thirty Years' War was devastating Europe. Nevertheless, much of his teaching has since borne fruit.

THE fifth volume of the annual summary of scientific and economic research work in agriculture, entitled "Agricultural Research in 1929", has been published by the Royal Agricultural Society of England (price 1*s.* 3*d.* post free). This publication has now established for itself a definite place in the periodical literature of the farming industry, and should be studied by all those wishing to keep themselves abreast of modern agricultural practice. The various branches of agriculture are considered under seven main headings as in previous years. The information covers such a wide field that it is impossible to do more than indicate some

of the many interesting and important subjects considered. The recently developed tar distillate sprays for fruit trees are discussed in some detail, and it is evident that as winter washes they are extremely effective against many insect pests. For the arable farmer, the articles on varieties of sugar beet, and the control of rust and smut diseases of cereals, in which practical methods with relative costs are included, will be of particular value. As regards dairy husbandry, fundamental problems such as breeding and management of cattle, milking methods, and the interpretation and use of milk records are considered. For those interested in engineering questions, articles on the use of electricity, traction, and the development of some of the newer farm implements are included. Feeding values for dairy cows and pigs are the chief subjects on animal nutrition discussed, the importance of minerals in stock-feeding being emphasised; and it is evident from the section on veterinary science that considerable advances have been made in the control of contagious abortion and tuberculosis. Under the heading of soils and fertilisers, soil classification and methods of land reclamation are discussed, and data as to the world production and consumption of the chief fertilisers are given, the use of nitrogen and potash in particular showing a large increase. Each section concludes with a list of papers quoted.

"THE Mechanism of Organic Evolution" was the subject of an address by Charles B. Davenport, to the Washington Academy of Sciences, which appears in the *Journal* of the Academy (vol. 20, p. 317; 1930). After revising some of the recent observations on the occurrence of mutations, their direction, and their natural selection, he summarises the mechanism of organic evolution as consisting of a series of processes: infinite capacity of the germinal material for reproduction; infinite capacity for mutation; an infinitude of different kinds of environments; extensive opportunities for dissemination of the mutant individuals over the earth, permitting some of them to find an environment for which they are specially fitted; as for the rest of the infinitude of individuals, non-mutant and mutant (beyond the number required for replacement), elimination. The organic world is far from being the infinitely diverse collection of haphazard and meaningless variants to be expected if mutations were uncontrolled. The directive influence, according to the author, appears to work through the repeated losses of something from the parental gene. This may be true of the cases Davenport selects, albinism, hairlessness, and the like, but our difficulty is to see how, looking broadly at the products of evolution, loss in the gene can mean greater complexity in the final product—in short, how the organic progress from amœba to man can be due to successive losses in the germinal content.

ONE of the most significant of the articles in the September-October number of *Natural History*, the journal of the American Museum of Natural History, discusses "The Museum in Education". The sub-title contains the challenge and gist of the argument: "the unparalleled present-day opportunity [of museums] to serve the community and to participate in the rapidly advancing movement for visual instruction". The way in which the American Museum of Natural History takes its share in this movement sets an example to be emulated. We need simply enumerate the museum educational activities to show their thoroughness and diversity. The extra-mural activities of museum service in the schools and colleges include circulation of nature-study collections, lending of lantern slides, distribution of motion picture films, lectures in schools, lending of circulating collections to branch libraries, co-operation with nature rooms in schools, and the Trailside Museum and Nature Trails at Bear Mountain. The intra-mural activities of school service at the museum comprise lecture courses in the museum, instruction for the blind, exhibition hall instruction and guidance for visiting groups, the Junior Astronomy Club, special courses for teachers, adult education, and co-operation with the training schools for teachers, high schools, and colleges.

A RECENT issue of the scientific journal *Physis* (vol. 10, No. 35), the publication of the Natural History Society of Argentina, contains a series of valuable papers on the structures of mammalia. Two papers discuss the fossil mammals of various parts of South America. From the pampean fauna of Patagonia, Lorenzo J. Parodi describes several interesting relics, including a new species of *Megatherium* of which a fine skull has been discovered, a portion of a carapace of *Glyptodon*, and phalanges of *Mylodon*. From the Friaseana beds of mid and lower Miocene, Lucas Kraglievich describes an extensive fauna, containing many new species of mammals, which he regards as a transitional association connecting the definite faunas of Santa Cruz on one hand and of Entre Rios, Catamarca, and Monte Hermoso on the other. An aspect of the evolution of the present-day mammalian fauna is dealt with by the same author in a useful paper on the craniometry and classification of South American wild dogs, in which he refers specially to the recent and fossil forms found in the Argentine. Finally, Rodolfo Parodi makes a contribution to the osteology of the larger living felines of the Argentine, the puma, the jaguar, and the ocelot.

WE have referred previously to Research Narratives published by Engineering Foundation, Inc., 29 West 39th Street, New York, which have been published in book form. By the courtesy of the Director, Mr. A. D. Flinn, we have now received copies of some further Narratives as they are first published, month by month, in leaflet form. Many leaders in finance, industry, engineering, and education, we are told, have these sent to them regularly in this convenient form, the leaflets being of such a size as can be slipped into a pocket-book or wallet so that they can be read at a convenient moment. Of those issued last year, that for April was on isotopes; that for June, on pressure and matter; that for August, on short-wave high-power radio tubes; while that for September contained an interesting account of the ingenious method adopted for damming the Saguenay River about 140 miles

north of the city of Quebec, where a mass of concrete, 92 ft. high and about 45 ft. square in section, was built upright on the bank of the river and then allowed to fall across the stream.

THE centenary of the birth of James Clerk Maxwell is to be celebrated in the University of Cambridge on Oct. 1 and 2, following on the Faraday celebration and the centenary meeting of the British Association in London. Addresses are to be given at Cambridge by Profs. Einstein, Langevin, Larmor, Planck, Sir James Jeans, and Sir J. J. Thomson.

MR. W. A. MACFADYEN, Longships, Capel-le-Ferne, Folkestone, has written objecting to the spelling in the letter by Dr. C. Crossland in NATURE of Dec. 27, p. 991, of the place Ghardáqa. He urges that since the Anglo-Egyptian Oilfields, Ltd., drilled the first oil well there in 1914, the spelling Hurghada has been used, and this form is also used officially by the Egyptian Government for the post and telegraph services. It would appear, however, that the name is correctly Ghardaqa, pronounced locally with the regular accentuation on the first syllable; writing from Cairo, Dr. Crossland would put the accent on the second syllable. The form Hurghada is supposed to be easier for Europeans to pronounce, but it is incorrect and phonetically distasteful to Arabic scholars.

MR. JAMES DRUMMOND, of Christchurch, New Zealand, who, at the age of sixty-one years, has retired from ordinary practical journalism, for a long time has successfully combined work on a daily newspaper with natural history. Interested in the botany, zoology, and geology of his own country, and realising that in the newspaper Press he had a unique means of passing knowledge on to the public, he seriously and earnestly took in hand an educational work in this direction. Every week for twenty-five years he has published a popular natural history article in a syndicate of leading New Zealand journals, with very gratifying results, evidenced by many expressions of appreciation. He has also published a number of books on New Zealand natural history, of which the most important, "The Animals of New Zealand", was written in collaboration with the late Capt. F. W. Hutton and is in its fourth edition. Mr. Drummond has published books on other subjects, but now intends to devote his literary activities to the natural history of New Zealand.

THE annual general meeting of the Institute of Metals will be held at the Institution of Mechanical Engineers on Mar. 11 and 12 under the presidency of Dr. R. Seligman; the programme includes fourteen papers on various aspects of non-ferrous metallurgy. It is also announced that the May lecture of the Institute will be delivered on May 6 by Mr. W. B. Woodhouse, of the Yorkshire Electric Power Company, who will deal with the technical and economic progress in large-scale electric power generation. The annual autumn meeting of the Institute will be held in Zurich on Sept. 13-16, immediately following the meeting of the International Association for Testing Materials.

THE Council of the Geological Society has this year made the following awards: Wollaston Medal to Dr. A. W. Rogers, of the Geological Survey of the Union of South Africa, in recognition of the value of his work on the geology of South Africa. Murchison Medal to Dr. G. W. Tyrell, of the University of Glasgow, for his work on the igneous rocks of the west of Scotland. Lyell Medal to Mr. E. C. Andrews, of the Geological Survey of New South Wales, for his researches on the economic geology of New South Wales and on physical geology. Bigsby Medal to Dr. Norman L. Bowen, of the Geological Laboratory, Carnegie Institution, Washington, D.C., in recognition of the value of his researches on the physical chemistry of igneous rocks. Wollaston Fund to Dr. R. G. S. Hudson, for his work on the stratigraphy and palæontology of the Carboniferous rocks of Yorkshire. Murchison Fund to Dr. C. J. Stubblefield, for his researches on the Cambrian rocks of Shropshire and on invertebrate palæontology. A moiety of the Lyell Fund to Dr. O. M. B. Bulman, in recognition of his work on the Cambrian rocks of Shropshire and of his palæontological researches; and a second moiety of the Lyell Fund to Mr. W. H. Wilcockson, for his work on petrology and economic geology.

WE have received from Science Service, Washington, a brief account of the demonstration by Dr. George W. Crile, at the recent meeting of the American Association for the Advancement of Science in Cleveland, of what he calls "autosynthetic cells". Dr. Crile brought together certain proteins, lipoidal brain extracts, and mineral salts in small cavities on glass slides, and in a few seconds the materials arrange themselves into masses showing certain resemblances to various types of unicellular organism. Among these resemblances are cited nucleation, growth and division by fission and budding, respiration, stainability, motility, and electric charge; they disintegrate when the difference of potential between 'cytoplasm' and 'nucleus' reaches zero. The addition of narcotics and anæsthetics causes a decrease in potential and in respiration, which are reduced to zero under the influence of cyanides and toxins. These structures have been kept in 'life' for ten weeks by the repeated addition of protein to the 'culture'. The experiments, so far as reported, suggest that certain mixtures of colloidal and other substances may be induced to arrange themselves into structures exhibiting some of the properties, both morphological and physiological, of living cells. Various experiments with irradiated proteins and lipoids, and with these substances derived from cancer cells, are also mentioned.

THAT chlorophyll and hæmaglobin are analogous organic compounds, which can be reduced to the same type of pyrrole derivative by removal of the metal—magnesium in the case of chlorophyll, iron in the case of hæmaglobin—and further treatment, has been well known since the classic researches of Willstätter upon chlorophyll. It is very interesting to learn, therefore, that liver extract, successfully used to check the course of pernicious anæmia in human beings, has now been used by Prof. O. Raber to check the yellowing of given plants grown under etiolation conditions. Prof. Raber's experiments were reported to the

American Society of Plant Physiologists meeting in Cleveland, U.S.A., according to a report received through Science Service, of Washington, D.C.

YEAR BOOK No. 28 of the Carnegie Institution of Washington contains a series of brief but interesting "Reports on Investigations" from the Department of Embryology under the directorship of Dr. Streeter. It is not possible to mention all the reports, covering as they do such a wide field, from more or less straightforward embryology to experimental work, pathology, and tissue culture. Certain reports, however, seem of wide interest. Drs. Gregory and Lewis have succeeded in making a kinematograph record of the developing rabbit's ovum from the first cleavage up to the formation of the cleavage cavity. Dr. Hartman has worked out the rate of intra-uterine and post-natal development of the opossum in considerable detail, and alone and in co-operation with colleagues added much to our knowledge of the phenomena associated with reproduction in *Macacus rhesus*. Dr. Hines has produced a monographic study of the brain of *Ornithorhynchus*.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—A science master and a master for engineering subjects (mechanics, machine drawing, and engineering science) in the Junior Technical School for Boys of the North-Western Polytechnic—The Secretary, North-Western Polytechnic, Prince of Wales Road, N.W.5 (Jan. 30). A laboratory assistant at the L.C.C. Shoreditch Technical Institution—The Education Officer (T.1), The County Hall, S.E.1 (Jan. 31). An assistant radiologist at the Hospital for Tropical Diseases, Endsleigh Gardens—The Secretary, Seamen's Hospital Society, Greenwich (Feb. 4). A professor of educational psychology in the Egyptian Institute of Education—The Director, Egyptian Education Office, 30 Victoria Street, S.W.1 (Feb. 9). A director of the Gardens of the Royal Horticultural Society, Wisley—The President, Royal Horticultural Society, Vincent Square, S.W.1 (Mar. 2). A professor of zoology in the Queen's University of Belfast—The Secretary, Queen's University, Belfast (April 30). A lecturer in agriculture in the University of Reading—The Registrar, The University, Reading. An assistant lecturer in mathematics and demonstrator in physics or chemistry at Faraday House Electrical Engineering College—Dr. A. Russell, Faraday House, Southampton Row, W.C.1.

Our Astronomical Column.

Eros.—Prof. Hartmann makes a bold suggestion in *Astr. Nach.*, 5762, to explain the twofold fact that Eros deviates considerably from the predicted ephemeris, and that it is about a magnitude fainter than was expected. He notes that even before the present apparition the peculiar curve of light variation had caused the suggestion to be made that the planet was shaped like a dumb-bell. He now suggests that Eros has broken into two portions, of which the one now under observation is the fainter. If anything of the nature of an explosion accompanied the separation, the two portions would drift apart, thus explaining the error of the ephemeris. The suggestion is ingenious, but there are two grave objections:

(1) If the fragment under observation is the smaller one, the other would be closer to the predicted place, and could not well have escaped detection on the numerous plates that have been taken.

(2) The splitting in two could scarcely leave the rotation period unaffected. The light curve now obtained agrees, both in period and type, with the observations made in 1901, which is against any notable change having taken place since then.

Planetary Nebulæ and *O*-type Stars.—A note in the Astronomical Column of NATURE of Feb. 1, 1930, p. 180, referred to an article by Prof. C. D. Perrine in *Astr. Nach.*, 5672, on the radial motions of the *O*-type stars. The note suggested that there was some difficulty in reconciling the two suggestions of Prof. Perrine: (1) that planetary nebulæ are the relics of former novæ; (2) that planetary nebulæ and the *O* and *B* type stars form a progressive series of objects. The idea in the reviewer's mind was the distinction between the catastrophic development of novæ and the apparently steady condition of the *O* and the *B* stars. In a letter to the Editor, Prof. Perrine now suggests that we have little guarantee of the permanence of spectral types: he says, "even to-day stars other than novæ are under suspicion of having changed type appreciably". Further, he notes that the spectra of novæ pass in succession through various spectral types, and that a nova the development of which was unusually slow might be classified as a normal *B*-type star while it was passing through this stage. Prof. Perrine further notes, in amplification of his former paper, that he has now applied the radial motion due to galactic rotation, as given by Plaskett's observations, to his results for the *O*-type stars: "These are made more consistent, strengthening the assumption of a systematic difference between the absorption and emission stars".

Sydney Astrographic Catalogue.—The Sydney Observatory is making great efforts to catch up its serious arrears in publishing its section of the astrographic catalogue, which extends from 51° to 65° S. Decl. It will be published in 52 sections, each covering 6 hours in R.A. and 2° in Decl., each region of the zone appearing on two plates at least. Volumes 11 and 12 have recently been issued; they include the plates the centres of which lie in Decl. 54° S., and R.A. from 12^h to 18^h, and 18^h to 24^h respectively. Vol. 11 contains 86 pages, and Vol. 12 43 pages; a full page contains 280 stars, but many of the pages have blank spaces. The lower galactic latitude in the region of Vol. 11 explains its greater star-density. The following volumes of the Sydney catalogue have now been published: 1 to 8, 11 and 12.

The method of denoting magnitude has not been uniform in these volumes: the earlier ones use a scale of letters; the later ones substitute the numbers, 1, 2, 3, etc., for the letters *a*, *b*, *c*, etc. The magnitude column is headed "Diameter", which is rather misleading, as numeral 1 denotes the brightest stars, of magnitude about 8·0, and therefore the largest diameters; while 10 denotes those that are just perceptible, magnitude about 12·2. For stars brighter than mag. 8 the actual diameter, in thousandths of a reseau interval, is given. The dates of exposure of the plates are mainly between 1892 and 1900, but a few are so late as 1925. The *X* and *Y* co-ordinates are given to the third decimal of a reseau interval. It is noted that up to the year 1912 the plates were measured at Melbourne, but since that date, at Sydney.

Research Items.

The Bundle of Life.—In *Ancient Egypt*, 1930, pt. 3, Miss M. A. Murray brings forward evidence from ancient Egypt in support of Sir James Frazer's contention that the expression 'bundle of life' used by Abigail when addressing David is a reference to the doctrine of the external soul. As the well-being of the whole country depended upon the life and soul of the Pharaoh, every effort was made to protect them from accident or illness. The royal soul would be completely safe if wrapped up and entrusted to the safe-keeping of a special official whose life terminated with the life of the king. The object so wrapped up and guarded might well be known as the 'bundle of life'. The placenta and umbilical cord are peculiarly important to primitive minds, and it seems that among certain peoples the placenta or the cord was regarded as the seat of the external soul. It has been pointed out that a certain standard carried before the Pharaoh on ceremonial occasions represented the royal placenta. The beliefs and practices of the Baganda in regard to the royal umbilical cord appear to afford close parallels to Egyptian ritual of the early historical period. In the early period of Egypt the actual object was represented; but later it became highly conventionalised, because the artist was accustomed to see the object in wrappings only. In Uganda the object was entrusted to a high official, ranking next to the Prime Minister; in Egypt it was entrusted to the Prime Minister himself, who was also the chief magician. The rare title in Egypt for which the translation "the Opener of the Placenta" is suggested, would then refer to the death of the king by the opening of the 'bundle of life' to release the soul. This officer would then be the executioner of the king when his divine powers began to wane. The custom was still remembered in the sixth dynasty, though a victim had then been substituted for the royal sacrifice. The title became extinct at the end of the Old Kingdom, but in the New Kingdom the object reappears in temple wall-sculptures, plaques, etc.

Chiefs and Shamans in California.—Mr. A. H. Gayton has made a study of the functions of chiefs and shamans respectively in the social organisation of the Yokut and Western Mono of the San Joaquin Valley of southern central California, which is published as No. 8 of vol. 24 of the *University of California Publications in American Archæology and Ethnology*. The political organisations of Yokut and Mono were as simple as any among Californian tribes. They had no clans, and the moiety regulated marriage and participation in ceremonial observance. Patrilineal families dwelt in permanent villages; but they owned no land other than an ill-defined tribal area. They lived by hunting, fishing, and food gathering. Truthfulness, industry, and generosity were not so much virtues as necessities. Legal authority was wielded by the chief, with the winatums as executive officers and go-betweens from the authority of the chief to the people. The chief made decisions on tribal and inter-family affairs, such as fandangoes and mourning ceremonies, the building of a sweat-house and so forth. He gave permission for the infliction of the death penalty. There was a complete absence of formulated law; each case was taken on its merits by the chief, who gave his decision without reference to precedent. Peace and public satisfaction were secured by a power which had no legal basis—the fear of sorcery. The peace of the community depended upon the character of each individual, and this was moulded by the fear of supernatural powers, which could be brought into operation by the individual himself or by a shaman hired for the purpose. Such transgressions as cheating in gambling, adultery, or neglect of any ceremonial duty, by these means would be visited on the offender or a member of his family. The shaman through whom the penalty for transgression was inflicted was not an official. Nevertheless he acted in co-operation with the chief, who utilised his services in punishing an individual who did not take his part in carrying out any public duty, such as contributing his fair share to a fandango, mourning ceremony, or the like. A check was kept on both the shaman and the chief by the fact that oppression or unfairness on the part of the chief, or trickery or abuse of his function by the shaman, would be punished by exposure, loss of influence and position, and even death.

Leonardo da Vinci as Anatomist.—In his recent excellent monograph entitled "Leonardo da Vinci the Anatomist (1452–1519)" (Publication No. 411 of the Carnegie Institution of Washington. Baltimore, Md.: Williams and Wilkins Co. 6 dollars), Dr. J. Playfair McMurrich, professor of anatomy of the University of Toronto, has given an impartial account of Leonardo's achievements as an anatomist and of his status in the history of anatomy. Dr. McMurrich points out that, though Leonardo was greatly influenced by the Arabists, particularly as regards his nomenclature and physiology, he merits the title of great anatomist as well as of great artist by being the inaugurator of a revolution in descriptive anatomy. Although he was guilty of many errors both of omission and of commission, he made many important discoveries, among which may be mentioned those of the frontal and maxillary sinuses, the moderator band of the heart, the bronchial arteries, and arteriosclerosis. He was, moreover, distinguished from his medieval predecessors and his contemporaries by greater thoroughness, which is particularly illustrated in his studies of individual bones and muscles, as well as by his investigations of the heart, digestive system, brain, and generative organs. As regards Leonardo's place in the history of anatomy, Dr. McMurrich maintains that though Leonardo's influence on the progress of anatomical knowledge was undoubtedly reduced by the fact that his discoveries were not published, it cannot have been entirely lacking, as his studies must have been known to the leaders of scientific thought, such as Pacioli, the Marliani, and the Cardani, who frequented the Florentine and Milanese courts, as well as to his fellow-artists and his colleagues in the Florentine Guild of Physicians and Apothecaries.

Place-Memory shown by Butterflies.—In 1918 William Beebe described what seemed to be a regular homing movement by a zebra butterfly, *Heliconia*, which nightly returned in groups to the same roosting place, and he interpreted his observations as indicating that these butterflies possessed memory, sociability, and caution. During 1930, as well as in preceding years, F. Morton Jones made definite attempts to check Beebe's observations, in the Royal Palm Shade Park of Florida, where *Heliconia clarithonia* is usually fairly abundant from mid-January to April (*Natural History*, Nov.-Dec. 1930, p. 635). Six roosting places were discovered, and about these, while daylight was failing, the butterflies collected in numbers, filling the air in swirling flight, making preliminary exploring surveys, and finally settling down for the night. The marking of several individuals showed that for several nights in succession the same butterfly may return to a particular twig, but this detailed accuracy of return was by no means a general rule. Was the homing due to place-memory or to scent? A simple experiment settled the question. Branches on which a number

of Heliconias had roosted were removed during the day and placed on another bush within the exploring range. The butterflies returned at nightfall, circled about the old bush, apparently observed that something was amiss, continued their exploring flights, and finally settled down upon twigs in the old roosting bush. Some, during their explorations, paused upon the transferred twigs, only to leave them again and rejoin the flying group. After dark, twenty-seven were found in new positions in the old bush, and only one on the transferred twigs, ten feet away. Apparently place-memory is the guiding power.

Teleost Fishes from the Bahamas.—Mr. Albert Eide Parr has continued his investigations on fishes from the *Pawnee* Expedition's "Teleostean Shore and Shallow-Water Fishes from the Bahamas and Turk's Island" (*Bulletin of the Bingham Oceanographic Collection*. Peabody Museum of Natural History, Yale University. Scientific results of the third oceanographic expedition of the *Pawnee*, 1927. July 1930). The present portion includes a very large number of fishes, numbering 150 species in all, in which there is one new genus, eleven new species, and one new sub-species, besides many rare and little-known forms which previously were insufficiently described. The new genus *Amphelikturus* is created for Barbour's *Siphostoma dendriticum* and a new species named *Amphelikturus brachyrhynchus*. The latter is a handsome fish with dendritic processes on almost the whole of the body, even on the ocular bulbs. The genus is closely related to *Haliicythys*, differing, however, by the presence of a caudal fin and of protecting processes for the brood pouch. The two genera occupy an intermediate position between the Syngnathinæ and the Hippocampinæ. There are, in this paper, valuable discussions on the affinities of certain species, based on careful measurements and colour notes taken from the living fishes.

Toxicity of Nicotine to Insects.—Previous investigations on the toxicity of nicotine to insects have involved chiefly a study of the effects of its application as sprays or dips, whereby the alkaloid is presented in molecular and ionic form. The actual toxic effect has been generally attributed to the entrance of the gaseous molecules into the tracheal system of the insect. C. H. Richardson and H. H. Shepard, however, describe some experiments (*Journal of Agricultural Research*, vol. 41, p. 337) with mosquito larvæ, in which the nicotine was presented in aqueous solution only, and in which a wide range in the relative concentration of ions and dissolved molecules was obtained by varying the *p*H value. With aqueous solutions of nicotine of 0·03*M* concentration an increased toxicity was shown with an increase in *p*H value, the maximum effect being obtained with *p*H 9·7 (the free base). Further, at *p*H 5·0, concentrations from 0·1*M* to 0·0001*M* nicotine were five to seven times more toxic than was the sulphate at the same concentration. Since these results show that the free base is more toxic than its salts in the absence of the gaseous phase, the view that the greater toxicity of the alkaloid is due to its greater volatility, hitherto put forward by other workers who obtained a similar result with methods including this form, cannot be accepted. The speed of the toxic action was found to be directly related to the concentration of the undissociated molecules, so that toxicity is believed to result largely from the penetration of the wall of the alimentary tract by the alkaloid in this form. Nicotine ions are also toxic, but considerably less so than the molecules.

Eye Colour in *Gammarus*.—The eye colour of the wild *Gammarus chevreuxi* is always black, and no variation from the normal black has ever been observed in the many thousands of this amphipod which have been collected in the native habitat of the species at Plymouth. This, however, does not preclude the possibility, as is pointed out by E. W. Sexton, A. R. Clark, and G. M. Spooner (*Jour. Mar. Biol. Assoc.*, **17**, No. 1, Sept. 1930), that mutations may have arisen in the wild stock and have disappeared in the struggle for survival. The difficulty these investigators have experienced in establishing mutant stocks in the laboratory indicates that the mutations of the type used for genetical study would have but little chance, under normal conditions in Nature, of survival through the early critical period. But once established, the mutants tend to become healthier with each generation, and some are able in time to hold their own with the normal wild black-eyed animals in vigour, length of life, and number of offspring. The pigment of the eye begins in normal cases as bright scarlet in the embryo and passes through various darkening stages to jet black by the time of hatching. In five stocks, all genetically distinct from one another, there have arisen red-eyed specimens in which the red colour persists after hatching. The first was observed in 1912, the second, third, and fourth in 1922, and the new mutant stock, dealt with in the present paper, is descended from one of the wild pairs brought into the laboratory in 1928 for temperature experiments. The inheritance of this type of red eye, in which intermediate stages and various colour changes occur, is of a complicated kind, and an interpretation in terms of Mendelian genes would clearly involve several genes and interplay of one kind or another among them. The matings with this stock have reached the eighth filial generation and the details thereof are clearly set out.

Mineral Production of India.—To all who are interested in the geology, mining industry, and economics of India the Quinquennial Review of the mineral production of India is a most useful and instructive publication. The period under review is from 1924 to 1928 inclusive (*Rec. Geol. Surv. India*, **64**, p. 446; 1930). The output of coal has slowly but steadily increased since 1925, though unfortunately there has been an equally steady drop in value. India is the largest coal-producer among the British dependencies. The output of petroleum has not varied much, but owing to the marked rise in world production India's percentage contribution has fallen to 0·7 per cent. The 1929 figures reveal a notable increase in value, though the world percentage has further dropped to 0·61 per cent. The total of the manganese output has gone up, and though the output has risen still further in 1929 the value has dropped, and the industry is at present in a somewhat depressed condition. There has been a steady decline in gold production since the early stages of the War period. A general increase in the production of lead, zinc, and silver is recorded. The output of tin is also increasing, and a slight set-back in 1928 was more than recovered in 1929. The quantity and value of iron ore showed a definite improvement. India is the second largest producer of iron in the Empire and yields place only to Great Britain. Copper also shows a marked increase, continued in 1929 as a result of the activities of the Indian Copper Corporation. The report of the mineral production for 1929 is published in the *Rec. Geol. Surv. India*, **63**, pt. 3, 1930, and brings the Indian statistics up-to-date.

Recent and Fossil Foraminifera.—In the hope of furnishing evidence for the interpretation of fossil faunas, R. D. Norton ("Ecologic Relations of some Foraminifera", *Bull. Scripps Instit. Oceanogr.*, **2**,

pp. 331-388; 1930) has studied the conditions affecting the distribution of some 550 species and varieties of Foraminifera found in the Floridan and West Indian regions, ranging in depth from the beach to 2849 fathoms. In water of 0-5 fm., where the annual temperature range is 21°-32° C., the Miliolidæ and Peneroplidæ are generally common or abundant, but at 5-60 fm., where the temperature range is 20°-31° C., there is a marked decrease in the number of species and individuals of those families. At 500-2850 fm., with a temperature range of only 2°-8° C., the Globigerinidæ and the Globorotaliidæ are predominant. The Rotaliidæ and Anomalinidæ are present at nearly all depths and, as families, do not seem to possess much ecologic value. J. A. Cushman and W. W. Valentine ("Shallow-water Foraminifera from the Channel Islands of Southern California", *Contrib. Depart. Geol. Stanford Univ.*, pp. 1-31, pls. i-x; 1930) give an account of the Foraminifera found in shallow water around the islands of Southern California. The fauna is related to that of the west coast of South America, and to some extent to that of the West Indian region. W. P. Woodring ("Upper Eocene Orbitoid Foraminifera from the Western Santa Ynez Range, California", *Trans. S. Diego Soc. Nat. Hist.*, **6**, pp. 145-170, pls. 13-17; 1930) describes new species of *Discocyclina* and *Actinocyclina* from a soft limestone of the western Santa Ynez range. The latter genus is widely distributed in eastern United States, the West Indies, and Central and South America, where it is limited to the Upper Eocene. H. Yabe and S. Hanzawa ("Tertiary Foraminiferous Rocks of Taiwan, Formosa", *Sci. Rep. Tôhoku Imp. Univ., Sendai*, ser. 2, Geol., **14**, pp. 1-46, pls. 1-16; 1930) record 38 species of Foraminifera from Oligocene and Miocene deposits of Taiwan. They belong principally to the genera *Lepidocyclina*, *Miogypsina*, *Gypsina*, and *Operculina*.

Cosmic Radiation.—Details of fresh measurements of the cosmic radiation are given by Prof. R. A. Millikan in the issue of the *Physical Review* for Dec. 1. These have been made partly at Pasadena and partly at Churchill, on the west side of Hudson's Bay and 730 miles south of the magnetic pole. A new high-pressure electroscope has been used which gives greater accuracy than Prof. Millikan's earlier instruments, and it has been found that the cosmic rays have the same intensity at these two places to within one per cent; it is concluded that they enter the earth uniformly from all parts of the sky, and that, at the outer limit of the atmosphere, they are composed of ether waves and not of electrons. The intensity was found to be independent of the positions of celestial objects, but it showed a diurnal variation, going through a maximum every afternoon and a minimum every morning, even after corrections had been made to bring the readings to a common barometric pressure. This is attributed to the fact that the barometer is affected by both the temperature and the weight of the superincumbent air, whilst the response of a closed cosmic ray electroscope depends only upon the mass of air above it. As Prof. Millikan points out, combined cosmic ray and pressure measurements may thus be of much value in meteorology. Prof. Millikan considers that the observed cosmic ray effects are all in good agreement with the predictions of the Klein-Nishina absorption formula, thus lending support to his hypothesis that the rays are due to atomic syntheses occurring "in the depths of space".

A Variable Capacitance Cylindrical Condenser.—In a paper read to the Institution of Electrical Engineers on Jan. 7, E. B. Moullin describes a cylindrical condenser the capacitance of which can be varied gradually through a wide range. One cylinder is totally enclosed by the other and their axes are parallel. The axes are coincident when the capacitance is a minimum. By moving the axis of the inner cylinder away from the central position the capacitance increases gradually, being a maximum when their axes are farthest apart. With the dimensions chosen, the capacitance is increased by one micro-microfarad (1 $\mu\mu$F) by rotating the pointer through 45°, the total change in the capacitance being 16 $\mu\mu$F. The capacitance values engraved on the scale are determined by calculation and not by experimental calibration. It is shown by electrostatic principles that the end effect capacitance, at least to a first approximation, is constant as the position of the inner cylinder is varied. This was verified experimentally by careful tests. It was also found possible to use the condenser as a small variable inductance. It was found that the residual inductance of the condenser was the twentieth part of a millihenry. A method is shown of combining the tubular inductance and the tubular condenser so as to form a robust and self-screening short-wave wavemeter of small range. Experiments prove that the instrument is capable of measuring a wavelength correctly to about 0·07 of 1 per cent. This practical device is a good illustration of a useful application of mathematics to physics.

Draper's Law.—The researches of Draper and of Bunsen and Roscoe showed that the rate of photochemical union of hydrogen and chlorine was proportional to the light intensity. In 1921 Baly and Barker found that the rate increased faster than the light intensity, but Mrs. Chapman in 1924 was unable to confirm this. In the December number of the *Journal of the Chemical Society*, Allmand and Beesley describe experiments which agree with Mrs. Chapman's results, and they also suggest a possible explanation of those of Baly and Barker.

Heterogeneous Equilibria in the Iron-Oxygen-Hydrogen System.—The values of the equilibrium constants in the reactions

$$FeO + H_2 = Fe + H_2O$$
$$\text{and } Fe_3O_4 + H_2 = 3\,FeO + H_2O$$

have been determined at various temperatures by Emmett and Shultz, whose experiments are described in the November number of the *Journal of the American Chemical Society*. A discussion of previous experiments is given, and the importance of surface effects is emphasised. The results are of importance, since, when taken in conjunction with previous experiments on the iron-carbon-oxygen system, they lead to values for the water gas equilibrium. These are calculated and are shown to be in agreement with the directly determined values of Neumann and Köhler, published in 1928.

Anhydrous Stannous Chloride.—Anhydrous stannous chloride, $SnCl_2$, may be obtained by passing hydrogen chloride over heated tin. A more convenient method is described by Stephen in the December number of the *Journal of the Chemical Society*. The crystalline hydrate ($SnCl_2$, $2H_2O$; 1 mol.) is treated with acetic anhydride (2 mols.). Much heat is evolved and the anhydrous salt separates. It is washed with dry ether and can then be kept indefinitely in a desiccator. The anhydrous chloride, which crystallises in long needles from acetic acid containing a little acetic anhydride, does not appear to be hydroscopic. It is soluble in acetone and amyl alcohol, insoluble in benzene, toluene, xylene, and chloroform. It dissolves readily in absolute methyl and ethyl alcohols, but a trace of water causes hydrolysis with the formation of an opalescent precipitate.

Sea Fisheries Statistics.*

THE statistical tables for 1928 of the sea fisheries of the north and west of Europe, brought together and edited by Prof. D'Arcy Wentworth Thompson, show much that is of interest. By a recent resolution of the International Council, "the value and quantity of fish landed in each country is now and henceforth to mean only such fish as is landed by the fishing-fleets of that country; all fish caught by the vessels of any particular country are credited to that country, whether they be landed at home or abroad, and (for instance) trawled fish landed by a German at Aberdeen is treated as part of the German catch and not of the Scotch". This does away with a statistical difficulty which in some countries, notably Great Britain and Germany, was serious.

The total values of the fisheries of northern and western Europe (including Portugal) amounted in 1928 to nearly £47,000,000, and the total quantity of fish landed was rather more than 3,300,000 English tons. Using the returns of the year 1913 as a normal standard of comparison, the money value of each catch was 46½ per cent above that of 1913, 6 per cent greater than in 1927, and the largest figure since 1924; but it was much less than the total earnings of the fisheries during the inflated prices of the years 1918–1920. These total values and quantities are unaffected by the change of statistical method, but this change affects the returns of some of the individual countries. In Great Britain the value of the fisheries has increased to an extent nearly sufficient to compensate for the deduction of value due to foreign landings. The total quantity of fish landed in 1928 is the largest on record for most of the countries concerned, as that for 1927 had been in its turn, exceeding the catch of 1913 by about 20 per cent. All countries show an increased catch in 1928 except Great Britain and France. The average price was the same in 1927, about 20 per cent above the average price in 1913. Of the more important fishes, herring alone in 1928 is at a lower average price (about 7 per cent lower) than in 1913. Trouble in the herring market and difficulties of export trade account for this.

In the North Sea fisheries the catch increased steadily until 1913, when it reached its maximum of a million and a quarter tons. During the War the landings were reduced to less than half. By 1920 the pre-War catch was nearly equalled, but again went down in 1921 and 1922. Since then the catches have increased, and in 1928 amounted to 91 per cent of the 1913 totals. The net fishery (to all intents and purposes identical with the herring fishery) is all but equal to that of 1913, the line fishing has increased considerably, but the trawl landings are no more than 85 per cent of those of 1913. The Danish seine came into use later, and only found its place as a separate entry in the tables in 1925. Within the last four years this fishery has not increased, but not diminished to any serious extent, and rather more fish were landed in 1928 from the North Sea by means of the Danish seine than by the line fishery.

Herring, haddock, cod, and plaice are the most important fishes in most of the countries concerned, yielding more than half of the whole revenue except in France, Belgium, Poland, and Portugal. The tables showing the share contributed by these fishes to the total fishery revenue vary little from year to year. The herring fishery in the North Sea is not so great as it was—at least in its relative importance—but is not going back, and for the last three or four years its relative share of the total value has been slowly but steadily rising. The fluctuations in the relative shares of the various countries in the North Sea catch are chiefly due to the herring. The catch of herring was a good one in 1928 in both the Kattegat and the Skagerrak, and herring constituted very nearly two-thirds of the whole quantity of fish landed from the North Sea. Haddock was higher in 1928 than in 1913, both in quantity and value; cod had risen in total value but fallen in quantity; plaice and sole had both improved in relative quantity and value.

Very high figures are shown for 'small' plaice from the trawlers, especially in Holland, and these tend to increase; this is also the case for the haddock, the cod increasing much after 1913, but dwindling again in 1928.

Part 2 is occupied with tables of general statistics, and there is a list of the common names of the fishes as used in the different countries.

* Conseil Permanent International pour l'Exploration de la Mer. "Bulletin statistique des pêches maritimes des pays du nord et de l'ouest de l'Europe.' Publié par le bureau du Conseil. Vol. 18, pour l'année 1928. (Copenhagen: Andr. Fred. Høst et fils, 1930.)

The Timber of Corsican Pine.

CORSICAN pine (*Pinus Laricio*) is being planted in Britain at the present day on a very considerable scale, especially under the auspices of the Forestry Commission. In fact, it is being given preference, owing to the greater rapidity of growth, over the indigenous pine; the volume of Quality I. Corsican being 40 per cent greater than for the same quality Scots pine. In how far this action will prove justifiable must be left to the future to disclose. Those who are paying serious attention to the question will welcome *Bulletin* No. 6, "The Timber of Corsican Pine", of the Forest Products Research Laboratory (London: H.M. Stationery Office, 1930. 2*s*. 6*d*. net), which gives the results so far attained in the study made in the laboratory of the timber of Corsican pine grown in Great Britain. As the introduction to the bulletin rightly says: "The extensive plantations of this species that are being formed throughout Great Britain will in time yield a considerable quantity of timber, and it is important to know what are the characteristics of this timber as grown in this country and hence for what purposes it is suited".

Fortunately, there are in existence plantations of sufficient age to enable timber tests to be carried out; for though it is only during the last fifty years that it has been at all extensively planted, the species was introduced into England about 1759. The timber used for the mechanical tests was obtained from a plantation on Lord Leicester's estate at Holkham and from the New Forest, near Knightswood. The value of this species for pit props has also been investigated, the material for the purpose being obtained through the Forestry Commissioners from the Forest of Bere, Leuchars, Fife, and the Forest of Dean. The pit props from these two areas were compared with imported props from Scandinavia and the Baltic.

For the very interesting and important data which have so far been obtained from the investigations carried out reference must be made to the bulletin. The conclusions arrived at are summarised as follows:

The timber is moderately light, very resinous, with a texture somewhat coarser than Scots pine. It can be readily seasoned, either in the open or in the kiln. The timber has a tendency to take on a deeper tinge if high temperatures are used, but this does not neces-

sarily prove detrimental to its use. It can be readily air-seasoned, but, as the sapwood is liable to blue stain, the logs must be converted as soon as possible after felling; and similarly seasoning should proceed as rapidly as possible after conversion. In the case of air-seasoning, open stacking is recommended.

Although the timber has a strength equal to the average pines, except the pitch pines, it is not so strong as Scots pine or home-grown Douglas, a point requiring careful consideration. It is inclined to be brittle and consequently should not be used in positions where it would have to resist the application of sudden loads or shocks. As a mechanical timber it is probably of most use as a post, where its strength in compression parallel to the grain is almost equal to that of the Scots pine. Corsican pine takes readily either creosote or water solutions. The timber works easily under all tools and takes a finish equal to Scots pine. There is, however, a considerable proportion of sapwood and this is more difficult to cut than the heartwood. The frequency of knots detracts also from the appearance in finishing any large surface of timber. The knots are to a considerable extent due to faulty methods of growth in the past, and this defect should be eliminated in the future. It is said that the timber would then be suitable for all classes of finer joinery in which Scots pine is at present used. It would also be useful for boxes, packing-cases, and crates. Owing to the readiness with which it takes creosote, it has a possible future as railway sleepers.

As regards pit props, this timber, when carefully graded (the latter point is of first importance), is equal to Scots pine and compares favourably with imported props of the same grade. The props must not be left with the bark on for any considerable time.

To those interested in the afforestation question and to the future uses to which the timbers of the species now being planted may be put, a study of this bulletin should prove of the greatest interest. It also furnishes evidence of the important nature of the work being undertaken by the Forest Products Research Laboratory at Princes Risborough.

Annual Conference of the Geographical Association.

THE annual conference of the Geographical Association was held at the London School of Economics on Dec. 31–Jan. 3, and was followed by a week-end visit to St. Albans. There could be few more adequate tributes to the vitality of the modern science of geography and the increasing recognition of its importance in all walks of life than the steadily expanding activities of this annual gathering. It is estimated that between five hundred and six hundred members took part, and more than a hundred sat down to the annual dinner on Jan. 2, whilst the publishers' exhibition was larger than on any previous occasion. It is significant of the mutual appreciation of two bodies engaged in spreading knowledge of the earth as the environment of man and the responsibilities of the voter of to-day as a citizen of the world, that the opening gathering of the conference took place in the galleries of the Imperial Institute. Here, members and their friends were welcomed by Lieut.-General Sir William Furse.

Mr. B. B. Dickinson, in his presidential address, dealt with the early history of the Association, modestly attempting to disclaim his title of founder. His interesting account of the steps by which geographical teaching has been improved and of how the interests of teachers were watched by the young Association was provided with a sequel at the annual dinner by the announcement of a presentation shortly to be made to Miss R. M. Fleming. Under the guidance of Prof. H. J. Fleure as honorary secretary, no one has done more to further the work of the Association—its membership of more than 4000, its library, its lantern-slide collection, and its branch organisations—than Miss Fleming. Very appropriately, her recent travels in Russia provided some of the material for a very able account of the geographical regions of the country, a lecture which attracted many more than could be admitted.

In the annual report, reference was made to the transfer of the headquarters to Manchester, and to the acceptance by Sir Leslie Mackenzie of the presidency for 1931. Mr. J. Fairgrieve reported on the work of the Commission on Educational Films, holding that the present-day teachers must in any case face the problem of using films for a generation of children already film-minded as freely as they would a blackboard. Dr. L. D. Stamp, as the director of the Land Utilisation Survey of Britain, referred to that organisation as having grown naturally out of a committee of the Association. It is the primary object of the survey to record on the 6-inch Ordnance Survey maps the uses to which the surface of the country is applied, the uses being grouped under half a dozen simple categories. So far as possible, county education authorities are being asked to organise the work, which has the approval, amongst others, of Sir Charles Trevelyan, Sir Henry Richards, the County Councils' Association, and the Forestry Commission. It is hoped to publish the results as a series of map sheets on the scale of 1 inch to 1 mile.

Amongst other lectures may be mentioned Major Hingston's on the investigation of the life of the 'roof' of the equatorial forests of Guiana, Miss Butcher's description of the methods of the study groups organised by Leplay House (Institute of Sociology) as exemplified by surveys made amongst the Chod villages of Bohemia, and Dr. P. W. Bryan's study of population groupings in Britain. Dr. Bryan maintains that the human habitations marked on the 1-inch Ordnance Survey maps show a characteristic grouping according to the dominant occupation of the area, the grouping for example being different in areas of arable farming, pastoral farming, or mining. An important series of original maps, showing on the dot method the principal areas of production of the leading crops of Scotland, was exhibited by Mr. H. J. Wood. Amongst the group discussions, that on school journeys, which was combined with an exhibition of photographs and work carried out by pupils taken on such journeys, was of special interest.

After the termination of the London meetings, about forty members paid a visit to St. Albans, where they were received by Sir John and Lady Russell and members of the St. Albans Rotary Club. An examination of the site of the Roman city (Verulamium) afforded an opportunity of discussing the geographical factors which helped to determine the site of the city on the now elm-lined meadows beyond the Ver, and of the Saxon church of St. Michael. After a visit to the Herts County Museum, the party was received by the Mayor and Mayoress, and a lecture was given by Mr. Woolley on the life of St. Albans, based on the manuscripts of Matthew Paris. On Sunday, after attending a civic service at the cathedral, the house and grounds of Gorhambury (Bacon's home) were seen under the personal guidance of Lady Verulam, and an address on Bacon and his times, given by Sir Richard Lodge, was greatly enjoyed. On Monday, after

seeing the cathedral, the party made a tour, visiting especially the Gade Valley, " one of the most interesting valleys in England for the student of transport ". Above Tring, from the chalk scarp, an excellent view of the plain was obtained, the richly cultivated chalk-marl terrace with its row of old villages standing out clearly. The tour finished with a visit to Rothamsted Experimental Station under the guidance of Sir John Russell.

L. DUDLEY STAMP.
E. E. EVANS.

University and Educational Intelligence.

CAMBRIDGE.—The Appointments Committee of the Faculty of Medicine has reappointed Dr. A. E. Barclay, of Christ's College, to be University lecturer in medical radiology and electrology.

Dr. F. G. Mann, of Downing College, has been elected to a fellowship at Trinity College. Dr. Mann, who was formerly assistant to the professor of chemistry, is a University lecturer in chemistry.

GLASGOW.—On Tuesday last, at a ceremony in the Randolph Hall of the University, Sir Frederick Gowland Hopkins, president of the Royal Society, presented, on behalf of the subscribers, to Prof. Robert Muir, his portrait by Mr. G. Fiddes Watt, and to the University a bust by Mr. G. H. Paulin.

LONDON.—The Court has accepted, on behalf of the University, the generous bequest of £4000, free of legacy duty, from the late Miss Mary Ethel Sim Scharlieb, who died on May 31, 1926. The purpose of the bequest is the founding of a scholarship in memory of Miss Scharlieb's mother, the late Dame Mary Ann Dacomb Scharlieb, to whose life interest the legacy was subject. The conditions of award are to be determined by the University.

THE eighteenth series of *Methods and Problems of Medical Education* has been issued by the Rockefeller Foundation, New York, U.S.A. This volume deals particularly with institutes and laboratories of physiology and physiological- and bio-chemistry, together with some pathological and other special departments, in all parts of the world. As in previous series, descriptions of the laboratories are given, with illustrations and plans, and in some instances the staffing and budgets of the departments are appended.

THE annual report of the University of Leeds to the Worshipful Company of Clothworkers of the City of London on its textile industries and colour chemistry and dyeing departments will be read with additional interest in view of the recent controversies regarding the Dyestuffs Act of 1920. Both departments showed a falling off in the number of day students, and the textile industries department's enrolment of evening students decreased from 110 to 94. They both report, however, a brisk demand for the services of their past students, and the colour chemistry and dyeing department could have placed in suitable positions more students than were ready for employment. Great interest was taken in the work of the department by numerous firms, which not only consulted its head when vacancies occurred in their staffs, but also gave a great variety of chemicals, artificial silks, and other textile materials, machinery, etc. All students awarded research scholarships in recent years have completed arrangements for their employment in industry some months in advance of leaving the Department. Attached to the report is a list of publications by members of the departments.

Birthdays and Research Centres.

Jan. 25, 1875.—Mr. S. S. COOK, F.R.S., technical manager of the Parsons Marine Steam Turbine Co.

The chief objects of present investigations are the development of high pressure turbine machinery for marine propulsion, and the investigation of thermodynamic and hydrodynamic problems, including cavitation and water-hammer erosion.

Jan. 26, 1885.—Mr. H. R. RICARDO, F.R.S., technical director of Ricardo and Co., Ltd., consulting engineers.

At present I am occupied chiefly with the design and development of light, high-speed, heavy oil engines for all mobile purposes. This problem includes an investigation into the factors controlling combustion under the conditions of compression ignition, in relation both to combustion chamber design and to the preparation of suitable fuels.

Jan. 27, 1856.—Prof. EDWARD B. POULTON, F.R.S., Hope professor of zoology in the University of Oxford.

My chief object is to bring together and publish in a series of parts the observations on the bionomics of insects which have appeared scattered through many journals and books during the past forty-five years, especially those which deal with protective (cryptic) resemblance, warning (aposematic) characters, and mimicry, both Müllerian (synaposematic) and Batesian (pseudaposematic); also with epigamic characters and their display or manifestation in other ways. I hope to be able to include such interesting new observations on these subjects as are likely to be recorded in the near future.

Jan. 27, 1864.—Prof. J. W. GREGORY, F.R.S., lately professor of geology in the University of Glasgow.

I am at present in a transitional stage, for, having recently resigned my chair, I am hoping for leisure to work at several problems which have always specially interested me. In the meanwhile, I am trying to finish some arrears of incomplete work, such as a paper on the sequence of the Dalradian rocks of the Southern Highlands of Scotland, and a paper on the australites or obsidian buttons of Australia. Later I hope to secure leisure for work on some problems of general geomorphology, including the analogies in tectonic structure of Africa and South America, and complete a study of the geological history of the oceans, of which two sections were dealt with in an address to the Geological Society. I have also material collected at various times and still undescribed.

Jan. 30, 1851.—Dr. HENRY OGG FORBES, consulting director of museums to the Corporation of Liverpool.

For some time I have been incapacitated from undertaking any new scientific or literary work, owing to the painful results of the collapse of a chair in the British Museum Reading-Room. Should, however, the surgical operation proposed restore me, as anticipated, to some measure of relief, I look forward hopefully to publishing the ethnographical and geographical observations made in Sokotra (indicated in the preface to " The Natural History of Sokotra and Abd-El-Kuri ") and in Peru.

Societies and Academies.

LONDON.

Royal Society, Jan. 15.—**Lord Rayleigh**: Iridescent colours of birds and insects. The reflection spectra of various brilliantly coloured insects have been examined in the ultra-violet. *Morpho* butterflies and *Urania* moths show ultra-violet maxima in general agreement with the theory of interference. Iridescent beetles showing a deep red colour at normal incidence may be made to pass through all the colours of the spectrum to violet, provided that arrangements are made to annul refraction at the air-chitin surface. Some of the golden beetles show transmission spectra of bands which vary continuously in position with the part of the specimen examined. Moist chlorine gas does not destroy the colours of *Morpho* or of *Urania*, though the black background is bleached; nor does chlorine decolorise the metallic beetles. The colours of all kinds of feathers, however, are rapidly discharged. Peacock feathers undergo a progressive change of colour in ultra-violet light or long-continued sunlight. Generally speaking, the colours become more refrangible. Other feathers, even when blue, are slowly decolorised without change of refrangibility. *Morpho* butterflies and *Urania* also lose colour without change of refrangibility. Fading under light or chlorine in these cases would seem to favour the idea of a pigment, but it is attributed to the breaking down of an interference structure.—**O. W. Richardson** and **L. G. Grimmett**: The emission of electrons under the influence of chemical action at lower gas pressures. A method is described by which partial pressures of phosgene can be controlled and their changes measured down to 10^{-5} mm. mercury. The electron emission from NaK in this gas has been measured down to directly measured pressures of 10^{-5} and to extrapolated pressures of 5×10^{-7} mm. under various conditions. In contrast to the results at pressures above 10^{-3} mm., the emission is now found to be a function of the gas pressure as Richardson originally supposed. The experimentally determined velocity distribution function among the electrons approaches a limit as the pressure is reduced.—**A. J. Allmand** and **A. Puttick**: The sorption of carbon tetrachloride at low pressures by activated charcoals (Part 4). Work has been done on the effect of high temperature evaluation on the nature of vapour isothermals on charcoal. It has been found that the carbon tetrachloride isothermal on at least one charcoal has a discontinuous structure. If a sufficiently high charging pressure of sorbate is used, a reversible isothermal can be obtained.—**D. Marshall** and **Sir Thomas Stanton**: The eddy system in the wake of flat circular plates in three-dimensional flow. The paper describes experiments on the flow of water in steady motion past flat circular plates normal to the direction of motion. The nature of the flow is rendered visible by colouring the streams, and simultaneous photographs on two planes at right angles of the motion in the wake of the plates were obtained. At speeds lying between a well-defined upper limit and a lower limit well above that corresponding with a state of flow in which the inertia terms are negligible, a permanent vortex ring was observed at the back of the plate. When the speed exceeded the upper limit the substance of the ring was discharged downstream in a series of vortices of definite pitch and periodicity.—**J. Chadwick**, **J. E. R. Constable**, and **E. C. Pollard**: Artificial disintegration by α-particles. The protons emitted by certain elements when bombarded by α-particles have been examined by an electrical method. Except in the cases of fluorine and sodium, the disintegration protons consisted of different groups. The origin of these groups is explained on the assumption that the protons and α-particles contained in a nucleus are in definite energy levels. The mass defects of certain nuclei formed in the disintegration processes are deduced.

Physical Society, Dec. 5.—**C. A. Kloss**: Relations between the fundamental physical constants. The numerical values of the fundamental physical constants have been expressed in forms all of which involve, exactly or approximately, the quantity 10^{-13}, and some possible inferences from these values have been suggested.—**W. A. Wood**: The influence of the crystal-orientation of the cathode on that of an electro-deposited layer. This is studied by X-ray methods for copper and nickel, respectively, deposited on rolled copper. The conditions of cathode surface and current density which accompany an oriented deposit are determined. The orientation of the copper deposit for small currents is the same as that of the cathode. The nickel, at low current densities, assumes a distinct orientation. As the current is increased there is a region of no orientation, followed, at still higher currents, by one exhibiting the same orientation as that of the cathode surface below.—**B. K. Johnson**: Sources of illumination for ultra-violet microscopy. Experiences encountered in an attempt to find means for reducing the exposures hitherto necessary in ultra-violet microscopy are described. Amongst the subjects dealt with are quantitative measurements of the relative intrinsic brightness of spectrum lines given by various sources of radiation; methods of producing a monochromatic source suitable for this work; the steadiness of the illuminant; the effect on the definition of the image when a triple spectrum line is used as a source; the study of electrical conditions for the production of increased brightness of the spark, such as the effects of change in frequency, secondary potential, capacity, and energy input; and the production of a compact and inexpensive electrical unit for use with the ultra-violet microscope.

PARIS.

Academy of Sciences, Dec. 8.—**P. Villard**: The titration of phosphoric acid. A study of the reaction of phosphoric acid with solutions of caustic soda, lime, and baryta in the presence of various indicators.—Emile Jouguet was elected a member of the Section of Mechanics in succession to the late M. Sebert. Sir Arnold Theiler was elected *Correspondant* for the Section of Rural Economy in succession to the late Paul Wagner.—**G. Pfeiffer**: The generalisation of the method of Jacobi-Mayer.—**Georges Giraud**: Extension of the results concerning certain problems of data at the frontier.—**J. A. Lappo-Danilevski**: Meromorph functions of matrices.—**Ridder**: Some theorems on primitive functions.—**E. Gugino**: The determination of the forces of reaction in the movement of a material system.—**Michel Vacher**: The modifications in the fine structure of a spectral line brought about by molecular diffusion. Study as a function of the angle of diffusion.—**Jean Cabannes**: The fine structure of a spectral line after molecular diffusion.—**Charles Dufraisse** and **Raymond Horclois**: The catalysis of autoxidation: the antoxygen or pro-oxygen actions of iron and its compounds. The catalytic activity of iron varies, both in intensity and sign, with the nature of the salt employed, and also with the nature of the autoxidisable materials with which it is in contact.—**André Courty**: Study of the casting of light aluminium alloys. The influence of chemical composition.—**L. Lematte**, **G. Boinot**, **E. Kahane**, and **Mme. M. Kahane**: The phosphotungstates and silico-

tungstates of some quaternary bases. Analytical applications. Choline and several substitution derivatives of choline form precipitates with phosphotungstic acid and with silicotungstic acid. These precipitates are sufficiently constant in composition to be used in analysis.—**E. Carrière and Juillard**: The action of sodium thiosulphate upon potassium iodate in faintly acid solution.—**Georges Laude**: The synthesis of cyanic acid and of urea by the ammoniacal oxidation of carbon. Carbon was prepared from camphor soot, purified by extraction with benzene and ether, and finally raised to a dull red heat in a vacuum. Acetylene carbon was also used. The oxidation was effected by copper powder and potassium permanganate in the presence of concentrated ammonia. The cyanic acid produced was estimated as dixanthylurea: 100 grams of camphor carbon gave 11 per cent and acetylene carbon 6 per cent of cyanic acid.—**Conrad Kilian**: An element of decision for the controversy concerning the Plio-Pleistocene Saharan sea. Since the work of Pomel and of Flamand, the hypothesis of Plio-Pleistocene marine penetration of the Sahara has been regarded as completely disproved. The observations of the author now described reopen the question: the marine hypothesis is still worthy of attention.—**M. Thoral**: New observations on the age of the limestones of the Monts de Lacaune.—**E. Bruet**: Observations on the continental alteration of certain sediments.—**J. Thoulet**: The water cycle: liquid columns and cones of gyration.—**J. P. Rothé**: The geological interpretation of magnetic measurements in the Paris basin.—**Pierre Chouard**: The regeneration of small bulbs on the green leaves of certain Liliaceæ. The mutilation of the bulb has been used as a means of determining a more active production of buds and small bulbs, but this destroys the mother bulb. The author describes a method of producing the small bulbs on the green limbs of the leaves without destroying the mother plant.—**Charles Pontillon**: The variations of the fatty acids of *Sterigmatocystis nigra* as a function of the mineral composition of the culture fluid.—**M. Bridel and C. Charaux**: The preparation and properties of the franguloside (franguline) of commercial alder buckthorn bark. A method is described for extracting franguloside from the bark by which the yield is much increased (25 grams per kilogram instead of 1 gram).—**R. Fosse, A. Brunel, P. de Graeve, P. E. Thomas, and J. Sarazin**: The presence of allantoin, with or without allantoic acid, allantoinase, and uricase, in numerous plants used for food.—**W. Kopaczewski**: The reduction of the capillary buffer action of cancerous serum.—**A. Bakke, Mlle. V. Aschehoug, and Chr. Zbinden**: A new factor of nutrition.—**Ph. Joyet-Lavergne**: The notion of somatic sexualisation.—**Georges Blanc and J. Caminopetros**: The transmission of Mediterranean kala-azar by a tick: *Rhipicephalus sanguineus*.—**Joseph Thomas**: Injections of cancerous autolysates in the treatment of cancer. Clinical observations of cases submitted to injections under the treatment described in an earlier paper. The author regards his results as proving that a cancerous tumour is the local expression of a general disease.—**F. Vlès and A. de Coulon**: Researches relating to the effects of certain amino-acids on the isoelectric points of human serum.

ROME.

Royal National Academy of the Lincei, June 15.—**U. Cisotti**: Isotropic quadruple tensors.—**G. Bruni and G. Natta**: Crystalline structure of benzene and its relations to that of thiophen (2). The results of X-ray examination of solid benzene at $-170°$ by the powder method show that the unit cell is of bipyramidal rhombic form of sides $a = 7{\cdot}34$, $b = 9{\cdot}52$, and $c = 6{\cdot}74$ A., corresponding with the axial ratio $a : b : c = 0{\cdot}771 : 1 : 0{\cdot}708$, which differs but little from that determined by Gordon Cox at $-22°$; the density is calculated to be 1·099. No true isomorphism exists between benzene and thiophen, but analogies are evident between the dimensions of the unit cells of the rhombic benzene and the tetragonal thiophen, which have volumes of 471×10^{-24} c.c. and 498×10^{-24} c.c. respectively. The radiations of long wave-length furnished by a metallic calcium anticathode proved of advantage in the measurements.—**G. De Lorenzo**: The geological cause of the disappearance of the ancient city of Paestum. It is now generally thought that the ancient Greek city of Poseidonia, which later became the Paistum of the Lucanians and the Paestum of the Romans, owed its disappearance, not to barbaric invasions and incursions of Saracens, but to conquest by malaria. Study of the variations of the sea-level observed during historical times along the Tyrrhenian coast of southern Italy indicates that, in the sixth century B.C., the surface of the travertine deposit on which this city stood was at least 25 metres above sea-level, whereas it is now buried under a deep layer of material of river and marshy origin, cemented by infiltrations of calcareous tufa.—**L. Petri**: An extensive infection of *Pythium* on grain plants.—**D. Montesano**: The normal descendences of geometrical Cremonian groups.—**Fausta Audisio**: Calculation of π by Leibniz's series.—**C. Popovici**: Remarks on integro-functional equations.—**Enrico Volterra**: The influence of several rigid nuclei immersed in an elastic medium.—**B. Finzi**: The deformation tensor of a film.—**M. Pierucci**: The orbit of the trans-Neptunian planet. The author's rule, that the distances of the planets—taken in the two groups of internal and external planets—from the sun increase in whole numbers, gives a lower mean error than any other known rule. Better agreement with this rule is obtained when it is applied to the geometrical mean of the two semi-axes of the orbit, which is termed the 'equivalent radius'. If this magnitude for Lowell's planet is taken as the mean of the values given by Banachiewicz and Crommelin, the value of the unit of measurement which renders minimum the sum of the squares of the errors is the same for the four old external planets as when Lowell's planet is included, the mean error of the rule being thus sensibly lowered by the discovery of the new planet.—**B. Gulotta**: The rigorous development, in series of spheric functions, of the external potential and the surface gravity of a spheroidal (not of rotation) planet.—**G. Bernardini**: Characteristic velocities of the electrons diffused by metallic surfaces.—**G. Racah**: Quantistic electrodynamics.—**G. R. Levi and D. Ghiron**: Reduction cells of alkali chlorites. Values are given for the reduction potentials at 20° of chlorites with certain reagents in practically neutral solution, neutrality being maintained, when necessary, by means of buffer solutions of sodium borate and magnesium sulphate, and bright platinum electrodes being used.—**A. Ostrogovich and V. Galea**: Investigations on γ-triazines. Synthesis of arylaminothioltriazines. Descriptions are given of five new arylaminothioltriazines, prepared by the condensation of cyanoguanidine with the corresponding arylthioacids.—**A. Migliavacca**: Regeneration of the central nervous system before and after birth.

MELBOURNE.

Royal Society of Victoria, Nov. 13.—**Jean Heyward**: Flowering periods of Victorian plants. A graphical record was made of the flowering periods of all Victorian genera of plants. From these graphs were constructed tables to test a theory put forward by

Illichevsky. He considers that plants flower in the order of their phylogenetic evolution : the most highly developed plants, being more complex, require for their development a longer time and a greater quantity of warmth than simpler ones, and hence they will flower later in the summer. This was not found to be the case with the Victorian flora.—**Cedric Deane** : Australian Hydrophilidæ. In this paper are described nine new species of *Ochthebius—O. clarki, O. angustipennis, O. tenebricosus, O. longipes, O. obcordatus, O. clypeatus, O. pallidipennis, O. leai*, and *O. fischeri* ; also one new *Hydræna, H. williamsensis*. These belong to the section in which the members, though living in the water, do not swim but cling to sticks, stones, and reeds. Being winged, it is presumed that they fly by night like their relatives of the swimming section. The total number of Australian Ochthebii is now thirteen, and the Hydrænæ six.—**Charles Oke** : On some Australian Curculionidæ. Four new genera are described—*Mandalotina, Daylesfordia, Dixoncis*, and *Nyella*. Also twenty-four new species. Three new species are referred to the New Zealand genus *Phrynixus*, not previously known in Australia.

SYDNEY.

Royal Society of New South Wales, Nov. 5.—George Smith : Notes on the mineralogy of the silver-lead-zinc deposits of New South Wales, with special reference to the Barrier Ranges Silver Field. This paper describes the occurrence of the ores and associated minerals, especially at Broken Hill, and particularly the manner in which the ore bodies have been affected by descending solutions, their destructive action on the original minerals contained in the lodes, and the production of new mineral combinations. The relation of the minerals to the lode gangue is discussed at some length, as well as the nature and causes of the secondary enrichment, which was such an important feature of the oxidised zone in the Broken Hill mines.

Official Publications Received.

BRITISH.

India : Meteorological Department. Scientific Notes. Vol. 2, No. 15 : Winds in Higher Levels over Agra. By Dr. N. K. Sur. Pp. 36-43+11 plates. 1 rupee ; 1*s*. 9*d*. Vol. 2, No. 16 : Winds in the first 3 Km. over Port Blair. By K. P. Ramakrishnan. Pp. 46-63+2 plates. 12 annas ; 1*s*. 3*d*. Vol. 2, No. 17 : Tables of Monthly Average Frequencies of Surface and Upper Winds up to 3 Km. in India. Part C. Pp. 195-232. 14 annas ; 1*s*. 6*d*. Part D. Pp. 235-272. 14 annas ; 1*s*. 6*d*. (Calcutta : Government of India Central Publication Branch.)

The Newcomen Society for the Study of the History of Engineering and Technology. Transactions, Vol. 8, 1927–1928. Pp. xi+196+23 plates. (London.) 20*s*.

Department of Agriculture, Straits Settlements and Federated Malay States. General Series, No. 3 : Technical Reports for the Year 1929. Pp. iii+79. (Kuala Lumpur.)

The Chemist and Druggist Diary, 1931. Pp. 488+Diary. (London.)

Report on the Operations of the Department of Agriculture, Madras Presidency, for the Year 1929-30. Pp. ii + 40 + 4 plates. (Madras : Government Press.) 14 annas.

Indian Central Cotton Committee : Technological Laboratory. Technological Bulletin, Series A, No. 17 : Limit Spinning Tests on Cambodia and Mollisoni Cottons. By R. P. Richardson and Dr. A. James Turner. Pp. ii+24. (Bombay.) 1 rupee.

The Journal of the Astronomical Society of South Africa. Edited by Dr. H. Spencer Jones. Vol. 2, No. 5, November. Pp. 213-264. (Cape Town.) 2*s*.

Report on the Administration of the Meteorological Department of the Government of India in 1929-30. Pp. 25 + 4 plates. (Calcutta : Government of India Central Publication Branch.) 1 rupee ; 1*s*. 9*d*.

Indian Journal of Physics, Vol. 5, Part 5, and Proceedings of the Indian Association for the Cultivation of Science, Vol. 14, Part 5. Conducted by Sir C. V. Raman. Pp. 473-572. (Calcutta.) 1.12 rupees ; 2*s*. 4*d*.

Transactions of the Institute of Marine Engineers, Incorporated. Session 1930, Vol. 42, December. Pp. 839-958+xliv. (London.)

Indian Journal of Physics, Vol. 5, Part 6, and Proceedings of the Indian Association for the Cultivation of Science, Vol. 14, Part 6. Conducted by Sir C. V. Raman. Pp. 573-668. (Calcutta.) 1.8 rupees ; 2*s*.

Department of Scientific and Industrial Research. Report of the Water Pollution Research Board for the Year ended 30th June 1930 ; with Report of the Director of Water Pollution Research. Pp. iii+33. (London : H.M. Stationery Office.) 9*d*. net.

Publications of the Safety in Mines Research Board. Vol. 5, 1929. Reports and Papers relating to Research into Coal Dust, Firedamp and other Sources of Danger in Coal Mines. Pp. 10. (London : H.M. Stationery Office.) 2*d*. net.

Imperial Department of Agriculture for the West Indies. Report on the Agricultural Department, St. Lucia, 1929. Pp. iv+29. (Castries, St. Lucia : Government Printing Office.) 6*d*.

Journal of the Chemical Society. December. Pp. iv+2583-2791+x. (London.)

British Industries Fair, 1931, Olympia, London, W.14, February 16th to 27th. Organised by the Department of Overseas Trade. Special Overseas Advance edition. Pp. xvi+416+Ad. 178+Ad. xvi. (London : Department of Overseas Trade.) 1*s*.

British Industries Fair, 1931, Birmingham, February 16th to February 27th. Organised by the Chamber of Commerce, Birmingham, being an Integral Part of the Board of Trade British Industries Fair. Advance edition. Pp. 241+iv+204. (London : Department of Overseas Trade.) 1*s*.

FOREIGN.

Smithsonian Miscellaneous Collections. Vol. 84 : A History of Applied Entomology (somewhat Anecdotal). By L. O. Howard. (Publication 3065.) Pp. viii+564+51 plates. (Washington, D.C. : Smithsonian Institution.)

Report of the Aeronautical Research Institute, Tôkyô Imperial University. No. 64 : Ensuigata-Rappa no Onkyôgakutekino Seisitu ni tuite (Sono 2) (On the Acoustical Properties of Conical Horns, Part 2). By Kôzi Satô. Pp. 261-285. 0.19 yen. No. 65 : Action of Antioxygens in the Oxidation of Unsaturated Fatty Oils. 2 : Inhibitory Effect of Diphenylamine, Diphenylguanidine and Hydroquinone. By Bunnosuke Yamaguchi. Pp. 287-305. 0.15 yen. (Tôkyô : Koseikai Publishing House.)

The Science Reports of the Tohoku Imperial University, Sendai, Japan. Fourth Series (Biology), Vol. 5, No. 3. Pp. 423-614+plates 15-20. (Tokyo and Sendai : Maruzen Co., Ltd.)

Proceedings of the Imperial Academy. Vol. 6, No. 8, October. Pp. xxv-xxvi+297-355. (Tokyo.)

Comptes rendus des travaux du Laboratoire Carlsberg. 18me Vol., No. 5. Pp. 124. (Copenhagen : H. Hagerup.)

U.S. Department of Commerce : Coast and Geodetic Survey. Annual Report of the Director, United States Coast and Geodetic Survey to the Secretary of Commerce for the Fiscal Year ended June 30, 1930. Pp. ii+47+10 plates. (Washington, D.C. : Government Printing Office.) 60 cents.

Scientific Papers of the Institute of Physical and Chemical Research. No. 274 : Studies on the Adsorbed Moisture by the Kanbara Clay. By Hajime Isobe. Pp. 229-274. 50 sen. Nos. 275-276 : On a certain Wax in Rice Polishings, by Ume Tange ; An Erratic Phenomenon of the Spark-over Voltages in the Sphere-Gap (Abridgement), by Takeshi Nishi and Yoshitane Ishigura. Pp. 275-286. 20 sen. No. 277 : On the Analysis of the Aluminium Group. By Sunao Ato. Pp. 287-311. 40 sen. (Tôkyô : Iwanami Shoten.)

Bulletin of the Vanderbilt Marine Museum. Vol. 3 : Scientific Results of the Cruises of the Yachts *Eagle* and *Ara*, 1921–1928, William K. Vanderbilt, Commanding. Crustacea : Anomura, Macrura, Schizopoda, Isopoda, Amphipoda, Mysidacea, Cirripedia and Copepoda. By Lee Boone. Pp. 221+83 plates. (Huntington, L.I.)

Proceedings of the United States National Museum. Vol. 77, Art. 16 : On Dinosaurian Reptiles from the Two Medicine Formation of Montana. By Charles W. Gilmore. (No. 2839.) Pp. 139+10 plates. Vol. 77, Art. 18 : New Species of North American Weevils of the Genus Lixus. By F. H. Chittenden. (No. 2841.) Pp. 26+1 plate. Vol. 78, Art. 5 : New and Old Land Shells from the Island of Luzon, Philippines. By Paul Bartsch. (No. 2848.) Pp. 20+9 plates. Vol. 78, Art. 6 : The South American Lizards in the Collection of the United States National Museum. By Charles E. Burt and May Danheim Burt. (No. 2849.) Pp. 52. (Washington, D.C. : Government Printing Office.)

United States Department of Agriculture. Technical Bulletin No. 212 : Mechanical Analysis of Finely Divided Natural Phosphates. By Lyle T. Alexander and K. D. Jacob. Pp. 24. (Washington, D.C. : Government Printing Office.) 5 cents.

Smithsonian Miscellaneous Collections. Vol. 82, No. 9 : The Further and Final Researches of Joseph Jackson Lister upon the Reproductive Processes of *Polystomella crispa* (Linné). (An unpublished Paper completed and edited from his Note-Books.) By Edward Heron-Allen. (Publication 3067.) Pp. 11+7 plates. (Washington, D.C. ; Government Printing Office.)

University of California Publications in American Archaeology and Ethnology. Vol. 24, No. 9 : Yuki Basketry. By Isabel T. Kelly. Pp. 421-444+plates 120-127. Vol. 30 : Klamath Ethnography. By Leslie Spier. Pp. viii+338. 4.00 dollars. (Berkeley, Cal. : University of California Press ; London : Cambridge University Press.)

Forty-sixth Annual Report of the Bureau of American Ethnology to the Secretary of the Smithsonian Institution, 1928-1929. Pp. vii+654 + 80 plates. (Washington, D.C. : Government Printing Office.) 1.90 dollars.

Proceedings of the Academy of Natural Sciences of Philadelphia, Vol. 82. Cerions of Andros, Bahamas, by Henry A. Pilsbry and Maurice Black ; List of Land and Freshwater Mollusks collected on Andros, Bahamas, by Henry A. Pilsbry. Pp. 289-302. Anatomy and Relationships of some American Helicidae and Polygyridae. By Henry A. Pilsbry. Pp. 303-327. The Resident West Indian Warblers of the Genus Dendroica. By James Bond. Pp. 329-337. Results of the Pinchot South Sea Expedition—II. Land Mollusks of the Canal Zone, the Republic of Panama and the Cayman Islands, by Henry A. Pilsbry ; South American Land and Freshwater Mollusks : Notes and Descriptions —VII., by Henry A. Pilsbry. Pp. 339-365. Descriptions of New Birds from Peru and Ecuador. By M. A. Carriker, Jr. Pp. 367-376. (Philadelphia, Pa.)

Zentralanstalt für Meteorologie und Geodynamik. Publikation Nr. 136 : Jahrbücher der Zentralanstalt für Meteorologie und Geodynamik. Amtliche Veröffentlichung. Jahrgang 1927, Neue Folge, Band 64. Pp. xxii+A42+B56+C44+D8. (Wien : Gerold und Komp.)

Diary of Societies.

FRIDAY, JANUARY 23.

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

ROYAL COLLEGE OF SURGEONS OF ENGLAND, at 5.—Prof. J. W. Tudor Thomas: Successful Grafting of the Cornea in Rabbits.

INSTITUTION OF MECHANICAL ENGINEERS, at 6.—H. N. Gresley: High Pressure Locomotives.

INSTITUTION OF ELECTRICAL ENGINEERS (London Students' Section), at 6.15.—Short Papers on Various Aspects of Lighting.

SOCIETY OF CHEMICAL INDUSTRY (Chemical Engineering Group) (at Friary Hotel, Derby), at 6.30.—J. C. Farrant: Modern Grinding.

INSTITUTE OF FUEL (at Institution of Civil Engineers), at 6.30.—Dr. K. Rümmel: The Calculation of the Thermal Characteristics of Regenerators (Melchett Lecture).

INSTITUTION OF STRUCTURAL ENGINEERS (at Chamber of Commerce, Birmingham), at 6.30.—H. M. Hale: Reinforced Construction at Bournemouth Gas Works.

SOCIETY OF CHEMICAL INDUSTRY (South Wales Section) (jointly with Institute of Chemistry and University College of Swansea Chemical Society) (at Thomas's Café, Swansea), at 7.—Dr. R. Lessing: Recent Improvements in Coal Cleaning.

INSTITUTION OF STRUCTURAL ENGINEERS (at College of Technology, Manchester), at 7.—A. E. Pierce: Structural Engineering in Modern Gas Works.

WEST OF SCOTLAND IRON AND STEEL INSTITUTE (at Royal Technical College, Glasgow), at 7.15.—J. K. Dickie: The Coking Industry and its Development in Relation to the Manufacture of Iron and Steel.

JUNIOR INSTITUTION OF ENGINEERS (Informal Meeting), at 7.30.—E. W. Thompson: The Progress and Development of Steam Generators.

INSTITUTION OF STRUCTURAL ENGINEERS (at Merchant Venturers' Technical College, Bristol), at 7.30.—M. Morgan: Fatigue of Metals.

ROYAL SOCIETY OF MEDICINE (Epidemiology and State Medicine Section), at 8.—Prof. E. L. Collis: Recent Views on Pneumokoniosis.

ROYAL INSTITUTION OF GREAT BRITAIN, at 9.—Sir William Bragg: The Scattering of Light.

SATURDAY, JANUARY 24.

ROYAL INSTITUTION OF GREAT BRITAIN, at 3.—Dr. E. Cammaerts: Flemish Art (1): The Van Eycks.

MONDAY, JANUARY 26.

INSTITUTE OF ACTUARIES, at 5.—W. Palin Elderton: Valuations in Modern Conditions.

ROYAL COLLEGE OF SURGEONS OF ENGLAND, at 5.—Prof. D. H. Patey: The Pathological Basis for the Treatment of Varicose Veins by Injections, and its Bearing on the Problems of Thrombosis.

INSTITUTION OF MECHANICAL ENGINEERS (Graduates' Section), at 6.45.—R. Wailes: Windmills and Millwrighting.

INSTITUTION OF ELECTRICAL ENGINEERS (Informal Meeting), at 7.—L. Murphy and others: Discussion on Reliable Fractional Horsepower Motors for Commercial Purposes.

INSTITUTION OF ELECTRICAL ENGINEERS (North-Eastern Centre) (at Armstrong College, Newcastle-upon-Tyne), at 7.—B. Leggett: The Medical and Surgical Applications of Electricity.

ROYAL SOCIETY OF ARTS, at 8.—Dr. L. C. Martin: Some Modern Developments in Microscopy (Cantor Lectures) (1).

ROYAL SOCIETY OF MEDICINE (Odontology Section), at 8.—Dr. A. A. Osman: The Importance of Sugar in the Diet of the School Child.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—L. S. B. Leakey: The East African Lakes.

TUESDAY, JANUARY 27.

ROYAL SOCIETY OF ARTS (Dominions and Colonies Meeting), at 4.30.—G. E. W. Humphery: Air Communications in Africa.

ROYAL SOCIETY OF MEDICINE (Medicine Section), at 5.—Dr. J. C. Bramwell: The Prognosis and Treatment of Heart Disease complicating Pregnancy.

ROYAL INSTITUTION OF GREAT BRITAIN, at 5.15.—Dr. J. W. T. Walsh: The Art of Illumination (2).

EUGENICS SOCIETY (at Linnean Society), at 5.30.

INSTITUTION OF CIVIL ENGINEERS, at 6.—F. R. Freeman: The Strength of Arc-welded Joints.

INSTITUTION OF ELECTRICAL ENGINEERS (North Midland Centre) (at Hotel Metropole, Leeds), at 7.—C. S. T. Paul and others: Informal Discussion on The Oil-immersed Circuit Breaker.

INSTITUTION OF ELECTRICAL ENGINEERS (North-Western Centre) (at College of Technology, Manchester), at 7.—S. G. Brown: Loud-speakers since their Conception, with Gramophone Pick-ups and Wireless Recording Apparatus.

ROYAL PHOTOGRAPHIC SOCIETY, at 7.—C. D. Hallam and R. S. Cox: Etching Three-colour Half-tone by means of a Colour Chart.—H. M. Cartwright, A. Haigh, and E. L. Turner: Improvements in Photolithography.—Dr. T. Slater Price: Secondary Reactions in Latent Image Formation. Influence of Free Alkali Halide.

QUEKETT MICROSCOPICAL CLUB (at Medical Society of London), at 7.30.—Gossip Meeting.

SHEFFIELD METALLURGICAL ASSOCIATION (at 198 West Street, Sheffield), at 7.30.—F. W. Rowe: The Selection of Suitable Steels for Gears.

WEDNESDAY, JANUARY 28.

BRITISH ASTRONOMICAL ASSOCIATION (at Sion College), at 5.

ROYAL COLLEGE OF SURGEONS OF ENGLAND, at 5.—Prof. J. Paterson Ross: The Treatment of Cerebral Tumours with Radium; with an Account of Experiments made to study the Effects of Radium upon Cerebral Tissue.

GEOLOGICAL SOCIETY OF LONDON, at 5.30.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS (Graduate Section: Joint Meeting) (at Mining Institute, Newcastle-on-Tyne), at 7.15.—B. Reed: Diesel Electric Vehicles for Railway Service.

ROYAL SOCIETY OF ARTS, at 8.30.—Very Rev. Dean Baillie: The Restoration of St. George's Chapel, Windsor Castle.

INSTITUTION OF ELECTRICAL ENGINEERS (South Midland Centre) (at Central Technical College, Birmingham).—Prof. W. Cramp: The Birth of Electrical Engineering (Faraday Lecture).

INSTITUTION OF CHEMICAL ENGINEERS (Graduates' and Students' Section).—M. L. Nathan: High Temperature Heat Insulation.

THURSDAY, JANUARY 29.

DIESEL ENGINE USERS' ASSOCIATION (at Abbey House, Westminster), at 3.—Report of Committee on Heavy Oil Engine Working Costs, 1928–29.

ROYAL SOCIETY, at 4.30.—W. Fernando: (*a*) The Origin of the Mesoderm in the Gastropod *Viviparus* (= *Paludina*); (*b*) The Origin and Development of the Pericardium and Kidneys in *Ostrea*.—L. A. Harvey: Studies on Echinoderm Oogenesis—I. *Antedon bifida* (Pennant); II. *Asterias rubens* (Linn.).—J. Young: The Pupillary Mechanism of the Teleostean Fish, *Uranoscopus scaber*.

ROYAL INSTITUTION OF GREAT BRITAIN, at 5.15.—Prof. H. Dingle: The Nature and Scope of Physical Science (2).

ROYAL SOCIETY OF MEDICINE (Neurology Section), at 5.30.—Sir Charles Sherrington: Quantitative Management of Contraction for 'Lowest-level' Co-ordination (Hughlings Jackson Lecture).

ROYAL AERONAUTICAL SOCIETY (at Royal Society of Arts), at 6.30.—A. Lippisch: Development and Construction of Sailplanes and Gliders.

ROYAL AERONAUTICAL SOCIETY (Yeovil Branch) (at Yeovil).—R. Waddell: Machining and Working of Stainless Steel.

SOCIETY OF DYERS AND COLOURISTS (West Riding Section).—Dr. S. G. Barker: The Physical Relationships of the Dimensional Characteristics of the Wool Fibre and their Importance in Manufacturing Practice.

FRIDAY, JANUARY 30.

ROYAL COLLEGE OF SURGEONS OF ENGLAND, at 5.—Dr. D. Hunter: Changes in the Bones in Hyperparathyroidism and Hyperthyroidism.

INSTITUTION OF ELECTRICAL ENGINEERS (West Wales (Swansea) Sub-Centre) (at Corporation Electricity Showrooms, Swansea), at 6.—J. Urmston: The Electrical High-Pressure Testing of Cables and the Localisation of Faults.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS (at Mining Institute, Newcastle-upon-Tyne), at 6.—C. F. Christensen: The Whaling-Factory Ship *Vikingen*, with Some Notes on Whaling.

JUNIOR INSTITUTION OF ENGINEERS (Informal Meeting), at 7.30.—W. Fish: Modern Methods of Production of Small Machined Work.

ROYAL INSTITUTION OF GREAT BRITAIN, at 9.—Prof. G. M. Trevelyan: The First Defence of Gibraltar by the English, Oct. 1704–April 1705.

ROYAL AERONAUTICAL SOCIETY (Hull and Leeds Branch).—Col. the Master of Sempill: Gliding and Soaring.

SOCIETY OF DYERS AND COLOURISTS (Scottish Section).—D. K. Colledge: Dyeing for the Scottish Tweed Trade.

SATURDAY, JANUARY 31.

MATHEMATICAL ASSOCIATION (at Bedford College for Women), at 3.—Annual Meeting.

ROYAL INSTITUTION OF GREAT BRITAIN, at 3.—Dr. E. Cammaerts: Flemish Art (2): Breughel.

PUBLIC LECTURES.

SATURDAY, JANUARY 24.

HORNIMAN MUSEUM (Forest Hill), at 3.30.—M. A. Phillips: Birds, Past and Present.

MONDAY, JANUARY 26.

LONDON SCHOOL OF HYGIENE AND TROPICAL MEDICINE (Public Health Division), at 5.—J. C. Dawes: Public Cleansing: The Composition and Storage of House and Trade Refuse.

KING'S COLLEGE, LONDON, at 5.30.—Prof. J. Barcroft: The Constancy of the Internal Environment: its Evolution and Purpose. (Succeeding Lectures on Feb. 2 and 9.)

TUESDAY, JANUARY 27.

LONDON SCHOOL OF ECONOMICS, at 5.—Dr. F. A. Hayek: Prices and Production. (Succeeding Lectures on Jan. 28, 29, and 30.)

IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY, at 5.30.—Prof. P. P. Ewald: The Theory of Interference of X-Rays as a Domain of General Crystal Optics. (Succeeding Lectures on Jan. 29 and 30.)

WEDNESDAY, JANUARY 28.

LONDON SCHOOL OF HYGIENE AND TROPICAL MEDICINE (Public Health Division), at 5.—J. C. Dawes: Public Cleansing: The Collection of House and Trade Refuse.

KING'S COLLEGE, LONDON, at 5.30.—Prof. A. Pastor: The Great Age of Discovery (2): The Renaissance in Spain and Portugal.

BELFAST MUSEUM AND ART GALLERY, at 8.—C. E. White: Josiah Wedgwood and what the World owes to him.

THURSDAY, JANUARY 29.

BEDFORD COLLEGE, at 5.15.—Sir Philip Hartog: Problems of Modern India (1): Education.

SATURDAY, JANUARY 31.

HORNIMAN MUSEUM (Forest Hill), at 3.30.—Miss M. A. Murray: Most Ancient Egypt.